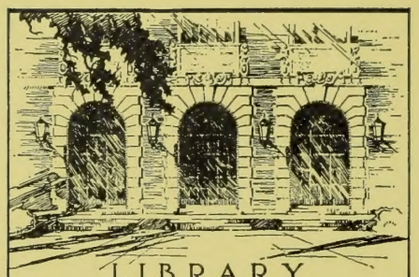

LIBRARY
OF THE
UNIVERSITY
OF ILLINOIS

016.333
So4
v. 2
no. 8-16
cop. 4

BOOKSTACKS

BOOKSTACKS-
DOCUMENTS

LIBRARY U. OF I. URBANA-CHAMPAIGN

LIBRARY OF THE UNIVERSITY OF ILLINOIS

[redacted]

NEW SERIES

UNIVERSITY OF ILLINOIS
AUG 2 9 1969
LIBRARY

SELECTED WATER RESOURCES ABSTRACTS

VOLUME 2, NUMBER 8
APRIL 15, 1969

WR 69-02801 -- WR 69-03200

Selected Water Resources Abstracts is published semimonthly for the Water Resources Scientific Information Center (WRSIC) by the Clearinghouse for Federal Scientific and Technical Information (CFSTI) of the Bureau of Standards, U. S. Department of Commerce. It is available to Federal agencies, contractors, or grantees in water resources upon request to: Manager, Water Resources Scientific Information Center, Office of Water Resources Research, U. S. Department of the Interior, Washington, D. C. 20240. Others can subscribe directly from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Virginia 22151. Annual subscription is $22 (domestic), $27.50 (foreign); single copy price is $3.

CLEARINGHOUSE
FOR FEDERAL SCIENTIFIC AND TECHNICAL INFORMATION
U.S. Department of Commerce, Springfield, Va., 22151

SELECTED
WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

LIBRARY U. OF I., URBANA-CHAMPAIGN

VOLUME 2, NUMBER 8
APRIL 15, 1969

WR 69-02801 -- WR 69-03200

Use of funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

Doc.
I 19.4/2:
2/4-8

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources. WRSIC is not presently prepared to furnish loan or retention copies of the publications announced.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas. Centers, and their subject coverage, now in operation are:

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

CONTENTS

FOREWORD_____iii

SUBJECT FIELDS AND GROUPS

(Use Edge Index on back cover to Locate Subject Fields and Indexes in the journal.)

01 NATURE OF WATER
Includes the following Groups: Properties; Aqueous Solutions and Suspensions

02 WATER CYCLE
Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION
Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL
Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Non-Water Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION
Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING
Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA
Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS
Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS, AND FACILITIES
Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.

10 SCIENTIFIC AND TECHNICAL INFORMATION
Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

SELECTED WATER RESOURCES ABSTRACTS

01. NATURE OF WATER

1B. Aqueous Solutions AND Suspensions

GRAPHICAL METHODS FOR STUDIES OF AQUEOUS ALUMINUM HYDROXIDE, FLUORIDE, AND SULFATE COMPLEXES,
Geological Survey, Washington, D.C.
J. D. Hem.
U S Geol Surv Water-Supply Pap 1827-B, 33 p, 1968. 18 fig, 3 tab, 14 ref.

Descriptors: *Water chemistry, *Aluminum, *Thermodynamic behavior, *Mathematical studies, Fluorides, Sulfates, Stability, Equilibrium, Aqueous solutions.
Identifiers: *Equilibrium calculations, *Graphical methods, Chemical complexes.

Published stability constants show that aluminum forms strong complexes with hydroxide, fluoride, and sulfate ions. This paper presents equilibrium calculations which show that fluoride complexes probably will be the predominant form of aluminum solute species in natural water below neutral pH, when more than a few tenths of a part per million of fluoride is present. Sulfate complexes of aluminum can be important below neutral pH if sulfate concentrations exceed 500 ppm. The predominant complex species and proportion of uncomplexed aluminum activity to total aluminum concentration are shown graphically as functions of the analytical concentration of aluminum and fluoride, or sulfate, for ionic strengths ranging from zero to that of sea water. In alkaline solutions the species Al (OH) (minus) sub 4 tends to predominate. The forms of aluminum complexes which can be expected to predominate, and extent of complexing in solutions containing both fluoride and sulfate, and the effects of pH on the complexing of aluminum by fluoride and sulfate are given graphically. (Steinhilber-USGS)
W69-02834

02. WATER CYCLE

2A. General

LOW-FLOW AND BASIN CHARACTERISTICS OF TWO STREAMS IN NORTHERN VERMONT,
Agricultural Research Service, Danville, Vt. Soil and Water Conservation Research Div.
G. H. Comer, and R. C. Zimmerman.
J Hydrol, Vol 7, (1969), No 1, pp 98-108, Nov 1968. 11 p, 3 fig, 4 tab, 14 ref.

Descriptors: *Small watersheds, *Rainfall-runoff relationships, *Vermont, Glacial soils, Duration curves, Land use, Topography, Organic soils, Infiltration, Storage.
Identifiers: Fragipans, Experimental watersheds.

During a 6-yr period, the minimum flows per unit of area in a 3.2 sq-mi basin of northern Vermont were 0.00027 in/h compared with 0.00003 in/h in an adjacent 8.4-sq-mi basin. As the climate, geology, and land use in the two basins are similar, the differences in low flow are probably caused by differences in topography and in soils. Fifty-four percent of the larger, low-yielding basin has slopes of 8% or less; slopes of 8% or less occur in only 28% of the smaller basin. Poorly and very poorly drained fragipan soils (Typic and Humic Fragiaquepts) occupy 44% of the larger basin, as opposed to only 22% of the smaller, steeper basin. These soils have an O horizon, and A horizon with high organic content, and a fragipan at depths generally between 12 and 18 in. Their effect is to retard or impede deep percolation to storage, and to retain moisture in the surficial horizons even at high tensions. In the smaller basin, high base flow is probably sustained by the slow release of moisture from the deeper, surficially well-drained soils that prevail in it.
W69-02814

INTERRELATIONSHIP BETWEEN PHYSIOGRAPHY, HYDROLOGY, SEDIMENTATION, AND SALINIZATION OF THE LODDON RIVER PLAINS, AUSTRALIA,
Geological Survey of Australia, Melbourne.
For primary bibliographic entry see Field 02B.
For abstract, see .
W69-02817

AVAILABILITY OF GROUND WATER IN THE PARTS OF THE ARLINGTON AND WICKLIFFE SW QUADRANGLES IN JACKSON PURCHASE REGION, KENTUCKY,
Geological Survey, Washington, D. C.
R. W. Davis.
U S Geol Surv Hydrol Invest Atlas HA-183, 1 sheet, 1968. Text, geol sec, 1 ref.

Descriptors: *Water resources, *Groundwater, *Kentucky, Water wells, Hydrologic data, Aquifers, Water quality, Water yield.
Identifiers: Wickliffe and Arlington Quadrangles (Ky).

The availability of groundwater in the parts of the Arlington and Wickliffe SW quadrangles in the Jackson Purchase region of western Kentucky is reported in an Atlas sheet containing a map showing availability of groundwater, location of wells, and quality of water, a columnar section showing stratigraphy and water bearing character of formations, and geologic cross sections showing water table elevations, and a short text. Sufficient supplies of groundwater for domestic, public, and industrial needs are available. All present development is from alluvium and a shallow Eocene aquifer; a deeper Eocene aquifer capable of yielding larger amounts is untapped. The largest well in the area yields 415 gpm. The quality of the groundwater is good, commonly less than 200 ppm dissolved solids. The shallow Eocene aquifer contains water that varies from hard near the Mississippi River, the western part of the area, to soft in the east. Iron content is less than 0.3 ppm. (Knapp-USGS)
W69-02822

HYDROLOGIC STUDIES OF SMALL WATERSHEDS IN AGRICULTURAL AREAS OF SOUTHERN MICHIGAN,
Geological Survey, Lansing, Mich.; Michigan State Univ., East Lansing; and Environmental Sciences Services Administration, East Lansing, Mich.
N. D. Strommen, R. L. Knutilla, and C. Mueller.
Mich Water Resources Comm Rep No 3, 191 p, July 1968. 15 fig, 16 tab, 2 ref.

Descriptors: *Data collections, *Streamflow, *Precipitation (Atmospheric), *Small watersheds, *Michigan, Rain gages, Runoff, Rainfall-runoff relationships, Hydrographs.
Identifiers: Southern Michigan (Ingham County), Deer-Sloan Creek Watershed.

To provide necessary data for use in the designing of drainage and water control facilities on small watersheds, a dense network of rain gages was installed on the Deer-Sloan Creek Watershed during April 1956 in Ingham County, Michigan. Because the relatively level to gently rolling terrain provides little orographic influence on the weather patterns in the area, the data obtained should be representative for much of southern Michigan. The report consists of two basic sections. The first, prepared by U.S. Geological Survey, deals with streamflow characteristics (1954-1964) and streamflow data (1954-1966) for the Deer and Sloan Creeks. The final section presents tabulated monthly summary precipitation data for the period 1956 through 1967. (Knapp-USGS)
W69-03045

RUNOFF AND HILLSLOPE EROSION RESULTING FROM A HIGH-INTENSITY THUNDERSTORM NEAR MACK, WESTERN COLORADO,
Geological Survey, Denver, Colo.
Richard F. Hadley, and Gregg C. Lusby.
Water Resources Res, Vol 3, No 1, pp 139-143, 1967. 5 p, 3 fig, 8 ref.

Descriptors: *Rainfall intensity, *Runoff, *Erosion, Sediment yield, Infiltration, Rainfall-runoff relationships, Colorado.

Data on hydrologic and geomorphic processes from single storm events are rare, but the opportunity to make such measurements occurred on August 12, 1964, when the runoff and hillslope erosion resulting from a high-intensity thunderstorm were measured in a small basin of 12 acres in western Colorado. The maximum intensity of rainfall for a 10-min period was 1.98 in. per hr. The total runoff as measured in a reservoir was 0.508 in. over the basin, and 0.90 in. of precipitation had been recorded when runoff stopped. Data from measurements of erosion pins along 6 hillslope profiles indicate that approximately 0.11 acre-foot was eroded from the basin during the storm; survey of the reservoir shows that 0.090 acre-foot was delivered to the lower end of the basin. Estimates of soil loss using measurements of erosion pin exposure are considered to be good in basins where sediment transport from hillslopes to the measuring point is not complicated by diverse topography or intermediate areas where deposition may occur. (Knapp-USGS)
W69-03052

EFFECTS OF CLIMATOLOGIC AND BASIN CHARACTERISTICS ON ANNUAL RUNOFF,
Board of Agriculture, Helsinki (Finland).
Seppo E. Mustonen.
Water Resources Res, Vol 3, No 1, pp 123-130, 1967. 8 p, 2 fig, 3 tab, 9 ref.

Descriptors: *Climatology, *Synoptic analysis, *Watersheds (Basins), *Rainfall-runoff relationships, Statistical methods, Regression analysis, Precipitation (Atmospheric), Temperature, Soils, Vegetation, Frost.
Identifiers: Finland, Drainage basin characteristics.

Climatologic and basin characteristics affecting the annual runoff in Finland are selected by the orthogonal regression method. Climatologic variables, especially seasonal precipitation and mean annual temperature, are found to be much more important than basin characteristics such as soil type and vegetation. Frost depth is inversely related to annual runoff. The percentages of cultivated land and peat land are not significant variables in these data. The simple linear multiple regression approach was successful ($R = 0.943$, $so = 34$ mm) in developing a reliable prediction equation. However, no statistical procedure can uncover the underlying laws governing runoff until the basic physical relationships are better understood. Furthermore, most available climatologic and basin characteristics are only indices of the combined effects of several physical factors. Hence, the utility of some of the more complex statistical approaches is questioned. (Knapp-USGS)
W69-03055

INFILTRATION, OVERLAND FLOW, AND SOIL MOVEMENT ON FROZEN AND SNOW-COVERED PLOTS,
Forestry Sciences Lab., Moscow, Idaho.
Harold F. Haupt.
Water Resources Res, Vol 3, No 1, pp 145-161, 1967. 17 p, 7 fig, 4 tab, 19 ref.

Descriptors: *Frost, *Frozen ground, *Snowpacks, *Slopes, *Rainfall-runoff relationships, Infiltration, California.
Identifiers: Sierra Nevada.

A small plot study shows how ground cover, furrowing, and the presence of frost in soils of the Sierra Nevada affect infiltration from prolonged

simulated winter rains. A rapidly melting snowpack over soil containing dense frost may accelerate onsite runoff. The presence of stalactite soil frost promotes rapid absorption of snowmelt and reduces overland flow. Conversely, porous concrete frost usually reduces infiltration capacity and increases overland flow on burned or sparsely vegetated sites but does not impair infiltration where plant and litter cover are appreciable. Snow cover, by cooling rain water, tends to preserve soil frost and keep it visibly intact. Snow absorbs raindrop energy much as dense vegetation does. Soil losses from snow-covered plots, regardless of vegetative cover, are practically nil. Generally, plants, litter and snow cover dissipate raindrop energy and increase infiltration, but exposed rock usually accelerates overland flow and erosion. Shallow contour furrowing seemed to facilitate infiltration and controlled over-land flow adequately. (Knapp-USGS)
W69-03060

ANALYTICALLY DERIVED UNIT GRAPH AND RUNOFF,
Tennessee Valley Authority, Knoxville.
Roger P. Betson, and Ralph F. Green.
ASCE Proc, J Hydraul Div, Vol 94, No Hy6, Pap 6256, pp 1489-1505, Nov 1968. 17 p, 6 fig, 2 tab, 11 ref.

Descriptors: *Mathematical models, *Unit hydrographs, *Synthetic hydrology, Rainfall-runoff relationships, Digital computers, Computer programs, Optimization, Methodology.
Identifiers: *Fitting technique, Effective rainfall.

A technique has been programed to solve analytically for measures of precipitation excess and unit graph shape parameters. The optimization procedures achieved a very high degree of adjustment of the model to data, but the results were inconsistent. The paper describes the development of an objective fitting technique. A two-step fitting procedure was devised which substantially increased the objectivity of the fitting technique. The two shape parameters were first individually corrected by a univariate technique to near-optimum values. This reduced the effect of the higher-order partial derivatives with respect to the shape parameters. The simultaneous differential correction technique was then used to obtain corrections for both the shape parameters and the runoff parameters. While this two-step solution technique does not quite yield exact results, they are close enough to the desired values and can be obtained consistently from different starting points. (Knapp-USGS)
W69-03069

AN EXPERIMENTAL RAINFALL-RUNOFF FACILITY,
Colorado State Univ., Fort Collins.
W. T. Dickinson, M. E. Holland, and G. L. Smith.
Colo State Univ Hydrol Pap No 25, 81 p, Sept 1967. 13 fig, 4 tab, 29 ref. OWRR Proj No. B-005-COLO.

Descriptors: *Rainfall-runoff relationships, *Model studies, Mathematical models, Hydraulic models, Bibliographies, Colorado.
Identifiers: *Experimental rainfall-runoff plot, Rainfall simulation.

An experimental facility for the investigation of the rainfall-runoff relationship was constructed. It is large enough to respond like a prototype watershed and small enough to study conveniently. The shape was designed to be like a generalized model derived from study of 61 natural small watersheds with a range in drainage area from 0.11 sq mi to 0.97 sq mi. The facility has a length of 285 ft, a length to width ratio of 1.8 to 1 and an area of about 44,000 sq ft. The mean slope is about 5%. Precipitation is simulated by nozzles on a tower. The site geometry and the data collecting and handling equipment are described in detail. The literature of mathematical models of hydrological watershed response is critically reviewed and an annotated bibliography of 226 references is included. (Knapp-USGS)
W69-03076

RAINFALL INTENSITY AND ELEVATION IN SOUTHWESTERN IDAHO,
Michigan Univ., Ann Arbor.
For primary bibliographic entry see Field 02B.
For abstract, see .
W69-03087

MOMENTS OF THE INPUT, OUTPUT, AND IMPULSE RESPONSE FUNCTIONS OF LINEAR SYSTEMS ABOUT ARBITRARY POINTS,
Technion-Israel Inst. of Tech., Haifa; and Water Planning for Israel Ltd., Tel-Aviv.
M. H. Diskin, and A. Boneh.
Water Resources Res, Vol 4, No 4, pp 727-735, Aug 1968. 9 p, 4 fig, 5 ref.

Descriptors: *Watershed (Basins), *Rainfall-runoff relationships, *Runoff, Synthesis, Time lag, Mathematical studies, Methodology.
Identifiers: *Linear time invariant systems, *Impulse response functions, Surface hydrology.

Consideration is given to the problem of the general relationship between the moments of three functions related by the convolution integral about any three arbitrary points (a,b,c,) on the time axis. One of the most important problems in surface hydrology is determining the impulse response function of a watershed system from historical records of rainfall excess and direct surface runoff, which are respectively the input and output of the watershed system. A useful approach to determining the shape of the impulse response function is, assuming the system to be linear, to use a moments theorem that relates the moments of the three functions. A general expression is derived for the relation between the moments of the systems about any three arbitrary points along the time axis. The derivation is given both by a method based on integration and summation operations, and by a method using Laplace transforms. The latter method also gives the influence on their output of initial time lags in the input and in the impulse response function of linear systems. (Llaverias-USGS)
W69-03089

RELATIONSHIP BETWEEN PRECIPITATION, EVAPORATION, AND RUNOFF IN TROPICAL-EQUATORIAL REGIONS,
Shawinigan Engineering Co. Ltd., Montreal (Quebec).
S. Solomon.
Water Resources Res, Vol 3, No 1, pp 163-172, 1967. 10 p, 7 fig, 17 ref.

Descriptors: *Hydrologic budget, *Tropical regions, *Evaporation, Rainfall-runoff relationships, Radiation, Lakes, Reservoir evaporation, River basins.
Identifiers: *Potential evaporation, Water budget, Bouchet's theory.

Methods for calculating water budgets of drainage basins are reviewed with particular attention to the calculation of evaporation. Bouchet's theory on actual and potential evaporation can be used a a basis to develop semi-empirical relationships between precipitation, actual evaporation, and radiation. These relationships are curvilinear, and the derived precipitation-runoff relationships are also curvilinear. Since the variation of annual radiation from one year to another in tropical-equatorial regions is not very significant, the average value of annual radiation can be approximated using direct measurements or indirect estimates from data taken over a period of from two to five years. This value can be used with the semi-empirical relationship developed to obtain fair estimates of the annual variation of actual evaporation and runoff from data on annual precipitation and good estimates of the long-term averages of these hydrologic characteristics. Bouchet's theory can be used to analyze evaporation and runoff for periods of less than one year and for estimating lake and reservoir evaporation. However, in this case, the assessment of the effect of heat and moisture storage requires further investigation.
W69-03092

DEPLETION OF FLOW IN RIGHT-ANGLE STREAM BENDS BY STEADY WELLS,
New Mexico Tech., Socorro.
Mahdi S. Hantush.
Water Resources Res, Vol 3, No 1, pp 235-240, 1967. 6 p, 1 fig, 1 tab, 15 ref.

Descriptors: *Surface-groundwater relationships, *Induced infiltration, *Water wells, Streamflow, Discharge (Water), Pumping, Artesian wells Water table.
Identifiers: *River depletion.

The flow of a stream that is hydraulically connected to an aquifer can be reduced considerably by nearby pumping wells. Pumping such wells will either increase the infiltration from the nearby streams or decrease the natural groundwater flow that would have discharged into the streams if the wells had not been pumped, or effect both processes at the same time. The depletion of the streamflow is an increase to the perennial yield of the sand. Consequently, greater supplies of water can be obtained than would be available as groundwater alone in such systems. Natural as well as artificial streams meeting at approximately right angles are not uncommon in nature. Irrigation and drainage canals, and streams having a trellis drainage pattern, are examples of such an occurrence. Wells for domestic as well as for irrigation use are often installed near such streams. Rational estimates of the rate of depleting such streams by the nearby pumping wells are therefore of practical interest. Formulas for estimating the rate and volume of stream depletion is such systems are developed in terms of extensively tabulated functions.
W69-03094

REVIEW AND ANALYSIS OF RAINFALL AND RUNOFF DATA FOR SELECTED WATERSHEDS IN MINNESOTA,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
C. Edward Bowers, and Arthur F. Pabst.
Water Resources Res Center Bull No 8, Dec 1968. 70 p, 55 fig, 9 tab, 10 ref.

Descriptors: *Rainfall-runoff relationships, *Watersheds, *Optimization, Frequency analysis, Unit hydrographs, Computer programs, Floods, Hydrographs, Minnesota, Infiltration, Structures, Design data.
Identifiers: Depression storage, Design runoff.

Available rainfall and runoff data for selected watersheds in Minnesota were analyzed to aid in the evaluation of peak runoff rates for design purposes. Analysis of data from 51 flood events in five watersheds was aided by an optimization program prepared by U.S. Army Corps of Engineers Hydrologic Engineering Center. This program was used to optimize nine variables associated with the watersheds, to develop characteristic unit hydrographs, and to evaluate loss rates for the watershed in terms of the mathematical model represented by the optimization program. Data on annual maximum floods as well as maximum summer floods were plotted on log-probability paper and theoretical flood-frequency curves determined by the log-Pearson Type 3 distribution. Hourly loss rates were quite high for the watersheds used in this study. The shape of unit hydrographs developed for the larger watersheds was affected considerably by storm pattern and storm location, and to some extent by storm direction. (Steinhilber-USGS)
W69-03098

HYDROLOGY AND WATER RESOURCES OF THE HOUSATONIC RIVER BASIN, MASSACHUSETTS,
Geological Survey, Washington, D. C.
Ralph F. Norvitch, Donald F. Farrell, and Felix H. Pauszek.
U S Geol Surv Hydrol Invest Atlas HA-281, 4 sheets, 1968. 20 fig, 6 map, 10 tab, 20 ref.

Descriptors: *Water resources, *Watersheds (Basins), *Hydrology, Water yield, Water quality, Hydrologic budget, Surface waters, Groundwater, Water utilization, Reservoir storage, Massachusetts.
Identifiers: Housatonic River basin (Mass.).

Water resources and water problems of the Upper Housatonic River basin are described on four sheets of a hydrologic atlas. Data are presented on the water budget and on the occurrence, availability, quality, and use of surface and groundwaters in the basin. Information presented shows that large quantities of water are available for development by impounding tributary streams within the hills bordering the valley. Also, additional quantities of good-quality water are available from groundwater sources in several places within the valley. The Housatonic River, the largest stream in the valley, is highly polluted and not fit for human consumption without treatment.
W69-03101

SOME ERROR PROPERTIES OF SEGMENTED HYDROLOGIC FUNCTIONS,
Georgia Inst. of Tech., Atlanta.
For primary bibliographic entry see Field 07C.
For abstract, see .
W69-03105

SLOPE LENGTH OF CLAYPAN SOIL AFFECTS RUNOFF,
Agricultural Research Service, Columbia, Mo.; and Agricultural Research Service, Urbana, Ill.
V. C. Jamison, and D. B. Peters.
Water Resources Res, Vol 3, No 2, pp 471-480, 1967. 10 p, 6 fig, 3 tab, 8 ref.

Descriptors: *Runoff, *Irrigation, *Infiltration, *Subsurface runoff, *Recession curves, Slopes, Rainfall-runoff relationships.
Identifiers: Claypan soils, Slope length.

Measurements of runoff after prolonged irrigation of grass plots on a claypan soil (Mexico silt loam) showed that recession yields per unit area increased with slope length. Yields from slopes of lengths varying from 76 to 323 ft indicated return flow or interflow during runoff recession of at least 0.1 in. from the longer plots. During a simulated wet season using irrigation to supplement rainfall in the summer of 1965, per unit area yields were greatest for long plots, except for small events or events of long duration. The seasonal yield was 1.69 in., or about 19% more from the long than from the short plots. Hydraulic conductivity measurements indicate that the predominant path of interflow is in the upper in. or two of the soil surface. However, soil moisture content and hydraulic pressure gradient changes during recession runoff indicated that there may be an interflow contribution from the loessal soil layer between weathered till and claypan.
W69-03106

THE HYDRAULICS OF OVERLAND FLOW ON HILLSLOPES,
Geological Survey, Washington, D. C. Water Resources Div.
For primary bibliographic entry see Field 02E.
For abstract, see .
W69-03110

CONTROL LEVELS FOR QUANTITATIVE EVALUATION OF WEATHER MODIFICATION ATTAINMENTS,
Colorado State Univ., Fort Collins.
Radmilo D. Markovic.
Water Resources Res, Vol 3, No 2, pp 423-431, 1967. 9 p, 3 fig, 4 tab, 8 ref.

Descriptors: *Evaluation, *Weather modification, Cloud seeding, Precipitation (Atmospheric), Runoff, Streamflow, Stream gages, Rain gages.

There are 3 basic control levels from which the quantitative statistical evaluation of cloud seeding weather modification attainments can be considered, corresponding to three particular stages in the general hydrologic cycle: cloud phenomena, precipitation, and river flow control levels. The cloud phenomena level of control is suitable for qualitative physical rather than for quantitative statistical evaluation of weather modification attainments. The precipitation level of control may be used for both qualitative and quantitative evaluations. However, the inaccuracy involved in single measurements of precipitation under different environmental conditions and in the determination of mean areal precipitation makes this level of control unreliable for the quantitative evaluation of weather modification attainments at present. The river flow control level has been shown to be suitable and promising, accurate, and reliable for practical purposes, and it is, therefore, highly recommended for use in the quantitative evaluation of weather modification attainments.
W69-03113

FLOW OF GROUNDWATER ADJACENT TO SMALL, CLOSED BASINS IN GLACIAL TILL,
Idaho Univ., Moscow.
For primary bibliographic entry see Field 02F.
For abstract, see .
W69-03119

A LAPLACE TRANSFORM PROOF OF THE THEOREM OF MOMENTS FOR THE INSTANTANEOUS UNIT HYDROGRAPH,
Technion Israel Inst. of Tech., Haifa.
For primary bibliographic entry see Field 06A.
For abstract, see .
W69-03120

2B. Precipitation

INFLUENCE OF THE FOREST ON PRECIPITATION,
State Hydrological Inst., Leningrad (USSR).
S. F. Fedorov, and A. S. Burov.
Translated from Trudy Gos Gidrol Inst, No 142, pp 8-19, 1967. Soviet Hydrol Selec Pap (AGU), No 3, pp 217-227, 1967. 11 p, 1 fig, 8 tab, 20 ref. 3 append.

Descriptors: *Precipitation (Atmospheric), *Forests, *Vegetation effects, Microclimatology, Precipitation gages, Rain gages, Permeability, Infiltration, Soil moisture.
Identifiers: USSR, Forest effect on atmospheric precipitation.

Experiments by the Valdai Hydrological Scientific Research Laboratory on the differences in precipitation on forests and open areas lead to the conclusion that a forest promotes an increase in precipitation of 10-15%. Analysis of the effect of surface roughness on precipitation yields a similar result. Average warm season (June-October) precipitation was measured by closely spaced rain gages located in areas with different ground surfaces, in spruce forest, in a deciduous forest, and in an experimental evaporation plot in a meadow. The greatest precipitation was in the spruce forest, somewhat lower in the deciduous forest, and the lowest in the meadow. The data are tabulated. (Knapp-USGS)
W69-02803

INTERRELATIONSHIP BETWEEN PHYSIOGRAPHY, HYDROLOGY, SEDIMENTATION, AND SALINIZATION OF THE LODDON RIVER PLAINS, AUSTRALIA,
Geological Survey of Australia, Melbourne.
P. G. Macumber.
J Hydrol, Vol 7, (1969), No 1, pp 39-57, Nov 1968. 19 p, 5 fig, 1 plate, 2 tab, 18 ref.

Descriptors: *Saline soils, *Saturated soils, *Land reclamation, *Drainage, *Irrigation practices, Flood control, Leaching, Alluvium, Water table.
Identifiers: Australia, Loddon River, Aeolian soils.

The causes of salinization of the Loddon River plain, Australia, were studied to attempt to find a means of halting the deterioration of irrigated farms and grazing land. The pattern of salinization was found to be closely linked to the fluvial and aeolian patterns of Quaternary sedimentation, with the most severe salinization in clays and fine soils. Flood control projects eliminated the winter sheet flood which leached salt from the upper soil profile each year, while summer irrigation causes rising water tables and soil salinization. Alluvial sand aquifers are found along some of the streams; pumping them heavily as groundwater drains can be done locally to lower the water table and alleviate soil salinity. Buried alluvial aquifers parallel to surface drainage were found and may also be pumped for drainage. (Knapp-USGS)
W69-02817

AN EVALUATION OF PRECIPITATION, VEGETATION AND RELATED FACTORS ON THE SANTA RITA EXPERIMENTAL RANGE,
Arizona Univ., Tucson. Inst. of Atmospheric Physics; and Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.
Christine R. Green, and S. Clark Martin.
Univ of Ariz, Inst Atmospheric Physics, Tech Repts Meteorology and Climatology of Arid Regions, No 17, pp 1-82, April 1967. 82 p, 18 fig, 5 tab.

Descriptors: Evaluation, *Statistical methods, *Rainfall, Precipitation (Atmospheric), Rain gages; Monthly, Annual, *Analytical techniques, *Data collections, Variability, *Climatic data, Regression analysis, Elevation, Seasonal, Correlation analysis, Crop response, Arid lands, Soil moisture.
Identifiers: *Santa Rita Experimental Range (Arizona).

Monthly and annual precipitation data for 45 rain gages over the Experimental Range were presented in this publication. The length of record for the 45 stations varied from 6 to 43 years. In the statistical analyses, a common 26-year period for 22 of the gages was used. The results were tabulated and presented graphically. The coefficient of variation provided the most satisfactory applied measure of variability for semidesert or desert precipitation. Product-moment correlations and stepwise multiple regression analyses were also calculated from the rainfall data comparing these with station elevation and location in respect to the eastern and southern peaks of the Santa Rita Mountains. The effectiveness of precipitation on vegetation and soil moisture in the area was discussed and the typical effects to be found within the Experimental Range were depicted by tables and graphs. (Affleck-Arizona)
W69-02989

HYDROLOGIC DATA: 1967 - VOLUME IV: SAN JOAQUIN VALLEY.
California Resources Agency. Dept. of Water Resources.
For primary bibliographic entry see Field 02E.
For abstract, see .
W69-03068

RAINFALL INTENSITY AND ELEVATION IN SOUTHWESTERN IDAHO,
Michigan Univ., Ann Arbor.
Charles F. Cooper.
Water Resources Res, Vol 3, No 1, pp 131-137, 1967. 7 p, 4 fig, 2 tab, 7 ref.

Descriptors: *Rainfall intensity, *Elevation, *Mountains, *Idaho, *Frequency analysis, Thunderstorms.

There is no apparent relationship between elevation and the intensity of spring and summer rainfall in a 93-sq-mi area with a range of 3,500 ft in elevation in semiarid southwestern Idaho. Analysis covered 4 years' data from recording rain gages with an average density of 1 per sq mi. Rainfall bursts amounting to 0.10 in. or more are considered. The maximum intensity recorded was 0.49 in. falling at 9.8 in. per hr. Rainfall in excess of 0.8 in. per hr occurred an average of once a yr. The logarithm of the amount of rain falling in excess of a given intensity plots as a straight line against intensity. There is no difference in this relationship when the data are separated by elevation classes. The amount of rainfall decreases by about 1/2 with each 1-in.-per-hr increase in rainfall rate. This ratio may be a characteristic of the regional climate. It is suggested that data from accessible valley stations can be used to estimate the relative frequency of high intensity rains throughout an area of appreciable range in elevation.
W69-03087

UNITED STATES TRITIUM RAINOUT AND ITS HYDROLOGIC IMPLICATIONS,
Geological Survey, Washington, D. C.
G. L. Stewart, and R. K. Farnsworth.
Water Resources Res, Vol 4, No 2, pp 273-289, April 1968. 9 fig, 2 tab, 7 ref.

Descriptors: *Tritium, *Tracers, *Radioactivity, Water quality, Precipitation, Tagging, Radioactive dating.
Identifiers: *Tritium rainout, Isotopes.

Information on tritium input to the hydrological environment is necessary before the tritium can be used as a tracer in hydrologic studies. Data are presented on tritium concentrations and tritium rainout for 1964 and 1965 at 15 precipitation stations in conterminous United States, Alaska, and Puerto Rico. These data show that the major increase in tritium rainout observed in 1963 was followed by noticeable declines during 1964 and 1965. Patterns of tritium rainout are characterized by increases in tritium rainout with northern latitudes and with distance from the oceans. The tremendous tritium pulse added to the hydrologic environment by nuclear devices can be useful in future hydrologic investigations, provided that caution is used in interpreting tritium data and that conclusions are based on sound hydrologic principles. The tritium data now available makes it possible to estimate present and past tritium input levels at any location in the United States with an accuracy sufficient for most practical hydrologic applications. (Steinhilber-USGS)
W69-03121

SOCIAL IMPACT OF METEOROLOGICAL DROUGHT IN ILLINOIS,
Illinois Univ., Urbana. Dept. of Geography.
Alfred W. Booth, and Don Voeller.
Water Resources Center. Report no. 9, March 1967, Washington, D. C. 31 p, 12 ref. OWRR Project A-007-Ill.

Descriptors: *Drought, *Social impact of drought, *Illinois.

Drought invariably infers a shortage of moisture in one context or another, wherein a situation of stress evolves; and attempts have been made to develop a procedure whereby the relative and absolute impact of this phenomenon can be measured. It was proposed to test the validity of meteorological drought, as defined by the recently derived Palmer Index, by comparing the variability of drought in Illinois, as indicated by the index, with the effects of this phenomenon on various sectors of the State's society. The research was based on the hypothesis that the impact of drought on the social realm varies as drought severity varies. Due primarily to the lack of long-term, readily available data and of developed methodology for isolating the effects of natural phenomenon on man and his activities, little conclusive objective evidence was obtained; however, it appears that drought has variable impact: (1) from one sector of society to another at a given time, (2) within the same sector of society in given areas at a given time, (3) in given sectors of society through space, and (4) through time on society as a whole, all because of the dynamic nature of man's culture which enables him to better cope with the vagaries of nature on the one hand and results in his becoming more susceptible to them on the other.
W69-03193

2C. Snow, Ice, AND Frost

INFILTRATION, OVERLAND FLOW, AND SOIL MOVEMENT ON FROZEN AND SNOW-COVERED PLOTS,
Forestry Sciences Lab., Moscow, Idaho.
For primary bibliographic entry see Field 02A.
For abstract, see .
W69-03060

RADIATION AND SNOWMELT ON A CLEAR-CUT WATERSHED,
Northeastern Forest Experiment Station, Durham, N. H.
C. A. Federer.
Proc of 1968 Annu East Snow Conf, Boston, Mass, Vol 13, pp 28-42, Feb 1968. 5 fig, 4 tab, 7 ref.

Descriptors: *Snowmelt, *Surface runoff, *Demonstration watershed, *Clear-cutting, Energy budget, Albedo, Watershed management, Water yield, New Hampshire.
Identifiers: Hubbard Brook Experimental Watershed.

Daily snowmelt on a clearcut watershed in central New Hampshire was estimated by using the energy balance. In melt periods, net solar radiation provided sufficient energy for melt and a small amount of evaporation; heat gain by convection was about equal to loss by net longwave radiation. Great spatial variation in slash density caused corresponding variation in net radiation and snowmelt. Clear-cutting did not advance snowmelt runoff very much in spite of large quantities of slash. Apparently the slash-covered watershed behaves quite similarly to the forested watershed in melt rate. (Knapp-USGS)
W69-03078

VELOCITY OF COMPRESSIONAL WAVES IN POROUS MEDIA AT PERMAFROST TEMPERATURES,
Chevron Research Co., La Habra, Calif.
A. Timur.
Geophys, Vol 33, No 4, pp 584-595, Aug 1968. 6 fig, 2 tab, 17 ref.

Descriptors: *Permafrost, *Porous media, Geophysics, Seismic properties, Subsurface investigations, Interstices.
Identifiers: Acoustic logging, Seismic exploration.

Data is presented on compressional wave propagation in frozen rocks as an aid in seismic exploration and acoustic log interpretation in permafrost. Velocity measurements were made of compressional waves in consolidated porous media within a temperature range of 26-36 deg C. The data indicate that compressional wave velocity increases with decreasing temperature in water-saturated rocks, whereas the velocity is nearly independent of temperature in dry rocks. Also the shapes of the velocity-temperature curves are functions of lithology, pore structure, and the nature of the interstitial fluids. Above the cryohydric temperature, compressional wave velocities may be estimated by using a three-phase, time-average equation; whereas below the cryohydric temperature, a two-phase, time-average equation may be used. Limited field data for compressional wave velocities in permafrost indicate that pore spaces in permafrost contain not only liquid and ice, but also gas. Therefore, the nature and percentages of pore saturants should be determined before making velocity estimates with the time-average equations. (Steinhilber-USGS)
W69-03090

2D. Evaporation and Transpiration

PREDICTING DISSOLVED OXYGEN CONCENTRATION IN A LAKE COVERED WITH EVAPORATION SUPPRESSANT,
Bovay Engineers, Inc., Houston, Tex.
M. T. Amad.
J Water Pollut Contr Federation, Vol 40, No 11, Part 2, pp R423-R433, Nov 1968. 11 p, 4 fig, 1 tab, 13 ref.

Descriptors: *Dissolved oxygen, *Monomolecular films, *Evaporation control, *Lakes, Hexadeconal, Octadecanol, Diffusion, Biodegradation, Environmental engineering.
Identifiers: *Oxygen balance, Evaporation suppressant.

An experimental and theoretical study undertaken to evaluate the diffusion of oxygen into water from the atmosphere through a monomolecular film of an evaporation suppressant (Hexadecanol-octadecanol mixture) under quiescent conditions revealed that the oxygen-uptake rate of organisms in a body of water can be measured and then introduced into a mathematical equation to predict the lowest dissolved oxygen concentration in the water during the early morning hours when the oxygen concentration is most critical. The oxygen-transfer rates in distilled water at 21 degrees and 36C treated with suppressant were 74 and 84%, respectively, of rates in untreated distilled water. Water from a pond containing 194 mg/l dissolved solids that was treated with suppressant showed 89.6 and 92.6% of the rate coefficients for untreated water at 21 and 36C, respectively. The temperature dependence of the diffusion coefficient can be expressed as ($K_t = K_{20}$) times a constant to the power (t-20); the constant is 1.047 for untreated water and 1.053 for treated water. Theoretical and measured values for minimum DO agreed closely. (Knapp-USGS)
W69-02825

THE CONCEPT OF POTENTIAL EVAPOTRANSPIRATION IN ARID ZONE AGRICULTURE,
National and Univ. Inst. of Agriculture, Rehovoth (Israel).
G. Stanhill.
Unesco Arid Zone Research, Vol 25, pp 109-117, 1965. 9 p, 5 fig, 2 tab, 28 ref.

Descriptors: *Evapotranspiration, *Meteorological data, Evaporation, Water loss, *Evaporation pans, Water requirements, *Agriculture, *Arid climates, Crop response, Moisture deficit, Irrigation efficiency, Soil moisture, Vapor pressure, Measurement, Microenvironment.
Identifiers: Penman's formula, Agrometeorology, Potential evapotranspiration.

An examination was made of the accuracy of eight widely used meteorological methods of estimation using data taken at Gilat in the arid region of southern Israel. The methods based on open water evaporation, either estimated from Penman's meteorological formula or measured in an evaporation tank, gave the most accurate estimate with the smallest error term. The use of Penman's formula was preferred since it offered the possibility of analysing the relative importance of various climatic factors in determining rate of water loss under nonlimiting soil moisture conditions. For agricultural purposes, use of measured or calculated open water evaporation with empirically derived reduction constants appeared to give the possibility of a practical and accurate method of irrigation control. (Blecker-Arizona)
W69-02967

AN ELECTRIC HYGROMETER APPARATUS FOR MEASURING WATER-VAPOUR LOSS FROM PLANTS IN THE FIELD,
Western Australia Univ., Nedlands; and Botanic Gardens, St. Louis, Mo.
B. J. Grieve, and F. W. Went.
Unesco Arid Zone Research, Vol 25, pp 247-257, 1965. 11 p, 7 fig, 2 tab.

Descriptors: *Hygrometry, *Moisture content, Atmosphere, *Water vapor, Humidity, *Leaves, Instrumentation, *Electrical equipment, Measurement, Desert plants, Weight, On-site tests, Plants, Boundary layers.

The sensing hygrometer apparatus described makes possible instantaneous determination of water-vapor loss using leaves intact on the plant. A better estimation of over-all daily water-vapor loss was possible since the speed of use allows numerous observations to be made on selected leaves in the course of a day. It is inherent in the electric hygrometer sensing method that the moving stream of air around the enclosed leaves disturbed the vapor shells or boundary layers. For field studies of water vapor loss involving comparison of rates in a number of character plants at a given station there were a number of advantages in the use of the electric hygrometer method over the cut and weigh method. (Blecker-Arizona)
W69-02968

ANTI-TRANSPIRANTS AS A RESEARCH TOOL FOR THE STUDY OF THE EFFECTS OF WATER STRESS ON PLANT BEHAVIOUR,
Hebrew Univ., Jerusalem (Israel). Dept. of Botany.
For primary bibliographic entry see Field 03F.
For abstract, see .
W69-02986

A NOTE CONCERNING THE EDDY TRANSFER COEFFICIENTS OF MOMENTUM AND WATER VAPOR UNDER NEAR-ADIABATIC CONDITIONS,
Geological Survey, Denver, Colo.
G. Earl Harbeck, Jr.
Water Resources Res, Vol 3, No 1, pp 201-202, 1967. 2 p, 1 tab, 5 ref.

Descriptors: *Evaporation, *Wind, *Vapor pressure, *Eddies, Turbulence, Temperature, Humidity.
Identifiers: Eddy transfer coefficients.

Data from the Lake Hefner evaporation study of 1950-51 were used to compute the eddy transfer coefficient for momentum and the eddy transfer coefficient for water vapor. For approximately adiabatic conditions the 2 coefficients were found to be almost exactly equal. (Knapp-USGS)
W69-03051

EVAPORATION FROM LARGE DEEP LAKES,
Great Lakes-St. Lawrence Study Office, Cornwall (Ontario). Dept. of Mines and Technical Surveys.
Fred I. Morton.
Water Resources Res, Vol 3, No 1, pp 181-200, 1967. 20 p, 6 fig, 10 tab, 9 ref.

Descriptors: *Evaporation, *Lakes, *Energy budget, Great Lakes, Limnology, Hydrology, Water budget, Radiation, Heat budget, Precipitation (Atmospheric), Temperature, Solar radiation.
Identifiers: Lake Superior, Lake Ontario.

Derived insolation and water budget evaporation data for Lake Superior and Lake Ontario are analyzed in terms of both the regional and the water surface energy balances. The results indicate that the seasonal pattern of evaporation is governed by heat storage changes, and that these changes are closely associated with atmospheric energy export from the lake. This finding provides a physical basis for the simple empirical relationships between monthly evaporation and island-to-mainland temperature differentials that are developed from the water budget evaporation data. Substantial atmospheric energy export, a concomitant of heat storage changes, reduces the energy available for evaporation. Therefore, evaporation from a large deep lake is less than that from a large shallow lake under comparable climatic conditions. The analysis also provides speculative reasoning and evidence to indicate that evaporation from a large deep lake is closely related to the radiant heat transfer to the sky.
W69-03083

A SIMPLE EVAPORIMETER FOR USE IN COLD AREAS,
Department of Agriculture, Summerland (British Columbia). Research Station.
For primary bibliographic entry see Field 07B.
For abstract, see .
W69-03115

THE EFFECT OF APPLIED INTERCEPTION ON TRANSPIRATION RATES OF POTTED PONDEROSA PINE,
Arizona Univ., Tucson. Dept. of Watershed Management.
For primary bibliographic entry see Field 02I.
For abstract, see .
W69-03116

RELATION OF SOIL PROPERTIES TO THE EVAPORATION OF WATER FROM SOILS,
Clemson Univ., S. C. Agricultural Experiment Station.
T. C. Peele.
Agronomy and Soils Research Series No. 70, Aug 1968. 20 p, 3 tab, 11 fig, 4 ref. OWRR Project A-006-SC.

Descriptors: *Evaporation, *Soil moisture, *Soil properties, Moisture conservation, Cultivation, Bulk density, Soil texture, Soil physics.

Effects of texture, bulk density, and cultivation on evaporation of water from bare soils was investigated using tanks placed in the soil. Evaporation from sand, sandy loam, and sandy clay loam was higher than the evaporation from a U. S. Weather Bureau Class A Type Evaporation Pan during the first three days after wetting to 3 percent above field capacity. Cultivation three days after wetting caused a temporary increase in the rate of water loss followed by lower rates of water loss except from the sand. Cultivation had little effect on the rate of evaporation from the sand except the temporary increase immediately after cultivation. The moisture contents of the soils below the 2-inch depths were appreciably higher in the cultivated than the non-cultivated soils at the end of the 19-day drying period except the sand which showed little effect of cultivation on the moisture content below the 2-inch depth.
W69-03175

CORRELATING SOIL MOISTURE CONDITIONS AND MICROCLIMATE WITH EVAPORATION LOSSES AND WATER REQUIREMENTS OF PLANTS,
South Dakota State Univ., Brookings.
Maurice L. Horton.
South Dakota Water Resources Research Institute. Research Project Technical Completion Report, September 1968. 11 p, 2 ref. OWRR Project A-005-SDak.

Descriptors: Solar radiation, Microclimate, *Evapotranspiration, Lysimeter, Soil water.

Full utilization of water resources in crop production requires reliable information about the climate and the manner in which energy and water are used. Evapotranspiration is a basic parameter used in water resource planning and development that tends to reflect the availability of energy and water. Micrometeorological measurements made in an irrigated grain sorghum field provided information about the supply and distribution of energy and water for a subhumid region in north central South Dakota. During the growing season, solar and sky radiation (Eppley) was 300 to 600 cal. cm. (-2) day (-1) with maximum values near 650 cal. cm. (-2) day (-1). Net radiation averaged approximately 70% of the Eppley values. Standard pan evaporation was 0.5 to 0.6 cm. day (-1) with maximum values near 1.0 cm. day (-1). Evapotranspiration rates for grain sorghum grown in weighing lysimeters were generally 0.3 to 0.6 cm. day (-1) with peak values of 1.0 cm. day (-1). Rates calculated from a water budget as determined from water content measurements were in general agreement with lysimeter values.
W69-03198

2E. Streamflow and Runoff

HYDROLOGIC FORECASTS, PREDICTION PERIODS, RELIABILITY AND EXPERIENCE USING THEM IN WATER RESOURCES SYSTEMS,
For primary bibliographic entry see Field 06A.
For abstract, see .
W69-02802

LOW STREAMFLOW IN THE MYAKKA RIVER BASIN AREA IN FLORIDA,
Geological Survey, Tallahassee, Fla.
H. N. Flippo, Jr., and B. F. Joyner.
Florida Board of Conserv, Rep of Invest No 53, 34 p, 1968. 5 fig, 6 tab, 11 ref.

Descriptors: *Streamflow, *Low flow, *Base flow, *Droughts, *Florida, Hydrogeology, Stream gages, Duration curves, Water quality, Water utilization.
Identifiers: *Myakka River (Florida).

Streamflow data, collected in the Myakka River basin area since 1936 and supplemented by means of a more complete network of stream-gaging stations since 1963, indicate that all non-tidal reaches of streams in the area ceased natural flows during at least five droughts since 1938. Many of these non-tidal reaches go virtually dry during the late spring of most years. Effective utilization of streamflow is restricted by these frequent droughts and a limited choice of practicable storage sites. Upper and Lower Myakka Lakes, through which the Myakka River flows, occupy two of the largest natural depressions in the area and have a total storage capacity of approximately 8,100 acre-feet. Average discharge at a stream-gaging station located between these lakes is 266 cfs or about 192,000 acre-feet per year. Draft-storage studies indicate that these lakes will provide a continuous draft of at least 6.5 mgd, provided their storage potential is adequately developed. Surface waters that are derived from natural drainage are of good quality, except for occasional high color and temperatures of about 90 deg F during the summer months. In many channels in low lying areas, low flows are often supplemented by waters of relatively high dissolved solids content derived from irrigation wells and domestic waste.
W69-02808

THE TEMPORAL AND SPATIAL DISTRIBUTION OF DISSOLVED OXYGEN IN STREAMS,
Manhattan Coll., Bronx, N. Y.
For primary bibliographic entry see Field 05A.
For abstract, see .
W69-02809

DERIVATION OF BASIN HYDROGRAPHS,
Kansas Water Resources Research Inst., Manhattan.
Robert L. Smith, and Alan M. Lumb.
Kans Water Resources Res Inst, Proj Completion Rep, 28 p, 1966. 8 fig, 16 ref, 2 append. OWRR Proj A-003 Kan.

Descriptors: *Rainfall-runoff relationships, *Mathematical models, *Hydrographs, Kansas, Hydrologic budget, Evapotranspiration, Groundwater movement, Routing, Storage, Soil water movement, Digital computers, Computer models, Computer programs.
Identifiers: Thiessen polygon.

A mathematical model of the land phase of the hydrologic cycle is being developed with special attention directed toward the nature and extent of available data in Kansas. Areal non-uniformity of rainfall is handled by subdividing the basin with a Thiessen polygon. Daily accounting is used whenever daily precipitation is less than 0.1 in.; for greater amounts hourly accounting is utilized. Subsurface zones include an upper and lower soil zone plus a groundwater zone. The latter is limited to the alluvial portion of the basin. Sub-surface drainage elsewhere in the basin is treated as interflow in response to geologic and topographic considerations. Evapotranspiration calculations utilize a potential rate based on mean daily temperature and discounted for moisture availability and depth. Hydrograph development in the initial model was based on a daily distribution graph. A lag and route procedure involving the use of distributed storage within the basin is being developed. Initial test results were satisfactory and continued development and testing is underway. A Fortran listing of the model is included.
W69-02811

LOW-FLOW AND BASIN CHARACTERISTICS OF TWO STREAMS IN NORTHERN VERMONT,
Agricultural Research Service, Danville, Vt. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 02A.
For abstract, see .
W69-02814

CARACTERIZAREA HIDROLOGICA A ANULUI 1966 (HYDROLOGICAL CHARACTERIZATION OF 1966),
Dumitru Lazarescu.
Hidrotehnica, Gospadarirea Apelor, Meteorologia, (Bucharest), Vol 12, No 7, p 351-55, 1967. 3 figs, 2 tables, 6 ref.

Descriptors: *Hydrologic cycle, *Streamflow, Water levels, Histograms, Average flow, Volume, Freezing, Melt water.
Identifiers: *Rumania, *Freezing waterways.

Hydrological conditions during 1966 in Rumania are compared with tabulated data from previous years. In general, the year was characterized by ample water supplies from March--May and lower levels from September--November. A high stage was noted in February. Maximum and minimum values of average annual flow, measured at various hydrological stations, are provided for thirty streams in Rumania. Histograms show values for average annual flow throughout the year. The monthly distribution of stream velocity and volume is tabulated for 12 rivers, and line graphs are presented to show monthly variations. The phenomena of freezing waterways was registered in January and February, but only in the Siret and Somes basins in December. This suggests that the melting ice accounted for higher water levels in February. Downstream on the Dunare River, floating ice was observed for several days. (Llaverias-USGS)
W69-02815

FLOODS IN WAIMANALO AREA, OAHU, HAWAII,
Geological Survey, Washington, D. C.
Reuben Lee, and William C. F. Chang.
U S Geol Surv, Hydrol Invest Atlas HA-314, 1 sheet, 1968. Text, 6 fig, 6 ref.

Descriptors: *Floods, *Hawaii, Discharge (Water), Stage-discharge relations, Streamflow, Flow measurement.
Identifiers: *Waimanalo (Oahu-Hawaii), Discharge-frequency, Stage-frequency, Flood data, Flooded area.

Hydrologic data on flooding in the Waimanalo area, Oahu, Hawaii, are presented in a 1-sheet Hydrological Atlas. The approximate areas inundated by the floods of November 12-14, 1965 are delineated on a topographic map scaled 1:12,000. Graphs show floods greater than 1,200 cfs, discharge-frequency relations, and stage-frequency relations. Recurrence intervals are tabulated. (Knapp-USGS)
W69-02818

WATER RESOURCES RESEARCH: ASPECTS OF A REGIONAL STUDY IN THE HUNTER VALLEY, NEW SOUTH WALES,
Monash Univ., Clayton (Australia).
T. A. McMahon.
J Hydrol, Vol 7, (1969), No 1, pp 14-38, Nov 1968. 25 p, 13 fig, 2 tab, 43 ref.

Descriptors: *Water resources, *Regional analysis, *Hydrologic data, Climatic data, Low flow, Base flow, Recession curves, Hydrographs, Storage, Streamflow, Water yield, Gaging stations, Duration curves.
Identifiers: *New South Wales (Australia), Hunter Valley (NSW), Flow duration.

The methods used within a regional analytical framework to survey and interpret the yield and low-flow characteristics of streams in the Hunter Valley, New South Wales are described. These methods may be grouped under three heads: the study of unregulated streams (yield, flow duration and low flow frequency analyses), the study of regulated streams (storage-draft analyses) and regional extrapolation procedures. For those particular techniques examined where the approach is not generally well known, the relevant literature is reviewed, the methodology is discussed and the general procedure for interpretation of the analysis is set down. Pertinent examples using Hunter Valley data are included.
W69-02819

FLOOD OF AUGUST 1966 AT CARLSBAD, NEW MEXICO,
Geological Survey, Washington, D. C.
L. P. Denis.
U S Geol Surv Hydrol Invest Atlas HA-318, 1 sheet, 1968. Text, 3 fig.

Descriptors: *Floods, *New Mexico, Discharge (Water), Stage-discharge relations, Streamflow, Flow measurement.
Identifiers: *Carlsbad (New Mexico), Discharge-frequency, Stage-frequency, Flood data, Flooded area.

The extent of flooding on August 23, 1966, at Carlsbad, New Mexico, is described in a 1-sheet Hydrological Atlas. The inundated area is delineated on a city street map scaled about 1,000 ft per in. Graphs show annual floods above 3,090 ft elevation, discharge-frequency relations, and the profile of the August 23, 1966 flood. Recurrence interval and stage data of historic floods are tabulated. (Knapp-USGS)
W69-02820

TRACER MEASUREMENT OF STREAM REAERATION. II. FIELD STUDIES,
Georgia Inst. of Tech., Atlanta; Arctic Health Research Center, Fairbanks, Alaska; and Southwestern Radiological Health Lab., Las Vegas, Nev.
E. C. Tsivoglou, J. B. Cohen, and S. D. Shearer.
J Water Pollut Contr Federation, Vol 40, No 2, Part 1, pp 285-305, Feb 1968. 21 p, 3 fig, 6 tab, 10 ref.

Descriptors: *Reaeration, *Surface waters, *Instrumentation, *Tracers, *Radioisotopes, Tritium, Dye releases, Dissolved oxygen, Dispersion, Diffusion.
Identifiers: Krypton.

A tracer method for accurate and independent measurement of the gas transfer and reaeration capacity of natural streams is presented. Instantaneous point dosing of 3 tracers-a fluorescent dye (rhodamine-WT), a dispersion indicator (tritium), and a gaseous tracer (krypton-85) is used. The dye gives information on flow time and longitudinal dispersion and indicates when to sample the other 2 tracers. Tritium is not lost from the flow, and provides an accurate dispersion measure. Krypton-85 disperses like tritium and also is lost to the atmosphere by gas transfer. Comparison of krypton and tritium accurately evaluates the reaeration rate for krypton. The relationship between the reaeration rates of Kr and O is well known. The method was checked in the laboratory and in the Jackson River of Virginia and West Virginia. (Knapp-USGS)
W69-02821

WATER RESOURCES OF THE MUSTINKA AND BOIS DE SIOUX RIVERS WATERSHED WEST-CENTRAL MINNESOTA,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02F.
For abstract, see .
W69-02829

URBANIZATION AND ITS EFFECT ON THE TEMPERATURE OF LONG ISLAND STREAMS,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 05A.
For abstract, see .
W69-02830

THE INITIAL PHASE OF THE RISING HYDROGRAPH OF TURBULENT FREE SURFACE FLOW WITH UNSTEADY LATERAL INFLOW,
Cornell Univ., Ithaca, N. Y.
Wilfried Brutsaert.
Water Resources Res, Vol 4, No 6, pp 1189-1192, December 1968. 4 p, 7 ref.

Descriptors: *Overland flow, *Unsteady flow, *Open channel flow, Mathematical studies, Chezy equation, Continuity equation, Mannings equation.
Identifiers: *Kinematic wave theory, St. Venant equations.

An exact solution is obtained for the de Saint Venant equations describing flow over a plane or in a very wide channel with a general turbulent friction law and with a uniform lateral inflow as a power function of time valid for the space-time domain bounded by x between 0 and L, $t = 0$, by the forward characteristic originating at $x = 0$, $t = 0$, and by the backward characteristic originating at $x = L$, $t = 0$. The quantity L denotes the length of the flow region, x the direction of flow, and t the time. It was found that, for very small values of time, the uniform flow velocity is everywhere directly proportional to t regardless of the nature of the lateral inflow. For a very large slope or a large roughness of the plane, or for a very small constant lateral inflow, the present solution reduces to the result obtainable with the kinematic wave approximation.
W69-02837

FLOODS ON CHENANGO RIVER AND CANASAWACTA CREEK AT NORWICH, NEW YORK,
Geological Survey, Washington, D. C.
Stephen Hladio.
U S Geol Surv Hydrol Invest Atlas HA-297, 1 sheet, 1968. Text, 4 fig, 1 map.

Descriptors: *Floods, *New York, Stage-discharge relations, Ice jams, Discharge (Water), Profiles, Flood protection.
Identifiers: *Chenango River Basin (NY), *Flood profiles, Recurrence intervals, Inundation.

Hydrologic data pertaining to the extent, depth, and frequency of flooding that may be expected

long Chenango River and Canasawacta Creek ear Norwich, New York, are presented in a 1-heet hydrological Atlas report. A map, scaled :12,000 shows topography and areas inundated by loods with recurrence intervals of 5,25, and 50 ears and one ice jam flood on Canasawacta Creek. igures show annual flood heights above 1046.2 ft n the Chenango River, above 1082.6 feet on anasawacta Creek, flood profiles on Chenango iver and Canasawacta Creek, and stage-frequen-y relations of floods. (Knapp-USGS)
W69-02839

EVALUATION OF ZINGG CONSERVATION BENCH TERRACES ON AMARILLO FINE SANDY LOAM SOIL.
Agricultural Research Service, Big Spring, Tex.; and Agricultural Research Service, Chichasha, Okla.
D. V. Armbrust, and N. H. Welch.
J Soil and Water Conserv, Vol 21, No 6, pp 224-226, Nov-Dec 1966. 3 p, 3 fig, 3 tab.

Descriptors: *Soil conservation, Water conservation, *Erosion control, *Terracing, *Surface runoff, Infiltration, *Rainfall intensity, *Loam, Moisture content, Bench leveling, Soil moisture, Crop response, Sands, Fine-textured soils, Storage capacity.

The Zingg terrace system was designed to control water erosion and conserve and distribute runoff water. The conservation bench terraces were constructed on Amarillo fine sandy loam soil at Big Spring, Texas. The bench terraces increased crop yields only 1 year in 4--an insignificant increase. The failure can be partially explained by the soil. The soil had a high intake rate and a small soil moisture storage capacity: about 4 inches of available water in the top 4 feet of soil. Runoff was limited to large rains, high-intensity rains, or rains that followed a previous rain within a day or two. Amount and distribution of rainfall may also partially explain the failure of the terraces to produce higher crop yields. Bench terraces could possibly be used in arid climates to conserve and distribute runoff water. (Blecker-Arizona)
W69-02971

FLOOD PLAIN INFORMATION, HARPETH RIVER, FRANKLIN, TENNESSEE.
Corps of Engineers, Nashville, Tenn.

U S Army Corps of Eng, Nashville Dist, Nashville, Tenn Rep, 37 p, July 1968. 8 fig, 11 plate, 7 tab.

Descriptors: *Floods, *Tennessee, *Flood damage, *Flood protection, Non-structural alternatives, Flood plain zoning, Floodproofing.
Identifiers: Franklin (Tenn), Harpeth River (Tenn).

Flooding of the Harpeth River in Franklin, Tenn. is described to aid in the solution of local flood problems and in planning land use for the area subject to flooding. Records of the largest known past floods are listed. Probable future floods are calculated. Maps, profiles, and cross sections show the extent of flooding in the past and what might take place in the future. Most of Franklin is on high ground west of the river but some residential and commercial development is on the flood plain. Flood plain zoning for parks and other uses that are not damaged by flooding is recommended. Corrective measures for present developments include floodproofing by closing lower openings of buildings, waterproofing walls and floors, installing removable bulkheads over doors, and other structural changes. (Knapp-USGS)
W69-03041

UNSTEADY FLOW IN OPEN CHANNELS,
Belgrade Univ. (Yugoslavia).
Dragutin Muskatirovic.
Translation from Proc Institut za Paljaprivredu 'Jaroslav Cerni' Vol 14, No 41-42, pp 49-54, 1967. TT67-58016.

Descriptors: *Unsteady flow, *Open channel flow, *Mathematical models, Digital computers, Dam failure, Routing, Streamflow forecasting.
Identifiers: St. Venant equations, Finite differences methods, Method of characteristics.

The hydraulic regime, usually involving unsteady flow, in natural and artificial open channels is studied and a general mathematical model for its solution is proposed. The general cases considered are flood wave transformation and propagation in natural watercourses, influence of reservoirs on water levels and discharges both up and downstream, analytical and model study of the hydraulic consequences of dam breaking, and the development of calculation methods and procedures to simplify calculations in routine practice, particularly by using computers. The mathematical model is based on St. Venant's equations. Solutions are obtained by the method of characteristics, finite difference methods, and empirical methods. Several practical solutions are presented for the cases discussed. Literature is cited for specific detailed discussion of each case. (Knapp-USGS)
W69-03044

HYDROLOGIC DATA: 1967 - VOLUME IV: SAN JOAQUIN VALLEY.
California Resources Agency. Dept. of Water Resources.

Calif Dep of Water Resources, Bull No 130-67, 321 p, 1968. 7 fig, 4 plate, 26 tab.

Descriptors: *Data collections, *Hydrologic data, *California, Climates, Streamflow, Groundwater, Water levels, Water level fluctuations, Recharge, Water quality, Water wells.
Identifiers: *San Joaquin Valley (California), Water level measurements, Periodic observations.

Annual hydrological data are compiled for the San Joaquin Valley, California, 1967. Tables show data on climate, surface water flow, ground water levels, ground water recharge, and surface and ground water quality in the San Joaquin Valley for the 1966-67 water year. Figures show location of climatological, surface water, and surface water quality measurement stations; fluctuation of water levels in selected wells and areas; and electrical conductance at selected stations. Plates show lines of equal elevation of water in wells in spring 1967, profile of ground water levels, cooperative study area, ground water level changes, and well locations. (Knapp-USGS)
W69-03068

ANALYTICALLY DERIVED UNIT GRAPH AND RUNOFF,
Tennessee Valley Authority, Knoxville.
For primary bibliographic entry see Field 02A.
For abstract, see .
W69-03069

RUNOFF HYDROGRAPHS FOR MATHEMATICAL WATERSHED MODEL,
Minnesota Univ., St Paul. Dept. of Agricultural Engineering.
Roger E. Machmeier, and Curtis L. Larson.
ASCE Proc, J Hydraul Div, Vol 94, No Hy6, Pap 6248, pp 1453-1474, Nov 1968. 22 p, 7 fig, 5 tab, 22 ref.

Descriptors: *Mathematical models, *Unit hydrographs, *Routing, Synthetic hydrology, Rainfall-runoff relationships, Digital computers, Computer programs, Watersheds (Basins).
Identifiers: Finite difference methods, Non-linear runoff-discharge relations.

A mathematical model of the channel system of a 21.35-sq mile watershed was developed. The partial-differential equations of momentum and continuity were expressed in finite difference form, and used to route the unsteady flow through the channel system, yielding outflow hydrographs. Rainfall excess in various rates and durations was used as the input to the model. All the hydrologic time parameters evaluated from the model output varied with the supply rate. If the response of the watershed model can be considered representative of a natural watershed, none of the presently defined time parameters should be considered constants for a given watershed. The time to virtual (97% of) equilibrium varied inversely as the 0.23 power of the supply rate. The peak-flow rates showed a nonlinear relationship to runoff amount for a given duration. Peak discharges obtained with the model watershed do not support the unit-hydrograph principle but add to the existing evidence of runoff nonlinearity. (Knapp-USGS)
W69-03070

RADIATION AND SNOWMELT ON A CLEAR-CUT WATERSHED,
Northeastern Forest Experiment Station, Durham, N. H.
For primary bibliographic entry see Field 02C.
For abstract, see .
W69-03078

FLOOD OF JUNE 7, 1967, IN THE WAPSINONOC CREEK BASIN, IOWA,
Geological Survey, Iowa City, Iowa.
Harlan H. Schwob.
U S Geol Surv open-file rep, Jan 1968. 16 p, 3 fig, 1 tab, 1 ref, 1 append.

Descriptors: *Floods, *Iowa, *Data collections, *Small watersheds, Discharge (Water), Stage-discharge relations, Hydrographs, Stream gages, Historic flood, Rain.
Identifiers: Wapsinonoc Creek (Iowa), Flood data, 50-year flood.

An outstanding flood occurred in the Wapsinonoc Creek basin in east-central Iowa on June 7, 1967. The flood was the result of rainfall totaling from 4 to 13 in. in about 14 hours on the night of June 6 and the morning of June 7. The storm was nearly centered over the 180-sq-mi basin. The resulting peak discharges ranged from about 1.9 to about 4.3 times the 50-yr recurrence interval flood. A peak discharge of 27,400 cu ft per second was measured from 161 square miles of the basin. This and other peak discharges for drainage areas larger than 40 sq mi were among the greatest recorded in the last 50 yr in eastern Iowa. Flood damage was light because the basin is used primarily for agriculture and the crops were in their early growth stage. There was no loss of human life attributed to the flood.
W69-03085

STATISTICAL TESTS FOR COMMON BANKFULL FREQUENCY IN RIVERS,
New South Wales Univ., Kensington (Australia). Dept. of Statistics; and Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Land Research.
C. A. McGilchrist, and K. D. Woodyer.
Water Resources Res, Vol 4, No 2, pp 331-334, April 1968. 4 p, 2 tab, 6 ref.

Descriptors: *Frequency analysis, *Floods, Statistics, Flood plains, Rivers, Geomorphology, Streamflow, Channel morphology.
Identifiers: *Bankfull frequency, Australia (New South Wales).

Two statistical tests are described for investigating the claim that rivers exceed bankfull level with a common frequency. The first test is necessary to demonstrate that vertically adjacent bench level categories at a site are separate in terms of expected recurrence intervals, The second test examines the homogeneity of bankfull frequencies from site to site for each bench level category. The tests were used to examine data from nine stream gaging sites in New South Wales, Australia. It was shown that three distinct bench levels could be identified in the field. The bankfull frequencies as-

sociated with the present flood-plain level were shown to form a homogeneous population of bankfull frequencies.
W69-03096

REVIEW AND ANALYSIS OF RAINFALL AND RUNOFF DATA FOR SELECTED WATERSHEDS IN MINNESOTA,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
For primary bibliographic entry see Field 02A.
For abstract, see .
W69-03098

METHODS OF FLOW FREQUENCY ANALYSIS,
Inter-Agency Committee on Water Resources, Washington, D. C. Subcommittee on Hydrology.
W. D. Potter, Manuel A. Benson, and Charles B. Pletcher.
Subcommittee on Hydrol, Inter-Agency Comm on Water Resources Bull No 13, April 1966. 41 p, 15 fig, 8 tab, 34 ref.

Descriptors: *Frequency analysis, *Statistical methods, *Mathematical studies, Methodology, Hydrologic aspects, Analytical techniques, Streamflow, Stream gages, Design.
Identifiers: *Flow frequency methods, Extension of records.

Flow frequency methods now most commonly used by Federal agencies are described. The history of the development of frequency methods, including the adoption of statistical methods to frequency analysis is also discussed. The five methods of frequency analysis, which are Hazen, Pearson type III, Gumbel, Gamma distribution, and Graphical distribution-free, have much in common. Experience rather than theory has been the factor in the development of the various methods. References in which these methods are discussed in great detail and a glossary of terms used in frequency analysis are appended. (Steinhilber-USGS)
W69-03102

THE HYDRAULICS OF OVERLAND FLOW ON HILLSLOPES,
Geological Survey, Washington, D. C. Water Resources Div.
William W. Emmett.
U S Geol Surv open-file rep, 205 p, 1968. 42 fig, 7 tab, 42 ref, 6 append.

Descriptors: *Overland flow, *Rainfall-runoff relationships, *Model studies, Statistical models, Hydraulic models, Sheet erosion, Laminar flow, Turbulent flow, Sheet flow, Darcy-Weisbach equation.
Identifiers: *Hillslope hydraulics.

Field and laboratory studies were made of the rainfall-overland flow relationship by sprinkling water at a known rate on an indoor flume and on natural hillslopes. Overland flow increases downslope in depth and velocity; depth accounts for about 2/3 and velocity, 1/3 of the flow increase. Flow resistance is nearly constant in the downslope direction. Field and laboratory results agree well, but illustrate the great influence of vegetation and topography on flow resistance. Flow occurred principally in anastomosing downhill paths. The flow regime was not truly laminar because of the influence of falling raindrops and land surface irregularities. Surface erosion was observed but no rilling developed. A statistical model of overland flow was developed and showed that the slope for laminar flow increases downslope, the slope for turbulent flow decreases, and for mixed flow, the slope may be constant. Thus, hillslopes that fit the model must have convex tops, straight middles, and concave bottoms, as usually found in nature. (Knapp-USGS)
W69-03110

FLOOD RUNOFF FROM PARTIALLY URBANIZED AREAS, WICHITA, KANSAS,
Geological Survey, Lawrence, Kans.; and Wichita and Sedgwick County Flood Control Office, Wichita, Kans.
I. C. James.
U S Geol Survey open-file rep, June 1967. 62 p, 21 fig, 10 tab, 13 ref.

Descriptors: *Urbanization, *Storm runoff, *Small watersheds, Kansas, Peak discharge, Floods, Hydrologic data, Stream gages.
Identifiers: Wichita (Kansas), Unit hydrographs.

The effect of changes in urbanization on flood runoff near Wichita, Kansas was studied from rainfall, runoff, and urbanization records. Data for the first 3 years of operation of the project include the degree of urbanization as of September 1964, the maximum flood hydrographs and associated rainfall experienced during the 3 years, and the developed unit hydrographs of six study basins. The types of urbanization are presented in tabular form, categorized according to land usage or coverage, and show that imperviousness varies from 0.86 percent to 30.48 percent in the six study basins. Variations between unit hydrographs developed from individual storms are probably caused by nonuniform rainfall excess. Urbanization may quite significantly affect flood peaks. For instance, fully urbanized Dry Creek, with a drainage area of 2.94 sq. mi. of which 30.48 percent is impervious, exhibited a unit hydrograph peak nearly the same as West Branch Chisholm Creek, with a drainage area of 16.10 sq. mi. and an imperviousness of 1.85 percent, although with the effect of drainage area and slope taken into consideration, the unit peak on West Branch Chisholm Creek should be 2 to 2 1/2 times that of Dry Creek.
W69-03118

2F. Groundwater

LOW STREAMFLOW IN THE MYAKKA RIVER BASIN AREA IN FLORIDA,
Geological Survey, Tallahassee, Fla.
For primary bibliographic entry see Field 02E.
For abstract, see .
W69-02808

MISCIBLE DISPLACEMENT IN AN UNSATURATED GLASS BEAD MEDIUM,
Guelph Univ., (Ontario).
For primary bibliographic entry see Field 02G.
For abstract, see .
W69-02810

PERMEABILITY OF ORTHOTROPIC POROUS MEDIUMS,
State Univ. of New York, Buffalo.
Barna A. Szabo.
Water Resources Res, Vol 4, No 4, pp 801-808, Aug 1968. 8 p, 4 fig, 1 tab, 13 ref.

Descriptors: *Porous media, *Mohr circle, *Permeability, Darcys law, Groundwater, Hydraulics, Mathematical studies.
Identifiers: Transformation law, Orthotropic, Porous mediums.

A mathematical definition of permeability is developed from the assumption that orthotropic porous mediums obey Darcy's Law in the three directions normal to the structural planes of symmetry of the medium. This assumption leads to the conclusion that permeability obeys the transformation law definitive of second-order tensors; and that consequently a permeability quadric (the Mohr circle representation of transformation of permeability components and permeability invariants) can be defined. It was concluded that permeability, because of its transformation properties, is analogous to these conceptually unrelated physical objects. This analogy permitted the application of the Mohr circle to represent the transformation of permeability components in any principal plane. (Llaverias-USGS)
W69-02812

GROUND-WATER WITHDRAWAL IN THE ODESSA AREA, ADAMS, GRANT, AND LINCOLN COUNTIES, WASHINGTON,
Washington State Dept. of Water Resources.
A. A. Garrett.
Wash State Dep of Water Resources Water-Supply Bull No 31, 84 p, 1968. 8 fig, 1 plate, 4 tab, 4 ref.

Descriptors: *Groundwater, *Water utilization, *Irrigation, *Water level fluctuations, *Washington, Data collections, Water wells, Water levels, Hydrographs.
Identifiers: Odessa area (Washington), Adams County, Grant County, Lincoln County.

The withdrawal and use of groundwater for irrigation near Odessa, Washington, was studied by the state of Washington in cooperation with the U. S. Geological Survey. Before 1960, groundwater was used only for public supply and for individual farmsteads. Since 1960, irrigation of wheat with groundwater has become common and withdrawals have greatly increased. In 1963, 66 irrigation wells pumped a total of about 11,400 acre-feet of water. In 1965, 94 wells pumped about 22,000 acre-feet. More irrigation wells are being drilled and still others are planned in the near future. Groundwater supplies are being developed nonuniformly within the project area and, as a result, groundwater levels are declining as much as 20 ft in some areas. Most wells in the area are pumped nearly continuously during 7 months of the year and are idle during the other 5. In many parts of the project area, water levels in shallow aquifers are different in altitude from those in the deeper aquifers tapped by many large-yield irrigation wells, but pumping of some of the deeper irrigation wells has resulted in declines of water levels in some shallow wells. Simultaneous pumping of several wells has resulted in declines of as much as a foot in shallow wells as far as 3 miles distant. (Knapp-USGS)
W69-02823

VIRUS MOVEMENT IN GROUNDWATER,
Arkansas Univ., Fayetteville; and Stanford Univ., Calif.
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-02824

GROUNDWATER FLOW SYSTEMS IN THE CRYSTALLINE ROCKS OF THE OKANAGAN HIGHLAND, BRITISH COLUMBIA,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
D. W. Lawson.
Can J of Earth Sci, Vol 5, pp 813-823, 1968. 11 p, 7 fig, 3 tab, 19 ref.

Descriptors: *Aquifers, *Groundwater movement, *Crystalline rocks, *Mountains, *Valleys, Glaciation, Piezometers, Water table, Fractures (Geology), Hydraulic conductivity, Transmissivity.
Identifiers: Okanagan Highland (British Columbia), Glacial valleys, Flow systems.

An investigation, using a line of piezometers ranging in depth from 25 to 102 ft, of the relation between groundwater flow systems and topography in the Okanagan Highland revealed that the hydraulic conductivity of the crystalline rock varies exponentially with depth. Local flow systems in the upper 150 ft conduct an estimated 10-17 imperial gpd per ft thickness in a 2-dimensional flow system. These shallow flow systems are the most important aquifers in the Okanagan Highland. (Knapp-USGS)
W69-02826

SPECIFIC YIELD-COMPILATION OF SPECIFIC YIELDS FOR VARIOUS MATERIALS,
Geological Survey, Washington, D. C.
A. I. Johnson.

U S Geol Surv Water-Supply Pap 1662-D, 74 p, 1967. 19 fig, 29 tab, 65 ref.

Descriptors: *Data collection, *Specific yield, *Earth materials, Laboratory tests, On-site tests, Hydrologic properties, Specific retention, Particle size, Porous media, Laboratory tests.
Identifiers: Groundwater storage, Water-bearing sediments, Graphics.

Specific yield is defined as the ratio of the volume of water that a saturated rock or soil will yield by gravity to the total volume of the rock or soil, usually expressed as a percentage. The value is not definitive, because the quantity of water that will drain by gravity depends on variables such as duration of drainage, temperature, mineral composition of the water, and various physical characteristics of the rock or soil under consideration. Values of specific yield, nevertheless, offer a convenient means by which hydrologists can estimate the water-yielding capacities of earth materials and, as such, are very useful in hydrologic studies. Direct or modified quotations from many selected reports that evaluate methods for determining specific yield, limitations of those methods, and results of the determinations made on a wide variety of rock and soil materials are compiled. Although no particular values are recommended, a table summarizes values of specific yield, and their averages, determined for 10 rock textures. (Knapp-USGS)
W69-02828

WATER RESOURCES OF THE MUSTINKA AND BOIS DE SIOUX RIVERS WATERSHED WEST-CENTRAL MINNESOTA,
Geological Survey, Washington, D. C.
R. W. Maclay, T. C. Winter, and L. E. Bidwell.
U S Geol Surv Hydrol Invest Atlas HA-272, 4 sheet, 1968, 4 ref.

Descriptors: *Water resources, *Groundwater, *Surface waters, *Hydrologic data, *Minnesota, Streamflow, Water wells, Water quality, Water levels, Water yield, Hydrogeology.
Identifiers: Mustinka River (Minn), Bois de Sioux River.

The water resources of the Mustinka and Bois de Sioux Rivers Watershed, West-Central Minnesota, were investigated and the results are presented in a 4-sheet Hydrological Atlas. The annual runoff of the area is about 1/2 inch, and ranges from 1/4 inch to nearly 3 inches. All municipal supplies are from groundwater sources. Streamflow is intermittent, with frequent flooding because of flat land surface, channels of low capacity, and low channel gradient. Most recharge is in a morainal area and groundwater moves through glacial drift to discharge in lowlands near lakes and rivers. Most wells are in the glacial drift. Only a few are drilled into the underlying Cretaceous sediments. Water in the drift is very hard, while water from the Cretaceous rocks is generally softer. Iron content of all groundwater is greater than 0.3 ppm. Water from the drift is suitable for irrigation where adequate drainage is provided, but water from the Cretaceous rocks has excessive Na content. Data on climate, water yield, surface water discharge, floods, groundwater occurrence, groundwater yield, and groundwater quality, are summarized in maps, graphs, and tables. (Knapp-USGS)
W69-02829

THE PERCHED WATER TABLE IN THE UPPER LIMESTONE AQUIFER OF MALTA,
Institution of Water Engineers, London (England).
J. Newbery.
J Inst Water Eng, Vol 22, No 8, pp 551-570, Nov 1968. 20 p, 8 fig, 3 tab, 4 ref.

Descriptors: *Water resources, *Groundwater, *Aquifers, *Perched water, Aquicludes, Limestones, Coral, Water yield, Permeability, Porosity, Specific yield, Saline water intrusion.
Identifiers: *Malta.

The groundwater resources of Malta were investigated with particular attention to the upper of 2 limestone aquifers separated by a clay aquiclude. In the lower limestone the water table is controlled by sea level, and in the upper aquifer, the Upper Coralline Limestone, the water table is perched. The lower aquifer is overpumped and salinity is increasing, so hydrogeological study of the upper aquifer was carried out to develop more water supplies. A survey was made using data from over 1,500 boreholes to determine geologic structure, permeability, and specific yield. The upper aquifer is as much as 335 ft thick, faulted into many small grabens and ridges, and has a large number of sinkholes. Permeability, measured in cores and in pumping tests, varies from almost nil to .00071 cm per sec. Potential total water yield is estimated to be 2,000 million gallons per year from a system of intercepting galleries and boreholes. The cost of groundwater development is about the same as that of developing and using sea water distillation. (Knapp-USGS)
W69-02833

HYDROGEOLOGY OF DESERT BASINS,
Nevada Univ., Reno.
George B. Maxey.
Ground Water, Vol 6, No 5, pp 10-22, Sept/Oct 1968. 13 p, 16 fig, 29 ref.

Descriptors: *Hydrogeology, *Deserts, *Arid lands, Hydrology, Nevada, *Groundwater, Surface waters, Water analysis, Optimum development plans, Drawdown, Aquifers, Bibliographies, Groundwater flow, Water quality, *Groundwater geology, Groundwater mining, Groundwater recharge.
Identifiers: Groundwater sources, Groundwater management.

Hydrologic systems in arid lands normally include a recharge area in mountains and a discharge area in lowlands, often with an intermediate area of lateral flow between recharge and discharge areas. This system is often modified by local geologic, climatic, and physiographic factors. Most water supply, contamination, and disposal problems arise from a combination of features superimposed on this system by concentration of population and agricultural activity in discharge areas. Data on this system come from the lowlands; little data are available from recharge areas. In the Great Basin, 2 general categories of groundwater flow systems are identified and their characteristics described. Although most flow systems in Nevada have not been delineated, integration of hydrologic, geologic, and chemical methods allows approximate portrayal of many local and regional systems. Adequate methods on which to base planning for optimum development of water resources in desert basins are available. A conceptual model of optimal ground-water reservoir development illustrates optimum use of storage and perennial yield, provided the use and time of withdrawal of the water are known. (USBR)
W69-02924

RADIUS OF INFLUENCE OF A WELL,
Mladen Boreli.
Saopstenja, Vol 14, No 43, pp 13-23, 1967. 11 p, 3 fig, 1 tab, 4 ref.

Descriptors: Groundwater, *Groundwater flow, Discharges, *Groundwater recharge, *Wells, Aquifers, *Water yield, Water table, Pumping, Artesian water, Foreign design practices, Reviews, Infiltration, Drawdown, *Water wells, Recharge.
Identifiers: Dupuit formula, Yugoslavia, Leaky aquifers, Well yield.

The radius of influence of a well is a representative indicator of the ground-water balance and is defined by ground-water recharging conditions. By determining the radius of influence in the field, information may be derived on the local water balance and recharge of water pumped out. The original definition for the radius of influence lacks sufficient precision for estimating well discharge under conditions of intensive ground-water pumping; a more rigorous definition is given, based on Dupuit's formula. Analytical expressions for various cases of horizontal and vertical recharge are summarized and several empirical formulas reviewed. Many formulas given in the literature are in error, are trivial, or give an illusion of accuracy when in fact they are only rough approximations. The radius of influence should be calculated only after analyzing the type of discharge according to given formulas. (USBR)
W69-02946

DETERMINING CONSUMPTIVE USE FOR PLANNING WATER DEVELOPMENTS,
California Univ., Los Angeles; and Clyde-Criddle-Woodward, Inc., Salt Lake City, Utah.
For primary bibliographic entry see Field 02I.
For abstract, see .
W69-02970

ELECTRIC-ANALOG AND DIGITAL-COMPUTER MODEL ANALYSIS OF STREAM DEPLETION BY WELLS,
Geological Survey, Denver, Colo.
C. T. Jenkins.
Groundwater, Vol 6, No 6, pp 27-34, Nov-Dec 1968. 8 p, 6 fig, 3 tab.

Descriptors: Model studies, *Analog computers, Analytical techniques, Aquifers, Computer models, *Digital computers, *Wells, Pumping, *Withdrawal, *Streamflow, Surface-groundwater relationships, Groundwater recharge, Maps, Recharge, Discharge (Water), Boundaries (Surface), Variability.
Identifiers: Ratios, Curves.

Electric-analog or digital-computer models are used to compute the effect of groundwater withdrawal or recharge on streamflow. The relation between pumping time and volume of stream depletion at any location in the system can be determined from tests on the model. As useful as such data may be, separate model tests for every possible location and for every conceivable pattern of pumping would require an inordinate amount of time and money. The purposes of this report were to examine the errors that are introduced by generalizing the results of a relatively small number of tests, and to show an example of a map showing lines of potential equal effect on streamflow. The generalization was based on the similarity in shape of the relations between pumping time and stream depletion for (1) semi-infinite homogenous aquifers drained by a straight, fully penetrating stream, and (2) complex heterogenous aquifers. (Affleck-Arizona)
W69-02976

APPLICATION OF THE GRAVITY SURVEY METHOD TO WATERSHED HYDROLOGY,
Agricultural Research Service, Tucson, Arizona. Southwest Watershed Research Center.
For primary bibliographic entry see Field 04D.
For abstract, see .
W69-02982

HYDRO-GEOLOGY OF QUATERNARY FORMATION FROM RIVER LUNI AND ITS TRIBUTARIES CATCHMENT.
Central Arid Zone Research Institute, Jodhpur (India).
P. C. Chatterji, R. K. Saxena, and M. L. Sharma.
Annals of Arid Zone, Vol 7, No 1, pp 31-48, March 1968. 18 p, 2 fig, 9 tab.

Descriptors: *Groundwater, *Groundwater basins, *Petrography, Salts, *Quaternary period, Geomorphology, Aquifers, Alluvium, *Hydrogeology, Sands, Surveys, Topography, Watersheds (Basins), Arid climates, Depth, Semiarid climates.
Identifiers: *Rajasthan (India), Water potential.

A hydro-geological survey was carried out in the arid and semi-arid zone of Rajasthan, India. Aerial photographs and 1:126720 scale topographical sheets were used to conduct the survey. Samples of groundwater were taken either from freshly dug wells or where the lithology of aquifers was exposed. The wells were studied for static water level, seasonal variation of static water level, and discharge potential. Taking the density of existing wells as the index of water potentiality of the lithological formation, younger alluvium stands first followed by older alluvium and blown sand. Water having total soluble salt contents up to 7000 ppm was associated equally with blown sand and younger alluvium while older alluvium had slightly higher salt contents. It was concluded that the younger alluvium was the more favorable formation for groundwater exploration in comparison to older alluvium and blown sand. (Affleck-Arizona)
W69-02983

THE EFFECT OF SILT-LADEN WATER ON INFILTRATION IN ALLUVIAL CHANNELS,
For primary bibliographic entry see Field 02J.
For abstract, see .
W69-02988

GROWTH AND DECAY OF GROUNDWATER-MOUNDS IN RESPONSE TO UNIFORM PERCOLATION,
New Mexico Inst. of Mining and Technology, Socorro.
Mahdi S. Hantush.
Water Resources Res, Vol 3, No 1, pp 227-234, 1967. 8 p, 1 fig, 1 tab, 14 ref.

Descriptors: *Groundwater, *Recharge, *Water level fluctuations, Surface-groundwater relationships, Water spreading, Uniform flow, Groundwater movement.
Identifiers: Groundwater mounds, Circular recharge areas, Rectangular recharge areas.

The rise and decay of the water table in response to deep percolation depends on the shape of the recharging area, among other factors. Solutions describing this phenomenon when the recharging area is rectangular or circular in shape are developed for the case where the underlying aquifer is effectively infinite in areal extent. The solution when the recharging area is circular is given in terms of a function that can be easily tabulated for a practical range of the parameters. Approximate solutions in terms of already tabulated functions are presented also. The solution when the recharging area is rectangular is obtained in terms of a function that depends on two parameters. This function is tabulated for a wide range of the parameters. This tabulation, as well as approximate relations, affords a means for relatively simple calculation. The solutions are applicable if the rise of water table relative to the initial depth of saturation does not exceed 50%. (Knapp-USGS)
W69-03048

DRAWDOWN IN A WELL OF LARGE DIAMETER,
Geological Survey, Washington, D. C. Water Resources Div.
Istavros S. Papadopulos, and Hilton H. Cooper, Jr.

Water Resources Res, Vol 3, No 1, pp 241-244, 1967. 4 p, 2 fig, 1 tab, 5 ref.

Descriptors: *Groundwater, *Drawdown, *Transmissivity, *Artesian wells, Discharge (Water), Permeability.
Identifiers: Large-diameter wells, Transmissivity calculations, Aquifer testing, Aquifer evaluation.

A large-diameter well drawdown solution which takes account of storage of water in the well bore is presented for the condition of constant rate discharge from a fully penetrated isotropic artesian aquifer. A set of type curves derived from this solution may be used to determine aquifer transmissibility by analysis of drawdown in the pumped well. (Knapp-USGS)
W69-03049

RESPONSE OF A FINITE-DIAMETER WELL TO AN INSTANTANEOUS CHARGE OF WATER,
Geological Survey, Washington, D C. Water Resources Div.
Hilton H. Cooper, Jr., John D. Bredehoeft, and Istavros S. Papadopulos.
Water Resources Res, Vol 3, No 1, pp 263-269, 1967. 7 p, 6 fig, 3 tab, 7 ref.

Descriptors: *Groundwater, *Recharge, *Injection, *Transmissivity, Discharge (Water), Permeability.
Identifiers: Large-diameter wells, Transmissivity calculations, Injection tests, Well testing, Aquifer tests.

A solution is presented for the change in water level in a well of finite diameter after a known volume of water is suddenly injected or withdrawn. A set of type curves computed from this solution permits a determination of the transmissibility of the aquifer. (Knapp-USGS)
W69-03057

STRATIFICATION OF FRESH AND SALT WATER ON BARRIER ISLANDS AS A RESULT OF DIFFERENCES IN SEDIMENT PERMEABILITY,
Geological Survey, Raleigh, N. C.
William H. Harris.
Water Resources Res, Vol 3, No 1, pp 89- 97, 1967. 9 p, 5 fig, 2 tab, 8 ref.

Descriptors: *Groundwater, *Saline water-freshwater interfaces, *Aquifers, *Aquitards, *Islands, Anisotropy, North Carolina, Saline water intrusion, Permeability.
Identifiers: Hatteras Island (N.C.).

Theoretical values are not valid for the relation of fresh-water head to the depth of the fresh-water-salt-water interface beneath barrier islands when there is substantial motion of fresh groundwater and where the sedimentary deposits are not homogeneous or isotropic. Where zones of fresh and salt water are stratified, fresh water occurs in zones of high permeability, whereas salty water occurs in zones of low permeability. Near Frisco, on Hatteras Island, North Carolina, the concentration of chloride in groundwater varies inversely with the relative permeability of the water-bearing zones to a depth of about 140 ft. Permeable zones generally contain water with a chloride content of less than 100 ppm, whereas relatively impermeable zones contain water with a chloride content greater than 100 ppm. The position of the contact of fresh water with salt water depends on the permeability of the sediments at depth and is affected by differential flushing by fresh groundwater as a result of the retreat of the sea water originally saturating the entire stratification, rather than by fresh-water head differences in the shallow aquifer system. (Knapp-USGS)
W69-03058

EXPERIENCE IN BURIAL OF LIQUID RADIOACTIVE WASTES IN DEEP GEOLOGICAL FORMATIONS,
For primary bibliographic entry see Field 05E.
For abstract, see .
W69-03061

HYDROLOGIC EFFECTS OF PUMPING FROM THE FLORIDAN AQUIFER IN NORTHWEST HILLSBOROUGH, NORTHEAST PINELLAS, AND SOUTHWEST PASCO COUNTIES, FLORIDA,
Geological Survey, Tallahassee, Fla.
J. W. Stewart.
U S Geol Surv open-file rep, 241 p, 1968. 60 fig, 6 tab, 13 ref.

Descriptors: *Water resources, *Groundwater, *Water level fluctuations, *Florida, Water wells, Aquifers, Water quality, Water sources, Water yield, Specific capacity, Transmissivity, Storage coefficient.
Identifiers: Hillsborough County (Florida), Pinellas County (Florida), Pasco County (Florida), Tampa, Floridan aquifer.

The Floridan aquifer is the principal source of water supply for the rapidly growing Tampa area of Florida. It is limestone interbedded with dolomite, sand, and clay, becomming dolomitic at depth. Most producing wells are in the Suwannee Limestone in the upper part of the aquifer system. Sand, silt, and clay deposits from 35-75 ft thick overlie the aquifer and provide its principal source of local recharge. The transmissivity of the Floridan aquifer ranges from 165,000 to 550,000 gpd per ft, the coefficient of storage from 0.0005-0.0015, and the coefficient of leakage is about 0.00015 gpd per cu ft. Recharge is estimated to be 103 mgd, and 44.2 mgd was pumped in 1966, 97% for public supplies. Lowering of water levels from 1933-36 was about 9-13 ft in the Lutz field, 3-6 ft in the Cosme field, and 2 ft or less in the Eldridge-Wilde field. Groundwater in the area is hard to moderately hard calcuim bicarbonate type, acceptable for most uses except near the coast where the chloride content is high. The aquifer can supply more than the amount pumped, enough for foreseeable needs. Proper planning of well fields is needed for optimum development of aquifer. (Knapp-USGS)
W69-03063

HYDROLOGIC DATA: 1967 - VOLUME IV: SAN JOAQUIN VALLEY.
California Resources Agency. Dept. of Water Resources.
For primary bibliographic entry see Field 02E.
For abstract, see .
W69-03068

GROUND-WATER OCCURRENCE AND STRATIGRAPHY OF UNCONSOLIDATED DEPOSITS, CENTRAL PIERCE COUNTY, WASHINGTON,
Department of Water Resources, Olympia, Wash.
Kenneth L. Walters, and Grant E. Kimmel.
Wash State Water Supply Bull No 22, 428 p, 1968. 19 fig, 3 plate, 9 tab, 34 ref.

Descriptors: *Water resources, *Groundwater, *Washington, Water wells, Water quality, Water levels, Data collections, Hydrographs, Water yields, Water utilization.
Identifiers: Tacoma, Pierce County (Wash).

The groundwater resources of an area of 660 sq mi in west-central Washington, which includes the city of Tacoma and extends from Puget Sound to the foothills of the Cascade Range are described. The annual precipitation averages 38.5 in.; 85% occurs in September through April. Unconsolidated rocks, consisting of gravel, sand, silt, and clay of Miocene through Recent age, yield most of the water to wells in the county. The most important aquifers are the Quaternary unconsolidated deposits, particularly the Salmon Springs Drift, Vashon deposits, and Recent alluvium. Flowing wells are found in the Puyallup River valley and the Tacoma tidal flats. Public water supply uses 43,000 acre-ft of water and about 32,000 acre-ft are used for all other purposes. Withdrawal could be increased several times without serious depletion. The water is of good quality, satisfactory for most uses. In the uplands, water is primarily of the Ca bicarbonate type and in the Puyallup valley it is of the Na bicarbonate type. Locally seawater intrusion causes high chloride concentrations. Well records, driller's logs, and chemical analyses are tabulated. Maps show geology and location of wells and springs. (Knapp-USGS)
W69-03081

CARBON 14 AGES AND FLOW RATES OF WATER IN CARRIZO SAND, AT ATASCOSA COUNTY, TEXAS,
Geological Survey, Austin, Tex. Water Resources Div.
F. J. Pearson, Jr., and D. E. White.
Water Resources Res, Vol 3, No 1, pp 251-261, 1967. 11 p, 6 fig, 1 tab, 15 ref.

Descriptors: *Groundwater movement, *Flow rates, *Radioactive dating, *Carbon radioisotopes, Carbonates, Groundwater, Texas.
Identifiers: Carrizo Sand, Atascosa County (Texas).

The ages of water samples from the Eocene Carrizo Sand in Atascosa County and adjacent counties of Texas were determined by study of the carbon 14 content of the carbonate in the water. The carbon 14 is in plant-produced carbon dioxide in the soil of the recharge area. Dilution by carbon 14-free carbonate dissolved from the soil and aquifer can be corrected in the technique used. The ages of the samples ranged from 0 yr to outcrop to 27,000 yr 35 mi downdip. Water velocities are about 8 ft per yr 10 mi from outcrop. Flow rates calculated from available hydrologic data agree with the carbon 14 results. (Knapp-USGS)
W69-03082

SOME ASPECTS OF THE HYDROLOGY OF PONDS AND SMALL LAKES,
Minnesota Univ., St. Paul. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 02H.
For abstract, see .
W69-03091

WATER AND SEDIMENT IN THE NORRIS GLACIER OUTWASH AREA, UPPER TAKU INLET, SOUTHEASTERN ALASKA,
Alaska Univ., College. Inst. of Water Resources.
For primary bibliographic entry see Field 02J.
For abstract, see .
W69-03093

DEPLETION OF FLOW IN RIGHT-ANGLE STREAM BENDS BY STEADY WELLS,
New Mexico Tech., Socorro.
For primary bibliographic entry see Field 02A.
For abstract, see .
W69-03094

GROUNDWATER FAVORABILITY AREAS AND SURFICIAL GEOLOGY OF THE LOWER ANDROSCOGGIN RIVER BASIN, MAINE,
Geological Survey, Washington, D. C.
Glenn C. Prescott, Jr.
U S Geol Surv Hydrol Invest Atlas HA-285, 1 sheet, 1968. Text, 1 map, 4 ref.

Descriptors: *Water resources, *Water yield, Aquifers, Water quality, Geohydrologic units, Groundwater, Maine.
Identifiers: Androscoggin River basin (Maine).

Areas favorable for groundwater development in the lower Androscoggin River basin, Maine, are portrayed on a map and discussed in accompanying text. Ice-contact and outwash deposits, which are identified on the map, are the principal aquifers in the area. Wells tapping for former generally can obtain 50 gpm or more (occasional yields of 2,000 gpm are obtainable) of good-quality water; wells tapping the latter generally can obtain up to 50 gpm of good-quality water. Other unconsolidated materials and the bedrock in the lower basin generally do not yield over 10 gpm. The chemical quality of water, which is graphically depicted in the atlas, generally is good, except in areas of localized contamination. (Steinhilber-USGS)
W69-03099

SLOPE LENGTH OF CLAYPAN SOIL AFFECTS RUNOFF,
Agricultural Research Service, Columbia, Mo.; and Agricultural Research Service, Urbana, Ill.
For primary bibliographic entry see Field 02A.
For abstract, see .
W69-03106

HYDRAULIC AND MICROMORPHOLOGICAL PROPERTIES OF STREAM CHANNEL SEDIMENTS,
Arizona Univ., Tucson; and North Carolina State Univ., Raleigh.
For primary bibliographic entry see Field 02J.
For abstract, see .
W69-03108

FLOW OF GROUNDWATER ADJACENT TO SMALL, CLOSED BASINS IN GLACIAL TILL,
Idaho Univ., Moscow.
R. E. Williams.
Water Resources Res, Vol 4, No 4, pp 777-783, Aug 1968. 7 p, 4 fig, 2 tab, 6 ref.

Descriptors: *Groundwater movement, *Glacial drift, *Till, Marshes, Basins, Flow, Water table, Precipitation (Atmospheric), Evapotranspiration, Water quality.
Identifiers: *Closed basins, Hydrologic systems.

In an area receiving approximately 34 in. average annual precipitation, the flow of groundwater was studied in the vicinity of 3 closed basins in glacial till. Piezometric data indicate that one of the basins was continually a groundwater discharge area, while the others alternated between recharge and discharge. Precipitation intensity, basin area, and geometry play significant roles in determining the frequency with which the closed basins convert from discharge areas to recharge areas. The water table rose adjacent to all three basins at some time during the study. Comparison of hydrographs of piezometers, precipitation data, and the level of marshes within the closed basins indicates a variable effect of precipitation on fluid potential and marsh level. Water quality data from the piezometers and from marshes in the basins suggest that the concentrations of dissolved solids are too low for a continuous discharge area. Basin area and shape influence the alternation of a given basin between recharge and discharge conditions. Given the appropriate distribution of precipitation, it appears that any basin of the type described herein can be expected to convert from a discharge to a recharge area at some time. All of the basins examined have had either surface water or groundwater outlets at some time. (Llaverias-USGS)
W69-03119

TRACE AND TRACER ELEMENTS IN GROUND WATER,
Arizona Univ., Tucson. Dept. of Hydrology.
Gordon R. Dutt.
Arizona Water Resources Research Center, Research Project Technical Completion Report, August 1968. 11 p, 1 tab, 2 ref. OWRR Project B-001-Ariz, B-002-Ariz, and B-004-Ariz.

Descriptors: *Ground water, *Trace elements, Chelate extraction, Atomic absorption analyses, Carbonate, Bicarbonate, Fluoride, Nitrate, Sulfate, Silicate, Ground water recharge, Hydrochemical facies, Sewage effluent, C.O.D., B.O.D., Waste waters, Hydraulic loading, Infiltration, Tucson Basin, Process-response model, Instrumentation, Hydrochemical data.

Over 680 wells are sampled and analyzed for conductivity, pH, Ca (++), Mg (++), Na (+), Cl (-), SO4 (=), CO3 (=), F (-), NO3 (-), K (+), Sr (++), and the trace elements, Fe, Mn, Cu, Zn, Cr (+6), Ni, Pb, Co, and Cd. A new method was developed for the simultaneous chelate extraction and atomic absorption analysis of the last nine elements in water and sewage samples. The surface and subsurface movement of the nine trace elements were studied on grassed plots with effluent from a domestic sewage effluent treatment facility. Analysis of recharged water was the same as above plus C.O.D. and B.O.D. determinations. A conceptual process-response model of the Tucson Basin was developed to relate ground water chemical composition to the soil, subsoil and geologic formations of the recharge and ground water flow pattern of the basin. A calcite-water chemical equilibrium model was used to determine the precipitation or dissolution of calcite in the basin aquifers.
W69-03197

2G. Water in Soils

AQUEOUS TRANSPORT OF DIELDRIN RESIDUES IN SOILS,
Cincinnati Univ., Ohio., Environmental Health Engineering.
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-02801

MISCIBLE DISPLACEMENT IN AN UNSATURATED GLASS BEAD MEDIUM,
Guelph Univ., (Ontario).
H. K. Krupp, and D. E. Elrick.
Water Resources Res, Vol 4, No 4, pp 809-815, Aug 1968. 7 p, 6 fig, 1 tab, 12 ref.

Descriptors: *Porous media, *Soil water movement, *Mixing, Water structure, Pore pressure, Model studies, Tracers.
Identifiers: *Miscible displacement, *Chemical transport, Unsaturated medium, Pore volumes.

In order to analyze the mixing behavior of solutes in a porous medium over a wide range of water contents, a series of miscible displacement experiments was conducted in an unsaturated glass bead medium, at constant average water content during each displacement. Variation in the form of the breakthrough curve with decreasing water content was not large and was not related in a simple way to the water content; however, there was a consistent shift of the breakthrough curve to the left of the relative concentration value of 0.5 and 1 pore volume and a long tail or slow approach to the final relative concentration of 1.0. Some of these effects may be attributed to the presence of 'stagnant' liquid in the pores. The earliest appearance of tracer in the effluent was observed at a saturation fraction in the range of 0.54 to 0.56. This behavior is largely the result of disorder in the sample liquid. Both filled and partially filled pores and pore sequences were present in different amounts and mixing was not simply related to moisture content. At the higher water contents, flow in filled pores was dominant, whereas at lower water contents flow in partially filled pores and surface films dominated the displacement. (Llaverias-USGS)
W69-02810

UNSTEADY SEEPAGE FLOW BETWEEN FULLY-PENETRATING TRENCHES,
Wisconsin Univ., Milwaukee; and Northwestern Univ., Evanston, Ill.
Gabor Karadi, Raymond J. Krizek, and Hameed Elnaggar.
J Hydrol, Vol 6, No 4, pp 417-430, Aug 1968. 14 p, 9 fig, 3 ref.

Descriptors: *Unsteady flow, Trenches, *Seepage, Groundwater movement, Infiltration, Evaporation, Differential equations, Seepage losses, Water table, Dupuit-Forchheimer theory, Phreatic lines, Homogeneity, Isotropy, Experimental data, Matrix algebra, Groundwater, Drainage, Groundwater flow.
Identifiers: Boundary conditions, Drain spacing, Porous media flow.

The problem of unsteady seepage flow (including either evaporation of infiltration) between 2 fully-penetrating trenches is considered. The method of solution is based on matrix mathematics and has

the advantages of being able to handle complicated boundary and initial conditions and to consider, step by step, the nonlinearity of the governing differential equation. Typical results are presented for a variety of boundary and initial conditions. Results calculated by this technique for one particular set of boundary and initial conditions exhibit better agreement with experimental data than results calculated by linearizing the governing field equation. (USBR)
W69-02913

NEUTRON MOISTURE METER CALIBRATION FOR USE IN SALINE SOILS,
California Univ., Davis.
L. C. Benz, W. O. Willis, F. M. Sandoval, and D. R. Nielsen.
Agr Eng, Vol 46, No 6, pp 326-327, June 1965. 2 p, 1 fig, 1 tab.

Descriptors: *Nuclear moisture meters, Moisture content, *Saline soils, Salinity, *Calibrations, Moisture meters, Soil moisture, Soil moisture meters, Arid lands, Electrical conductance, *On-site tests, Aqueous solutions, *Sodium chloride.

Data presented in the paper emphasized the necessity of field calibration of neutron meters where salinity levels were high. Neutron meter count reductions occurred when readings were taken in aqueous sodium chloride solutions. Count reductions increased as the sodium chloride concentration increased. The accuracy of soil moisture determinations by neutron moisture meters was reduced by relatively high levels of soil salinity. The higher the soil salt content, the greater was the deviation from the master curve or field calibration curves obtained under nonsaline conditions. Field calibration of neutron-moisture-measuring equipment may be necessary in arid soils where salinity levels are high. (Blecker-Arizona)
W69-02965

SOIL-WATER MOVEMENT IN VAPOUR AND LIQUID PHASES,
Utah State Univ., Logan.
S. A. Taylor, and J. W. Cary.
Unesco Arid Zone Research, Vol 25, pp 159-165, 1965. 7 p, 3 fig, 1 tab.

Descriptors: *Soil water movement, *Liquids, *Saturated soils, Soil moisture, Moisture content, Soil water, *Gases, Soil physics, Flow measurement, Thermocline, Heat transfer, Fluctuation, Arid lands, Soil temperature, Soil pressure, Conductivity, Temperature, Equations.
Identifiers: Heat flux, Vapor flux.

The procedure for measuring and separating the liquid and vapor flow of water in soil material that is subjected to a temperature difference under conditions of constant pressure and matric potential is considered in detail. Results indicate that the proportion of water transmitted in the liquid in response to a thermal difference increases with water content of the sample until, in saturated soil, there is no vapor transfer remaining. It appears that as soil dries out, the proportion of the total water transmission that occurs in the vapor phase increases to a maximum that is reached when the amount transmitted in the liquid phase becomes negligibly small in comparison. Methods used in the study could be applied to determine the soil-water movement in arid soils. (Blecker-Arizona)
W69-02966

GERMINATION OF PROMISING DESERT GRASS SEEDS UNDER DIFFERENT DEPTHS OF SOWING IN SANDY SOIL,
Central Arid Zone Research Inst., Jodhpur (India).
A. K. Chakravarty, and C. M. Verma.
Ann Arid Zone, Vol 7, No 1, pp 75-81, March 1968. 7 p, 2 tab, 2 chart.

Descriptors: *Germination, *Seeds, *Grasses, *Soil moisture, *Sands, Arid climates, Pasture management, Vegetation regrowth, Deserts, Depth, Temperature, Humidity, Evaporation, Moisture content.
Identifiers: India.

Seeds of three perennial grass species viz, Cenchrus ciliaris, Cenchrus setigerus and Panicum antidotale were sown at depths of 1, 2, 4, 6, and 9 cm under irrigated nursery conditions at the Central Arid Zone Research Institute, Jodhpur, India. The soil moisture percentage in the different depths of sowing treatments varied from 8.1 to 10.9 on the different dates of sowing. Results indicated that the seeds show optimum germination when sown at shallow depths of 1 to 2 cm even under low moisture regime. All three grass species continued to germinate up to 28 days after sowing. (Blecker-Arizona)
W69-02972

SOIL WATER FLUX BELOW A RYEGRASS ROOT ZONE,
California Univ., Davis.
M. E. LaRue, D. R. Nielsen, and R. M. Hagan.
Agron J, Vol 60, No 6, pp 625-629, Nov-Dec 1968. 5 p, 6 fig, 1 tab.

Descriptors: *Soil water movement, Hydraulic conductivity, Moisture content, Perennial ryegrass, Soil profiles, Soil-water-plant relationships, Root zone, Evapotranspiration, Rates of application, Sampling, Field capacity, Variability, Water pressure, Frequency, Irrigation efficiency, Hydraulic gradient, Percolation, Gravimetry.
Identifiers: *Fluxes, Soil water pressure.

The objective of a study conducted in California was to assess the net water flux below the root zone of a rye grass crop irrigated with equal total quantities of water but applied at different frequencies. Soil water flux was computed using hydraulic conductivity values calculated from field-measured soil-water characteristics. Irrigation frequency influenced the amount of water moving into or out of the root zone. The nature of the hydraulics of a natural field soil, its variability in space, and its implications for the interpretation of soil-water depletion data were also presented. (Affleck-Arizona)
W69-02975

COMPARISON OF THREE COMMERCIAL DRAIN TILES IN A HEAVY CLAY SOIL OF IMPERIAL VALLEY,
California Univ., Davis. Dept. of Water Science and Engineering.
For primary bibliographic entry see Field 08G.
For abstract, see .
W69-02977

FURROW SIZE, PLACEMENT, AND GRASS CULTURE EFFECTS ON VINEYARD IRRIGATION,
California Univ., Davis. Department of Water Science and Engineering; and Calif. Univ., Davis. Agricultural Extension Service.
For primary bibliographic entry see Field 03F.
For abstract, see .
W69-02978

CHAPARRAL FIRES CHANGE SOIL MOISTURE DEPLETION PATTERNS,
California Univ., Riverside. Dept. of Agronomy.
C. M. McKell, J. R. Goodin, and C. C. Duncan.
Calif Agr, Vol 22, No 11, pp 15-16, Nov 1968. 2 p, 1 fig, 1 tab.

Descriptors: *Burning, *Chaparral, *Vegetation regrowth, *Soil moisture, Competition, Grasses, Bouyoucos blocks, California, *Moisture deficit, Withdrawal.
Identifiers: Wildfires.

In the fall of 1964, a wildfire swept through 85 acres of chaparral covered hillsides near Lake Henshaw in San Diego County. The pattern of soil moisture depletion was observed for three years on four sites in the burned area and on four similar sites in the adjacent unburned area using gypsum electrical resistance blocks. During the first year, very large differences in soil moisture depletion between the burned and unburned areas were evident. Soil moisture depletion on the burned area during the second year after the fire was essentially the same as on the nearby unburned area. By the end of the third year the volume of chaparral regrowth had developed to such an extent that soil moisture depletion occurred earlier on the burned area than on the unburned area. This study showed that the period of favorable soil moisture for the establishment of perennial species as a replacement for chaparral was very short, under natural conditions. (Affleck-Arizona)
W69-02979

PSYCHROMETRIC MEASUREMENT OF SOIL WATER POTENTIAL IN SITU UNDER COTTON PLANTS,
Commonwealth Scientific and Industrial Research Organization, Griffith (Australia). Div. of Irrigation Research.
A. R. G. Lang.
Soil Sci, Vol 106, No 6, pp 460-464, Dec 1968. 5 p, 4 fig.

Descriptors: *Soil moisture, Soil water movement, *Moisture content, *Cotton, *Hygrometry, Soil-water-plant relationships, Root systems, *Measurement, Instrumentation, Moisture uptake, Variability, Temperature, Absorption, Diurnal, Nocturnal, Translocation.
Identifiers: *Soil water potential, Water potential, *Psychrometers.

Water potentials were measured directly and continually at 9 different positions in 16 liter volumes of soil, while water was removed via the roots of intact cotton plants in Australia. Measurements were made using Spanner thermocouple psychrometers inserted into cages previously buried in the soil. Water potentials displayed the expected patterns: water potential decreased more rapidly during the day than night, while day by day it decreased. The results confirmed by direct measurement, that cotton plants continue to withdraw water from soils at soil water potentials less than -3000J kg super -1. The apparatus, which may have application in the field, and the variability of results were discussed in detail. Part of the variability was probably caused by uneven distribution of roots. The probable error of the mean water potential at a given time was small relative to the changes in water potential with time. (Affleck-Arizona)
W69-02980

PRECISION LYSIMETRY FOR DIRECT MEASUREMENT OF EVAPORATIVE FLUX,
Agricultural Research Service, Tempe, Ariz. Water Conservation Lab.
C. H. M. van Bavel, and R. J. Reginato.
UNESCO, Arid Zone Research, Vol 25, pp 129-137, 1965. 7 p, 9 fig, disc.

Descriptors: *Lysimeters, Measurement, *Soil water, *Moisture content, Water loss, *Evaporation, Fluctuation, Electrical equipment, Instrumentation, Logging (Recording), Moisture tension, Data collections, Air-earth interfaces, Weight, Environmental effects.
Identifiers: Evaporation flux, Fluxes.

The article describes the precision automated weighing lysimeter installation at the United States Water Conservation Laboratory, Tempe, Arizona. Details regarding mechanical and electrical features together with examples of the performance of the system were given. The system allowed for various forms of recording. One distinct advantage of lysimeters for measuring evaporative flux as compared to other methods was that they could be simply calibrated. The sensitivity of the system is between 10 and 20 grams. Precautions were taken to ensure that the lysimeter soil and the environ-

ment it provided for any crops grown therein were similar to that existing in its immediate environment. Moisture content in the lysimeter was slightly higher since the soil, having been artificially compacted, was devoid of those large pores that would result from continued activity of soil organisms and plant roots. (Blecker-Arizona)
W69-02981

SOIL STUDY FOR WATER ECONOMICS,
Institut za Vodoprivredu Jaroslav Cerni, Belgrade (Yugoslavia).
Ljubomir Grujic, Nikola Plamenac, and Predrag Marinkovic.
Translation from Proc Institut za Vodoprivredu 'Jaroslav Cerni', Vol 14 No 41-42, pp 113-122, 1967. TT67-58016.

Descriptors: *Soil water, *Irrigation, *Drainage, Hydrogeology, Soil structure, Soil water movement, Soil physics, Hydrology, Return flow.
Identifiers: Yugoslavia.

The study of soil hydrology in Yugoslavia from 1947-1967 is reviewed and a bibliography is listed. The topics covered are hydrophysical properties, structural properties, drainage methods and results, irrigation and irrigation return water, and efficiency of irrigation on various soils and crops. (Knapp-USGS)
W69-03042

AN ANALYSIS OF TEMPERATURE BEHAVIOR IN IRRIGATED SOIL PROFILES,
California Univ., Davis. Department of Water Science and Engineering.
P. J. Wierenga.
Calif Univ Water, Sci and Eng Pap 7002, 152 p, Sept 1968. 34 fig, 8 tab, 95 ref, 3 append.

Descriptors: *Irrigation water, *Soil temperature, *Soil water, Heat budget, Experimental farms, Water temperature, Thermal properties, Diffusivity, Fourier analysis.
Identifiers: Soil temperature changes, Irrigation water temperature.

A detailed analysis of the temperature pattern in irrigated soil, determining the effect on temperature of water of various amounts and temperatures, was made by energy-budget methods. A simplified model to predict soil temperature changes after irrigation with warm or cold water was tested in an instrumented experimental plot. The soil temperature, water content, net radiation, evaporation, bulk density, heat capacity, particle size distribution, and soil chemical composition were determined. Soil thermal conductivity was measured and compared with theoretical values of de Vries' model. Accurate predictions of temperature changes caused by irrigation depends on knowledge of the amount and temperature of water applied, temperature and heat capacity of soil before irrigation, and soil-water content before and after irrigation. Harmonic analysis of diurnal temperature fluctuation in soil yielded apparent thermal diffusivity values which agreed with thermal conductivity calculations and field measurements. (Knapp-USGS)
W69-03053

TRANSPORT IN SOILS: THE BALANCE OF MOMENTUM,
Forest Products Lab., Madison, Wisconsin; and Illinois Univ., Champaign.
P. A. C. Raats, and A. Klute.
Soil Sci Soc of Amer Proc, Vol 32, No 4, pp 452-456, July-Aug 1968. 5 p, 30 ref.

Descriptors: *Flow, *Porous media, *Momentum equation, Compressible flow, Saturated flow, Soil water movement, Darcys law.
Identifiers: Miltiphase flow, Non-rigid porous media.

Soil fluid-phase movement is discussed on the basis of a balance of momentum for each phase in saturated as well as unsaturated soils with one or more fluid phases. Darcy's law is a special case of the relations presented, which account for several compressible as well as incompressible fluid phases moving through solid phase porous media which are not necessarily stationary, rigid, or isotropic. Various limiting assumptions are discussed and as one case, the form of Darcy's law for soils in which the solid phase undergoes deformation during fluid flow, is deduced. (Knapp-USGS)
W69-03071

VELOCITY-GRADIENT RELATIONSHIPS FOR STEADY-STATE UNSATURATED FLOW OF WATER IN NON-SWELLING ARTIFICIAL SOILS,
Department of Agriculture, Brookings, S. D.; and Purdue Univ., Lafayette, Ind. Dept. of Agronomy.
T. C. Olson, and D. Swartzendruber.
Soil Sci Soc of Amer Proc, Vol 32, No 4, pp 457-462, July-Aug 1968. 6 p, 10 fig, 22 ref.

Descriptors: *Unsaturated flow, *Porous media, *Soils, Clays, Kaolinite, Darcys law, Steady flow, Soil water movement, Soil water, Tension, Tensiometers.
Identifiers: Non-swelling clay soils.

The relationship between flow velocity and hydraulic gradient was studied for steady-state unsaturated flow of water in horizontal columns of two nonswelling porous media, one a mixture of sand, ground silica, and kaolinite, and the other a mixture of sand and ground silica only. The flowing water contained 0.1% phenol to inhibit bacteria. Soil-moisture tension was measured with three tensiometers positioned within the soil column. Gradients at different velocities could be determined at a single location. Tension changes were always from low to high, to eliminate hysteresis effects. This required the use of a graphical analysis to calculate corresponding values of velocity and gradient at a given constant tension. In general, essential proportionality between flow velocity and tension gradient at given tension was found for both materials. Very slight greater-than-proportional tendencies were present in the sand-kaolinite mixture, but were not consistently related to tension. In the sand-silica mixture less-than-proportional flow response was observed at low and intermediate tensions, but became proportional as the tension increased. Minimal pore-volume saturations achieved were 0.74 for the sand-silica-kaolinite, and 0.65 for the sand-silica. (Knapp-USGS)
W69-03072

MOVEMENT OF WATER TAGGED WITH (2)H, (3)H, and (18)O THROUGH ACIDIC KAOLINITIC SOIL,
Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
John C. Corey, and J. H. Horton.
Soil Sci Soc of Amer Proc, Vol 32, No 4, pp 471-475, July-Aug 1968. 5 p, 3 fig, 2 tab, 45 ref.

Descriptors: *Soil water movement, *Tracers, Tritium, Deuterium, Model studies, Infiltrometers.
Identifiers: Miscible displacement, Oxygen isotopes.

Miscible displacement techniques were used to compare the behavior of deuterium, tritium, and oxygen-18 as water tracers. Displacement of a 170-ml portion of triply tagged water through a 186-cm-long column of water-saturated acidic kaolinitic soil by distilled water revealed no differences in the relative rates of movement of deuterium-, tritium-, and oxygen-18-tagged water. (Knapp-USGS)
W69-03073

DETECTION OF SATURATED INTERFLOW IN SOILS WITH PIEZOMETERS,
Tennessee Valley Authority, Knoxville.
For primary bibliographic entry see Field 07B.
For abstract, see .
W69-03074

ROLE OF SOILS AND SEDIMENT IN WATER POLLUTION CONTROL--PART I, REACTIONS OF NITROGENOUS AND PHOSPHATIC COMPOUNDS WITH SOILS AND GEOLOGIC STRATA,
Federal Water Pollution Control Administration, Washington, D. C.
For primary bibliographic entry see Field 05E.
For abstract, see .
W69-03080

RELATION OF SOIL PROPERTIES TO THE EVAPORATION OF WATER FROM SOILS,
Clemson Univ., S. C. Agricultural Experiment Station.
For primary bibliographic entry see Field 02D.
For abstract, see .
W69-03175

MOVEMENT OF WATER FROM CANALS TO GROUNDWATER TABLE,
Idaho Univ., Moscow. Dept. of Civil Engineering; and Idaho Univ., Moscow. Dept. of Agricultural Engineering.
C. E. Brockway, and G. L. Bloomsburg.
Technical Completion Report, Water Resources Research Institute, Sept 1968. 7 p, 1 fig, 7 ref. OWRR Project A-009-Ida.

Descriptors: *Seepage, Canals, Irrigation, *Tensiometers, Permeability, Unsaturated flow, Hydraulic conductivity, *Groundwater.
Identifiers: Southern Idaho.

Investigation of the mechanics of water movement from irrigation canals to the water table has been performed on selected canals in southern Idaho. Field studies of existing seepage measurement techniques including ponding tests, inflow-outflow techniques and seepage meters were made. A new seepage meter which will operate efficiently in large operating canals was developed. An accurate and reliable tensiometer system for monitoring changes in soil moisture pressure beneath operating canals was developed. Measured decreases in soil moisture and pressure beneath an operating canal during the irrigation season indicated decreasing seepage rates caused by natural sealing of a thin soil layer on the canal bottom. A fast response, inexpensive null point tensiometer was laboratory tested and a device for measuring the capillary pressure - saturation curve for soils in situ was investigated. New techniques for obtaining and testing undisturbed soil cores using heat shrinkable tubing allow efficient laboratory determination of hydraulic characteristics.
W69-03179

DRAINAGE THEORY FOR REMOVAL OF EXCESS WATER FROM IRRIGATED LANDS,
Washington State Univ., Pullman. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03189

ADSORPTION OF PESTICIDES ON EARTH MATERIALS,
Massachusetts Univ., Amherst.
For primary bibliographic entry see Field 05G.
For abstract, see .
W69-03192

NON-DARCY FLOW CHARACTERISTICS OF WATER AS INFLUENCED BY CLAY CONCENTRATION,
Illinois Univ., Urbana. Dept. of Agronomy.
Raymond J. Miller, Allen R. Overman, and John H. Peverly.

Water Resources Center. Research Report No. 16, June 1968, 50 p, 3 tab, 11 fig, 33 ref. OWRR Project B-002-Ill.

Descriptors: *Clays, Flow. Hydraulic conductivity, Saturated flow, Saturated soils, *Soil water movement, Ground water movement, Porous media, Montmorillonite, Kaolinite, Darcy's Law, Flow characteristics, Flow rates, *Flow measurement.
Identifiers: *Non-Darcy flow, Threshold gradients, Pressure transducers.

The flow of water through saturated samples of montmorillonite and kaolinite was studied to help clarify the existence and nature of non-Darcian flow. No threshold gradients were found in any of the samples studied. Non-Darcy flow was found in 9, 30 and 40 weight percent montmorillonite samples but not in a 50 weight percent montmorillonite or in kaolinite samples. The possible causes of the non-Darcian flow are discussed. A refined technique using a pressure transducer was developed to measure hydraulic conductivities. The hydraulic conductivities of several types of samples under varying conditions were measured. Transport equations for convective diffusion in porous media were derived and tested for capillaries, porous diaphragms, sand columns and clay plugs.
W69-03195

2H. Lakes

PREDICTING DISSOLVED OXYGEN CONCENTRATION IN A LAKE COVERED WITH EVAPORATION SUPPRESSANT,
Bovay Engineers, Inc., Houston, Tex.
For primary bibliographic entry see Field 02D.
For abstract, see .
W69-02825

EVALUATION OF SEEPAGE FROM CHESTER MORSE LAKE AND MASONRY POOL, KING COUNTY, WASHINGTON,
Geological Survey, Washington, D. C. Water Resources Div.
F. T. Hidaka, and A. A. Garrett.
U S Geol Surv Water-Supply Pap 1839-J, 1967. 26 p, 9 fig, 7 tab, 7 ref.

Descriptors: *Reservoir leakage, *Surface waters, *Streamflow, *Washington, Seepage, Water loss, Regression analysis, Runoff, Hydrographs.
Identifiers: Runoff regimen change, Losing stream, Gaining stream, King County (Washington).

Hydrologic data collected in the Cedar and Snoqualmie River basins on the west slope of the Cascade Range were analyzed to determine the amount of water lost by seepage from Chester Morse Lake and Masonry Pool and the consequent gain by seepage to the Cedar and South Fork Snoqualmie Rivers. Average losses for water years 1957-64 were about 220 cfs while average gains were about 180 cfs in the Cedar River and 50 cfs in the South Fort Snoqualmie River. Streamflow and precipitation data for water years 1908-26 and 1930-32 indicate that a change in runoff regimen occurred in Cedar and South Fork Snoqualmie Rivers after the Boxley Creek washout in December 1918. For water years 1919-26 and 1930-32, the flow of Cedar River near Landsburg averaged about 80 cfs less than it would have if the washout had not occurred. In contrast, the flow of South Fork Snoqualmie River at North Bend averaged about 60 cfs more than it would have. (Steinhilber-USGS)
W69-02827

SEASONAL CHANGES OF SLOUGH AND LAKE WATER CHEMISTRY IN SOUTHERN SASKATCHEWAN (CANADA),
Instytut Geologiczny, Sosnowiec (Poland).
A. D. Rozkowska, and A. Rozkowski.
J Hydrol, Vol 7, (1969), No 1, pp 1-13, pub Nov 1968. 13 p, 4 fig, 4 tab, 7 ref.

Descriptors: *Water chemistry, *Lakes, *Saline water systems, *Evaporation, Water quality, Sulfates, Hydrogen ion concentration, Calcium, Magnesium, Carbonates, Bicarbonates, Chlorides.
Identifiers: *Canada, Saskatchewan.

Detailed hydrochemical studies of lakes and sloughs in the Moose Mountain area of Southern Saskatchewan show an increase of the water salinity and the enrichment of waters with easily soluble salts during the summer season. Concurrently, there was observed precipitation of the poorly soluble salts. The salinity and chemistry of the large lakes vary less than that of the smaller sloughs. Degree of salinity increase depends on the hydrological and hydrographical conditions as well as on the biological environment. The highly mineralized shallow sloughs located in deep kettles show increases of salinity during summer of 200 to 300% and particularly a sharp rise of sulfate and magnesium ions. (Knapp-USGS)
W69-02838

DWINDLING LAKES,
Wisconsin Univ., Madison. Lab. of Limnology.
Arthur D. Hasler, and Bruce Ingersoll.
Nat Hist, Vol 77, No 9, pp 8+, Nov 1968. 6 p, 1 fig, 1 tab.

Descriptors: *Cyanophyta, *Plant growth, *Eutrophication, Agricultural watersheds, Aquatic weed control, Algicides, Fertilization, Great Lakes, Great Lakes region, Harvesting, Impoundments, Lake stages, Maine, Nutrients, Oligotrophy, Rivers, Sewage, Systems analysis, Water pollution, *Lakes.
Identifiers: Oscillatoria rubescens, Lake Zurich (Switzerland), Cochran Lake (Wis), Lake Tahoe (Calif), Lake Monona (Wis), Upper Klamath Lake (Ore), Lake Sallie (Minn), Lake Mendota (Wis), Moses Lake (Wash), Lake Washington (Wash), Lake Kegonsa (Wis), Lake Waubesa (Wis), Crater Lake (Ore), Lake George (NY), Lake Cayuga (NY), Lake Okoboji (Iowa), Douglas Lake (Mich), Lake Okeechobee (Fla), Lake Apopka (Fla).

Eutrophication and subsequent extinction of lakes is a naturally occurring process whose rate is governed by many limnological and geological factors. Man's activities, including waste disposal and agricultural practices, substantially hasten the process by polluting rivers, lakes and impoundments with excessive plant nutrients. Consequent growth of blue-green algae and rooted aquatic vegetation initiate a cycle of events which are aesthetically offensive and economically costly. Authors classified 12 selected American lakes as follows: excellent--Crater, Ore; excellent but endangered--Superior and Tahoe; good but endangered--George and Cayuga, NY; fair but improving--Washington, Seattle; good and improving--Okoboji, Iowa; fair and endangered--Mendota, Wis; poor and endangered--Erie; good but endangered--Douglas, Mich; and Okeechobee, Fla; and poor but improving--Apopka, Fla. Authors discuss diversion, improved sewage treatment, enlightened agricultural practices, and harvesting as methods of control, but discourage techniques such as application of biocides, which treat effects without eliminating nutrients. Air pollution is involved as source of nitrogen pollution via rainfall. Authors urge more and careful study of manifold factors influencing eutrophication and indicate the great promise of systems analysis as means of generating large-scale data needed for control.
W69-02956

FERTILIZATION OF NATURAL LAKES IN MICHIGAN,
Michigan State Univ., East Lansing Dept. of Zoology.
Robert C. Ball.
Trans Amer Fish Soc, Vol 78, pp 145-155, 1948. 16 p, 3 fig, 2 tab, 9 ref.

Descriptors: *Lakes, *Eutrophication, *Fertilization, *Michigan, Phosphorus, Nitrogen, Nutrients, Pondweeds, Water pollution effects, Winterkilling, Oxygen requirements, Marginal productivity, Trout, Diptera, Pan fish, Invertebrates, Fish management, Pikes, Minnows, Bull heads.
Identifiers: Secchi disk, Lower Peninsula (Mich), North Twin Lake, Cheboygan County (Mich), Otsego County (Mich), South Twin Lake, Hybrid sunfish, Solution lakes, Nymphae, Comparative studies.

During summers of 1946 and 1947, high-nitrogen, high-phosphorus commercial fertilizer (10-6-4) was applied at 3-week intervals of two Michigan lakes--a warm-water lake and a trout lake. Two fairly similar adjacent lakes served as unfertilized controls. Both summers, the equivalent of 2 ppm/week of fertilizer (ie, 2800 lb) was supplied to the warm-water lake; the smaller trout lake received the equivalents of 2 ppm/week (ie, 400 lb) in 1946 and 3 ppm/week in 1947. The former responded with planktonic algae bloom during the first summer and with a dense growth of filamentous algae the second. The trout lake, where Secchi disk readings were not less than 8.2 feet, responded less markedly to added nutrients, although total alkalinity increased from original 48 ppm to 53 ppm, as compared to a steady 41 ppm in control. Little oxygen depletion occurred in treated lakes during first post-treatment winter; however, in February 1948 oxygen decreased below 1 ppm at all depths. In both treated lakes, winterkill of fishes and invertebrates resulted. No observable winterkill occurred in control lakes. Author emphasizes need for further research and discourages indiscriminate fertilization of lakes as a management technique. (Wisc)
W69-02957

LONG-TERM CHANGES IN WATER CHEMISTRY AND ABUNDANCE OF PLANKTON AT A SINGLE SAMPLING LOCATION IN LAKE ONTARIO,
Ontario Water Resources Commission, Toronto; and Municipality of Metropolitan Toronto (Ontario). Dept. of Works.
C. F. Schenk, and R. E. Thompson.
Publication Number 13, Great Lakes Res Div, Univ Mich, pp 197-208, 1965. 12 p, 6 fig, 1 tab, 15 ref.

Descriptors: *Lake Ontario, *Water chemistry, *Plankton, Water pollution effects, Annual succession, Phytoplankton, Regression analysis, Ammonia, Chlorides, Hardness (Water), Sampling, Analytical techniques, Hydrogen ion concentration, Eutrophication, Oligotrophy, Bioindicators, Protozoa, Rotifers, Diatoms.
Identifiers: Canada, Toronto Island Filtration Plant (Ontario), R V Port Dauphine, R C Harris Filtration Plant (Ontario), Comparative studies, Mallomonas, Anabaena, Cladophora. Vorticella, Oscillatoria, Plankton abundance, Synura, Dinobryon, Fragilaria, Tabellaria, Synedra, Stephanodiscus, Cyclotella, Melosira, Ulothrix, Codonella, Actinophrys.

Depending upon wind conditions, the intake of Toronto Island Filtration Plant, Ontario, samples epilimnetic or hypolimnetic waters of Lake Ontario. Evaluation of data accumulated from 1923 to 1954 indicated that the level of plankton approximately doubled during this period. Levels of free ammonia, chlorides, hardness and turbidity continued to increase through 1964. Turbidity levels and concentration of free ammonia in the 'raw' water were substantially greater than those obtained farther out in the lake. As determined from a highly statistically significant linear regression, mean increase in plankton was computed at 5.6 areal standard units (asu) per annum with confidence limits (95%), 3-7 asu/year. Well-defined spring maximal and winter minimal populations were apparent nearly every year, but fall maxima developed inconsistently and were characterized by levels of abundance lower than those for the spring pulses. No definite changes in the duration of spring maxima were evident in later years, but an alteration in the pattern of diatom dominance emerged after 1940. Between 1925 and 1940, Asterionella dominated the spring pulse in 13 of 16

years. Beginning in 1941, Cyclotella became an important constituent of the maximum, sharing dominance with Asterionella in 6 of 14 years, and being the dominant species in three additional years. (Wisc)
W69-02958

PRIMARY PRODUCTIVITY STUDIES IN ONONDAGA LAKE, NEW YORK,
Syracuse Univ., N. Y. Dept of Civil Engineering.
For primary bibliographic entry see Field 05C.
For abstract, see .
W69-02959

THE CHEMISTRY OF LAKE SEDIMENTS FROM INDIAN TIBET,
Yale Univ., New Haven, Conn. Osborn Zoological Lab.
G. E. Hutchinson, Anne Wollack and Jane K. Setlow.
Amer J Sci, Vol 241, No 9, pp 533-542, Sept 1943. 11 p, 1 fig, 2 tab, 11 ref.

Descriptors: *Lakes, *Geochemistry, *Sediments, *Water chemistry, *Lake stages, Silica, Manganese, Eutrophication, Oligotrophy, Magnesium, Calcium, Chlorides, Analytical techniques, Aluminum, Phosphorous compounds, Nitrogen compounds, Potassium compounds, Stratigraphy, Iron, Titanium.
Identifiers: *India, *Tibet, Mesotrophy, Yaye Tso, Sta-tsa-puk Tso, Tso Morirr, Mitpai Tso, Khyagar Tso, Panggong Tso, Tso Kar, Pyramid Lake (Nevada), Linsley Pond (Connecticut), Closed lakes, Open lakes, Lake origins, Ekman-Birge grab, Strontium, Comparative studies, Barium, Ororotse Tso.

Calcium content of lake sediments is correlated with presence or absence of an outlet Magnesium increases only in sediments of more concentrated closed lakes. Strontium appears to follow calcium, but strontium content is probably also controlled lithologically. Barium is probably sedimented with the silt fraction and is independent of water chemistry. Calcium content of the deep sediment of Panggong Tso has clearly undergone changes, presumably owing to a fall in water level. Author suggests that study of samples from long cores, either by gravimetric analysis of CaO and SiO sub 2 or by spectrographic comparison by Sr and Ba should make possible the recognition of periods of high and low levels in a lake's history. The mean phosphorus content of the sediment ash is 0.10%, little above the mean geochemical value of 0.08%. Loss of phosphorus from water by precipitation as Ca sub 3 (PO sub 4) sub 2 is clearly of little importance in the economy of even the closed alkaline lakes. The ratio of combined nitrogen to phosphorus varies from 1.7 to 7.8; such low values are regarded as characteristic of relatively oligotrophic lakes. The proximate composition of the organic matter is essentially as in other harmonic lake sediments. (Wisc)
W69-02960

ONONDAGA LAKE, NEW YORK, AN UNUSUAL ALGAL ENVIRONMENT,
Syracuse Univ., N. Y. Dept. of Civil Engineering.
Daniel F. Jackson.
For publication in 'Algae, Man, and the Environment,' Syracuse Univ Press, 1968. 19 p. NY Dept. of Health C-19638.

Descriptors: *Algae, *Bioassay, *Bioindicators, *Eutrophication, Plant growth, Chlorophyta, Chrysophyta, Cyanophyta, Euglenophyta, Diatoms, Lakes, Meromixis, Sewage effluents, Sewage treatment, Water pollution effects.
Identifiers: *Onondaga Lake (New York), Cladophora, Enteromorpha intestinalis, Anabaena, Anacystis, Gloeocapsa, Gloeotrichia, Synechococcus, Cyclotella, Navicula, Nitzschia, Pinnularia, Gomphonema, Amphora, Eunotia, Saturoneis, Carteria, Chlamydomonas, Gonium, Ankistrodesmus, Chlorella, Microspora, Pediastrum, Halochlorococcum, Scenedesmus, Euglena, Lepocinclis.

Made highly brackish (1700-1960 ppm chloride) from inflow of saline springs, Lake Onondaga, NY, is thought to be meromictic. Although subject to heavy influences of cultural eutrophication and industrial pollution, lake fails to bloom with cyanophytes, but annual blooms of chlorophytes and euglenophytes have occurred in summers since 1962. Author speculates that scarcity of cyanophytes may result from salinity, from growth inhibition by high calcium concentrations (typical analysis: 472 mg/L as ion), or from decreased mineralization of allochthonous organic matter. Preliminary to a study of effects on lake of replacing existing primary treatment sewage plant with a planned secondary type, a bioassay was devised. Five species of cyanophytes, 8 chrysophytes, 10 chlorophytes, and 2 euglenophytes were cultured in 5 concentrations of filtered lake water enriched with appropriate growth medium held for 10 days at 25 deg C and at a diel cycle of 14 hours light (400 lux), 10 hours dark. Cyanophytes did not grow in unenriched lake water. Evaluated in cells/liter, following forms grew better in unenriched lake water than in undiluted growth medium to extent indicated by multiplicative factor in parentheses: diatom--Cyclotella (119); chlorophytes--Halochlorococcum (15); Chlorella (Milford strain) 9); Chlamydomonas (16).
W69-02961

A NOTE CONCERNING THE EDDY TRANSFER COEFFICIENTS OF MOMENTUM AND WATER VAPOR UNDER NEAR-ADIABATIC CONDITIONS,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 02D.
For abstract, see .
W69-03051

SYSTEMS APPROACH TO WATER QUALITY IN THE GREAT LAKES.

Proc of 3rd Annual Symp on Water Resources Res, Ohio State Univ Water Resources Center, 130 p, Sept 1967. OWRR A-999-Ohio.

Descriptors: *Systems analysis, *Great Lakes, *Lake Erie, *Water quality, Eutrophication, Water pollution, Water pollution control, Management, Model studies.

A symposium on the subject of using the systems approach to water quality in the Great Lakes, particularly Lake Erie, was held at Ohio State University, September 1967. It was agreed that Lake Erie water quality changed markedly in the past 70-100 years in temperature, ecology, and suspended and dissolved solids, but the cause has not been firmly established. Pollution, invasion by marine organisms, natural eutrophication, and other causes are all involved. A systems approach helps solve the problem by pointing out inadequacies in knowledge and in conceptual, mathematical, and computer models used as tools, and when sufficient good evidence has been collected, systems methods are powerful tools for problem solving and management. The general conclusion is that a systems-modeling approach to quality problems in the Great Lakes is feasible and should be instigated as soon as possible on as large a geographical scale as possible. (Knapp-USGS)
W69-03059

ADSORPTION OF PHOSPHORUS BY LAKE SEDIMENT,
Connecticut Agricultural Experimental Station, New Haven.
Robert D. Harter.
Soil Sci Soc of Amer Proc, Vol 32, No 4, pp 514-518, July-Aug 1968. 5 p, 5 fig, 1 tab, 12 ref.

Descriptors: *Adsorption, *Phosphorus compounds, *Lakes, *Sediments, *Eutrophication, Algae, Clays, Silicates.
Identifiers: Extractable phosphorus.

To study the mechanism of sorption of phosphorous by eutrophic lake sediments, between 0 and 2.2 mg P was added to 0.1-g sediment samples at a 1:50 sediment-solution ratio. After equilibrium had been established, P remaining in solution was determined, and adsorbed P was extracted with 0.5N ammonium fluoride and 0.1N NaOH. Whereas all P adsorbed into the NaOH-extractable fraction appeared to occur as an iron phosphate, ammonium fluoride apparently extracted P bonded by two different mechanisms. When less than about 0.1 mg P was added, ammonium fluoride extracted a tightly bonded form of P, probably occurring as an aluminum phosphate. When more than 0.1 mg P was added, additional P in a more loosely bonded form was absorbed into the ammonium fluoride-extractable fraction. The loosely bonded P appeared to be independent of Al content of the sediment, and could be removed by successive water extraction. The capability of the sediment to adsorb considerable loosely bonded P means that large influxes of P into the lake may be held temporarily and subsequently released to growing plants and algae. (Knapp-USGS)
W69-03075

ANALYSIS OF WATER AND WATER-RELATED RESEARCH REQUIREMENTS IN THE GREAT LAKES REGION.
Michigan Univ., Ann Arbor.
For primary bibliographic entry see Field 07A.
For abstract, see .
W69-03079

EVAPORATION FROM LARGE DEEP LAKES,
Great Lakes-St. Lawrence Study Office, Cornwall (Ontario). Dept. of Mines and Technical Surveys.
For primary bibliographic entry see Field 02D.
For abstract, see .
W69-03083

A SURVEY AND EVALUATION OF SMALL ARTIFICIAL RECREATIONAL PONDS IN CENTRAL MASSACHUSETTS,
Massachusetts Univ., Amherst.
James A. McCann, Eugene F. Zanella, and Larry R. Scofield.
Proj Completion Rep. Mass Univ Water Resources Res Inst Rep, 2 theses, 2 parts, total 226 p, Oct 1968. Total 19 fig, 39 tab, 82 ref, 10 append. OWRR: A-001-Mass.

Descriptors: *Farm ponds, *Multiple-purpose reservoirs, *Limnology, *Massachusetts, Recreation, Fishing, Swimming, Stock water, Fish management, Water storage.
Identifiers: Fire protection ponds, Skating ponds, Multiple-purpose farm ponds.

A survey of the physical, biological, and chemical properties and water uses of 167 small artificial ponds in Hampshire County, Massachusetts, and a detailed limnological evaluation of 12 of them showed that land uses and geographical features seriously affect their multiple use. In the past, ponds in Hampshire County were constructed primarily for fire protection and livestock watering, while skating, swimming, and fishing were secondary. Satisfying angling desires is the most difficult use to achieve in a pond. Weed control and species composition regulation work must be done annually. The most common difficulties are low acidity, dense algal blooms, periods of deficient oxygen, and drought. Many of the ponds studied had no recreational use because of incorrect construction, conflicting uses, or lack of annual management. The most serious problems are in ponds being used for purposes other than those originally planned. (Knapp-USGS)
W69-03086

CHEMICAL AND ISOTOPIC BALANCES FOR A MEROMICTIC LAKE,
Lamont Geological Observatory, Palisades, N. Y.

Taro Takahashi, Wallace Broecker, and Yuan Hui Li.
Limnol and Oceanogr, Vol 13, No 2, pp 272-292, April 1968. 21 p, 10 fig, 11 tab, 23 ref.

Descriptors: *Meromixis, *Lakes, *Chemical stratification, *Stagnant water, New York, Sediments, Calcite, Photosynthesis, Carbon cycle, Supersaturation.
Identifiers: *Isotopic balance, *Green Lake (N. Y.), Chemocline, Hydrologic transport.

Chemical and isotopic studies of the waters and sediments of Green Lake near Fayetteville, New York, are described and causes of the meromixis are defined. Stagnation results from water of two different types entering the lake. The water entering below the chemocline is almost twice as saline as the water entering the surface layer according to the hydrologic, isotopic, and chemical balances. For carbon and its isotopes, consideration is given to the contributions of CaCO sub 3 precipitation, the photosynthetic cycle, exchange of gas with the atmosphere, and hydrologic transport. A mean time residence of two years is indicated for surface water and of 4 to 30 yr for deep water. Although both surface and deep waters are supersaturated with calcite, the carbon isotope data indicate that precipitation occurs largely from the surface water. (Lang-USGS)
W69-03088

SOME ASPECTS OF THE HYDROLOGY OF PONDS AND SMALL LAKES,
Minnesota Univ., St. Paul. Dept. of Agricultural Engineering.
P. W. Manson, G. M. Schwartz, and E. R. Allred.
Minn Univ Agr Exp Sta Tech Bull 257, 1968. 88 p, 55 fig, 40 tab, 14 ref. OWWR: A-001-Minn.

Descriptors: *Potholes, *Regimen, Groundwater recharge, Drainage, Minnesota, Water levels.

Information is presented on the annual regimen of about 40 small lakes and ponds (potholes) in an area extending from Mankato to Detroit Lakes, Minnesota. The usual regimen of a small body of water follows a general pattern. From Dec. 1 to about Apr. 1, the ponds normally have an ice cover and the water and ice level in most ponds is notably stable. During this period, seepage losses from 47 small water bodies were calculated to average about 0.0032 foot per day. Water levels begin to rise in the spring after ice break-up and the advent of the usual frequent rains; the crest of the rise may occur from mid-May to mid-June. Levels decline sharply from mid-June through August, because of high evaporation rates. From September to freeze-up, the decline becomes more gentle. These data indicate that the main factor controlling water levels in small, shallow lakes and ponds is the relation between precipitation and evaporation. A factor that controls flood levels is the permeability of the soil and drift that surround the ponds. These materials generally have a much higher permeability than those of the bottom of the pond, hence infiltration is rapid and significant during flood levels. (Steinhilber-USGS)
W69-03091

AN INVESTIGATION OF THE EFFECT OF CONTROLLED RELEASES ON THE PHYSICAL, CHEMICAL AND BACTERIOLOGICAL CHARACTERISTICS OF FORT LOUDOUN RESERVOIR,
Tennessee Univ., Knoxville. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05C.
For abstract, see .
W69-03180

UNDERWATER SOILS: A REVIEW OF LAKE SEDIMENTS,
Freshwater Biological Association, Ambleside (England).
C. H. Mortimer.
J Soil Sci, Vol 1, pp 63-73, 1949. 11 p, 1 fig, 35 ref.

Descriptors: *Sedimentation, *Sediment-water interfaces, *Nutrients, *Soil properties, Lakes, Metabolism, Seasonal, Cycles, Stratification, Mud-water interface, Surface waters, Thermal stratification, Sampling, Drainage systems, Dissolved oxygen.
Identifiers: Seasonal changes, Mud-water relationship, Sediment-water relationship, Nutrient cycles, Surface sediments, Mud surface, Esthwaite Water, Bacteria in sediments, Animals in sediments, Biological productivity.

Sampling methods, factors which influence sedimentation, the role of sediments in lake metabolism, and the activities of bacteria and animals in sediments are reviewed. Sediments often record changes in such factors as extent of soil cover, cultivation or pollution. For a large drainage area compared with the lake area, most of the sediment parent material may be expected from inflows. Sediments affect the biological productivity in the lakes as a whole, especially with regard to their influence on the supply of plant nutrients. This is illustrated by seasonal changes in Esthwaite Water in the English Lake District with depth-time diagrams of the distribution of dissolved oxygen in the water, distribution of redox potential above and below the mud surface and concentration of some dissolved substances in water. Samples were taken approximately 10 cm above mud surface. Questions are raised concerning future studies of the sediment-water system.
W69-03187

2I. Water in Plants

INFLUENCE OF THE FOREST ON PRECIPITATION,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02B.
For abstract, see .
W69-02803

EFFECTS OF MOISTURE AND NITROGEN FERTILIZER ON GROWTH AND WATER USE BY NATIVE GRASS,
Agricultural Research Service, Washington, D. C.
D. E. Smika, H. J. Haas, and J. F. Power.
Agronomy J, Vol 57, No 5, pp 483-486, September-October 1965. 4 p, 4 fig, 3 tab.

Descriptors: *Soil moisture, Water utilization, *Nitrogen, *Grasses, *Moisture availability, Soil-water-plant relationships, Semiarid climates, Precipitation (Atmospheric), North Dakota, Fertilizers, *Crop response, Forage grasses, Plant growth.
Identifiers: Water-use efficiency.

A study was conducted at Mandan, North Dakota, to determine the influence of available moisture supply and nitrogen fertilizer on yield, water use efficiency and recovery of nitrogen fertilizer by native grass. Production increased with each added increment of nitrogen, whether applied annually or only once the first year. Total water use was not affected by fertilizer nitrogen on the natural moisture treatment, but was increased about 1.5 inches with the addition of 160 pounds of nitrogen per acre on the high moisture treatment. Water-use efficiency increased as rate of fertilizer nitrogen increased and was related curvilinearly to available moisture supply. Recovery of fertilizer nitrogen by the forage was greater on the high moisture treatment than on the natural moisture treatment. Native grasses on arid soils are more efficient with respect to water when proper levels of nitrogen are maintained. (Blecker-Arizona)
W69-02969

DETERMINING CONSUMPTIVE USE FOR PLANNING WATER DEVELOPMENTS,
California Univ., Los Angeles; and Clyde-Criddle-Woodward, Inc., Salt Lake City, Utah.
Harry F. Blaney, Sr., and Wayne D. Criddle.
Irrig Drainage Speciality Conference, American Society of Civil Engs, Las Vegas, Nevada, pp 1-34, November 2-4, 1966. 34 p, 8 tab, 32 ref, append.

Descriptors: *Consumptive use, *Water requirements, Water demand, Water resources development, *Irrigation efficiency, *Climatic data, Arid lands, Beneficial use, Crop production, *Evapotranspiration, Irrigation water, Legal aspects, Temperature, Reclamation states, Solar radiation, Precipitation (Atmospheric), Interstate compacts.
Identifiers: Blaney-Criddle method.

The purpose of this paper was to describe the Blaney-Criddle (B-C) method for estimating consumptive use and irrigation requirements for areas where few or no data, except limited climatological data, are available. Many terms used in the report are defined. The procedure was to correlate existing consumptive use data for different crops with monthly temperature, percent of daytime hours, precipitation, frost-free (growing) period, or irrigation season. The coefficients developed were used to transpose the consumptive-use data for a given area to other areas for which only climatological data were available. The method was found to be satisfactory for computing use where measured water-use data were not available. The described method can be used to determine the consumptive use for planning water developments in arid climates. (Blecker-Arizona)
W69-02970

INVESTIGATIONS ON THE IRRIGATION REQUIREMENTS OF HYBRID MAIZE CROP IN ARID REGION OF PUNJAB,
Punjab Agricultural Univ., Hissar (India). Dept. of Agronomy.
For primary bibliographic entry see Field 03F.
For abstract, see .
W69-02973

SPRINKLER AND SURFACE IRRIGATION OF VEGETABLE AND FIELD CROPS IN AN ARID ENVIRONMENT,
California Univ., Berkeley.
For primary bibliographic entry see Field 03F.
For abstract, see .
W69-02974

PSYCHROMETRIC MEASUREMENT OF SOIL WATER POTENTIAL IN SITU UNDER COTTON PLANTS,
Commonwealth Scientific and Industrial Research Organization, Griffith (Australia). Div. of Irrigation Research.
For primary bibliographic entry see Field 02G.
For abstract, see .
W69-02980

GERMINATION IN LOWER OSMOTIC POTENTIAL AS AN INDEX OF DROUGHT RESISTANCE IN CROP PLANTS - A REVIEW,
Udaipur Univ. (India) Agricultural Experiment Station.
Man Singh Manohar, Suraj Bhan, and Ram Prasad.

Annals of Arid Zone, Vol 7, No 1, pp 82-92, March 1968. 11 p, 57 ref.

Descriptors: *Germination, Seeds, Drought resistance, Soil moisture, Crop response, *Osmotic pressure, Soil-water-plant relationships, Arid lands, Plant physiology, Moisture content, Field capacity, Salt tolerance, Biochemistry, Wilting point, Absorption, Moisture uptake.
Identifiers: *Osmotic potential, Polyethelen glycol.

A review of studies of 'Germination in lowe osmotic potential as an index of drought resistanc in crop plants' was presented. These studies sho that little systematic work has been done in the pa to confirm the prevailing hypotheses. Conflictin results have been reported by investigators workin with various crop species, using different levels o osmotic potentials, produced from several differe chemicals, and under varying environmental cond tions. It was difficult, therefore, to conclude

definite relationship between the germinability of seeds in lower osmotic potentials and its relation to drought resistance in the resultant crop plants. It was apparent from the review that most of the chemicals which have been used in the past may enter inside the germinating seeds and thus their effects are much more complex than producing drought. Recent work has shown, however, that the true osmotic stress may be produced by using polyethelene glycol solutions. (Affleck-Arizona)
W69-02984

ROOT DEVELOPMENT IN RELATION TO PLANT POPULATION AND FERTILITY LEVELS IN SOYBEAN,
Agriculture Coll., Kanpur (India).
M. N. Mishra, and A. N. Singh.
Annals of Arid Zone, Vol 7, No 1, pp 121-126, March 1968. 6 p, 3 fig, 2 tab.

Descriptors: *Root development, *Drought resistance, Arid lands, Fertilizer, Plant populations, *Soybean.

In arid and semi-arid regions where moisture is almost always a limiting factor, the study of root development assumes a significant place. A sound and deep root system is an index of the ability of plants to withstand deficient moisture conditions and to absorb plant nutrients from deeper layers of the soil profile, thus affecting efficient utilization of plant nutrients. An experiment was conducted to study the effect of three plant populations (25, 50, and 75 cm spacing between rows) with 2 levels of nitrogen (0 and 10 kg/ha) and 5 levels of P sub 2 0 sub 5 (0, 20, 40, 60, and 80 kg/ha) on root development of soybean T49. The length of the main root increased in 25 cm row spacing followed by 50 and 75 cm, while the reverse was true with number and weight of nodules per plant. Nitrogen had no marked influence on root development, but the application of phosphorus enhanced the length of the main root as well as the number and weight of nodules per plant. (Affleck-Arizona)
W69-02985

PONTACYL BRILLIANT PINK AS A TRACER DYE IN THE MOVEMENT OF WATER IN PHREATORPHYTES,
Geological Survey, Menlo Park, Calif.
T. W. Robinson, and Donald Donaldson.
Water Resources Res, Vol 3, No 1, pp 203-211, 1967. 9 p, 5 fig, 4 ref.

Descriptors: *Evapotranspiration, *Phreatophytes, *Tracers, *Dye releases, Soil moisture.
Identifiers: Fluorescent dye tracers.

In connection with evapotranspiration studies, Pontacyl Brilliant Pink, a fluorescent dye, was used to trace the movement of water in 2 species of woody phreatophytes, willow and wildrose. The dye was introduced into water surrounding the plant roots on August 4, 1964. Thereafter, leaf samples were collected periodically until the end of the growing season in October. Fluorometric measurements showed the presence of the dye in the leaves. Dye was also found in samples of roots and stems and in transpired water collected in plastic bags. Dye concentration was greatest in the upper part of the stems. As a tracer the dye offers a rapid method for studying the source, movement, and disposal of water used by phreatophytes. The method is rapid and inexpensive, and the laboratory determination is not difficult. The fluoremetric determinations were made with a GK Turner Fluorometer Model III, which has a sensitivity of 1 ppb. (Knapp-USGS)
W69-03047

THE EFFECT OF APPLIED INTERCEPTION ON TRANSPIRATION RATES OF POTTED PONDEROSA PINE,
Arizona Univ., Tucson. Dept. of Watershed Management.
David B. Thorud.
Water Resources Res, Vol 3, No 2, pp 443-450, 1967. 8 p, 2 fig, 2 tab, 11 ref.

Descriptors: *Evapotranspiration, *Transpiration, *Interception, *Ponderosa pine trees, Soil moisture, Winds, Humidity, Temperature.

Water was artificially applied to the foliage of small potted ponderosa pine trees to determine the effect of wetting on transpiration rates. By means of unwetted control trees and a prediction equation, the hypothetical unwetted transpiration of wetted trees could be estimated. The difference between the estimated and actual transpiration was a measure of the transpiration reduction due to treatment. For 36 2 hr periods the average transpiration reduction was 14%, or 9% of the applied water. Thus, about 91% of the applied water was a net loss to soil moisture supplies. The saving as a percent of applied water varied from 4 to 14 and appeared to be weather related. Minimum values were generally observed on both cool, humid days and dry, hot, windy days. Higher savings were observed with more moderate weather.
W69-03116

COLOR-INFRARED AERIAL PHOTOGRAPHIC INTERPRETATION AND NET PRIMARY PRODUCTIVITY OF A REGULARLY-FLOODED NORTH CAROLINA SALT MARSH,
North Carolina State Univ., Raleigh. Dept. of Botany.
Linda M. Stroud, and Arthur W. Cooper.
North Carolina Water Resources Research Institute Report 14, November 1968. 86 p, 1 fig, 34 tab, 41 ref, 1 append. OWRR Project A-003-NC.

Descriptors: North Carolina, *Salt marshes, Coastal marshes, Tidal marshes, *Primary productivity, Biomass, *Aerial photography, Remote sensing, *Statistical models, Regression analysis, Photogrammetry.
Identifiers: Spartina alterniflora, *Cordgrass, Juncus roemerianus, *Black needlerush, Brunswick County (NC).

A study was made of net primary productivity of salt marsh communities in a 2000-acre, regularly flooded marsh in Brunswick County, N. C. Color infra-red aerial photographs were used to determine acreages of community types. Acreages were: short Spartina alterniflora (cordgrass) - 837; medium cordgrass - 195; tall cordgrass - 110; Juncus roemerianus (black needlerush) - 161; water - 474; other - 118. Net primary productivity estimates were based on harvest method data. Observed harvest data were fitted to a fourth degree polynomial in time in order to express the average behavior of the standing crop through the year. Net productivity was determined by two methods: (1) use of living standing crop only, and (2) use of changes in living and dead standing crop. Estimates of net primary productivity using changes in living and dead standing crops based on the prediction equation were: short cordgrass - 1106 kcal/m sq/yr; medium cordgrass 1856 kcal/m sq/yr; tall cordgrass - 6471 kcal/m sq/yr; black needlerush - 5346 kcal/m sq/yr. Over the entire marsh net primary productivity was estimated to be 1534 kcal/m sq/yr. These values were lower than similar values from Georgia but resembled closely other estimates of net primary productivity for salt marsh vascular plants in North Carolina.
W69-03177

CORRELATING SOIL MOISTURE CONDITIONS AND MICROCLIMATE WITH EVAPORATION LOSSES AND WATER REQUIREMENTS OF PLANTS,
South Dakota State Univ., Brookings.
For primary bibliographic entry see Field 02D.
For abstract, see .
W69-03198

2J. Erosion and Sedimentation

METHODOLOGICAL PREREQUISITES FOR CONDUCTING NETWORK OBSERVATIONS OF THE CHANNEL PROCESS,
For primary bibliographic entry see Field 07A.
For abstract, see .
W69-02807

BED FORMS IN THE LOWER RED DEER RIVER, ALBERTA,
Research Council of Alberta, Edmonton.
C. R. Neill.
J Hydrol, Vol 7, (1969), No 1, pp 58-85, Nov 1968. 28 p, 12 fig, 3 tab, 16 ref.

Descriptors: *Alluvial channels, *Channel morphology, *Bed load, *Sand waves, Dunes, Flumes, Model studies, Discharge (Water), Sediment discharge, Streamflow.
Identifiers: Alberta (Canada), Red Deer River (Alberta), Streambed morphology.

Observations in the form of air photographs and echo soundings were made at various times over a period of 4 years on the Red Deer River near Duchess, Alberta. These revealed a complex system of both large- and small-scale features or wave forms on the sandy bed of the river. It is shown that the features, and with them the bed elevations at certain points, change considerably from time to time, and that minor forms in particular change size rapidly in response to changes in flow. The observations are discussed in terms of some recent efforts towards classification of riverbed forms and towards ralating their properties to hydraulic factors. It is suggested that very detailed and extensive field observations would be needed to fully describe the bed topography and its changes at similar locations, and that laboratory observations of bed-forms in flumes do not in general reflect the extreme complexity of river situations.
W69-02816

INTERRELATIONSHIP BETWEEN PHYSIOGRAPHY, HYDROLOGY, SEDIMENTATION, AND SALINIZATION OF THE LODDON RIVER PLAINS, AUSTRALIA,
Geological Survey of Australia, Melbourne.
For primary bibliographic entry see Field 02B.
For abstract, see .
W69-02817

USE OF THE COTTONWOOD IN AN INVESTIGATION OF THE RECENT HISTORY OF A FLOOD PLAIN,
Johns Hopkins Univ., Baltimore, Md. Dept. of Geography.
Ben L. Everitt.
Amer J Sci, Vol 266, pp 417-439, June 1968. 22 p, 9 fig, 2 plate, 14 ref.

Descriptors: *Flood plains, *Sedimentation rates, *Sediment distribution, *Dendrochronology, Ecological distribution, Cottonwoods, Alluvial channels, Geomorphology, Sediments, Deposition (Sediments), Alluvium, Ecology, North Dakota.
Identifiers: Little Missouri River, Flood plain development, Channel migration.

By examining the growth of the flood plain forest and its relation to the river, this study presents information on the origin of the sediments, time in transit, and the percentage of time the average sediment particle spends at rest in the flood plain deposits. Standard point measurements of sediment transport at gaging stations show only the amount of sediment being transported at a given time. In a 1-1/2 mi section of the Little Missouri River valley in western N. Dakota, data indicate that germination and growth of the cottonwood is intricately re-

lated to discharge of the river, movement of the channel, and flood-plain development. On the basis of age-area distribution of flood plain cottonwoods, a model has been constructed to describe channel migration and sediment transport. In the reach studied the river redistributes an average volume of sediments each century equal to the total available sediments in the valley by undercutting banks and depositing on point bars and flooded surfaces. Deposition on a unit of valley floor decreases exponentially with time owing to the progressive increase in elevation brought about by the deposition. Complex topography of the valley floor, including terrace-like forms and inset fills, may be explained entirely by modern processes presently at work in the valley. (Steinhilber-USGS)
W69-02836

THE CHEMISTRY OF LAKE SEDIMENTS FROM INDIAN TIBET,
Yale Univ., New Haven, Conn. Osborn Zoological Lab.
For primary bibliographic entry see Field 02H.
For abstract, see .
W69-02960

PROCESSES AND EXTENT OF EROSION AND ITS EFFECTS ON LAND USE IN THE CENTRAL LUNI BASIN, WESTERN RAJASTHAN,
Central Arid Zone Research Inst., Jodhpur (India).
B. Ghose, S. Pandey, and S. Singh.
Ann of Arid Zone, Vol 7, No 1, pp 15-30, March 1968. 16 p, 2 fig, 2 tab.

Descriptors: *Soil erosion, *Erosion control, *Slopes, *Water control, *Wind erosion, Slope stabilization, Vegetation regrowth, Arid climates, Sands, Soil conservation, Surveys, Dunes, Gully erosion, Geomorphology, Aerial photography, Mapping.
Identifiers: Rajasthan (India).

An erosion study was undertaken using the vertical aerial photographs of the Central Luni Basin of Western Rajasthan. With the use of photo-patterns, photo-interpretation and selected field surveys, maps were drawn up showing the erosion damage. Slope plays a significant role in water erosion only in the piedmont zones and hills. Water erosion was negligible in the Central Luni Basin. As a result of severe water erosion, which was confined to the (sand covered) piedmont zones and denuded surfaces, uncrossable gullies have been formed in the southeastern sector of the study area. Soil conservation measures like gully stabilization by revegetation, diversion channels and check dams could be used to lessen the soil erosion of this arid area. (Blecker-Arizona)
W69-02987

THE EFFECT OF SILT-LADEN WATER ON INFILTRATION IN ALLUVIAL CHANNELS,
William Gerald Matlock.
Ph D dissertation, University of Arizona, 1965. 102 p, 34 fig, 12 tab, 52 ref.

Descriptors: *Silting, *Infiltration, *Alluvial channels, *Flumes, *Suspended load, Sediment load, Streambeds, Velocity, Arid lands, Arizona, Bed load, Channel flow, Variability, Permeability, Natural recharge, Flash floods, Correlation analysis, Groundwater recharge, Turbidity.
Identifiers: Tilting-bed flume.

A tilting bed flume study was conducted at Tucson, Arizona to examine the relationships between velocity, suspended sediment and infiltration rate in alluvial channels for velocities from 2 to 5 feet per second and suspended sediment up to 0.6 percent. Bed materials from Rillito Creek were used in the flume experiments, which were made with constant velocity and variable suspended sediment and variable velocity. Samples from different locations along the creek bed showed considerable variability in mechanical analyses, permeability and infiltration tests, and suspended sediment content. A direct relationship between velocity and infiltration rate and an inverse relationship between suspended sediment content and infiltration rate were found from the flume studies. A good correlation was obtained for flume results with the flow losses and natural recharge occurring in the river channels in the Tucson area. (Affleck-Arizona)
W69-02988

RESEARCH ON BED-LOAD,
Institut za Vodoprivredu, Jaroslav Cerni, Belgrade (Yugoslavia); and Belgrade Univ. (Yugoslavia).
Vojislav Vukmirovic, and Slavoljub Jovanovic.
Translation from Proc Institut za Vodoprivredu 'Jaroslav Cerni' Vol 14, No 41-42, pp 137-147, 1967. TT67-58016.

Descriptors: *Bed load, *Stochastic processes, *Statistical methods, Sampling, Particle size, Instrumentation, Tracers.
Identifiers: Yugoslavia.

The work of the Jaroslav Cerni Institute of Yugoslavia in the study of bed load movement over the past 20 years is reviewed and discussed. A bibliography is included. Earlier work consisted of grain-size analysis of bank, bed, and moving sediment samples. More recently, electrical resistance probes were used to measure movement. Present work stresses radioactive tracer study of bed load movement and statistical study of the stochastic nature of particle movement. (Knapp-USGS)
W69-03043

RUNOFF AND HILLSLOPE EROSION RESULTING FROM A HIGH-INTENSITY THUNDERSTORM NEAR MACK, WESTERN COLORADO,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 02A.
For abstract, see .
W69-03052

MEASUREMENT OF HYDRAULIC AND SEDIMENT TRANSPORT VARIABLES IN A SMALL RECIRCULATING FLUME,
Geological Survey, Fort Collins, Colo.
R. E. Rathbun, and H. P. Guy.
Water Resources Res, Vol 3, No 1, pp 107-122, 1967. 16 p, 4 fig, 6 tab, 9 ref.

Descriptors: *Model studies, *Hydraulic models, *Flumes, *Sediment transport, *Research and development, *Instrumentation, Depth, Velocity, Dunes.

An evaluation of techniques for measuring the hydraulic and sediment transport variables in a small recirculating flume showed that (1) the average depth of flow over a ripple bed could be determined adequately by measuring the difference between the water-surface elevation and the sand-bed elevation at a large number of positions and averaging the results; (2) the water-surface slope could be determined easily and accurately from a series of piezometers with taps positioned at 1-meter intervals along the flume center line; (3) the sediment transport rate was determined by passing all the water-sediment mixture through a trap covered with screen fine enough to hold the sand. The transport rate varied considerably (10-fold range) with respect to time. The following transport phenomena were noted: (1) there was no particle movement on the plane bed before ripple formation; (2) the mean velocity for cessation of particle movement (on the ripple bed) was about half that at which first movement occurred (on the plane and sand bed). (Knapp-USGS)
W69-03056

SUSPENDED LOAD RESEARCH,
Institut za Vodoprivredu Jaroslav Cerni, Belgrade (Yugoslavia).
Vera Miloradov, and Branislav Dordevic.
Translation from Proc 'Institut za Poljoprivredu 'Jaroslav Cerni' Vol 14 No 41, pp 177-191, 1967. TT-67-58016.

Descriptors: *Suspended load, *Sediment transport, *Research facilities, Data collections, Reservoir silting, Density currents, Sampling, Hydraulic properties, Silting, Forecasting, Water structure.
Identifiers: *Yugoslavia, Hydrometeorological studies.

In Yugoslavia the first hydrometeorological stations for daily measurements of suspended load on the Danube, Sava, Tisa and Velika Morava Rivers began operation in 1957-1958. The work of the Jaroslav Cerni Institute in this field is reviewed and systematized and a bibliography presented. A description is given of equipment and methods used in field and laboratory, analyses to establish the load discharge balance at selected sites, special measurements and determination of water pattern and sediment movement under natural conditions, and studies of sedimentation in storage reservoirs and at river mouths. Research is being carried out for the needs of design of large water structures. (Lang-USGS)
W69-03062

DESIGN OF STABLE CHANNELS IN ALLUVIAL MATERIALS,
Kansas State Univ., Manhattan; and Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 08B.
For abstract, see .
W69-03066

DEPOSITIONAL BEHAVIOR OF KAOLINITE IN TURBULENT FLOW,
Massachusetts Inst. of Tech., Cambridge; and State Univ. of New York, Buffalo.
Robert J. Etter, Richard P. Hoyer, and Emmanuel Partheniades.
ASCE Proc, J Hydraul Div, Vol 94, No Hy6, Pap 6242, pp 1439-1452, Nov 1968. 14 p, 12 fig, 12 ref.

Descriptors: *Suspended load, *Bed load, *Kaolinite, *Turbulent flow, *Deposition (Sediments), Open channel flow, Sedimentation, Streams, Laboratory tests, Model studies.

An experimental investigation, utilizing an annular-rotating channel and a counterrotating ring, of the depositional characteristics of a fine, cohesive sediment revealed that after an initial period of rapid deposition, the sediment concentration approaches asymptotically an equilibrium value. Ratio of this equilibrium concentration to the initial concentration is nearly independent of initial concentration, and for given sediment properties and water chemistry, depends only on flow conditions. In the three water depths investigated, ratio was a single function of an average shear stress around the channel-section perimeter. A silty-clay sediment with a mean particle diameter of 0.0009 mm was used in all experiments. Comparison of size distributions of the parent material with the material retained in suspension when equilibrium was achieved indicated the greatest deposition occurs amont the clay-size fractions, suggesting that the deposition is controlled predominantly by flocculation, and that strength and size of the flocs exert a stronger influence on deposition than does the initial particle weight. (Knapp-USGS)
W69-03067

SEDIMENTATION IN THE PIRU CREEK WATERSHED SOUTHERN CALIFORNIA,
Geological Survey, Washington, D. C. Water Resources Div.
Kevin M. Scott, John R. Ritter, and James M. Knott.
U S Geol Surv Water-Supply Pap 1798-E, 1968. 48 p, 24 fig, 13 tab, 35 ref.

Descriptors: *Sediment yield, *Watersheds (Basins), Sediments, Analytical techniques, Regression analysis, Geomorphology, California.

dentifiers: Piru Creek, Transverse Ranges, Sediment-yield factors.

Methods used in estimating sediment yield of the Piru Creek watershed a tectonically active and physiographically diverse region in the Transverse Ranges, are presented and compared. The estimated yields determined by the various methods range from 165-303 acre-ft per yr. The probable sediment yield of the watershed above Pyramid Rock, site of a proposed reservoir, is 225 acre-ft per yr. This yield was determined by applying a basin-size correction to the yield of the entire basin, which was obtained by an adjusted sediment survey of a reservoir (Santa Felicia) near the mouth of the creek. The expectable maximum yield is believed to be about 504 acre-ft per year, which represents the amount of suspended sediment measured at the damsite during 1965, a year that included one of the most intense storm periods in Southern California history. Analyses and correlations of sediment yield in other basins of the Transverse Ranges are discussed. Also, the factors affecting erosion and sediment yield, such as regional climatic parameters, effective precipitation, precipitation intensity, soil erodibility, drainage area, physiographic parameters, and land-use, are discussed and evaluated. Equations relating these factors and regression analyses used in correlation procedures are presented. (SteinhilberUSGS)
W69-03084

WATER AND SEDIMENT IN THE NORRIS GLACIER OUTWASH AREA, UPPER TAKU INLET, SOUTHEASTERN ALASKA,
Alaska Univ., College. Inst. of Water Resources.
Roger M. Slatt, and Charles M. Hoskin.
J of Sediment Petrol, Vol 38, No 2, pp 434-456, June 1968. 23 p, 19 fig, 3 tab, 51 ref. OWRR: A-008-ALAS.

Descriptors: *Alluvium, *Glacial drift, *Melt water, *Estuaries, Alaska, Particle size, Particle shape, Permeability, Salinity, Saline water intrusion, Aquifers.
Identifiers: Alluvial fans, Taku Inlet (Alaska).

A study was made of the sediments and hydrology of an alluvial fan extending from the terminus of Norris Glacier to upper Taku Inlet, southeastern Alaska. The tidal flat is composed of poorly sorted muddy sediment and relatively well sorted sand overlying outwash gravel. The sand-size fraction contains feldspar, quartz, rock fragments, amphiboles, pyroxenes, micas, and opaque minerals, and the clay-size fraction contains micas, chlorite, montmorillonite, feldspar, and amphibole. The sediments consist of abrasion products of glaciers in the Juneau Ice Field. Absence of quartz and presence of fledspar in the clay-size fraction may indicate the limits of size to which the various minerals are abraded by valley glaciers. Permeability and salinity measurements show that water in the outwash is always fresh although the deposit is covered by salt water at high tide. The outwash apparently carries a large enough flow of melt water with higher head than the high tide level, preventing intrusion of salt water or flushing out any intruded salt water. (Knapp-USGS)
W69-03093

SIMILITUDE THEORY APPLIED TO CORRELATION OF FLUME SEDIMENT TRANSPORT DATA,
Strathclyde Univ., Glasgow (Scotland). Dept. of Civil Engineering.
David I. H. Barr, and John G. Herbertson.
Water Resources Res, Vol 4, No 2, pp 307-315, April 1968. 9 p, 4 fig, 2 tab, 16 ref.

Descriptors: *Sediment transport, *Correlation analysis, Synthesis, Sediments, Data processing, Analytical techniques, Hydraulics, Flumes.
Identifiers: Similitude theory.

A second variant of the method of synthesis, the method of linear proportionalities, is presented and shown to be a powerful device for seeking correlation procedures for sediment transportation data. It is apparent that correlations for sediment transportation data under conditions of quasi-uniform flow are of the same basic form as those for rough pipe flow, with some amplification for practical reasons. Certain established correlations are shown to be based on similarity equations from which parametric terms have been omitted, mostly without justification. A rigorous method of correlation compatible with feasible laboratory procedures is presented and illustrated in figure form using available data. It was found that the bulk of the published data was in a form unsuitable for use in a rational correlation. The authors conclude that new experimentation is required and that this could best be done by cooperation among institutions with the necessary apparatus.
W69-03095

HYDRAULIC AND MICROMORPHOLOGICAL PROPERTIES OF STREAM CHANNEL SEDIMENTS,
Arizona Univ., Tucson; and North Carolina State Univ., Raleigh.
H. K. Qashu, and S. W. Buol.
Water Resources Res, Vol 3, No 2, pp 465-469, 1967. 5 p, 3 fig, 1 tab, 4 ref.

Descriptors: *Alluvium, *Alluvial channels, *Clays, *Silts, *Hydraulic conductivity, *Infiltration, Permeability, Porosity, Aggregates, Mixing.
Identifiers: *Micromorphological properties.

In the arid and semiarid regions of the southwestern United States, a large portion of the natural water recharge is through channel beds and alluvial deposits in river basins. Water transmission in these beds varies with time, location, depth and extent of alluvium, and hydraulic characteristics of flows, sediment loads, and morphology of the channels. An alluvial profile in an ephemeral stream channel was found to have layers with relatively high clay and silt accumulation. Samples from a pit in the channel were subjected to a micromorphological examination using thin sections. Clay and silt were found to have accumulated on sand and gravel particles and around aggregates. In the laboratory, samples of alluvium material were dispersed. The clay and silt fractions were collected, dried, and then mixed again with the washed material. The hydraulic conductivity of the mixed material was 30% less than that for the nondispersed sample. These results are attributed to the orderly arrangement of clay and silt on the surfaces and between the larger sand and gravel particles of the nondispersed samples.
W69-03108

SEDIMENT SURVEYS IN CANADA,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
W. Stichling, and T. F. Smith.
Tech Bull 12, 1968. 17 p, 14 fig, 1 tab.

Descriptors: *Sediment transport, *Geomorphology, Sediments, Reservoirs, Bed load, Suspended load, Particle size, Sampling, Equipment.
Identifiers: Sediment survey, Canada.

An outline of sediment surveys in Canada, including a brief history of sediment surveys, current status of the program, and future plans is presented. Prior to 1961, measurements of suspended sediments were undertaken by individual organizations and agencies at a few specific-purpose sites. A continuous sediment survey program was initiated in 1961 in response to the growing demands for sediment data by water management. By January 1968, the Water Survey of Canada was operating 77 stations. The techniques and instrumentation used in collecting data at these stations are discussed. Plans for the future call for expansion of the network during the next 5-10 yr to 300 sediment stations to cover all areas in the country in which streams are affected by sediment processes. The future program includes analyses of the sediment data for special geomorphological studies of the major river channels and reservoirs. (Steinhilber-USGS)
W69-03123

2K. Chemical Processes

TRACER MEASUREMENT OF STREAM REAERATION. II. FIELD STUDIES,
Georgia Inst. of Tech., Atlanta; Arctic Health Research Center, Fairbanks, Alaska; and Southwestern Radiological Health Lab., Las Vegas, Nev.
For primary bibliographic entry see Field 02E.
For abstract, see .
W69-02821

GRAPHICAL METHODS FOR STUDIES OF AQUEOUS ALUMINUM HYDROXIDE, FLUORIDE, AND SULFATE COMPLEXES,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 01B.
For abstract, see .
W69-02834

UNITED STATES TRITIUM RAINOUT AND ITS HYDROLOGIC IMPLICATIONS,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02B.
For abstract, see .
W69-03121

2L. Estuaries

A MODEL OF MIXING AND DISPERSION IN SAN FRANCISCO BAY,
California Univ., Berkeley.
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-02831

SOME HYDROLOGICAL OBSERVATIONS IN AUCKLAND AND OTAGO HARBOURS,
Auckland Univ. (New Zealand); and Marine Biological Station, Port Erin, Isle of Man (England).
D. J. Slinn.
Trans Royal Soc of New Zealand (General), Vol 2, No 5, pp 79-97, Jan 1968. 19 p, 11 tab, 7 fig, 32 ref.

Descriptors: *Tidal waters, *Harbors, *Saline water, Intertidal areas, Water quality, Coasts, Nutrients, Oxygen, Salinity, Temperature.
Identifiers: New Zealand, Auckland, Otago, Hydrological observations, Tidal water quality.

Data on monthly means of temperature, salinity, oxygen, and nutrients (nitrate, nitrite, phosphate, and silicate) are presented for Auckland and Otago Harbors during 1963. Some data from other years are used, however little information was collected prior to 1963 for the coastal waters of New Zealand. Sea surface temperatures are compared with local air temperatures, and salinity with rainfall. In both harbors, fresh water influence is small in summer, but more noticeable in winter. Generally, nutrients are low in summer and high in winter, although phosphate does not appear to have a well defined pattern. There seems to be little chemical evidence of organic pollution in either harbor. Conclusions presented are that Auckland Harbor is vertically well-mixed as a result of tidal currents; this may apply to Otago Harbor as well. (Steinhilber-USGS)
W69-02835

ACCURACY OF DISCRETE MODELS USED TO PREDICT ESTUARY POLLUTION,
Rice Univ., Houston, Tex.
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-03107

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

OPTIMIZATION AND RANGE OF APPLICATION OF NUCLEAR REACTORS AND FLASH EVAPORATORS FOR SEA WATER DESALINATION,
Technion-Israel Inst. of Tech., Haifa.
F. S. Aschner, S. Yiftah, and P. Glueckstern.
Desalination, Vol 3, No 1, pp 82-90, 1967. 9 p, 4 fig, 1 tab, 3 ref.

Descriptors: *Desalination plants, *Mathematical models, *Optimization, Dual purpose, Technical feasibility, Economic efficiency, Electric power production, Water supply, Nuclear reactors, Flash distillation, Water costs.
Identifiers: Israel.

Desalination plants were defined by mathematical models and optimized technically and economically. The research dealt with nuclear reactors, and for comparison with conventional boilers, as heat sources for dual- and single-purpose plants. The distillation plants considered were of the multistage flash evaporator type. The dual-purpose plant research covered a range from 50 MW to 300 MW net power generation, and 10 to 200 mgpd water production. The single-purpose plant investigation covered the thermal ratings in the range from 200-1600 MWt corresponding to the same range of water output as the dual-purpose plants. Optimum water costs were tabled. The influence of the water cost of turbine exhaust temperature and of economic parameters, such as fixed charge rate and electricity value was also analyzed. (Gysi-Cornell)
W69-03147

3B. Water Yield Improvement

USE OF MONOMOLECULAR FILMS TO REDUCE EVAPORATION FROM THE SURFACE OF BODIES OF WATER,
V. F. Pushkarev, and G. P. Levchenko.
Translated from Trudy Gos Gidrol Inst, No 142, pp 84-107, 1967. Soviet Hydrol Selec Pap (AGU), No 3, pp 253-272, 1967. 20 p, 5 fig, 5 tab, 13 ref.

Descriptors: *Evaporation control, *Monomolecular films, Alcohols, Hexadecanol, Byproducts, Organic acids, Water conservation, Lakes, Ponds.
Identifiers: *USSR, Aliphatic acid-manufacturing byproducts.

The results of experimental investigations of monomolecular films as evaporation depressants by the USSR State Hydrological Institute are summarized and recommendations are made for their use and for methods to determine both their physical and cost effectiveness. More than 120 types of alcohols were tested. Secondary unsaponifiable substances formed as byproducts of synthetic aliphatic acids are being produced in large quantities and are the most available and inexpensive alcohols. They have evaporation--retarding properties as good as those of alcohols obtained from natural fats and oils. Devices for monolayer application are described. Alcohol is delivered to the water surface at a rate proportional to wind velocity. (Knapp-USGS)
W69-02805

EFFECTS OF A MONOLAYER ON RESERVOIR TEMPERATURE AND EVAPORATION,
Army Electronics Command, Fort Huachuca, Ariz. Atmospheric Sciences Laboratory; and Texas A and M Univ., College Station.
Jon F. Bartholic, Jack R. Runkles, and Ernest B. Stenmark.
Water Resources Res, Vol 3, No 1, pp 173-179, 1967. 7 p, 3 fig, 1 tab, 12 ref.

Descriptors: *Evaporation control, *Monomolecular films, *Temperature, Heat budget.

Data collected specifically to evaluate the increase in the water temperature in a reservoir due to the presence of a monolayer showed an increase in temperature not only at the surface but also at greater depths. This increase in temperature must be accounted for in predicting the reduction in evaporation by monolayers. Use of values for the increase in temperature predicted from the combined energy-budget mass-transfer method indicates a decrease of 8 to 14% in values for evaporation reduction as estimated by the simplified Bureau of Reclamation method, which does not account for the rise in temperature. An approach to predicting the increase in reservoir temperature and the reduction in evaporation as applied to one reservoir gave values for the temperature increase close to those measured. (Knapp-USGS)
W69-03054

GROUND-WATER OCCURRENCE AND STRATIGRAPHY OF UNCONSOLIDATED DEPOSITS, CENTRAL PIERCE COUNTY, WASHINGTON,
Department of Water Resources, Olympia, Wash.
For primary bibliographic entry see Field 02F.
For abstract, see .
W69-03081

3E. Conservation in Industry

RECLAIMED WATER FOR INDUSTRY,
T. H. V. Tebbutt.
Effl and Water Treat J, Vol 7, pp 587-593, 1967. 7 p.

Descriptors: *Water utilization, *Waste water treatment, *Beneficial use, *Water reuse, Industrial water, Potable water, Sewage effluents, Management, Water quality, Water conservation.
Identifiers: *Reclaimed water.

Summary information is given of the potential use of reclaimed waste water from industry and the possibilities for thus increasing the supply of potable water in many places. Water for cooling is the largest use, with steam generation, process needs, and potable water in that order. Re-cycling and utilization of sewage effluent and other good management procedures are suggested as methods of reducing water demand. To prevent growth of micro-organisms, chlorination of sewage water may be necessary but the cost of such treatment is less than half that of using potable water. Reclaimed waste water would be of better chemical quality than most available river or canal waters. Various processes for contaminant removal are presented. Studies in progress to prevent eutrophication of Lake Tahoe by sewage effluent and the production of good-quality water from industrial effluent at a plant in SW Africa are described. (Lang-USGS)
W69-02806

3F. Conservation in Agriculture

INVESTIGATIONS ON THE IRRIGATION REQUIREMENTS OF HYBRID MAIZE CROP IN ARID REGION OF PUNJAB,
Punjab Agricultural Univ., Hissar (India). Dept. of Agronomy.
M. K. Moolani, and N. K. Behl.
Ann of Arid Zone, Vol 7, No 1, pp 105-115, March 1968. 11 p, 2 fig, 7 tab, 18 ref.

Descriptors: Irrigation effects, *Water requirements, *Consumptive use, Fertilizers, *Arid lands, *Nitrogen, Crop response, Irrigation efficiency, *Corn (Field), Field capacity, Soil moisture, Depth, Seasonal, Soil-water-plant relationships.
Identifiers: Hybrid maize.

A field experiment was conducted at the Agronomy Research Farm, Punjab Agricultural University, Hissar, India, to determine the effects of different levels of irrigation, nitrogen and plant density on the yield of hybrid maize. Consumptive use, seasonal water requirements and irrigation requirements of maize were found to vary from 45-53 cm, 52-72 cm, and 20-40 cm, respectively under various treatments. These values were found to be highest in maximum delta of irrigation. Irrigation efficiency ranged from 70-81%. The crop used the maximum amount of available moisture (50%) from the upper 30cm soil layer and the rest of the available moisture was made up from the lower soil layers. (Blecker-Arizona)
W69-02973

SPRINKLER AND SURFACE IRRIGATION OF VEGETABLE AND FIELD CROPS IN AN ARID ENVIRONMENT,
California Univ., Berkeley.
F. E. Robinson, O. D. McCoy, G. F. Worker Jr., and W. F. Lehman.
Agron J, Vol 60, No 6, pp 696-700, Nov-Dec 1968. 5 p, 10 tab.

Descriptors: Arid climates, Crop response, *Irrigation effects, *Sprinkler irrigation, *Surface irrigation, *Field crops, *Vegatable crops, Rates of application, Plant growth, Leaching, Irrigation efficiency, Deserts, Application methods, Water utilization, Furrow irrigation, Saline soils, Flood irrigation, Soil texture.
Identifiers: Imperial Valley (California), Dry matter.

Four experiments were conducted in the Imperial Valley of California to investigate the effects of sprinkler irrigation on a number of different crops, and to obtain comparisons of emergence, growth, and soil characteristics under surface and sprinkler irrigation. In addition, modification of conventional bed shapes to improve land utilization efficiency under sprinkler irrigation were explored. The experiments were conducted on clay and sandy clay loam soils. Emergence and early growth rates of five field crops were equal or better under sprinkling in the clay soil. Early growth rates of 10 vegetable crops were equal or greater under sprinklers on the sandy clay loam. Final yields indicated the sprinkler irrigation would require more frequent applications than the surface systems, however, sprinkler irrigation was shown to have a higher water use efficiency than the surface systems. (Affleck-Arizona)
W69-02974

SOIL WATER FLUX BELOW A RYEGRASS ROOT ZONE,
California Univ., Davis.
For primary bibliographic entry see Field 02G.
For abstract, see .
W69-02975

FURROW SIZE, PLACEMENT, AND GRASS CULTURE EFFECTS ON VINEYARD IRRIGATION,
California Univ., Davis. Department of Water Science and Engineering; and Calif. Univ., Davis Agricultural Extension Service.
P. Christensen, L. Doneen, L. Werenfels, and C. Houston.
Calif Agr, Vol 22, No 6, pp 10-12, June 1968. 3 p, 7 fig.

Descriptors: *Irrigation water, Turf grasses, Furrow systems, *Furrows, *Grassed waterways, *Irrigation efficiency, Cultivation, California, *Percolation, Infiltration, Flow measurement.
Identifiers: *Vineyard irrigation, Undervine furrows.

Studies were conducted in Fresno County, California to evaluate irrigation water penetration rates affected by size and placement of furrows and the use of grass culture. The test plots were established in a 30-year-old vineyard on a Dinuba fine sandy loam soil and included (1) flat furrows with cle

ultivation; (2) flat furrows with grass culture; (3) wide middle-row basin with clean cultivation; (4) wide middle-row basin with clean grass culture; and (5) a wide furrow under the vine row. The undervine furrows showed excellent water penetration as compared to the other four methods. The grass culture nearly doubled the water intake rate in the furrows and basins from mid-summer on, presumably after a sod-condition developed). (Afleck-Arizona)
W69-02978

ANTI-TRANSPIRANTS AS A RESEARCH TOOL FOR THE STUDY OF THE EFFECTS OF WATER STRESS ON PLANT BEHAVIOUR,
Hebrew Univ., Jerusalem (Israel). Dept. of Botany.
I. Gale, and A. Poljakoff-Mayber.
Unesco Arid Zone Research, Vol 25, pp 269-274, 1965. 6 p, 5 fig, 1 tab.

Descriptors: *Transpiration control, Water conservation, *Stomata, *Moisture deficit, *Moisture stress, Turgidity, Water balance, Plant physiology, Plant growth, *Retardants, Wilting point, Weight, Sprays, Films, Arid lands, Diurnal.
Identifiers: Israel.

One aspect of the study of anti-transpirants is their direct and indirect effect on plant water stress. Evidence that anti-transpirant sprays actually decrease plant water stress has been obtained from experiments in which stomata of treated plants have been found to remain open wider and for longer periods than those of non-treated plants. Increased relative turgidity of treated plants is additional evidence of the direct effect of anti-transpirants on the water balance of plants. Anti-transpirants have been shown to modify growth and development of plants in the field in a manner which closely resembles the effect of reduced moisture stress obtained by irrigation. In addition to their potentialities as reducers of irrigation water expenditure in arid climates, anti-transpirants may prove to be a versatile research tool for water stress studies if their numerous side effects are taken into account. (Blecker-Arizona)
W69-02986

PONTACYL BRILLIANT PINK AS A TRACER DYE IN THE MOVEMENT OF WATER IN PHREATORPHYTES,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 02I.
For abstract, see .
W69-03047

AN ANALYSIS OF TEMPERATURE BEHAVIOR IN IRRIGATED SOIL PROFILES,
California Univ., Davis. Department of Water Science and Engineering.
For primary bibliographic entry see Field 02G.
For abstract, see .
W69-03053

PROJECTION OF AGRICULTURAL WATER AND LAND USE FOR LONG RANGE WATER RESOURCES IN TEXAS,
Texas A and M Univ., College Station.
Fred A. Schmer, and Glen L. Wistrand.
Proceedings of the Third Annual American Water Resources Conference (American Water Resources Assn; Urbana, Ill), c 1967, pp 405-413. 9 p, 1 fig, 1 chart, 1 ref.

Descriptors: *Agriculture, Irrigated land, Land use, Water supply, Water resource development, Texas, Planning, Future planning, Model studies, Land.

Four models of resource use and commodity output illustrate the probable effects of alternative water supply situations in Texas. Model A represents Texas' physical potential for agricultural production if unlimited water supplies existed while Model B is tempered by the inclusion of economic limitations on the irrigated production of some commodities and production goal limitations for the state. Model D is realistic within the limits imposed by the assumptions made about prices, factor proportions and cropping patterns. It suggests the development which we can expect in Texas in terms of projected water availability, crop yields, land use and producers' competitive positions in national markets. Model D suggests what might happen if we do little or nothing in the way of water resource development. These models are useful in water resource planning. (Winn-Rutgers)
W69-03144

DRAINAGE THEORY FOR REMOVAL OF EXCESS WATER FROM IRRIGATED LANDS,
Washington State Univ., Pullman. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03189

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on THE Surface

EICKSTEDT V SEIFERT (NEGLIGENCE IN DRAINING ARTIFICIAL RESERVOIR).

273 Wisc 122, 76 NW 2d 582-585 (1956).

Descriptors: *Wisconsin, *Drainage effects, *Pumping, *Reservoirs, Judicial decisions, Drainage systems, Water conveyance, Ditches, Drainage water, Percolation, Percolating water, Underseepage, Subsurface drainage, Tile drains, Outlets, Legal aspects, Highways, Crops, Damages.
Identifiers: Negligence, Crop damage.

Plaintiffs produced truck crops on land located across a highway from land of defendant. Several years prior to this action, defendant Seifert escavated a large pit, thus creating an artifical reservoir. Seifert contracted to sell gravel from the pit bottom to the co-defendant, Ozaukee County. Plans were made to pump the water from the pit into an established drainage ditch along defendant's side of the highway. Plaintiff, before the pumping began, asked the defendants to place the pump outlets in such a way as to avoid drainage onto plaintiff's land and to use tile drains. The defendants ignored plaintiff's warnings and requests and proceeded to drain the pit as originally planned. The ditch was unable to adequately carry away the large volume, and water percolated underneath the highway onto plaintiff's land causing crop damage. Plaintiff's claim for damages was dismissed by the lower court for failure to state a cause of action. The Supreme Court reversed and remanded for a jury trial on issue of negligence. Court found it to be immaterial whether the damage resulted from waters directly overflowing the surface or from waters reaching the lands through percolation. (Wheeler-Fla)
W69-02856

CRAIG V BOROUGH OF EBENSBURG (DAMS).

137 A 2d 886-890 (Super Ct Pa 1958).

Descriptors: Judicial decisions, Legal aspects, *Pennsylvania, Cities, Flood damage, *Dams, Diversion structures, Personnel, Obstruction to flow, Floods, Dam construction, Dam Design.

Defendant's employees constructed flashboards on the spillway of a dam of which it had assumed responsibility from the Commonwealth of Pennsylvania. The flashboards caused the water to back up and flood plaintiff's land. Before the construction of the flashboards, Plaintiff had called attention to the fact that his land might be flooded if the construction was performed. The defendant erected the flashboards, and, thus, it was held liable notwithstanding the fact that the specifications were prepared and the work was done under supervision of the Commonwealth of Pennsylvania. (Molica-Fla)
W69-02859

ANDERSON V ARGRAVES (RECOVERY AGAINST STATE FOR NEGLIGENT WATER COURSE CONSTRUCTION).
20 Conn Super 138, 127 A 2d 620-624 (Super Ct Conn 1956).

Descriptors: Judicial decisions, Connecticut, Controlled drainage, Drainage effects, Floodwater, Flood routing, Flood protection, Watercourses (Legal), Storm runoff, Streams, Damages, Bridge Design, Culverts, Roads, Drains, Operation and maintenance, Highways, Rain water.
Identifiers: Negligence, Debris.

Plaintiff, a non-adjacent landowner to highway and culvert constructed by the state, sought damages for negligent construction and maintenance of the road and culvert. During a heavy rainstorm, the culvert became clogged with debris and subsequently burst open, causing damage to plaintiff's downstream property. Plaintiff claimed the culvert was too narrow to safely accommodate the normal amount of water. Plaintiff relied on three Conn statutes, in attempting to circumvent the problem of governmental immunity. (These were Conn gen stat secs 2134, 2194, 2201.) Sec 2134 authorized the state to construct water course drainage for highway purposes into or on private land and provided relief for unnecessary damage resulting therefrom. Defendant did not drain water onto, or open any water course on, plaintiff's land; consequently, section 2134, was inapplicable. Unnecessary damage was all that secion 2194 protected against. Plaintiff failed to show the damage caused was unnecessary since storm complained of caused unprecedented damage in many parts of the state. Section 2201 authorized recovery for damages caused by defective highways, but only for persons on the highway for some legitimate purpose connected with travel thereon. It provided no right of recovery for an abutting landowner, much less a non-abutting landowner. (Holt-Fla)
W69-02862

ATLANTIC CRUSHED COKE CO V UNITED STATES (FLOOD DAMAGE).

151 F Supp 317-322 (Ct Cl 1957).

Descriptors: Judicial decisions, Legal aspects, Pennsylvania, *Federal governments, *Eminent domain, Coal mines, Flood damage, *Water injury, Flooding, Dams, Backwater, Ponding, Mine water, Compensation.
Identifiers: Inverse condemnation.

Defendant constructed a dam which would periodically cause waters to back up into the coal mines adjacent to the mine of plaintiff. The Secretary of Mines issued an order prohibiting the plaintiff from mining because the barrier between his mine and those adjacent to it was not sufficient to withstand the expected water pressure. Defendant was not liable for the loss of use of plaintiff's mine, because such loss was not the natural and necessary consequence of the erection of the dam. Defendant was not held to have known that the barrier between plaintiff's mine and those adjacent to it was insufficient to keep plaintiff's mine from flooding. Plaintiff did not make a bona fide effort to enter into an agreement with the defendant to make it possible to operate its mine, and did not appeal the order, which was its right under statute. Therefore, there was no basis for plaintiff's plea for compensation for a taking by eminent domain. (Molica-Fla)
W69-02864

HUTHER V UNITED STATES (DAMAGE CLAIM DUE TO RISING LAKE WATERS).

145 F Supp 916-919 (Ct Cl 1956).

Descriptors: *United States, *Lake Ontario, *Dam construction, *Eminent domain, Judicial decisions, St Lawrence River, Dams, Contracts, Federal government, Backwater, Damages, High water mark, Legal aspects, Operation + maintenance, Navigable waters, Compensation.
Identifiers: Canadian government.

Congress gave its consent for Canada to construct a dam which would cross or abut territory of the United States. It was expressly stated that the construction would not materially affect the water level of Lake Ontario or the Saint Lawrence River, or cause any injury to the United States, or its citizens. Following construction, rising lake waters allegedly caused damage to United States citizens owing property on the lake shore. These persons brought suit against the United States. The Court of Claims granted a motion to dismiss. The Court reasoned that the United States had no part in the construction and that an action for taking property without compensation would not lie since there was no taking of property by the United States for public use. The court suggested that claim should be made against the Canadian government, through Canadian courts. (Wheeler-Fla)
W69-02865

GEIS V ROHRER (RIGHT OF NATURAL DRAINAGE).

145 N E 2d 596-599 (Ill 1957).

Descriptors: *Illinois, Judicial decision, *Relative rights, Surface runoff, Farm management, Drainage systems, *Drainage, Outlets, Culverts, Water conveyance, Ditches, *Natural flow, Easements, Obstruction to flow, Land fills, Water courses (Legal).

Plaintiffs owned farm land located above lands of the defendants. For many years, water flowed from plaintiff's land, through a culvert, into a waterway upon defendant's land, and out a lower culvert. Defendants' farming operations caused a filling of the waterway sufficient to impede the prior natural drainage. Plaintiffs brought suit for injunctive relief, praying that the obstruction be removed and defendants be restrained from further interference with the natural drainage. The lower court granted the injunction and gave the higher landowners a perpetual easement to enter defendant's land and to insure that the waterway was kept open. The Supreme Court affirmed the injunction but disallowed the easement. The Court held that the lower landowner owed a duty not to interfere with the natural drainage, but that it was not necessary, in order to protect the rights of the parties, to grant the easement. (Wheeler-Fla)
W69-02877

LOMBARDI V BAILEY (SUIT FOR FLOOD DAMAGES UNDER MILL ACT).
147 N E 2d 169-175 (Mass 1957).

Descriptors: *Massachusetts, Judicial decisions, *Flood damage, *Dams, Overflow, Reservoirs, Water injury, Floods, Damages, Legal aspects, Legislation.
Identifiers: *Mill acts, Measure of damages.

Petitioners brought suit under the Massachusetts Mill Act to recover for damage to their lands from flooding caused by respondents' dam. Respondents had built a dam across a brook for the purpose of flooding their cranberry bogs. However, the water overflowed onto petitioners' lands, making them unsuitable for agricultural purposes. The case was referred to an auditor for final findings of fact. The major issue on appeal was the action of the auditor. However, the Supreme Judicial Court did state that the purpose of the Mill Act was to substitute a more simple and expeditious remedy for flooding than was available at common law. The measure of damages is the dimunition in rental value of the land during the period of the injury. The period of limitations begins to run at the date of the first injury from the water, not the date of completion of the dam. (Williams-Fla)
W69-02878

SENCO V LACROSSE DREDGING CORP (DEFINITION OF NAVIGABLE WATERS).

16 Ill App 2d 154, 147 N E 2d 708-711 (1957).

Descriptors: *Illinois, Federal government, Mississippi River, *Navigable waters, *Dredging, Judicial decisions, Legislation, Rivers, Navigation, Accidents, Damages, Legal aspects, Backwater.

Plaintiff had sued his employer under the Jones Act for injuries he received on land during a dredging operation. The dredging was taking place in some backwaters of the Mississippi River, and, on remand one of the issues was whether these constituted navigable waters. The court held that 'navigable waters of the United States' meant bodies of water which were used, or susceptible of being used, in their ordinary condition or with reasonable improvements, as a highway for commerce. Such bodies of water do not have to actually be used for commerce, and the fact that artificial aids are necessary to make possible their commercial use does not necessarily make them nonnavigable. Once a waterway is found to be navigable, it retains that character. (Williams-Fla)
W69-02879

NAYLOR V EAGLE (DAMAGE FROM BACKWATER OF DAM).
303 SW 2d 239-242 (Ark 1957).

Descriptors: *Arkansas, Judicial decisions, Damages, Flood damage, *Dams, Backwater, *Overflow, Dams, Flow control, Water injury, Non-navigable waters, Alteration of flow, Obstruction of flow, Relative rights, *Riparian land, River flow, Riparian rights, Legal aspects.
Identifiers: Injunction.

In a suit for damages and a mandatory injunction the plaintiff alleged that overflow backwaters from the defendant's dam injured his farmland, making cultivation impossible. The defendant denied the allegations and further contended that the suit was barred by three year statute of limitations. The plaintiff appealed from the chancellor's finding for the defendant. The Supreme Court held that although the suit was filed more than three years after the dam's construction, the statute of limitations had not run. If damage to land above a dam is only probable upon the construction of the dam, and the certainty and extent of such damage is only speculative, the statute will begin to run only when injury occurs. In such a situation there may be as many successive recoveries as there are injuries. A riparian owner along a nonnavigable stream has no right to upset the natural flow of a stream to the detriment or damage of other riparian owners. However, the court held in affirming the chancellor's decisions that the finding was not against the preponderance of the evidence even though there was expert testimony contrary to the finding. (Blunt-Fla)
W69-02883

WOLFF V LOUISVILLE WATER CO (DENIAL OF WATER MAIN EXTENSION REQUEST).

302 SW 2d 104-105 (Ct App Ky 1957).

Descriptors: *Kentucky, Judicial decisions, Water distribution (Applied), Pipelines, *Public utilities, Water demand, Water delivery, *Water allocation (Policy), Administrative decisions, Local governments.

The plaintiff sought a court order directing the defendant water company to extend its main to his property. The water company refused to extend the main unless the plaintiff agreed to pay the cost of the extension. This amount would be repaid if the net revenue to the company from the user amounted to 15% of the adjusted cost of line in the 12 months following the extension. The circuit court granted the company's motion for summary judgment and the plaintiff appealed. In affirming the judgment this court noted that the defendant water company was an operating facility of the City of Louisville. The city itself was therefore engaged in the business of furnishing water to its inhabitants. Since the company was governmentally controlled it must be granted governmental discretion in devising reasonable regulations for operating the company. Where, as here, such regulations are deemed reasonable and the agents of the water company exercise reasonable discretion in refusing a request to extend a main without the party requesting the service paying the actual cost, the company could not be made to extend the main under the compulsion of a mandatory court order. (Blunt-Fla)
W69-02884

FERGUSON V UNION ELECTRIC COMPANY (SUIT FOR DAMAGES CAUSED BY IMPROPER OPERATION OF A DAM).
305 S W 2d 401-407 (Mo 1957).

Descriptors: *Missouri, Judicial decisions, Public utilities, Damages, Dams, Sedimentation, Flood waters, *Overflow, *Obstruction to flow, Floodgates, Water level fluctuations, *Reservoir silting, Operation and maintenance, Legal aspects, Lakes.

Plaintiffs sued to recover for damage to their crops caused by flood eaters. It was alleged that a dam operated and constructed by defendant formed a lake which caused silt to be deposited in the sloughs and river beds so as to cause the flood water to rise higher than it normally would. Defendant negligently failed to open the floodgates at the dam and permitted the water in the lake to rise above the 660 foot elevation considered normal for a full reservoir. It was alleged that the silt and high water level retarded the flow of floodwater and caused the damage. The court found that the evidence supported the allegations and was sufficient for the jury to find for plaintiffs. (Childs-Fla)
W69-02885

CURTIS V LOUISVILLE AND JEFFERSON COUNTY METROPOLITAN SEWER DISTRICT (ASSESSMENT FOR DRAINAGE IMPROVEMENT).
311 S W 2d 378-384 (Ky Ct App 1958).

Descriptors: *Kentucky, Judicial decisions, *Drainage districts, Watersheds (Divides), Drainage effects, Sewers, Water management (Applied), *Decision making, Project planning, Cost benefit theory, *Construction costs, Drainage systems, Local governments, Cities, Cost allocation, Legal aspects.

The sewer district and other named parties submitted several questions relating to the construction of, and assessments to pay for, new drainage facilities. All the parties appealed from the decision of the Circuit Court, and the Court of Appeals held that, although the proposed addition was to be constructed wholly outside the Louisville City limits the proposed plans must still be approved by the legislation body of the city. This was so because the word 'constructed,' as used in the statute, could not be said to refer only to the actual physical construction work. The court agreed with the determination that 'constructed' encompassed more than the situs of the physical construction, and, in this case, it included all areas which could reasonably be expected to be improved or affected as a result of the construction. Ordering the sewer district to secure the approval of the city alderman before proceed

ing was not an unconstitutional subordination of the authority of the sewer district to that of the municipality. It could not be said that this ruling had the effect of permitting city and county officers to operate as officers of the sewer district in contravention of state constitutional prohibitions. In making assessment for the costs of the drainage improvements, it is not necessary to show a specific enhancement of value of each parcel of property affected to justify an assessment. (Blunt-Fla)
W69-02887

GRAVITY DRAINAGE DISTRICT NO 1 V KEY (CONDEMNATION PROCEEDING FOR DRAINAGE DITCH CONSTRUCTION).
99 So 2d 82-88 (La 1958).

Descriptors: *Louisiana, Judicial decisions, Drainage district, Condemnation, *Drainage systems, *Condemnation value, Damages, Severance, *Culverts, Eminent domain.
Identifiers: *Expropriation, Diminution in value.

Plaintiff sought to expropriate land for the construction of a drainage ditch. The basis of findings in an expropriation suit must be predicated on the physical value of realty taken at the time of taking and the diminution of value to realty after taking. The court found that the evidence supported the damages awarded. The award for one culvert adjoining each tract was held fair, although more than one culvert over the proposed ditch might be needed for industrial use of the remainder of the tracts. (Childs-Fla)
W69-02888

ALBURY V CENTRAL AND SOUTH FLORIDA FLOOD CONTROL DIST (NO COMPENSATION ALLOWED FOR CONSTRUCTION OF A DRAINAGE CANAL).

99 So 2d 248-252 (3d DCA Fla 1957).

Descriptors: *Florida, Judicial decisions, Local governments, Drainage, *Reclamation, *Drainage district, Canal construction, *Compensation, Damages, Legal aspects, Eminent domain.
Identifiers: *Swamp Land Act, Internal Improvement Fund.

Action was brought to enjoin defendants from the alleged unlawful invasion of plaintiffs' land for the prupose of building a drainage canal, and for compensation for property appropriated by defendants. The land in question was originally state land, granted under the Federal Swamp Land Act. The deed of these state lands reserved to the Trustees of the Internal Improvement Fund of the state and their successors the right to enter upon these lands to construct improvements necessary for their drainage or reclamation, absent a showing that the district's purpose was beyond the purpose of the reservation. The court held this to be sufficient authorization to construct a canal without compensation for damage to the plaintiff's land. (Childs-Fla)
W69-02889

WEIMER V CAUBLE (ACTION TO ENJOIN DIVERSION OF SURFACE WATERS ONTO PLAINTIFF'S LAND IN HARMFUL MANNER).

214 Ga 634, 106 S E 2d 781-783 (1959).

Descriptors: *Georgia, Judicial decisions, Damages, *Natural flow doctrine, *Alteration of flow, *Surface waters, Surface runoff, Abatement, Legal aspects, Discharge (Water).
Identifiers: Land descriptions, Injunction, Trespass, Demurrer.

Suit was brought to enjoin an alleged trespass and to recover damages caused by the discharge of water from defendant's land onto property belonging to the plaintiff on the ground that the natural flow of water had been changed. The trial court overruled the general demurrer of defendant and granted relief to the plaintiff. The Supreme Court of Georgia reversed the trial court holding that the allegation of the petition that the plaintiff was the owner of valuable realty lying immediately southeasterly of, adjoining and adjacent to, the described realty of the defendant, was too vague and indefinite to be the basis of an action to enjoin the alleged trespass. The question of such a defective description could be raised by general demurrer. The court also stated that if the defendant had caused the natural flow of surface water to be concentrated and then discharged on the plaintiff's land causing damages, he would be liable. The court further stated that notice to the defendant that he would be held responsible for damages subsequently caused was tantamount to a request to abate the nuisance or trespass. (Watson-Fla)
W69-02902

CUGLAR V POWER AUTHORITY (EMINENT DOMAIN BY POWER AUTHORITY TO FORM POWER POOL).

4 Misc 2d 879, 163 NYS 2d 902-931 (Sup Ct 1957).

Descriptors: *New York, Administrative agencies, Administrative decisions, Judicial decisions, Legislation, *Eminent domain, Condemnation, Islands, Dams, *Reservoirs, *Hydroelectric power, St Lawrence River, Rivers, Legal aspects.

Defendant Power Authority sought to appropriate plaintiffs' lands for a power pool in connection with the construction of dams on the St. Lawrence River. Such lands were not to be submerged, but were uplands which would be peninsular and islands when the land was flooded by the pool. Plaintiffs sought to enjoin the taking on the grounds that it was excessive and not for a public purpose. The Power Authority moved to dismiss for failure to state a cause of action. The Supreme Court, special term, granted the motion. The court was concerned mainly with the questions: (1) whether the taking in this case was authorized by statute; and (2) what degree of reliance was to be placed upon the administrative determination of the necessity of the taking. The court held that the taking was authorized, and that it was necessary for a public purpose. The land need not be 'intimately connected with' or 'absolutely necessary for' the public purpose, and the fact that the land will be leased does not necessarily make the taking for a private purpose. This decision was affirmed by the Supreme Court, Appellate Division. (Williams-Fla)
W69-02993

ADAMS V ADAMS (DAMAGE FROM OBSTRUCTING DRAINAGE DITCH).
310 S W 2d 813-816 (Ark 1958).

Descriptors: *Arkansas, Judicial decisions, Dams, Barriers, *Flood damages, Overflow, Rent, Value, *Obstruction to flow, Reasonable use, Storm runoff, Surface runoff, *Damages.
Identifiers: *Measure of damages.

Plaintiff landowner sued defendant for flood damage to his land allegedly resulting from an obstruction placed in drainage ditch along with torrential rains, which combined to cause an overflow onto the plaintiff's property, making cultivation impossible. The drainage ditch was part of a drainage district network and it was found that the defendants had not obtained the requisite permission of the drainage district before constructing the dam. The defendants claimed that the excessive rainfall, not their dam, was the cause of the plaintiff's damage. The Chancery Court ruled for the defendants, but this court reversed the decision. The evidence sustained the plaintiff's charge that the presence of the unauthorized dam, combined with the unusual rainfall, was a substantial factor in causing the overflow that damaged the plaintiff's lands. In situations like this the burden of establishing damages is on the plaintiff. Since the plaintiff introduced no evidence that the crops destroyed had any market value, the rental or usable value of the land was the proper measure of damages. The plaintiff, by showing that the defendants were liable, but failing to fix his loss by the correct measure of damages, was entitled to nominal damages only. (Blunt-Fla)
W69-02996

BLYDENBURGH V AMELUNG (DAMAGES FOR ARTIFICIALLY IMPOUNDING AND DISCHARGING WATER ON NEIGHBOR'S LAND).

309 S W 2d 150-154 (Ct App Mo 1958).

Descriptors: *Missouri, Judicial decisions, Damages, *Impounded waters, Water law, Surface waters, Repulsion (Legal aspects), *Surface runoff, *Riddance (Legal aspects).

The plaintiffs, landowners, brought this action to recover damages from defendants, adjoining landowners, which resulted when the defendants artificially impounded and discharged water on to the plaintiffs' property. The defendants had constructed a tile that ran from a small basin on their property to the property of the plaintiffs. The trial court awarded damages to the plaintiffs, and the Kansas City Court of Appeals affirmed. The court held that surface water is a common enemy and property owners may deflect it off their property. However, they may not collect such water and cast it on to adjoining property in increased and destructive quantities. The appellate court also held that although the instruction relating to damages was inaccurate because it permitted the jury to duplicate the amount of recovery, the verdict was not excessive, and therefore it did not constitute not reversible error. (Watson-Fla)
W69-02997

TRUSTEES OF INTERNAL IMPROVEMENT FUND V CLAUGHTON (THE RIGHT TO FILL SUBMERGED LANDS GRANTED BY THE TRUSTEES DOES NOT EXTEND BEYOND THE BOUNDARIES ACTUALLY CONVEYED).
86 So 2d 775-792 (Fla 1956).

Descriptors: *Florida, Judicial decisions, Islands, Beds, *Riparian rights, *Bulkheads, *Land fills, Wetlands, Sand bars, Shallow water, Boundaries, Legislation, Tidal marshes, Legal aspects.
Identifiers: Internal Improvement fund, Swamplands Act, Riparian Rights Act.

Defendant was estopped to question the validity of plaintiff's title to submerged lands included in a grant by defendant out of tidal lands vested in the trustees by a 1913 statute. However, plaintiff was not authorized to fill beyond the boundaries conveyed. The right to fill under the 1856 Riparian Rights Act and the Butler Bill attaches only to uplands or lands other than sovereign lands. These acts are inapplicable to islands, sand bars, and shallow banks, title to which was vested by the legislature in defendant for purposes of sale. The provision in the act allowing sale by defendant and providing that grantees should have the right to 'bulkhead and fill in same' was only a grant of a special riparian right and did not bring such lands within the terms of the 1856 and 1921 Riparian Rights Acts. Thus, only the original lands conveyed could be filled. (Childs-Fla)
W69-02999

INJURIES TO DAMS AND WATER CHANNELS OF MILLS AND FACTORIES.

N C Gen Stat sec 14-142 (1967).

Descriptors: *North Carolina, *Legislation, Mills, *Dams, Channels, *Industrial plants, Canals, Obstruction to flow, Industrial water.

In North Carolina, by statute, if any person cuts away, destroys, or otherwise injures any dam, or obstructs or damages any race, canal, or other water channel erected, opened, used, or constructed for the purpose of furnishing water for the operation of any mill, factory, or machine works, or for the escape of water therefrom, he shall, upon conviction, be fined and/or imprisoned at the discretion of the court. (Watson-Fla)
W69-03001

HILTON V DUKE POWER CO (DAM ADDITIONS CAUSED FLOODING OF UPSTREAM LAND).
254 F 2d 118-126 (4th Cir 1958).

Descriptors: United States, *South Carolina, Judicial decisions, *Dams, *Backwater, Dredging, Silt, Hydroelectric plants, *Flooding, Water rights, Condemnation, Eminent domain, Impounded waters, Legal aspects, Water law.
Identifiers: Statute of limitations, Accrual of action.

Plaintiff brought this action for damage to his lands caused by the maintenance of a neighboring dam. Plaintiff's lands lie 12 miles upstream from the dam, and it is contended that the natural flow of the waters provided ample drainage before the erection of the dam. Still waters, in the lake formed behind the dam, caused silt to accumulate. The silting continued and gradually the creek banks on plaintiff's land, which had averaged six to eight feet, were diminished. The creek overflowed depositing water and silt on plaintiff's land. Under South Carolina law, there is liability if a dam is the proximate cause of injury to neighboring property, but the statute of limitations for damage to real estate affects the remedy. There is a 'taking' requiring just compensation and accrual of the right of action when neighboring real estate is actually invaded; but the statute of limitations does not begin to run until actual injury occurs. As long as the dam remained at the level established at the time of condemnation, the right acquired included damage that might accrue. The release signed by landowners extinguished every right existing at the time of release. However, a jury verdict awarding damages to the plaintiff was reinstated because a jury question was presented as to whether the damage was reasonably foreseeable within the meaning of the release. (Childa-Fla)
W69-03006

FRYE V PENNSYLVANIA RR (ACTION BY LANDOWNERS FOR DAMAGES FROM FLOODING CAUSED BY CLOGGED DRAINAGE PIPE UNDER DEFENDANTS RAILROAD).

187 Pa Super 367, 144 A 2d 475-477 (1958).

Descriptors: *Pennsylvania, Judicial decisions, *Railroads, Damages, *Flooding, Drainage, Pipes, *Culverts, Right-of-way, Rainfall, Legal aspects, Obstruction to flow, Streamflow, Streams.
Identifiers: Act of God, Debris.

This action was brought by landowners against a railroad for damages caused by flooding of certain of their lands due to clogging of a drainage pipe under defendant-railroad's right-of-way. The trial court entered judgment for the plaintiffs, but the Superior Court reversed, ordering a retrial. The Superior Court held that the measure of damages for restoration of the land to its former undamaged condition was the restoration cost at prices prevailing during the year of the damage. The admission of the testimony of a witness as to the restoration cost based on costs five years later was reversible error due to absence of evidence that there had been no change in prices between the year of the damage and 1956, the year when the witness inspected the property. The court also held that where flooding damage to the landowners' property did not result from rainfalls so extraordinary that their consequences could not have been foreseen, but instead, was due to the clogging of a drain under the railroad's right-of-way, the damages could not be attributed to an act of God. (Watson-Fla)
W69-03014

CENTRAL MAINE POWER CO V PUBLIC UTIL COMM'N (RIPARIAN LAND PURCHASE TO AVOID LIABILITY FOR DAM OPERATION).

163 A 2d 762-789 (Me 1960).

Descriptors: *Maine, *Riparian rights, *Dams, *Reasonable use, Judicial decisions, Riparian land, Riparian waters, Electric power rates, Hydroelectric plants, Administrative decisions, Legislation, Water rights.
Identifiers: *Mill Act.

Petitioner, Central Maine Power Company, sought review of an adverse determination by the Public Utilities Commission of an electricity rate claim. The Supreme Judicial Court held that the Commission erred in not admitting to the rate base of the electric company the value of the riparian lands and water easements purchased as property 'used or required to be used' in the public service. The court reasoned that it was necessary for the electric company to purchase this property in order to operate its plant without fear of violating the riparian rights of downstream proprietors through sudden, large releases of water necessary for the plant's operation. It was ruled that riparian ownership extends to the thread of the stream and includes a right to its natural flow and reasonable use, subject only to public rights of passage for fish, boats and logs. Water may not be diverted unlawfully or unreasonably. A riparian owner may use the stream for manufacturing or industrial purposes if the water is not unreasonably detained or essentially diminished. As to the relation of upper and lower riparian owners, if water is accumulated rightfully and lawfully in a reservoir above a dam, ordinary care must be exercised in releasing it. If accumulated wrongfully, the water is released at the peril of the upper owner. (Patterson-Fla)
W69-03017

FAIRCHILD V KRAEMER (ACCESS TO ARTIFICIALLY CREATED BASIN).

11 App Div 2d 232, 204 NYS 2d 823-827 (1960).

Descriptors: *Dredging, Channel improvement, *Inlets, Marinas, *Navigable rivers, Public rights, Judicial decisions, High water mark, Low water mark, Water law, Bulkhead line, Harbors.

Plaintiff, owner and lessee of a boat basin created through dredging some 67 years prior to the case, brought an action in trespass to restrain defendant from using the basin. Prior to the dredging, the area of the basin had been sand dunes through which a small creek passed and emptied into Long Island Sound. After the dredging, several creeks emptied into the basin which was connected to the sound. Defendant used the basin as an anchorage, claiming a right of use based on the theory that the dredging had enlarged the navigable area of the creeks which it had supplanted. The lower court dismissed the complaint and the plaintiff appealed. It was held that evidence of the ebb and flow of the tide in the creek was insufficient to show its navigability, and a new trial was ordered. Under the modern and majority rule which prevails in the U S and N Y, a waterway is navigable on fact only when it is used, or is susceptible of being used, in its natural, ordinary, and original condition, as a highway for commerce over which trade and travel are or may be conducted in the customary manner. If the stream was proved to be navigable, the basin would be accessible to the public.
W69-03018

BURKE V FREY (SURFACE WATER DRAINAGE).
358 Mich 606, 101 N W 2d 385-387 (1960).

Descriptors: *Michigan, Judicial decisions, *Surface runoff, *Surface drainage, Drainage systems, Repulsion (Legal aspects), Lake Erie, Storm runoff, Flooding.

Property owners blamed surface flooding of their lots on the refusal of neighboring owners to reopen and maintain a drainage ditch. Plaintiffs alleged that defendants had lessened the efficiency of the method of drainage of their own property and that, in consequence, surface waters on occasion flowed onto plaintiffs' lots. The court stated that a landowner has a duty not to increase the natural flow of water upon a neighbor's land either by erecting barriers to natural drainage or by taking steps to facilitate drainage of his own property. It was held that defendants had not violated their duty to protect plaintiffs' property from surface water and that flooding had resulted from proximity to Lake Erie and the occurrence of unusually heavy storms. (MacMillan-Fla)
W69-03019

BECK V CITY OF NEW YORK (OVERFLOWING SEWERS).
199 NYS 2d 584-595 (N Y Sup Ct 1960).

Descriptors: *New York, Judicial decisions, Damages, Cities, *Sewers, Drainage systems, Storm drains, Storm runoff, *Overflow, *Flood damage, Land tenure.

Resident property owners sued New York City for flood damages resulting from overflowing storm sewers. The city was not required to install sewers at all. If a sewer system proves inadequate, a property owner is not entitled to compensation for this error in judgment in the absence of negligence. The court found that rainfall during the relevant specified period had been 'far greater than normal' and that plaintiffs failed to prove that negligence on the part of the city created the conditions and the resulting floods. (MacMillan-Fla)
W69-03020

BINO V CITY OF HURLEY (CONSTITUTIONALITY OF ORDINANCE DENYING RIPARIAN RIGHTS WITHOUT COMPENSATION).
273 Wisc 10, 76 N W 2d 571-581 (1956).

Descriptors: *Wisconsin, Judicial decisions, Water law, Cities, *Municipal water, Lakes, *Riparian rights, Riparian land, *Eminent domain, Easements, Legislation, Water pollution, Water supply, Legal aspects, Water sources, Swimming, Boating, Comdemnation value, Compensation.

The plaintiffs owned all the land surrounding a non-meandered lake lying within the corporate limits of the City of Hurley. The plaintiffs granted the city an easement across their property to lay pipe and use the lake as a water supply. However, they specifically retained all riparian rights to the lake. The city later passed an ordinance prohibiting swimming, boating, and bathing in the lake. The plaintiffs brought this action for a declaratory judgment that the ordinance was unconstitutional. The trial court upheld the ordinance, but the Supreme Court of Wisconsin reversed, holding that riparian rights are property rights and it is a denial of due process to take them without just compensation. The Supreme Court also stated that the city could acquire the riparian rights by contract or the property could be acquired by eminent domain if necessary. (Watson-Fla)
W69-03021

GRASLEY V EPPLEY (SURFACE DRAINAGE).
134 NE 2d 742-746 (C P Ohio 1953).

Descriptors: *Ohio, Judicial decisions, Legal aspects, *Surface drainage, *Repulsion (Legal aspects), Diversion structures, Barriers, *Obstruction to flow, Surface runoff, Natural flow, Ditches.

Plaintiffs sought an injunction to prevent defendant from interfering with the natural flow of drainage water passing between the adjoining plots of the parties. The court held that defendant could deepen and widen his portion of the ditch in order to prevent an overflow onto his land. He could not, however, erect artificial barriers or open passages between the adjoining lands in order to cause a flowage onto the lands of plaintiffs which would be disruptive of the natural topography of the land prior to his acts. (Molica-Fla)
W69-03025

SEC 452 WATER SUPPLY TO OTHER STATES.
N Y Conserv Law sec 452 (McKinney 1967).

Descriptors: *New York, *Legislation, Permits, Legal aspects, *Fresh water, *Transportation, Water resources, Administration, Administrative agencies, Interstate.

New York prohibits the transporting of waters by means of conduits, etc., from any fresh water body into another state unless, upon written petition, consent is obtained from the Water Resources Commission. The New York Supreme Court may enjoin any unauthorized transportation upon application by the Commission. (Molica-Fla)
W69-03028

NAVIGATION AND FLOOD CONTROL IMPROVEMENTS IN COOPERATION WITH THE FEDERAL GOVERNMENT.
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-03033

STATE V CITY OF DEFIANCE (CONSTITUTIONALITY OF STATUTE REQUIRING CITIES TO FURNISH OUTSIDERS WITH WATER).
167 Ohio St 313, 148 N E 2d 221-225 (1958).

Descriptors: *Ohio, Judicial decisions, Legislation, *Cities, Conduits, *Pipelines, *Water supply.
Identifiers: Constitutional law.

McCann, the relator in this case, petitioned the Ohio Supreme Court to issue a writ of mandamus to compel the city to issue a permit allowing her to tap into the city's water line. McCann lived outside the city and relied upon Sec 743.13 of the Revised Code, which provided that if a city extended its water pipes beyond its limits at the expense of someone else, it must provide service to anyone along the extended line. The city alleged that this statute was unconstitutional because it purported to restrict the constitutionally granted power of a municipality to provide public utility services. The Ohio Supreme Court held the act unconstitutional and refused to issue the writ. (Williams-Fla)
W69-03035

BOARD OF SUPERVISORS OF LOUDOUN CITY V TOWN OF FAIRFAX (APPLICATION TO ERECT DAM FOR MUNICIPAL WATER SUPPLY).

199 Va 612, 101 S E 2d 519-523 (Sup Ct App 1958).

Descriptors: *Virginia, Judicial decisions, Water law, Legislation, *Dams, *Municipal water, Administrative agencies, *Water supply, Water sources, Streams, Cities, Public Health, Administrative decisions.

The Town of Fairfax made application for permission to erect a dam for the purpose of establishing a water supply. The Board of Supervisors of Loudoun County and others were allowed to intervene as defendants. The trial court ruled in favor of the application, and the Supreme Court of Appeals of Virginia affirmed the decision. The court held that the evidence was sufficient to sustain the trial court's finding that a public necessity or an essential public necessity or an essential public convenience would be served by the erection of such a dam, and against the contention that the town could obtain water from other sources. The word 'necessity' within the statute, which authorizes erection of a dam where a public necessity or an essential public convenience will be served, does not denote an absolute, imperative, or indispensable necessity, but means reasonable necessity. (Watson-Fla)
W69-03036

SHEPHEARD V BOGGS (LAND EXTENSION BY RIPARIAN LANDOWNER BLOCKING STREAM).
198 Va 299, 94 S E 2d 300-304 (Sup Ct App 1956).

Descriptors: *Virginia, Judicial decisions, Water law, *Riparian rights, Rivers, Streams, Dams, Piers, *Boundaries (Property), *Low water mark.

Plaintiffs brought this bill in equity to require a lot owner to remove an earthen dam and pier constructed across a small stream, flowing into a river. The Supreme Court of Appeals of Virginia held that the lot owner's property, which extended to the low water mark rather than a bluff line sloping from his lot down to the stream, ended at the stream in question. Therefore, the lot owner did have the riparian right to extend his property to the low water mark but he could not block the stream and deprive his neighbors of their riparian rights since they existed before the land was extended. (Watson-Fla)
W69-03037

CORDOVANA V VIPOND (INJUNCTION TO REMOVE FENCE WHICH DENIED RIPARIAN RIGHTS).
198 Va 353, 94 SE 2d 295-299 (S C App 1956).

Descriptors: *Virginia, Judicial decisions, Water law, Legislation, *Riparian rights, *Navigable waters, *Boundary disputes, Streams, Shores, Low water mark, Riparian land, Ownership of beds, Streambeds.

The complainants sought a mandatory injunction in equity to require the adjoining property owners to remove a fence which denied the complainants their riparian rights. The trial court entered an order extending the property lines of the lots in question straight out into the stream without taking into account the irregular shore line. The Supreme Court of Appeals of Virginia reversed, holding that extending the property lines beyond the low water mark was a violation of statute and deprived the complainants of their riparian rights. The court also held that each riparian owner is entitled to a parcel of underwater land as wide at its outer end, upon the line of navigability, as the inner or shore end that the riparian owner possesses. (Watson-Fla)
W69-03038

CITY OF ASHLAND V KITTLE (LIABILITY OF A CITY FOR FLOODING CAUSED BY INADEQUATE CULVERT).
305 SW 2d 768-769 (Ky Ct App 1957).

Descriptors: *Kentucky, Judicial decisions, *Flood damage, Overflow, Surface waters, *Culverts, Rainfall, Cities, Surface runoff, Surface drainage, Legal aspects.

Plaintiff sued the city of Ashland, alleging injury to real estate caused by the overflow of surface water from a negligently constructed culvert. The Court found the culvert to be a temporary structure since it could be readily corrected or abated at a reasonable expense. Suits may be brought for each recurring injury resulting from a temporary structure. A municipal corporation is not liable for damages caused by extraordinary rainfall which could not have been anticipated by a person of ordinary experience. The evidence indicated that the extraordinary rainfall experienced could have been anticipated and that the city failed to keep the culvert in condition to carry off water from an ordinary rainfall. The judgment awarding damages was affirmed. (Childs-Fla)
W69-03040

FLOOD PLAIN INFORMATION, HARPETH RIVER, FRANKLIN, TENNESSEE.
Corps of Engineers, Nashville, Tenn.
For primary bibliographic entry see Field 02E.
For abstract, see .
W69-03041

STEPS TOWARD A BETTER UNDERSTANDING OF URBAN RUNOFF PROGRESS,
Michigan Univ., Ann Arbor.
For primary bibliographic entry see Field 04C.
For abstract, see .
W69-03097

ECONOMIC ANALYSIS OF ALTERNATIVE FLOOD CONTROL MEASURES,
Kentucky Univ., Lexington. Dept. of Civil Engineering.
James L. Douglas.
Water Resources Res, Vol 3, No 2, pp 333-343, 1967. 11 p, 1 tab, 14 ref.

Descriptors: *Flood control, *Non-structural alternatives, *Flood damage, *Economic efficiency, *Computer programs, Digital computers, Flood plains, Flood plain zoning, Floodproofing, Channel improvement, Flood plain insurance, Planning.
Identifiers: Land use control.

A digital computer program was developed for determining the optimum combination of structural and nonstructural measures for flood control according to the criterion of economic efficiency. The program may be readily applied by any agency interested in analyzing the relative merits of structural and nonstructural measures or in more rapid economic analysis of alternative channel improvement designs. It selects the optimum combination of channel improvement, floodproofing, and land use control for each portion of the flood plain during planning stages of specified duration. The program was used to relate the optimum combination of the three measures to specific flood-plain properties. Finally, the sensitivity of the nature and the total cost of the optimum program was related for various flood-plain conditions to variation in cost of channel improvement, cost of land use control, cost of flood proofing, right-of-way value, value of the coefficient relating flood damage to flood severity, value of open space preserved in an urban area, extent of aversion to irregular timing of flood damage, discount rate, population projections, and the exclusion of alternative combinations.
W69-03111

RECREATIONAL USE OF MUNICIPAL RESERVOIRS,
Cornell Univ., Ithaca, N. Y.; and Michigan State Univ., East Lansing.
For primary bibliographic entry see Field 06B.
For abstract, see .
W69-03136

SIMULATION OF FLOOD FLOW DIVERSION FROM A LAKE SYSTEM,
Southern Methodist Univ., Dallas, Tex.; and Northwestern Univ., Evanston, Ill.
Jerry R. Rogers, and Robert S. Gemmell.
Proceedings of the Third Annual American Water Resources Conference (American Water Resources Assn; Urbana, Ill), c 1967, pp 285-293. 9 p, 1 map, 2 tab, 3 fig, 3 ref.

Descriptors: *Model studies, Computer models, *Flood control, Lakes, Lake Michigan, Illinois, River flow, Water level fluctuations.
Identifiers: *Flood flow diversion, Lake system, Chain of Lakes.

This study was directed at the evaluation of water export as a means for controlling floods on a small lake system. Stochastic flood simulations were based on the history of lake level fluctuations and an estimate of the stage-volume relationship for the lakes. The use of the General Systems Simulation language greatly facilitated construction of the computer model for simulation of lake flooding and diversion. The available economic data was inadequate to permit evaluation of diversion performance in economic terms, although such a procedure could have easily been incorporated in the simulation model. It is concluded that simulation technique has considerable merit, especially for the preliminary planning and evaluation of alternatives. (Winn-Rutgers)
W69-03143

DRAINAGE THEORY FOR REMOVAL OF EXCESS WATER FROM IRRIGATED LANDS,
Washington State Univ., Pullman. Dept. of Agricultural Engineering.
Max C. Jensen.
Washington Water Research Center, Completion Report, Dec 1968. 32 p, 4 tab, 11 fig, 9 ref, 1 append. OWRR Project A-006-Wash.

Descriptors: Drainage, *Drainage theory, Drainage density, *Drainage engineering, Drainage systems, Drainage water, Drainage wells, Drains, Pores, *Porosity.

Gravel pack flow conductance envelopes around drain tile--previously wrongly called 'gravel envelope filters'--have important influences on drain performance. Boundary conditions created by conductance envelopes must be described in equations for mathematical solutions to be descriptive. Good conductance envelopes prevent solid particle movement. Outside surface of good conductance envelope can be used as minimum equipotential surface. Substantial amounts of water were found to move toward drain tile above water table. Hydraulic conductivity within capillary fringe zone was found to be nearly as high as saturated conductivity below water table. Above capillary fringe (zone of complete saturation) hydraulic conductivity rapidly decreased to near zero in two porous media investigated. Hence lateral water movement above capillary fringe was very small. By increasing definition of flow area in flow equations to include capillary fringe zone, a near accurate calculation of discharge was obtained.
W69-03189

4B. Groundwater Management

MENNE V CITY OF FOND DU LAC (RIGHT OF WATER REMOVAL TO NON-CONTIGUOUS LANDS).
77 N W 2d 703-707 (Wisc 1956).

Descriptors: *Wisconsin, Judicial decisions, Water sources, *Water wells, Relative rights, Water transfer, Water law, *Competing uses, Water conservation, Reasonable use, *Percolating water, Basins, Legal aspects, Water supply, Legislation.

The City of Fond du Lac planned to construct a well and remove water from other towns for the purpose of sale to non-contiguous property. Town residents brought action for an injunction against the construction and water removal. In the alternative, plaintiffs sought to restrain the city from removing water from the water basin under the towns to an extent constituting an unreasonable use by the city relative to the property rights of the plaintiffs. The Supreme Court affirmed the lower court's decision that the use of percolating water underneath an owner's land is a property right, and that water so obtained could be sold. The Court left the solution of the problem to the legislature, basing the opinion upon stare decisis. The dissenting opinion stressed that uses of one neighbor should not impair the substantially equal uses of another. (Wheeler-Fla)
W69-02855

RADIUS OF INFLUENCE OF A WELL,
For primary bibliographic entry see Field 02F.
For abstract, see .
W69-02946

DUNCAN V GHEEN (ENFORCEMENT OF EASEMENT GRANTING RIGHT TO SPRING WATER).
185 Pa Super 328, 138 A 2d 168-170 (Super Ct Pa 1958).

Descriptors: *Pennsylvania, Judicial decisions, *Easements, Legal aspects, *Spring waters, Springs, Water sources, Water users, Water contracts, *Water rights, Water conveyance, Burrows, Domestic water, Rodents, Diversion, Conduits.

Plaintiff's predecessor in title acquired the right to the water of a certain spring on defendant's land. The easement was created by deed, with the spring serving as a source of water for domestic use. Due to burrowing marmots, the water was diverted underground from the original source of the spring. Plaintiffs, by the terms of the easement, had acquired the right to enter upon the defendant's land to keep in repair the conduit through which the water was conveyed via a catch basin to plaintiff's house. A subsequent grantee of the land containing the spring destroyed plaintiff's modifications to the conduit, alleging that such action became necessary due to the change in surface location of the spring. The lower court granted a permanent injunction restraining the defendants from interfering with the plaintiff's right to the water from the spring in accordance with the easement. The appellate court affirmed, ruling that it was immaterial that the location of the spring changed. (Wheeler-Fla)
W69-03023

OPTIMAL GROUNDWATER MINING,
Nevada Bureau of Mines, Reno. Desert Research Inst.
P. A. Domenico, D. V. Anderson, and C. M. Case.

Water Resources Res, Vol 4, No 2, pp 247-255, April 1968. 9 p, 3 fig, 10 ref.

Descriptors: *Water management (Applied), *Groundwater mining, Water yield, Mathematical models, Economics, Withdrawal, Groundwater basins, Safe yield.
Identifiers: *Optimal yield, Economics of water development.

Managerial concepts of yield from a groundwater basin, e.g. safe yield, encompass ambiguous considerations. A mathematical expression is presented that relates the economic worth of groundwater mining to the remaining worth of a basin after it has been partially depleted and permits establishment of an optimal, one-time storage reserve that may justifiably be exploited. With water-level position selected as the denominator common to both the ground-water basin and its economic worth, the extreme conditions of perennial use of natural replenishment and depletion of the entire reserve emerge as special cases of the general model. This is reflected through an expression for optimal mining yield, a one-time volume of nonrenewable water that may take on values ranging from zero to the maximum amount of usable water in storage. The maximizing conditions are expressed in terms of verbal decision rules and give new interpretation to the concept of overdevelopment generally associated with exceeding safe yield. A criterion is thus provided by which the economic state of development can be tested at any time. (Steinhilber-USGS)
W69-03114

SYSTEMS ANALYSIS FOR GROUND WATER BASIN MANAGEMENT,
California Univ., Berkeley. Dept. of Civil Engineering.
David K. Todd.
California Water Resources Center, Technical Completion Report, Sept 1967. 9 p, 10 ref. OWRR Project A-003-Cal.

Descriptors: *Systems analysis, Groundwater, Groundwater modeling, Optimization, *Groundwater management, Groundwater quality.

The purpose of this project was to investigate fundamental problems of ground water dynamics and concepts for managing ground water basins. The research was conducted as a series of subprojects, the responsibility for each being assigned to a graduate student. The results have, or soon will be, reported in the form of 15 publications, including 2 articles in the technical journals, 7 research reports and 6 PhD dissertations. Following is a list of the subprojects completed: (1) Mechanics of Turbulent Flow; (2) Lateral Flow in the Unsaturated zone; (3) Optimization of a Ground Water Basin; (4) Theoretical Analysis of Groundwater Basin Operation Studies; (5) Scheduling of Water Resources Developments in Emerging Nations; (6) Techniques for determining Ground Water Flow Fields.
W69-03200

4C. Effects on Water OF Man's Non-Water Activities

BARTOW COUNTY V DARNELL (REQUIREMENTS FOR STATING A CAUSE OF ACTION FOR FLOOD DAMAGE).
97 S E 2d 610-612 (Ct App Ga 1957).

Descriptors: *Georgia, Judicial decisions, Local governments, Damages, *Highways, Land fills, *Flood damages, *Legal aspects, Surface runoff, Surface drainage.

Plaintiffs brought an action for damage to realty due to the construction of a highway by the county in such a manner that water along the highway flooded plaintiffs' property. A fill had been constructed, resulting in water being cast onto the property. It was held that these allegations stated a cause of action for damages under a statute, Ga Code Ann sec 95-1710, which does not require that the plaintiff prove negligence. The judgment upholding the plaintiffs' petition was affirmed. (Childs-Fla)
W69-02880

STATE V SIMS (ACTION TO COMPEL PAYMENT OUT OF ALLOCATED FUNDS FOR FLOOD DAMAGE CAUSED BY A STATE AGENCY).
97 S E 2d 295 - 299 (Sup Ct App W Va 1957).

Descriptors: *West Virginia, Judicial decisions, State governments, Administrative agencies, Damages, *Flooding, Highways, Bridges, Land fills, Rainfall, *Compensation, *Obstruction to flow, Dams, Legal aspects.
Identifiers: State Road Commission (Florida).

An original mandamus proceeding was brought to compel the State Auditor to issue warrants for payment out of an appropriation made by the Legislature for damages caused by the negligence of the State Road Commission in construction and maintenance of a highway bridge. The court held that the State Road Commission was negligent in constructing a fill and bridge in such a manner that flooding was caused during heavy rainfall. Since such negligence would be actionable as between private persons, there existed a moral obligation upon the state to make compensation for damages caused by the flood. Where the state had made the appropriation for payment, it was the duty of the State Auditor to make the necessary disbursement. (Childs-Fla)
W69-02881

PRESCOTT V HERRING (BOUNDARY DISPUTE).

212 Ga 571, 94 S E 2d 417-422 (1956).

Descriptors: *Georgia, Judicial decisions, Water law, Lumber, *Boundary disputes, Mills, *Ponds, Low water mark, Boundaries (Property), *High water mark, Legal aspects.
Identifiers: Land descriptions.

Action was brought by decedent's heirs at law to enjoin defendants from cutting timber on decedent's land. The trial court ruled for the heirs and the Supreme Court affirmed, holding that, where the deed described the land conveyed as that covered by a certain mill pond to be maintained at no more than a certain maximum height and stated that the land was located in the northeast corner of a certain lot, the deed conveyed all the land covered by the pond, even though part of the land did not lie in the northeast corner of the lot. The Supreme Court also stated that, in construing deeds, the controlling rule is to ascertain the intentions of the parties. (Watson-Fla)
W69-02882

ROSKIN BROS, INC V STATE (LIABILITY OF STATE FOR NEGLIGENT MAINTENANCE OF CULVERT).

160 NYS 2d 32-35 (Ct Cl 1957).

Descriptors: *New York, Jucicial decision, *Water injury, State government, Roads, Surface drainage, Surface runoff, *Culverts, Roads, Floods, Percolating water, Seepage, *Excessive precipitation, Legal aspects.
Identifiers: Negligence, Evidence, Proximate cause.

Claimant sought to recover from the State for water damage to his property and building following the alleged negligence of the State in allowing a culvert under a state highway to become clogged during a three-day rain, causing water to back up. Claimant alleged that, due to the blockage of the culvert, overflow-water percolated and flowed over the land to a point where it seeped into his basement. The court held that the State had been negligent in removing a screen from the culvert and not replacing it for a period of six months before damage. However, Claimant had not demonstrated that the State's negligence was the proximate cuase of the injury suffered. Claimant introduced expert testimony to the effect that the waters which entered his basement were those from the overflow of the culvert, but the court stated that this testimony was not based on proven facts and therefore lacked probative force. (Williams-Fla)
W69-02992

RINALDI V STATE (DAMAGE FROM STANDING WATERS).

4 Misc 178, 158 NYS 2d 271-273 (1956).

Descriptors: *New York, *Standing waters, Muck soils, Floods, Judicial decisions, Legal aspects, Highways, Crops, *Damages, Surface waters, *Road construction, Ponding.

Plaintiffs, owners of a muck farm, had their onion crop destroyed by water accumulating on their lands. They sued the state, alleging that negligence in the construction of a highway caused the harmful accumulation. The court found that this allegation was not sustained by the proofs and dismissed the cause. (Scott-Fla)
W69-02994

CITY OF MADISON V STATE (PUBLIC BUILDINGS ON FILLED LAKE LAND).
1 Wisc 2d 252, 83 NW 2d 674-679 (1957).

Descriptors: *Wisconsin, *Cities, *Landfills, Legal aspects, Judicial decisions, Public benefits, Construction, Navigable lakes, Public rights, Riparian rights, Public lands, Reclamation, Boating, Fishing.
Identifiers: Dockline, Lake Monona.

Action by city seeking declaration of its right to erect an auditorium and civic center on a filled area of Lake Monona. City filled a portion of lake and made it into parks, etc. It then proposed to build a civic center and auditorium on the filled property. The proposed construction would not interfere with the navigable character of the lake. A statute passed in 1927 established a dock line in the lake and authorized the city to construct in or on the lake out to this line. The court held that a building of the type described was not so unrelated to the use and enjoyment of the lake as to be outside the scope of the term 'public buildings.' Enjoyment of scenic beauty has been recognized as one of the public rights in navigable waters. Disappointment to those who would desire to boat, fish or swim in the area to be filled is negligible when compared with the greater convenience to be afforded those members of the public who will use the building. The city is authorized to expand tax money for this project. (Shevin-Fla)
W69-03022

STEPS TOWARD A BETTER UNDERSTANDING OF URBAN RUNOFF PROGRESS,
Michigan Univ., Ann Arbor.
E. F. Brater.
Water Resources Res, Vol 4, No 2, pp 335-347, April 1968. 13 p, 9 fig, 20 ref.

Descriptors: *Infiltration, *Rainfall-runoff relationships, *Urbanization, Runoff, Hydrographs, Analysis, Retention, Rainfall, Michigan, Watersheds (Basins).
Identifiers: Detroit metropolitan area, Hydrologically impermeable area.

Rainfall and runoff from drainage basins in various stages of urbanization were analyzed to determine the initial retention, the hydrologically significant impermeable area, and the infiltration capacities of the permeable portions of the basins. The drainage basins, varying in size from 9.5 to 185 sq mi, are located in the Detroit metropolitan area. Techniques were developed that largely eliminated personal judgment in separating surface runoff from groundwater discharge. Infiltration capacities in this region are from 3 to 5 times higher in late summer than in early spring. The average initial retention for the basins studied is approximately 0.2 in. The hydrologically significant impermeable area appears to be closely related to the population density, but the effect of other factors is being studied. An investigation of the cause of seasonal and short period variations of infiltration capacity may provide a better understanding of the infiltration process.
W69-03097

CONSERVATION DECISION-MAKING: A RATIONALIZATION,
Southern Illinois Univ., Carbondale.
Ronald Beazley.
Natural Resources Journal, Vol 7, No 3, pp 345-360, July 1967. 16 p.

Descriptors: Natural resources, *Decision making, *Conservation, Environmental effects, *Land management, Multiple purpose, Institutions, *Social values.
Identifiers: Uncertainty, Pressure groups, Feedback.

Conservation is the establishment and observation of economically, socially, and politically acceptable norms, standards, patterns or models of behaviour in the use of natural resources by a given society. The magnitude and implications of conservation should not be underestimated. In the aggregate the effects of these requirements are great, representing millions and perhaps billions of dollars annually in the way we use natural resources. These effects have further multiple reactions throughout the whole economy and society, quite outside of what we generally think of literally as conservation. In this sense conservation decision-making deserves a great deal more effort and care than we have given it. Ultimately, the obligation of conservation is to pass along resource potential to those in the future, while trying to raise that potential through research in conservation values, technology, organization, and decision-making. (Sokoloff-Rutgers)
W69-03127

4D. Watershed Protection

DETACHMENT OF SOIL PARTICLES IN SIMULATED RAINFALL,
Nebraska Univ., Lincoln. Dept. of Agronomy.
Andrew P. Muzurak, and Peter N. Mosher.
Soil Sci Soc of Amer Proc, Vol 32, No 5, pp 716-719, Sept-Oct, 1968. 4 p, 3 fig, 1 tab, 8 ref.

Descriptors: *Soil erosion, *Impact (Rainfall), Sediments, Erosion, Particle size, Water management (Applied), Soil conservation, Soil water movement.
Identifiers: Particle detachment, Splash erosion.

Discussed is the relation between falling raindrops and detachment of soil particles from a soil mass, which is the first stage of erosion. Information is presented that relates particle diameter to rainfall intensity when soil particles are exposed to simulated rainfall. Experimental procedure involved subjecting separates of soil materials of various particle sizes to variable simulated rainfall intensities. The amount of detached soil particles was linearly related to simulated rainfall intensity. Detachment of soil particles exposed to simulated rainfall increased from 2.2 mg per cubic centimeter of water for separates 4,760 to 3,360 microns in diameter to a maximum amount of 288 mg per cubic centimeter of water for separates 210 to 149 microns and 149 to 105 microns in diameter. Then the amount of detached particles decreased with decreasing diameter of particles. Detachment for less than 2 micron diameter particles was 11 mg per cubic centimeter of water. (Steinhilber-USGS)
W69-02832

APPLICATION OF THE GRAVITY SURVEY METHOD TO WATERSHED HYDROLOGY,
Agricultural Research Service, Tucson, Arizona. Southwest Watershed Research Center.
Daniel P. Spangler, and Fred J. Libby.
Groundwater, Vol 6, No 6, pp 21-26, November-December 1968. 6 p, 4 fig, 1 tab.

Descriptors: *Watersheds (Basins), *Gravity studies, Arizona, Groundwater, Alluvium, *Surveys, *Hydrogeology, *Hydrology, Density, Semiarid climates, Geophysics, On-site investigations, Mapping, Data collections, Variability.
Identifiers: Walnut Gulch Experimental Watershed (Tombstone--Arizona).

A gravity survey was conducted which covered 250 square miles and included the Walnut Gulch watershed at Tombstone, Arizona. This survey method detects and measures variations in the earth's gravitational force which are associated with changes in rock and alluvium density near the surface. Before making extensive surveys by the seismic refraction method, the gravity survey method was chosen as the geophysical method that would give a regional picture of the subsurface geology. The area was found to be typical of Basin and Range physiography, with isolated mountain blocks separated by broad alluvium-filled basins. The principals of the gravity survey method, the field procedures, and the data reduction technique used were described in the report. It was shown that the gravity survey method can be applied to watershed ground-water hydrology. (Affleck-Arizona)
W69-02982

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification OF Pollutants

THE TEMPORAL AND SPATIAL DISTRIBUTION OF DISSOLVED OXYGEN IN STREAMS,
Manhattan Coll., Bronx, N. Y.
Donald J. O'Connor.
Water Resources Res, Vol 3, No 1, pp 65-79, 1967. 15 p, 5 fig, 1 tab, 17 ref.

Descriptors: *Dissolved oxygen, *Surface waters, *Water pollution, *Mathematical studies, Continuity equation, Spatial distribution, Temporal distribution, Aeration, Biochemical oxygen demand, Chemical oxygen demand, Temperature, Streamflow, Channel morphology.
Identifiers: Stream ecosystem.

The geophysical characteristics of drainage basins and the biochemical and physical environment of rivers affect the concentration of dissolved oxygen. These factors are embodied in a fundamental equation of continuity that describes the oxygen balance. Variations of the fresh-water flow and cross-sectional area are included, as well as sources and sinks of oxygen, including natural and artificial aeration, the photosynthetic contribution, bacterial and algae respiration, carbonaceous and nitrogenous oxidation, and benthal deposits. Application of the basic equation is summarized by two general cases, the first in which bacterial respiration and spatial profiles are significant and the second in which the algae activity and the temporal changes are predominant. The equations provide functions to assess water quality and pollution and to determine the effect of many natural or artificial changes in the stream environment.
W69-02809

URBANIZATION AND ITS EFFECT ON THE TEMPERATURE OF LONG ISLAND STREAMS,
Geological Survey, Washington, D. C.
Edward J. Pluhowski.
U S Geol Surv open-file rep, 277 p, 1968. 56 fig, 13 tab, 38 ref, 3 append.

Descriptors: *Urbanization, *Temperature, *Streamflow, *Thermal pollution, Storm runoff, Vegetation effects, Solar radiation, Reservoirs, Heat budget, New York.
Identifiers: Long Island (New York).

To isolate and evaluate the effect of man-made changes of stream temperature, the thermal patterns of 5 streams on Long Island, New York, were defined and analyzed. The Connetquot River is included as a control stream because its upper part is in essentially its natural state. Urban development on the other 4 basins ranges from slight to nearly complete; otherwise the 5 streams are similar. Urban development has increased stream temperatures in summer by 10-15 deg F by the construction of ponds and lakes, clearcutting of vegetation from streambanks, increasing storm runoff, and reducing groundwater inflow. Winter stream temperature average 3-5 deg F lower than normal. Stormwater runoff raised stream temperatures 10-15 deg F on August 25-20, 1967. Shading on the Connetquot River reduces incoming solar radiation as much as 70%. Solar radiation and groundwater seepage are the most important controls on stream thermal patterns on Long Island and are the most easily influenced by human activity. Energy budget methods were developed to assess modifications in natural stream environments. (Knapp-USGS)
W69-02830

FIELD AND LABORATORY EVALUATIONS OF BIOASSAYS FOR NITROGEN AND PHOSPHORUS WITH ALGAE AND AQUATIC WEEDS,
Wisconsin Univ., Madison. Engineering Experimental Station.
George P. Fitzgerald.
In: Detection of limiting or surplus nutrients in algae, 9 December 1968. 12 p. WP - 297.

Descriptors: *Chlorophyta, *Cycling nutrients, *Enzymes, *Essential nutrients, *Nitrogen cycle, *Nutrient requirements, Algae, Analytical techniques, Aquatic algae, Aquatic microbiology, Aquatic productivity, Aquatic weeds, Bioassay, Cyanophyta, Environmental effects, Eutrophication, Limnology, Nitrogen compounds, Nitrogen-fixation, Phosphorus compounds, Physiological ecology, Phytoplankton, Pollutant identification, Rain, Rainfall-runoff relationships, Rain water, Rooted aquatic plants, Water pollution, Water pollution control, Water pollution effects, Water pollution sources, Sewers.

The rate of ammonia absorption in the dark and the amount of orthophosphate extracted by boiling water treatments have been used to follow the transient nature of the nitrogen and phosphorus nutrition of algae and aquatic weeds. The measurement of the enzymatic activity of algal alkaline phosphatase also used to follow phosphorus nutrition has been shown to be inhibited by the presence of 5 mg/L or more of phosphate-phosphorus, but the actual enzymatic activity of the algae is not inhibited by phosphate-phosphorus and is reduced only by growth (or dilution) under conditions of surplus available phosphorus. It is suggested that only terminal portions of aquatic weeds be used for nutritional bioassays because of nutritional differences between young and old portions of the same plant. Available nitrogen compounds related to rainfall have been shown to influence the nitrogen nutritional status of Spirogyra and Cladophora. In applications of bioassays the importance of testing each species of plants separately is shown by contrasting results obtained with nitrogen-fixing (phosphorus-limited) and non-fixing (nitrogen-limited) blue-green algae from the same environment.
W69-03186

TRACE AND TRACER ELEMENTS IN GROUND WATER,
Arizona Univ., Tucson. Dept. of Hydrology.
For primary bibliographic entry see Field 02F.
For abstract, see .
W69-03197

5B. Sources of Pollution

AQUEOUS TRANSPORT OF DIELDRIN RESIDUES IN SOILS,
Cincinnati Univ., Ohio., Environmental Health Engineering.
J. David Eye.
J Water Pollut Contr Federation, Vol 40, No 8, Part 2, pp R316-332, Aug 1968. 17 p, 4 fig, 7 tab, 44 ref.

Descriptors: *Soil water movement, *Dieldrin, *Organic soils, *Adsorption, Ion exchange, Solubility, Anion adsorption, Cation adsorption.

The apparent solubility of dieldrin in water ranges from 100 ppb at about 10 deg C at 300 ppb at 40 deg C. Its adsorption at equilibrium follows the Lnagmuir isotherm. In both equilibrium and column percolation experiments, the cation- and base-exchange capacities, specific surface areas, and clay contents of the various soils tested did not appear to affect adsorption capacity strongly, but higher organic contents appeard to be related to high adsorption capacity. At 20 deg C about 3 acre-ft of soil can be saturated by 1 lb of dieldrin. When dieldrin is applied at 1 lb/acre, only 0.06 ft of soil depth could be saturated with dieldrin if the soil density were 90 lb/cu ft and adsorptive capacity 5,000 mg/g. At the latter capacity and 25 deg C, and infiltration of 12 in./yr, 48 yr would be required to saturate the soil to 1 ft depth. Since 5,000 mg/g is far less than the adsorptive capacities of most natural soils and clays, danger to groundwater supply appears remote. (Knapp-USGS)
W69-02801

COMPOSITION OF WATER DISCHARGED FROM BITUMINOUS COAL MINES IN NORTHERN WEST VIRGINIA,
West Virginia Univ., Morgantown.
Robert G. Corbett, and Douglas J. Growitz.
Econ Geol, Vol 62, No 6, pp 848-851, Sept-Oct 1967. 4 p, 1 tab, 10 ref.

Descriptors: *Acid mine water, *Water analysis, Chemical analysis, Data collections, Trace elements, Water chemistry, West Virginia.

Chemical analyses were made of 5 samples of bituminous coal mine water to determine ferrous iron, total iron, aluminum, manganese, sodium, potassium, calcium, magnesium, chloride, sulfate, silica, and pH. Selected trace elements were sought in 2 of the 5 samples chosen because of their extreme values in pH (3.2 and 7.4). Four of the samples may be considered 'acid mine drainage' so characterized by pH of from 3.2 to 5.5, total iron in excess of 500 ppm, and aluminum greater than 100 ppm in the more acid samples. The fifth sample resembles uncontaminated ground water from the Monongahela Group and has a pH of 7.4, total iron less than 4 ppm, and aluminum less than 20 ppm. Similar distinctions in composition are reflected in trace elements of the 2 extreme samples. Marked differences in the neutral sample and the acid samples indicate the efficacy of minimizing contact of water with the underground workings. Water of good quality is discharged from a mine designed to minimize residence time of water in the workings, whereas the acid samples come from mines with more extensive drainage systems. (Knapp-USGS)
W69-02804

MATHEMATICAL MODEL FOR UNDERGROUND DISCHARGE OF RADIOACTIVE GASES,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
L. G. King.
Battelle-Pacific Northwest Lab Rep, 21 p, Mar 1967.

Descriptors: *Mathematical model, *Radioactive waste disposal, *Gases, Underground storage, Methodology, Steady flow, Homogeneity, Injection wells, Darcys law, Soil moisture.
Identifiers: *Radioactive gases, Isothermal flow, Symmetric system.

Injection of radioactive gas into the partially saturated section above the water table was investigated with mathematical models. One model was used during injection and another after cessation of injection. Assumptions made were: the gas obeys the Darcy equation, soil moisture is immobile, flow is isothermal and steady, soil is homogeneous and isotropic, soil moisture content is uniform, equation of state for dry air is sufficient to describe the gas, the gas is compressible, and the system is symmetric about the axis of the injection well. Calculated and measured values were found to be in satisfactory agreement. (Lang-USGS)
W69-02813

VIRUS MOVEMENT IN GROUNDWATER,
Arkansas Univ., Fayetteville; and Stanford Univ., Calif.
William A. Drewry, and Rolf Eliassen.
J Water Pollut Contr Federation, Vol 40, No 8, Part 2, pp R257-R271, Aug 1968. 15 p, 7 fig, 4 tab, 27 ref.

Descriptors: *Viruses, *Groundwater movement, *Adsorption, *Soils, Soil chemical properties, Soil physical properties, Soil texture, Fissures (Geology).

Identifiers: Virus adsorption on soils, Viral groundwater contamination.

Experiments in which water containing radioisotope-tagged viruses was passed through columns of various soils showed that virus retention by soils is an adsorption process characterized by linear adsorption isotherms. The adsorption is greatly affected by pH of the soil-water system, being greatest at pH of 7.0-7.5 and decreasing at higher pH. Increasing the cation concentration in the liquid enhances virus adsorption by some soils. The ability of a soil to adsorb viruses cannot be judged by the normally measured soil characteristics. Virus movement through saturated soils should present little hazard to underground water supplies provided that soil strata are continuous and the usual public health practices of separation of wells and disposal systems are followed.
W69-02824

A MODEL OF MIXING AND DISPERSION IN SAN FRANCISCO BAY,
California Univ., Berkeley.
Robert E. Selleck.
J Water Pollut Contr Federation, Vol 40, No 11, Part 1, pp 1873-1886, Nov 1968. 14 p, 9 fig, 5 ref.

Descriptors: *Mixing, *Dispersion, *Bays, Biochemical oxygen demand, Chlorides, Dissolved oxygen, Waste water (Pollution), Diffusion, California.
Identifiers: *San Francisco Bay.

A method of predicting solute distributions in a system with various hydrologic and waste discharge conditions was developed as part of an investigation of water and sediment quality of San Francisco Bay. The model was developed using a one-dimensional diffusion analogy. The coefficient of dispersion was determined from chloride and dissolved silica concentration distributions. Examples of steady- and unsteady-state conservative and non-conservative systems are given. Observed and predicted results are comparable. The dispersion coefficient is proportional to the 0.75 power of net advective velocity. Chlorosity at Chipps Island ranged from 2.0 to 5.0 g/l with a decay rate in South Bay of 0.20 per day. (Knapp-USGS)
W69-02831

SOME HYDROLOGICAL OBSERVATIONS IN AUCKLAND AND OTAGO HARBOURS,
Auckland Univ. (New Zealand); and Marine Biological Station, Port Erin, Isle of Man (England).
For primary bibliographic entry see Field 02L.
For abstract, see .
W69-02835

CITY OF MURPHYSBORO V SANITARY WATER BOARD OF ILLINOIS (POLLUTION ABATEMENT).

134 NE 2d 522-525 (4th DCA Ill 1956).

Descriptors: *Illinois, Judicial decisions, Legal aspects, *Water pollution, *Public health, Sewage disposal, Sewage treatment, *Cities, Fouling, Domestic water, Rivers, Fish.
Identifiers: Nuisance.

Defendant city discharged its untreated sewage into a river downstream from a point at which it obtained their water supply for domestic use. Under certain conditions the river would reverse itself, so that waters from below the outlets would get into the intake system. (However, the waters was still fit for drinking purposes). The court held that the order by the sanitary Water Board directing the city to cease discharging the sewage into the river was proper because such discharge created a nuisance and was detrimental to fish. The Sanitary Water Board Act prohibits disposal of matter into state waters which causes pollution. Pollution encompasses such acts as tend to create a nuisance. The power of the Board is not limited to the abatement of common law nuisances. (Molica-Fla)
W69-02869

RESERVOIRS.

N Y Village Law sec 231 (McKinney 1966).

Descriptors: *New York, *Legislation, Water law, *Reservoirs, Water storage, Public health, Water pollution, Water supply, Water sources, Water works, Vegetation, Degradation (Decomposition), Decomposing organic matter, *Banks, Gravels.

In the construction of a storage reservoir connected with a system of water works in the State of New York, all vegetable or other matter subject to decay must be removed from the banks of the reservoir site between its highest and lowest possible flow line, or such space must be covered by gravel or stone to prevent such decay. (Watson-Fla)
W69-02874

POLLUTION OF WATER ON LANDS USED FOR DAIRY PURPOSES.
N C Gen Stat sec 14-382 (1967).

Descriptors: *North Carolina, *Legislation, Cities, *Water pollution, *Dairy industry, Farms, Milk, Pasture management, Grazing, Grasslands, Wastes, Sewage, Animal wastes (Wildlife), Mine wastes, Chemical wastes, Sewage disposal.

It is unlawful for any person, firm, or corporation owning lands adjoining lands which are, or may be, used for dairy purposes or for grazing milk cows to dispose of, or permit the disposal of, any animal, mineral, chemical, or vegetable refuse, sewage, or other deleterious matter in such a way as to pollute the waters on the lands so used, or which may be used, for dairy purposes or for grazing milk cows, or to render unfit or unsafe for use, the milk produced from cows feeding upon the grasses and herbage growing on such lands. This statute does not apply to incorporated towns maintaining a sewer system. Anyone who violates this statute is guilty of a misdemeanor punishable by a maximum fine of $50 and/or 30 days imprisonment. Each day that the pollution is committed or exists constitutes a separate offense. (Watson-Fla)
W69-02893

HILLHOUSE V CITY OF AURORA (ACTION FOR DAMAGES BROUGHT BY FARM OWNER FOR POLLUTION OF CREEK BY CITY SEWER SYSTEM).
E - 316 S W 2d 883-890 (Mo Ct App 1958).

Descriptors: *Missouri, Judicial decisions, Damages, *Cities, Water pollution, Sewage, Legislation, Farms, *Sewage disposal, Invasion, Abatement, Feasibility, *Streams, Legal aspects.

The owners of a farm brought this action against the city for damages sustained during 1955-56 because of the pollution of a creek running through the farm by wastes from the sewage system constructed by the city in 1923. The city claimed that the action was barred by a five year limitation statute since the nuisance was permanent and was created in 1923. The trial court entered a judgment in favor of the landowners, but the Court of Appeals set the judgment aside and remanded the case for further proceedings. The appellate court held that the instruction of the trial judge was reversible error. The instruction, in effect, directed a verdict for the landowner because it did not require the jury to find when the permanent nuisance resulted. This was prejudicial in that the five year statute of limitations would have begun to run only at the time when the course of action occurred. A permanent nuisance occurred when the operation of the sewage system resulted in substantial invasion or intrusion of the use or enjoyment of the farm. (Watson-Fla)
W69-02898

SPAUGH V CITY OF WINSTON-SALEM (DAMAGES FOR POLLUTION).
249 N C 194, 105 SE 2d 610-614 (1958).

Descriptors: *North Carolina, *Water pollution, *Damages, Judicial decisions, Local governments, Sewage districts, Sewage, Odor, Disposal, Reasonable use, Easements, Water pollution effects, Legal aspects, Water rights.

Plaintiff alleged that defendant, city of Winston-Salem, emptied sewage into a creek, thereby causing their nearby residence to become unfit for use and habitation, and causing the sand in the stream bed of a separate tract to be unusable and unmarketable for use in their business of pumping out sand for use in construction work. Plaintiff was awarded permanent damages for the partial taking of his land. The court held that this award vested a permanent easement in the defendant. The court also held that the fact that the jury sought to award temporary damages without a request for same by plaintiff was not reversible error, as long as the verdict was, as in this case, founded upon the same cause of action. (Scott-Fla)
W69-03011

BOARD OF HEALTH V CREW (STATE'S RIGHT TO ORDER WELL CLOSING).
For primary bibliographic entry see Field 05G.
For abstract, see .
W69-03024

DISCHARGE OF SEWAGE INTO WATERS (PERMITS REQUIRED).
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-03029

ACTIONS BY MUNICIPALITIES TO PREVENT DISCHARGE OF SEWAGE INTO WATERS.
N Y Pub Health Law sec 1157 (McKinney 1954).

Descriptors: *New York, *Pollution abatement, *Potable water, *Water quality control, Legislation, Legal aspects, Administrative agencies, Sewage, Water pollution sources, Public health, Domestic water, Water quality, Water pollution control, Impaired water quality, Pipes, Cities, Local governments, Inspection, Water analysis.

Any municipality which provides for the disposal of sewage may maintain an action in the Supreme Court to prevent the discharge of sewage into any body of water located in the same county as the city and from which the city takes its water supply when such discharge injures the potable quality of the water. Before such action may be brought, the Department of Public Health must determine, by examination at the city's expense, whether the sewage does pollute the water. When it is so determined, the Supreme Court shall issue a mandatory injunction, including as a part of that injunction plans for the discontinuance of such discharge of sewage. Those plans must be submitted to the Department for its approval. Section 1168, N Y Pub Health Laws (McKinney Supp 1968) states that Sec 1157 shall be in force only until April 1, 1969. (Sisserson-Fla)
W69-03031

ORDER TO DISCONTINUE POLLUTION OF WATERS.
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-03032

CITY OF GALLIPOLIS V STATE EX REL WATER POLLUTION CONTROL BD (DENIAL OF PERMIT TO DISCHARGE SEWAGE INTO RIVER).
145 NE 2d 237-240 (Ct App Ohio 1957).

Descriptors: *Ohio, Water pollution, Legislation, Administrative agencies, *Administrative deci-

sions, *Permits, Cities, *Sewage, Rivers, Ohio River, Water law, Legal aspects.

The city appealed from a final order of the Water Pollution Control Board of Ohio which denied the renewal of a permit previously granted to the city. The permit allowed the city to discharge untreated sewage into the Ohio River for a limited period of time, and its renewal was to be conditioned upon the city's taking the initial steps toward the establishment of a sewage treatment plant. The city failed to meet the condition and consequently the renewal of its permit was denied. The Common Pleas Court reversed the Board's order, but on appeal to the Ohio Court of Appeals, that decision was reversed and the Board's order reinstated. The Court of Appeals held that the denial of the permit under these circumstances was within the discretion granted to the Board by statute, and that there was sufficient evidence to deny renewal of the permit. (Williams-Fla)
W69-03034

NEWMAN V CITY OF EL DORADO SPRINGS (ACTION FOR POLLUTION CAUSED BY CITY'S SEWAGE SYSTEM).
292 SW 2d 314-321 (Ct App Mo 1956).

Descriptors: *Missouri, Judicial decisions, Cities, *Damages, Riparian land, *Water pollution, Outlets, Sewage system, Drainage, Condemnation, Eminent domain, Watercourses (Legal), Legal aspects, *Riparian rights.
Identifiers: *Measure of damages.

Plaintiffs, as lower riparian landowners, sued a municipality for damages sustained because of the pollution of a watercourse from the outfall in the drainage of the municipality's sewer system. The municipality had appropriated the right to dump sewage in the watercourse about the year 1903, but there was never any temporary or permanent nuisance that affected plaintiffs' land prior to the year 1952. The court, in affirming a verdict for the plaintiff, stated that if the nuisance created by the municipality necessarily follows the right to dump sewage as an inherent, permanent result, then it is merged with and becomes a part of the appropriation of the right, and the measure of damages is the dimunition of value of the land affected. But, if the nuisance created is reasonably remediable, and, therefore a right of action in the riparian owner arises each time the nuisance is imposed, the measure of damages is the extent of damage resulting from that particular occasion. The nuisance was held to be a temporary nuisance. The right acquired to dump sewage was held not to include the right to create a nuisance. (Childs-Fla)
W69-03039

SIGNIFICANCE OF NITRIFICATION IN STREAM ANALYSIS--EFFECTS ON THE OXYGEN BALANCE,
Michigan Water Resources Commission, Lansing.
Robert J. Courchaine.
J Water Pollut Contr Federation, Vol 40, No 5, Part 1, pp 835-847, May 1968. 13 p, 12 fig, 11 ref.

Descriptors: *Biochemical oxygen demand, *Nitrification, *Dissolved oxygen, *Streams, Municipal wastes, Nitrogen fixing bacteria, Nitrates, Water Pollution sources, Michigan.
Identifiers: Lansing (Michigan), Grand River (Michigan).

A study of biological oxygen demand of the Grand River below Lansing, Michigan, determined that oxidation of nitrogenous material was the single most important source of oxygen demand. About 2/3 of the effluent nitrate load was oxidized in a 17.5 hr period. The high rate of nitrification and the high proportion of nitrogenous to carbonaceous BOD are associated with optimum nitrification water temperatures of about 30 deg C, caused in part by waste heat discharge of the Lansing steam power generating plants. This must be taken into account in planning treatment facilities to control stream BOD. (Knapp-USGS)
W69-03077

ACCURACY OF DISCRETE MODELS USED TO PREDICT ESTUARY POLLUTION,
Rice Univ., Houston, Tex.
J. V. Leeds.
Water Resources Res, Vol 3, No 2, pp 481-490, 1967. 10 p, 9 fig, 4 ref.

Descriptors: *Estuaries, *Path of pollutants, *Water pollution, *Mathematical models, *Digital computers, Water quality, Diffusion, Frequency analysis.
Identifiers: Discrete models.

In the solution of estuary pollution problems, the mathematical model is a partial differential equation, which is often replaced by a set of ordinary differential equations with time as the independent variable. The solution to these equations is taken as the solution of the partial differential equations at points dx apart. A significant problem is to determine the closeness of the solution of the ordinary differential equation to the solution of the partial differential equation, the spacing, and the number of sections. The closeness of the solution can be judged by examining the magnitude and phase of the frequency response of the partial differential equations and the set of ordinary differential equations. Selecting a given phase error allows one to obtain a relation giving the allowed spacing. Selecting an attenuation error sets the number of sections. Thus, from the knowledge of the frequency response of the system the rules developed give the number of sections and spacing to meet specified errors in the approximation.
W69-03107

INVESTIGATION OF THE INFLUENCE OF WASTE DISPOSAL PRACTICES ON GROUNDWATER QUALITIES,
South Dakota State Univ., Brookings. Dept. of Civil Engineering.
John R. Anderson, and James N. Dornbush.
Technical Completion Report, Water Resources Institute, November, 1968, Washington, D. C., 41 p, 5 tab, 11 fig, 13 ref. OWRR Project A-003-SDak.

Descriptors: *Waste disposal, *Groundwater, *Water quality, *Landfill, Sanitary fill, Waste dilution, Water pollution control, Leaching, Water quality control, Domestic wastes, Infiltration, Aquifors, Sanitary engineering.
Identifiers: Brookings (South Dakota).

An evaluation of the effects of its landfill on the groundwater quality was initiated by the city of Brookings, S. D. in 1960, and incorporated in a comprehensive study by this project in 1964. The initial phase of the project concluded that the most useful parameters for detecting contamination were chlorides, sodium and specific conductance with the next phase, concluding that seasonal rainfall intensified leaching. Increased ionic concentrations during rainy periods implied that effects of leaching overrode those attributed to dilution. It appeared that as the water moved downstream from the landfill the quality improved and was suitable as a domestic water supply and for irrigational purposes before it left the landfill area. In as much as it was found that a pond seemed to improve the quality of the degraded groundwater, a trench was constructed to intercept the groundwater as it moved from the fill area. It was shown that chemical constituents that were leached from the refuse were modified by the trench and water quality exhibited an improvement. The trench also modified the concentrations of organic materials and the threshold odor levels. General recommended practices were made for disposing of refuse into abandoned gravel pits located in a region of high water table.
W69-03178

A STUDY OF THE SURVIVAL OF BACTERIAL INDICATORS OF POLLUTION IN NATURAL WATERS,
Tennessee Univ., Knoxville. Dept. of Civil Engineering.
James D. Womack.
Termination Report, January 1969, 5 p. OWRR Project A-005-Tenn.

Descriptors: *Coliforms, *Enterococci, Fecal streptococci, *Persistence, Dye tracer studies, Self-purification, Neutral sulfite wastes, False positive coliforms.
Identifiers: Kraft wastes, Indicator organisms, Survival, Death rates.

Several studies related to the survival, persistence, or growth of bacteria associated with fecal pollution have been completed. Regular weekly analyses of the indicator organism concentration in Fort Loudoun Lake have been performed from April 1966 to present. The extension of these populations down stream from the major source of fecal pollution is correlated with a number of water quality parameters. Bacterial populations studied include mainly standard coliforms, fecal coliforms, and enterococci. Some studies relating IMVIC types to survival patterns in natural waters have been made. Survival pattern related to both distance and time-of-flow have been made. A detailed study of the significance of false-positive coliform bacteria using the membrane filter technique was made with the finding that at distances from the polluting source as many as seventy-five percent of those coliforms recovered as coliform may be shown not to ferment lactose to gas. Paper mill effluents of both Kraft and neutral sulfite types have been shown in this study cause growth of coliforms used to estimate water quality. The relative levels of standard coliforms, fecal coliforms, and IMVIC types with the groups have been measured and are presently being evaluated.
W69-03181

NUTRIENT SOURCES FOR ALGAE AND AQUATIC WEEDS,
Wisconsin Univ., Madison. Engineering Experiment Station.
George P. Fitzgerald.
In: Detection of limiting or surplus nutrients in algae, 9 December 1968. 21 p. WP - 297.

Descriptors: *Algae, *Cycling nutrients, *Enzymes, *Essential nutrients, *Nitrogen cycle, Analytical techniques, Aquatic algae, Aquatic microbiology, Aquatic productivity, Aquatic weeds, Balance of nature, Bioassay, Chlorophyta, Cyanophyta, Environmental effects, Eutrophication, Limnology, Nitrogen compounds, Nitrogen fixation, Nutrient requirements, Phosphorus compounds, Physiological ecology, Phytoplankton, Pollutant identification, Rain, Rainfall-runoff relationships, Rain water, Rooted aquatic plants, Sewers, Water pollution, Water pollution control, Water pollution effects, Water pollution sources.
Identifiers: Lake Mendota (Wis).

Simple bioassays for limiting or surplus nitrogen and phosphorus conditions in algae or aquatic weeds have been used to follow the nutrition of algae and aquatic weeds during summer of 1968. Of particular interest have been the sources of nitrogen and phosphorus available to these plants. It has been shown that during summer rain could be the major source of available nitrogen to Cladophora sp in Lake Mendota, Wis. Increases in phosphorus associated with rainfalls were detected but were not as dramatic as increases in nitrogen. In addition, studies have shown that mixed blooms of planktonic algae do not share their nutrients with other algae even when one species may have a surplus and another be nutrient-limited. Comparisons of surface and subsurface phytoplankton have indicated that at certain times surface plankton could be nutrient-limited while the same species from subsurface sources had adequate or surplus nutrients. Fall overturn as a nutrient source has been used to demonstrate how similar changes

can occur in the nutrition of different types of algae. The results of these studies are used to point out some of the important factors involved in field studies of the nutrition of aquatic plants.
W69-03185

5C. Effects of Pollution

AN EVALUATION OF ARTIFICIAL SUBSTRATES FOR MEASURING PERIPHYTON PRODUCTION,
Michigan State Univ., East Lansing. Dept. of Fisheries and Wildlife.
J. C. Peters, R. C. Ball, and N. R. Kevern.
Inst of Water Research, Technical Report No. 1, Red Cedar River Series, May 1968. 70 p.

Descriptors: *Diatoms, *Periphyton, *Aquatic productivity, *Streams, *Rivers, Benthic flora, Biomass, Bioindicators, Chlorophyll, Correlation analysis, Estimating equations, Eutrophication, Michigan, Photosynthesis, Plant pigments, Regression analysis, Seasonal, Sewage, Succession, Water pollution effects.
Identifiers: *Red Cedar River (Mich), *Substrates, Cocconeis placentula, Navicula cryptocephala, Gomphonema olivaceum, Cyclotella menehiniana, Cymbella, Synedra ulna, Melosira virians, Analysis of variance, Covariance analysis, Deer Creek (Mich), Duncan's multiple range test, Eppley pyrheliometer data, Experimental design, Insolation rates, McGinnis index, Spring maximum, Trophodynamics, Vallesneria americana, Williamston (Mich).

Red Cedar River is subject to cultural eutrophication in vicinity of Williamston, Mich. Plexiglass plates (2 in. x 5 in. x 1/4 in.), which proved to be non-selective, were used to sample the aufwuchs community (principally diatoms) at four stations from July 1958 through February 1959. Data derived from substrates were subjected to statistical analysis to determine relationships among the following rates: growth in number of organisms; accumulation of organic matter; accumulation of phytopigments. A site on Deer Creek, a tributary, showed greatest number of dominant communities during study period. Correlation coefficient (r) between phytopigment units (PU) and numbers of organisms is highly significant ($r = 0.75 - 0.90$). Although there was good correlation ($r = 0.93$) in the relationship between PU and weight of organic matter, a single regression line could not be used to estimate organic matter from PU for all stations. Compared with main stream, the tributary produced at significantly higher levels during summer. Production immediately downstream from a sewage treatment plant was not greater than for station above the outfall. Productivity of aufwuchs community corresponded closely with insolation rate. No evidence of photo-inactivation of photosynthesis was adduced. Authors presents a series of predictor equations for production and discusses their reliability.
W69-02955

PRIMARY PRODUCTIVITY STUDIES IN ONONDAGA LAKE, NEW YORK,
Syracuse Univ., N. Y. Dept of Civil Engineering.
Daniel F. Jackson.
For publication in 'XVII Verhandlungen Internationale Vereinigung Fur Theoretische und Angewandte Limnologie', 1968. 19 p. NY Dept. of Health C-19638.

Descriptors: *Eutrophication, *Water pollution sources, *Water pollution effects, *Primary productivity, Algae, Biomass, Calcium compounds, Chlorides, Saline lakes, Heavy metals, Industrial wastes, Lakes, Photosynthesis, Phytoplankton, Cisco, Carp, Diatoms, Chlorophyta, Chlamydomonas, Chlorella.
Identifiers: *Onondaga Lake, Onondaga County, Syracuse, Warburg respirometer, Cladophora, Enteromorpha, Lepocinclis, Chlorogonium, Scenedesmus, Cyclotella, Stephanodsicus.

Onondaga Lake, whose south end is within the city limits of Syracuse, NY, is small, brackish, and grossly polluted. It receives daily 200,000,000 liters of partially treated sewage, 172 metric tons of calcium chloride, 32 metric tons of calcium sulfate, one metric ton of grease and oil, and 22 kilograms of heavy metals. To establish a base line for determining extent of eutrophication, author established two stations: I at north end of lake, which is subject to inorganic pollution; and V, a southern station influenced by outfall from a primary treatment sewage plant. Between May and October 1967, monthly determinations were made of algal counts, ash-free dry weights, and respiratory and photosynthetic rates (by Warburg manometry). Phytoplankton was dominated by species of chlorophytes and diatoms; very cyanophytes were counted. Patterns of dominance did not differ between stations. At 1% level of confidence, there were significant differences between stations. As compared with I, values at V were greater in the following (sample numbers in parentheses): (N=3) nitrate-nitrogen, ammonium-nitrogen, phosphates; (N=6) algal numbers, ash-free dry weights; (N=98) photosynthetic rate, respiratory rate. Detailed limnological studies are needed before the expenditure of large sums for pollution abatement projects.
W69-02959

ADSORPTION OF PHOSPHORUS BY LAKE SEDIMENT,
Connecticut Agricultural Experimental Station, New Haven.
For primary bibliographic entry see Field 02H.
For abstract, see .
W69-03075

AN INVESTIGATION OF THE EFFECT OF CONTROLLED RELEASES ON THE PHYSICAL, CHEMICAL AND BACTERIOLOGICAL CHARACTERISTICS OF FORT LOUDOUN RESERVOIR,
Tennessee Univ., Knoxville. Dept. of Civil Engineering.
Floyd C. Larson.
Termination Report, June 1968, 5 p. OWRR Project A-006-Tenn.

Descriptors: Reservoirs, Impoundments, *Stratification, *Nutrients, Eutrophication, Water quality, Phosphates, Nitrogen.
Identifiers: *Controlled release effects in reservoirs, Cherokee Lake, Douglas Lake.

Controlled releases from upstream tributary lakes did not prevent stratification in the reservoir. The 'duck-under' point (where stratification begins) varied about six miles, but with extremely large discharge changes it moved about twelve miles in three days. During stratification the oxygen sag curve for the surface was normal, but was not during non-stratified flow periods. An equation was developed for the determination of the coefficient of reoxygenation in a non-stratified flow system. Changes of flows influenced BODs and coliforms in the non-stratified regime but no influence was observed in the stratified regime. Phosphate and nitrogen levels found in the reservoir indicate that conditions are favorable for eutrophication.
W69-03180

THE PRODUCTIVITY OF A LAKE POLLUTED BY ORGANIC WASTES DERIVED PRIMARILY FROM SEPTIC TANKS,
Tennessee Univ., Knoxville. Dept. of Zoology and Entomology.
Dewey L. Bunting.
Termination Report, June 1968. 14 p, 8 fig, 1 tab. OWRR Project A-008-Tenn.

Descriptors: *Primary production, *Eutrophication, *Septic tanks, Domestic wastes, Water pollution, Photosynthesis, Ponds, Lakes, Drainage, Phytoplankton, Nutrients, *Oxygen, Diurnal.
Identifiers: *Production-respiration ratio, Autotrophy, Heterotrophy.

Weekly diurnal studies of oxygen rate-of-change and community metabolism were used to provide estimates of primary productivity in a small homothermal lake receiving organic wastes. These estimates were compared with data from other aquatic habitats. During the study period the production-respiration ratio varied around unity with a tendency toward heterotrophy during the early summer. Evidence is presented to support the assumption that heterotrophy will dominate the summer metabolism. The results of weekly analyses of eleven chemical and physical parameters are presented with a discussion of the relationship of heterotrophy to spring and early summer increases. The application of the study as a basis for the design of future work is discussed with particular reference to the repetition of the present study after completion of a sewer system being constructed in the area around the lake. By comparing the present work and that done after diversion of the wastes, it is anticipated that the contribution of septic tank wastes to the productivity of the lake can be quantified.
W69-03182

SOME FACTORS IN THE COMPETITION OR ANTAGONISM BETWEEN BACTERIA, ALGAE, AND AQUATIC WEEDS,
Wisconsin Univ., Madison. Engineering Experiment Station.
George P. Fitzgerald.
In: Detection of limiting or surplus nutrients in algae, 9 December 1968. 19 p. WP-297.

Descriptors: *Algae, *Algal toxins, *Aquaria, *Aquatic weeds, *Inhibition, *Physiological ecology, *Phytotoxicity, Algal control, Algal poisoning, Analytical techniques, Aquatic algae, Aquatic bacteria, Aquatic microbiology, Balance of nature, Bioassay, Chlorophyta, Cyanophyta, Diatoms, Cycling nutrients, Environmental effects, Enzymes, Essential nutrients, Nitrogen compounds, Nuisance algae, Nutrient requirements, Phosphorus compounds, Phytoplankton, Plankton, Pollutant identification, Rooted aquatic plants, Sewers, Sewage, Sewage effluents, Sewage treatment, Water pollution, Water pollution effects, Water pollution sources.

Field observations of changes in the populations of aquatic weeds and phytoplankton have confirmed that aquatic weeds have antagonistic activity against phytoplankton. Nutritional studies in the laboratory indicate that cultures of the aquatic weeds Myriophyllum sp, Ceratophyllum sp, and duckweed (Lemna minor L); liquid cultures of barley (Hordeum vulgare L, Dickson variety); and cultures of the filamentous green algae, Cladophora sp and Pithophora oedogonium (Mont) Withrock will remain relatively free of epiphytes or competing phytoplankton if the cultures are nitrogen limited. Field observations of Cladophora sp have confirmed that the growth of epiphytes on the Cladophora is related to conditions of surplus available nitrogen compounds. It is proposed that this antagonistic activity may be due to a 'nitrogen sink' effect in which the aquatic weeds or filamentous green algae prevent the growth of contaminating algae by competition for the limited nitrogen compounds available. However, the presence of bacteria-sized organisms which have selective toxicity to certain algae indicates that perhaps multiple factors exist. Author discusses the ecological implications, such as nitrogen-limited growth, of associations of certain algae with bacteria having selective toxicities to other algae under certain environmental conditions.
W69-03188

WATER QUALITY AS RELATED TO THE SURVIVAL OF SALMON EGGS AND LARVAE,
Washington Univ., Seattle. Coll. of Fisheries.
Donald E. Bevan, and Ernest O. Salo.
Washington Water Research Center, Completion Report, August 8, 1968. 76 p, 16 tab, 24 fig, 13 ref. OWRR Project B-004-Wash.

Descriptors: *Chinook salmon, Chum salmon, Washington, Fish diets, Fish reproduction, *Spawning, *Fish management.

The Snohomish River watershed, which consists of watersheds of Snoqualmie, Skykomish, and Pilchuck rivers, was surveyed for spawning adult salmon during fall and winter of 1965-66. Index streams were chosen for study of egg and fry survival and rearing potential. Movements of dye in intragravel waters were examined by means of fluorometer. No definite conclusions were drawn; however, techniques for studies of chum fry survival were refined. Preliminary estimates of chum fry survival and gravel quality are available. Chinook salmon from May Creek Hatchery were marked with fluorescent pigment, and one lot was released upstream while another was released in Everett Bay proper. An attempt was made to determine survival rates in Everett Bay in relation to sulphite waste liquor from local pulp and paper mills. Chinook salmon apparently migrated out extremely rapidly and did not use Everett Bay as a feeding or rearing area. A similar experiment was conducted on Elliott Bay with very successful results. Apparently migration pattern through Everett Bay is vastly different from that of chinooks released into Duwamish Complex. (Gladwell-Wash)
W69-03190

STUDIES OF JUVENILE SALMON IN THE NOOKSACK RIVER SYSTEM AND BELLINGHAM BAY,
Washington Univ., Seattle. Coll. of Fisheries.
Donald E. Bevan, and Ernest O. Salo.
Washington Water Research Center, Final Report, January 2, 1969. 53 p, 12 tab, 15 fig, 25 ref. OWRR Project B-003-Wash.

Descriptors: Washington, Pacific Northwest U. S., *Salmon, *Fish migration, Fishkill, *Water pollution effects, Fish management, Fish population.

Waters of Bellingham Bay have been studied extensively since 1963 by Fisheries Research Institute and were studied as early as 1957 by other investigators (Wagner, Ziebell, and Livingston, 1957) because of pulp mill wastes they receive and possible effects of these wastes upon fish. Studies of juvenile salmon in Nooksack River system and Bellingham Bay were conducted during 1966 and 1967 with financial assistance from Georgia-Pacific Corp. and federal government and are detailed in this report. Studies of Nooksack River salmon commenced on June 15, 1966 and continued into March 1967. The object was to describe early life history with emphasis on seasonal abundance and natural mortality and growth rates. Coho salmon were studied most extensively because they are most vulnerable to environmental fluctuations from their comparatively long residence in freshwater. Little was known about seasonal mortality rate since it had not been investigated previously. Studies in Bellingham Bay began in March 1967 and continued into June. They were concerned with movement and behavior of juvenile salmon during migration and their distribution in relation to concentrations of sulfite waste liquor, dissolved oxygen, turbidity, salinity, and temperature.
W69-03191

ACTIVITY PATTERNS OF FISH EXPOSED TO TOXIC MATERIAL,
Kansas State Univ., Manhattan.
John Cairns, Jr., and Hampton W. Shirer.
Project Completion Report, Kansas Water Resources Research Institute, June 1968. 21 p, 11 fig, 19 ref. OWRR Project A-014-Kan.

Descriptors: Activity patterns, Fish, Toxic material, Waste disposal, Aquatic organisms, Behavior patterns, Sublethal effects, *Bioassay system, *Toxicant, *Swimming behavior, Light beam, Tanks, Zinc, Movement patterns, Goldfish, Golden shiners.

Waste disposal concentrations which merely permit survival of aquatic organisms may not permit them to function properly. Temporary survival of fish and other aquatic organisms is meaningless if they have aberrant behavior patterns, fail to reproduce, have poor growth rates, or are not able to function properly in other respects. Most means of assessing sublethal effects require chronic exposures to the test material and use techniques that require considerable expenditures for equipment, space, and personnel. An inexpensive bioassay system was developed that permitted rapid quantitative study of toxicant-induced changes in swimming behavior of fish by counting lightbeam interruptions in test tanks. The results of this investigation indicated (1) that the apparatus described functioned adequately, (2) sublethal concentrations of zinc altered the movement patterns of the goldfish and the golden shiner, (3) there was considerably more individual variation in movement patterns than in dose-response curves plotting survival againstconcentration, and (4) a single individual varied in response from time to time. It was evident that many non-lethal concentrations are not safe in the functional sense and bioassay techniques and data are badly needed so that standards and management methods for industrial areas can be developed.
W69-03194

EVALUATION OF THE EFFECT OF TRACE ELEMENTS ON THE ACTIVITY OF MICROORGANISMS,
Virginia Polytechnic Inst., Blacksburg. Water Resources Research Center.
Robert E. Benoit.
Virginia Water Resources Research Center, Project Completion Report, August 1968. 5 p, 3 ref. OWRR Project A-005-Va.

Descriptors: *Microorganisms, *Trace elements, Water analysis, Streptocccus, Ion exchange.

In this study, a chromatographic procedure was developed which permits the rapid identification of S. lactis var. tardus. It is possible to prevent a rapid fermenting strain of S. lactis from losing this potential, if the water used in the media to cultivate this bacterium is first passed through an anion/cation mixed bed ion exchange column. It was demonstrated that the 'tardus' factor which is responsible for the conversion of fast fermenting strains of S. lactis into var. tardus strains is present in several watershed systems in southwestern Virginia. The data indicate that the 'tardus' factor is a trace element, but it has not been established which element produces this change. Also, it was demonstrated that S. lactis has the genetic potential to produce a number of endproducts in major quantity which were not previously believed possible with this bacterium, which include: acetic acid, formic acid, ethanol, several neutral products, and carbon dioxide. The 'tardus' factor permits the selection of mutant bacteria which are able to become the dominant bacterium in natural systems, producing these products. The results should be useful to any industry that uses microbial fermentation.
W69-03196

5D. Waste Treatment Processes

MUNICIPAL CORPORATIONS: SEWER SYSTEMS.
N C Gen Stat sec 160-239--160-241, 160-250, 160-255 (1964).

Descriptors: *Sewers, Municipal wastes, Assessments, *Eminent domain, Right of way, *Treatment facilities, Urbanization, Water law, North Carolina, Local governments, Legislation, Cities, Operation and maintenance, Condemnation, State governments, Administrative agencies.
Identifiers: Liability, Monetary damages.

Awxrion 160-239 provides for the establishment and maintenance of municipal sewage systems. The governing body of the system shall be empowered to extend the system beyond the municipal limits, to condemn property for the system, to provide, construct and maintain the system, and to protect it by regulations. Any conflicts between the general statute and local municipal regulations shall be controlled by the local provisions if the local authorities so desire. Section 160-140 empowers the governing body to require that property owners have various discharge devices on their property connected to the system if lines are close to their property. Section 160-141 provides for assessments against property owners who benefit from the system. Such assessments may be paid in installments but the period of payment shall not exceed 10 years. Section 160-250 allows two or more adjoining municipalities to jointly construct and operate their systems. Section 160-255 empowers municipalities to furnish service within or outside the municipality, but limits liability for failure to provide service to those within the corporate limits. (Dann-Fla)
W69-02895

WASTE WATER RENOVATION FOR REUSE: KEY TO OPTIMUM USE OF WATER RESOURCES,
Pennsylvania State Univ., University Park.
William E. Sopper.
Water Res, Vol 2, No 7, pp 471-480, Sept 1968. 10 p, 3 tab, 14 ref.

Descriptors: *Waste water, *Reclaimed water, *Water reuse, Groundwater basins, *Waste water treatment, Effluents, Optimum use, Forests, Sewage effluents, Sanitary engineering, Industrial wastes, Vegetation, Filters, Aquifers, Water quality, *Groundwater recharge, Groundwater.
Identifiers: Forestry land, *Renovating, *Waste water reclamation.

Treated municipal waste water was applied to forested areas to determine feasibility of land disposal of the effluents and the extent effluents could be renovated by the biosystem and recharged to the ground-water reservoir. Satisfactory renovation of waste water was achieved when the effluent was applied at rates of 1, 2, and 4 in./wk in forested areas during Apr-Nov. The concentration of MBAS (methylene blue active substance), the only constituent in the effluent exceeding the levels acceptable under U S Public Health Standards for potable water, was decreased below this level after passing through the forest floor and 6 in. of mineral soil. The renovation efficiency of forested sites may diminish in time, since many nutrients absorbed by the trees are replaced annually in leaf fall. Approximately 90% of the water applied at 2 in./wk during Apr-Nov was recharged to the ground-water reservoir. Results of this study indicate that municipal waste water can be satisfactorily renovated for ground-water recharge through irrigation of forested areas under controlled conditions. (USBR)
W69-02929

APPLICATION OF THE TOWN OF WATERFORD (VALIDITY OF STREAM CLASSIFICATION).

164 N Y S 2d 914-922 (Sup Ct 1957).

Descriptors: *New York, Administrative agencies, *Administrative decisions, Judicial decisions, Water quality, *Standards, Water pollution, *Water quality control, Cities, Taxes, Sewage, Municipal wastes, Legislation, Classification, Streams, Legal aspects, Rivers.
Identifiers: *Stream classification, Mohawk River.

Petitioners, municipalities along the Mohawk River, sought review of a determination by the Water Pollution Control Board assigning a classification of 'C' to the waters on which the cities bordered. Such classification was made pursuant to the

Public Health Law and was part of a program designed to implement standards of quality and purity adopted by the Board. The undisputed result of such classification was that the cities would have to construct sewage treatment facilities. The cities attacked the classification on the grounds that the board had not complied with the correct procedure prescribed by statute and that the Board had not given consideration to the great expense and resultant tax increase for the residents of the cities. The Supreme Court, Appellate Division, held that the anticipated financial burdens were not reasonable grounds for invalidating the classification. Such hardships should be dealt with by legislature. The court stated that, where there were no disputed factual questions, the procedures followed, which did not include swearing of witnesses and cross-examination, were adequate. (Williams-Fla)
W69-02990

REGIONAL MANAGEMENT OF WATER QUALITY - A SYSTEMS APPROACH,
Louisiana State Univ., Baton Rouge; Carnegie-Mellon Univ., Pittsburgh, Pa.; and Harza Engineering Co., Chicago, Ill.
For primary bibliographic entry see Field 05G.
For abstract, see .
W69-03146

OPTIMAL WASTE TREATMENT AND POLLUTION ABATEMENT BENEFITS ON A CLOSED RIVER SYSTEM,
Toronto Univ., Ontario.
Donald J. Clough, and M. B. Bayer.
J Can Oper Res Soc, Vol 6, No 3, pp 153-170, Nov 1968. 18 p, 15 ref.

Descriptors: *Mathematical models, *Water pollution control, *River systems, Multiple-purpose reservoirs, Benefits, Dissolved oxygen, Biochemical oxygen demand, *Waste water treatment, Economic efficiency, Standards, Constraints, *Efficiencies.

A nonlinear programming model was used for the selection of an optimal set of waste treatment plant efficiencies on a closed river system. The short-run objective was to minimize the incremental costs of adjusting plant efficiencies to satisfy stream quality constraints (DO and BOD levels) at various points in the system. The long-run objective was to minimize the relevant incremental costs of a sequence of irreversible changes in efficiencies over a finite planning horizon. Stream dilution effects of multipurpose storage reservoirs were also described, and a new basis laid for the measurement of the economic pollution abatement benefits of multipurpose reservoir systems. (Gysi-Cornell)
W69-03150

5E. Ultimate Disposal of Wastes

MATHEMATICAL MODEL FOR UNDERGROUND DISCHARGE OF RADIOACTIVE GASES,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-02813

EXPERIENCE IN BURIAL OF LIQUID RADIOACTIVE WASTES IN DEEP GEOLOGICAL FORMATIONS,
F. P. Yudin, M. K. Pimenov, and A. I. Nazarov.
ranslation from Atomnaya Energiya, Vol 25, No 2, pp 128-133, Aug 1968. U S Joint Publication Res Serv, Pub No 46535, 10 p, Sept 26, 1968. 1 fig, 1 tab, 10 ref.

Descriptors: *Radioactive waste disposal, *Injection wells, Research and Development, Geohydrologic units, Hydrologic aspects, Economic feasibility.
Identifiers: *USSR, *Hydrogeological conditions, Russian platform (Geologic).

Investigations conducted on the disposal of radioactive wastes by injection wells in lower Carboniferous sandstones of the Russian Platform show that injection is economically feasible on industrial scales under favorable geohydrological conditions. The top of the injection zone is at a depth of 1,432 m and its bottom is at 1,508 m. The formation water has a total dissolved solids content of 245 g/1, mainly of sodium and cholride. The zone has almost no hydraulic connection with overlying aquifers; it is separated from then by a minimum of 40 m of clay. The injection well may be flushed by pumping, and the radioactive water pumped out is filtered and returned to the well. Observation wells are 100, 500, 1300, and 550 m from the injection well. Injection at 100-150 cu m per day for a total of 40,000 cu m did not result in any detected radioactivity at any observation well. (Knapp-USGS)
W69-03061

ROLE OF SOILS AND SEDIMENT IN WATER POLLUTION CONTROL--PART I, REACTIONS OF NITROGENOUS AND PHOSPHATIC COMPOUNDS WITH SOILS AND GEOLOGIC STRATA,
Federal Water Pollution Control Administration, Washington, D. C.
George W. Bailey.
Fed Water Pollut Contr Admin, Southeast Water Lab Rep, Part 1, 90 p, March 1968. 13 fig, 8 tab, 196 ref.

Descriptors: *Soil chemical properties, *Soil physical properties, *Soil disposal fields, *Waste water disposal, Industrial wastes, Municipal wastes, Organic wastes, Sewage, Nitrogen, Phosphorus.
Identifiers: Soil biological properties.

Literature on the reaction, nature, fate, and behavior of nitrogenous and phosphatic compounds in soils and geologic strata was reviewed in relation to the use of soil and geologic strata as a media for municipal and industrial disposal. Principles of soils science are discussed in terms of soil-forming processes, soilphysico-chemical, mineralogical, and biological properties, and their interrelationships. The quantitative and qualitative aspects of nitrogen and phosphorus in both raw sewage and treated effluent are indicated. The mobility of inorganic and organic nitrogen in soils is discussed, as well as the reaction mechanisms by which inorganic forms can be removed from percolating solutions and fixed. The factors affecting fixation, subsequent release, and degradation are also discussed. The immobile nature of phosphorus in soils compared to nitrogen, the generally high phosphorus fixation power of soil, and factors affecting the fixation of phosphorus by soils are discussed. The fixation mechanisms for both inorganic and organic forms of phosphorus are treated in detail. A glossary of soil science terms is included. (Knapp-USGS)
W69-03080

5F. Water Treatment and Quality Alteration

LONG-TERM CHANGES IN WATER CHEMISTRY AND ABUNDANCE OF PLANKTON AT A SINGLE SAMPLING LOCATION IN LAKE ONTARIO,
Ontario Water Resources Commission, Toronto; and Municipality of Metropolitan Toronto (Ontario). Dept. of Works.
For primary bibliographic entry see Field 02H.
For abstract, see .
W69-02958

5G. Water Quality Control

COMPOSITION OF WATER DISCHARGED FROM BITUMINOUS COAL MINES IN NORTHERN WEST VIRGINIA,
West Virginia Univ., Morgantown.
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-02804

DANIELS V BETHLEHEM MINES CORP (RIPARIAN EASEMENTS).

391 Pa 195, 137 A 2d 304 (1958).

Descriptors: Judicial decisions, *Pennsylvania, Legal aspects, Riparian rights, Competing uses, *Riparian waters, Stock water, *Water pollution, Reasonable use, Right-of-way, *Easements, Riparian land, Mine water, Streams, Fouling.
Identifiers: Covenants running with land.

Plaintiff's grantor had executed a written agreement with defendant's grantor which permitted the latter, an upper riparian owner, to discharge mine water into a stream flowing over the land of plaintiff. The court held that the easement granted in the agreement ran with the land. The language was construed to allow defendant to discharge mine water into the stream, even though this resulted in pollution or fouling of the waters, thus rendering it unfit for plaintiff's cattle. The agreement was neither illegal nor contrary to public policy. (Molica-Fla)
W69-02858

NAVIGATION -- BUOYS, BEACONS, FLOODGATES, AND DUMPING MUD OR REFUSE.
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-02870

TAPPING, INTERFERING WITH, OR DAMAGING SEWERAGE WORKS - RUNNING WATER INTO MINES.

N J Stat Ann tit 2A, Para 122-5, 122-7 (1968) 2 p.

Descriptors: *New Jersey, *Legislation, Water law, Pipelines, Pumping plants, Sewage disposal, Sewers, *Mining, Channels, Drains, Sewage, Sewage treatment, Legal aspects, Damages.

Any person in the State of New Jersey who unlawfully breaks into, makes connection with, interferes with, or willfully damages any of the facilities of a sewerage company is guilty of a misdemeanor. Also, person who, with intent to hinder or delay the working of any mine, clay pit or marl pit, willfully or maliciously runs water into the mine or pit, or damages any airway, waterway, drain or shaft of the mine or pit is guilty of a misdemeanor. (Watson-Fla)
W69-02871

PRIVATE SEWERS.
N Y Village Law sec 89 (55) (McKinney 1966).

Descriptors: *New York, *Legislation, Water law, *Sewers, Drains, Sinks, Cisterns, *Pipelines, Financing, Assessments, Legal aspects, Construction, Operation and maintenance.

The officers of a village of the State of New York may regulate and prohibit the construction and use of private sewers, drains, sinks, vaults, and privies. They may also compel the owner or occupant of land upon which is situated any objectionable stable, privy, sewer, drain, cistern, vault, or any unwholesome or nauseous condition to cleanse, remove, or abate the condition. The officers of the village may also compel the owner or occupant of any building or structure to connect with the sewer system of the village. If the owner or occupant fails to comply with the order, the officers may have the connection made and assess the cost upon the land upon which the improvement was made. (Watson-Fla)
W69-02876

BUMBARGER V WALKER (CONTAMINATION OF SPRING BY MINE DRAINAGE).
393 Pa 143, 142 A 2d 171-174 (1958).

Descriptors: *Pennsylvania, *Mine wastes, *Water pollution, *Reasonable use, Judicial decisions, Water law, Damages, Mine drainage, Mine water, Mining, Springs, Drainage, Ditches, Invasion.
Identifiers: Open-pit mining.

Plaintiff, a lower landowner, brought this action to recover damages from persons in charge of an open pit mining operation on upper land which caused the contamination of the plaintiff's spring. The trial court rendered a judgment for the plaintiff. The Supreme Court of Pennsylvania affirmed on the ground that the evidence presented a question for the jury as to whether the contamination was caused by the defendant's discharge of drain water from the mine or some other cause. The operator of an open-pit mine has a right to discharge drainage waters accompanying such an operation in a manner consistent with a reasonable use of the land. The operator is not liable to an adjoining property owner if waters used in the mine's operation reach the other property through some natural watercourse. However, in this case, the mine workers dug a ditch into which they then pumped mining drainage waters that subsequently flowed upon the plaintiff's land, thus contaminating his spring. (Watson-Fla)
W69-02901

BOARD OF HEALTH V CREW (STATE'S RIGHT TO ORDER WELL CLOSING).

212 Md 229, 129 A 2d 115-120 (1957).

Descriptors: *Maryland, Judicial decisions, *Water pollution sources, Sewage, Septic tanks, Water pollution control, Administrative agencies, State governments, Water supply, Well permits, Well regulations, *Shallow wells, *Public health, Public utilities, Legal aspects, Legislation.
Identifiers: Police power.

Plaintiff owned and lived in a house in a small Maryland community. Each house had its own septic tank. Public water was furnished by a privately owned company. When the water supplied by the water company became impure (it contained excessive iron), plaintiff began to dig a well near certain septic tanks. Plaintiff did not seek any permit for the shallow well. After the digging had begun, state health officials warned that the well would become contaminated and advised that the well would be subject to provisions of a state statute. The statute authorized the State Health Board to order the discontinuance of any well whenever it may have deemed it to be prejudiced to public health. Plaintiff completed the well, and the Health Board ordered the well to be abandoned. At the time of the order, the well water was found to be uncontaminated. Plaintiff brought suit to set aside the order and to enjoin enforcement. The lower court vacated the order, but the appellate court reversed. The higher court rulde that action taken for protection of the public health is not required to be postponed until contamination is shown to exist. The order was a constitutional exercise of state's police power. The court noted that the impure condition of the public supply was later corrected. (Wheeler-Fla)
W69-03024

WATER POLLUTION RESEARCH 1967.
Water Pollution Research Steering Committee, London (England).

Water Pollut Res Pub Annu Rep, 1967, 213 p, 1968. 77 fig, 4 plate, 40 tab, 6 append.

Descriptors: *Water pollution, *Water pollution control, *Water pollution effects, *Water pollution sources, Water pollution treatment, Industrial wastes, Municipal wastes, Sewage treatment, Disposal, Estuaries, Streams, Chemical analysis, Fish, Bacteria.
Identifiers: Water Pollution Research Laboratory (England).

The result of work at the Water Pollution Research Laboratory in 1967 are reported. Topics studied include coastal pollution, estuaries, freshwater streams, effects of pollution of fish, aerobic biological treatment processes, activated sludge process, percolating filters, sludge treatment, sewage, industrial waste waters, microbiology, methods of chemical analysis, and instrumentation. Lists of papers published by the Water Pollution Research Laboratory, reports of Laboratory work published in scientific journals, and reports of work sponsored by the Laboratory are included. (Knapp-USGS)
W69-03065

SIGNIFICANCE OF NITRIFICATION IN STREAM ANALYSIS--EFFECTS ON THE OXYGEN BALANCE,
Michigan Water Resources Commission, Lansing.
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-03077

THE HYDROLOGIC REGIME DUE TO SPRINKLER IRRIGATION OF TREATED MUNICIPAL EFFLUENT ON SLOPING LAND,
Pennsylvania State Univ., University Park. Dept. of Agricultural Engineering.
Ernest C. Rebuck.
Penn State Grad Sch Thesis, Dec 1967. 53 p, 12 fig, 14 tab, 24 ref.

Descriptors: *Irrigation effects, *Hydrologic data, *Waste water disposal, Sprinkler irrigation, Regimen, Runoff, Pressure head, Hydrographs, Agricultural engineering, Water management (Applied).
Identifiers: *Effluent irrigation.

Data are presented that relate the changes in the hydrologic regime and the amount of effluent irrigation applied to a small experimental plot. Effluent was applied by successively increasing amounts during three 6-week cycles. Changes in the hydrologic regime were determined from outflow hydrographs and piezometer responses. Outflow amounts and piezometer peak heads were highest during the early spring cycle and lowest during the summer cycle. The fall cycle produced responses intermediate between the other two. Outflows tended to increase with amount of application for all cycles. Piezometer peak heads showed pronounced increases for lower amounts of effluent application. Peak heads were similar for larger application amounts, and appeared to be more dependent on antecedent soil moisture conditions than on actual irrigation amounts. (Steinhilber-USGS)
W69-03109

MATHEMATICAL MODELS FOR EXPRESSING THE BIOCHEMICAL OXYGEN DEMAND IN WATER QUALITY STUDIES,
Iowa State Univ., Ames.
Merwin D. Dougal, and E. Robert Baumann.
Proceedings of the Third Annual American Water Resources Conference (American Water Resources Association: Urbana, Ill), c 1967, pp 242-253. 12 p, 4 tab, 13 ref.

Descriptors: Model studies, Water equality, *Mathematical models, *Biochemical oxygen demand, Impaired water quality, Oxidation, Oxygen demand, Forecasting, Wastes.
Identifiers: *Monomolecular model, Modified monomolecular model, Second order model.

The development and application of the widely used monomolecular model for biochemical oxygen demand (B.O.D.) is reviewed. Results of laboratory B.O.D. studies are used to reveal that the monomolecular model fails to satisfy its fundamental assumptions. Temporal variations in the rate constant and the ultimate B.O.D. value are explored for three types of cases: (a) raw domestic sewage, (b) final effluents from waste treatment processes, and (c) contents of an agricultural waste lagoon. Two different models for B.O.D. are presented which statistically are superior to the nonmolecular model. These models may be useful in future studies of stream water quality and in the determination of stream assimilative capacities. (Winn-Rutgers)
W69-03138

REGIONAL MANAGEMENT OF WATER QUALITY - A SYSTEMS APPROACH,
Louisiana State Univ., Baton Rouge; Carnegie-Mellon Univ., Pittsburgh, Pa.; and Harza Engineering Co., Chicago, Ill.
Melvin W. Anderson, and H. J. Day.
J Water Pollut Contr Fed, pp 1679-1687, Oct 1968. 9 p, 4 fig, 1 tab, 8 ref.

Descriptors: Stream improvement, *Waste water treatment, *Linear programming, Simulation analysis, Regional analysis, *Decision making, Biochemical oxygen demand, Dissolved oxygen, Optimization, Municipal wastes, Industrial wastes, River basins, *Water policy, Public benefits, Standards, Oxygen sag.
Identifiers: Miami River, Ohio, *Regional management, Dayton.

A linear programming model combined with simulation of hydrologic data was used to compare five waste treatment policies for the Miami River below Dayton, Ohio, in order to determine the minimal regional operating costs while trying to maintain river quality (DO) standards. An oxygen sag model for the river was developed using a modified Streeter-Phelps equation. 400 years of streamflow were generated from the 51-year existing record. It was assumed that monthly treatment (BOD removal) could be varied uniformly between 45 to 90 at each plant, and that cost was a linear function of treatment. The 5 policies tested assumed max and min levels of possible treatment. Results for the study were plotted, showing percent of time standards were violated, extent of violations in critical month, and monthly treatment costs. It was concluded that a regional authority could bring about improved river quality at present treatment costs. (Gysi-Cornell)
W69-03146

STREAM RESPONSES AND SYSTEM ANALYSIS IN WATER QUALITY MANAGEMENT,
Oklahoma Univ., Norman.
For primary bibliographic entry see Field 06A.
For abstract, see .
W69-03159

SYSTEMS ANALYSIS AND SIMULATION IN WATER QUALITY MANAGEMENT,
Manhattan Coll., Bronx, N. Y.
Robert V. Thomann.
Proc, IBM Sci Comput Symp Water Air Resource Manage, Thomas J. Watson Research Center, Yorktown Heights, N. Y., pp 223-233, Oct 1967. 11 p, 4 fig, 7 ref.

Descriptors: *Systems analysis, *Simulation analysis, *Water quality, Analytical techniques, *Input output analysis, Streamflow improvement, Water management (Applied), Estuaries, Dissolved oxygen, Time series analysis, Mathematical models.
Identifiers: Delaware Estuary.

Several aspects of systems analysis and simulation in the management of water quality in a time-variable sense were presented. The dissolved oxygen of a stream or estuary was used as the primary indicator of water quality. The basic equations that describe the time variability of dissolved oxygen in the stream or estuary were presented first. This was followed by an analysis of the problem of determining the variance of dissolved oxygen at downstream locations due to a stochastic waste load input

Finally, some results of a relatively large scale simulation of the Delaware Estuary were presented and some new problems of system verification were discussed. (Gysi-Cornell)
W69-03161

RESULTS FROM A SYSTEMS ANALYSIS APPROACH TO THE OPTIMUM CONTROL OF ESTUARINE WATER QUALITY,
Federal Water Pollution Control Administration, Philadelphia, Pa.
Robert V. Thomann, and David H. Marks.
Advances Water Pollut Res, Vol 3, pp 29-48, Proc Third Int Conf, Int Ass Water Pollut Res, Munich, Sept 1966. 20 p, 6 fig, 4 ref, 3 dics.

Descriptors: *Linear programming, *Water quality control, *Estuaries, Optimization, Dissolved oxygen, Standards, Constraints, Wastewater treatment, Water policy, Decision making, Aeration, Diffusion, Digital computers.
Identifiers: Delaware Estuary, Least-cost treatment, Uniform treatment, *Sensitivity analysis.

A parametric linear programming analysis checked the effect of various estuarine and wastewater treatment conditions on the water quality (DO) levels in the Delaware Estuary. The model of the physical environment was presented and discussed. This model was one of the principal inputs of the optimization model. The least cost solutions were determined for various ranges of reaeration and diffusion coefficients, and DO standard levels. The uniform-treatment solutions were graphed and discussed. It was concluded that the model was more sensitive to the reaeration coefficient than the diffusion coefficient and that the difference in least-cost and uniform solutions was a valuable guide to policy decisions. Three discussions followed the report. (Gysi-Cornell)
W69-03162

DESIGN SENSITIVITY OF POLLUTION CONTROL RESERVOIRS,
Federal Water Pollution Control Administration, Washington, D. C.
George K. Young, Roland W. Schrecongost, and William N. Fitch.
Proc Amer Soc Civil Eng, Vol 94, No SA5, pp 829-840, Oct 1968. 12 p, 2 fig, 4 tab, 11 ref, 2 append.

Descriptors: Oxygen sag, Reservoir design, Streamflow improvement, Waste dilution, Waste water treatment, *Low-flow augmentation, Dissolved oxygen, Standards, Synthetic hydrology, Simulation analysis, Mathematical models, Decision making, Water policy, Hydrologic data, Routing.
Identifiers: *Sensitivity analysis, Kanawha River.

The sensitivity of the 'central design' of a low-flow augmentation reservoir to changes in parameter values used for the study was investigated. Two models were used to obtain the central design. A DO model was used to determine the effect of 3 levels of waste treatment on Kanawha River. For each level of treatment, augmentation of the river flow was increased until the required standard of 4 MG/l DO was met. These required flows were used as inputs to a hydrologic routing model which made the required releases when possible for each of several tried reservoir volumes. The 26-year historic flows were used to obtain the central design (required releases met 90% of time). 20 synthetic 26-year records were generated, and the solution repeated. The same central design resulted. Parameter sensitivity studies were performed on deoxygenation and reaeration rates, waste loading rates, DO standards, and stream velocity. Results of these studies are tabled and discussed. (Gysi-Cornell)
W69-03163

A PROPOSAL FOR A SYSTEMS ENGINEERING STUDY OF WATER POLLUTION ABATEMENT,
Johnson (Bernard) Engineers, Inc., Houston, Tex.
Bernard G. Johnson.
Consult Eng, Vol 30, No 3, pp 185-189, Mar 1968. 5 p, 5 fig.

Descriptors: *Water pollution control, *Systems analysis, Linear programming, Simulation analysis, Hydraulic models, River basins, Water resources development.
Identifiers: Galveston Bay, Texas.

The techniques and approach to a water pollution abatement study of the Galveston Bay area were outlined. The study area, planning goals, and the makeup of the study team were described. The project approach, including the use of linear programming, simulation analysis and hydraulic modelling were discussed. The equipment available for the study was listed. (Gysi-Cornell)
W69-03164

A STUDY IN THE ECONOMICS OF WATER QUALITY MANAGEMENT,
Federal Water Pollution Control Administration, Washington, D. C.
Edwin L. Johnson.
Water Resources Research, Vol. 3, No. 2, pp 291-305, Second Quarter 1967, 15 p, 2 fig, 9 tab, 3 ref.

Descriptors: *Effluents, *Water quality, Waste disposal, *Use cost allocation, Water management, Water resource development, Water resource planning, Estimated benefits, Estimated costs, Regional analysis.
Identifiers: Delaware Estuary Study.

The study attempts to estimate the charge required to attain specific levels of water quality, investigate the relation of the charge level to industrial output, and compare the effluent charge method with other methods of pollution control. The physical model employed is a linear steady-state version of a dynamic waste system developed in the Delaware Estuary Study. Input data consists of a matrix relating the effect on (DO) level in each reach to a unit removal of oxygen-demanding material in another reach and a piecewise linear cost function showing the waste removal cost of each discharger. The findings of the study indicate that effluent charges should be considered as a method of improving water quality and that of waste treatment using the effluent charge method is approaching the least costly treatment plan. The study does not find evidence for regional economic effects from the charge level. The Charge method is preferred to conventional methods because it attains the same goal at lower cost, is more equitable and effective and provides a guide to public investment decisions. Further study is needed in problems of differential charges, prediction of induced responses, and administrative performance and cost. (Abodeely-Chicago)
W69-03173

ADSORPTION OF PESTICIDES ON EARTH MATERIALS,
Massachusetts Univ., Amherst.
John H. Baker.
Water Resources Center, Project Completion Report, August 1968. 14 p, 2 tab, 12 fig, 7 ref. OWRR Project A-019-Mass.

Descriptors: Atrazine, Diazinon, Soils, Leaching, Adsorption, Pesticides.

Atrazine adsorption by soils was independent of CaCl2 concentration in the range of concentration to be expected in soil solutions but increased as equilibration time increased up to about 10 hours after which time the amount of atrazine adsorbed by the soils after 24 hours of equilibration was found to be dependent on atrazine concentration, soil pH and soil organic matter content. The linear regression equation relating the distribution coefficient for atrazine adsorption to the organic matter content of 25 soils was found to be Kd = 0.85 % O.M. - 0.2. The correlation coefficient was 0.91. Although the distribution coefficient for atrazine adsorption was independent of soil to solution ratio when this ratio was varied from 0.1 to 1 the adsorption of atrazine by surface soils was not completely reversible. Atrazine was found to leach in soil columns but was eluted from columns of the two soils tested with less water than predicted using chromatographic theory and the distribution coefficient for atrazine adsorption by the soils measured after 24 hours of equilibration. The linear regression equation relating the distribution coefficient for Diazinon adsorption to the organic matter content of 11 soils was found to be Kd = 1.2 % O.M. + 0.2. The correlation coefficient was 0.93. Diazinon was more strongly adsorbed than Atrazine by soils.
W69-03192

06. WATER RESOURCES PLANNING

6A. Techniques OF Planning

HYDROLOGIC FORECASTS, PREDICTION PERIODS, RELIABILITY AND EXPERIENCE USING THEM IN WATER RESOURCES SYSTEMS,
Ye. G. Popov.
Soviet Hydrol Selec Pap (AGU), No 3, pp 297-303, 1967. 7 p, 3 tab.

Descriptors: *Forecasting, *River forecasting, *Streamflow forecasting, Routing, Low flow, Peak discharge, Floods, Ice, Ice breakup, Freezing, Navigable rivers, Reservoirs.
Identifiers: *USSR hydrological forecasts.

The hydrological forecasts available in the USSR are reviewed and their uses are listed. The types available are long range water and ice regime forecasts, short range forecasts including dangerous phenomena, hydroelectric power riverflow forecasts, high-water level forecasts, runoff predictions for mountain rivers for irrigation projects, predictions of minimum levels of navigable rivers, predictions of dates of freeze and breakup of rivers and reservoirs, and short-range water level predictions issued during high water periods, floods, and low water. (Knapp-USGS)
W69-02802

OPTIMIZATION OF THE OPERATION OF A MULTIPURPOSE RESERVOIR BY DYNAMIC PROGRAMMING,
California Univ., Los Angeles.
Warren A. Hall, William S. Butcher, and Austin Escohbue.
Water Resources Research, Vol. 4, No. 3, 1968, pp 471-479, 3 fig, 4 ref.

Descriptors: Optimum development plans, Project planning, Multipurpose projects, *River basin planning, Water resource development, Hydroelectric power, *Dynamic programming, Linear programming, *Formulation.
Identifiers: Shasta Dam, Keswick afterbay, Sacramento River.

A technique of analysis is presented by which dynamic operation policies for planning complex reservoir systems producing hydroelectric power and providing water can be optimized for the maximum return from firm water, firm power, dump water, and dump power. The technique provides for complex constraints, such as mandatory flood control reservations variable in time, fish, wildlife and recreational releases, navigation minimum flows, as well as evaporation losses and inter-basin diversions. This paper presents in detail the operational analysis of a component reservoir-river system and the procedure to be used to combine optimally a number of such subsystems into a coordinated mutually reinforcing, multiple system. (Gargola-Chicago)
W69-02842

FORMAL MODELS IN THE DESIGN OF WATER RESOURCE SYSTEMS,
Harvard Univ., Cambridge, Mass. Harvard Water Program.
Robert Dorfman.
Water Resource Research, Vol. 1, No. 3, 1965, pp 329-337, 5 ref.

Descriptors: Attitudes, Computer models, *Water resource management, Simulation models, Computer programming, Analytic techniques, Mathematical models, Optimum development plans, *Decision-making, Stochastic processes, *Formulation, River basin planning.
Identifiers: Water resource design, Harvard Water Program.

New methods for designing water resource systems are being evolved as part of a general social tendency toward expressing social problems in the formal modes that have been restricted to scientific and engineering problems. Two general types of models have been fruitful in the field of water resource development: the simulation model and the analytic model. In simulation models temporal sequences of events are reproduced on electronic computers on a time scale in which minutes represent decades, leading to convenient estimates of the consequences of design decisions even in complicated circumstances. In analytic models, consequences are expressed as explicit mathematical functions of design variables. Simulations are awkward when a wide range of design decisions have to be evaluated. Analytic models cannot be applied to practical problems without drastically simplifying them. But the two methods can be used in tandem, with analytic models delineating the range within which simulation is required. (Gargola-Chicago)
W69-02846

THE FUNCTION OF FEASIBILITY REPORTS,
Tudor Engineering Co., San Francisco, Calif.
Louis W. Riggs.
Consult Eng, Vol 31, No 3, pp 120-125, Sept 1968. 6 p, 5 fig.

Descriptors: *Feasibility studies, Project planning, Planning, Project feasibility, Technical feasibility, Feasibility, *Consulting engineers, Economic feasibility, Financial feasibility, Investigations, *Reports.

A feasibility report surveys the need for action, proposes a specific response, and evaluates the probable economic results. The feasibility report is neither a planning document nor a preliminary design analysis, but may incorporate these elements. For example, where a comprehensive general plan exists, reexamining assumptions and testing forecasts are often appropriate before making new public commitments. Occasionally, a prospective project demands a large measure of technical innovation so that the design approach must be explored in depth. In every instance, a feasibility report presumes a problem at hand or an opportunity in mind. Although the consulting engineer is helpful in isolating the problem and crystallizing the opportunity, excellent ideas ofte are found closest to the problem and within the agency staff. The consulting engineer will procure these ideas, add his own perspectives, and develop a plan of analysis. He will then formulate a plan of action, test it against other alternatives, and present his conclusions and judgments. Functions essential to every feasibility report are defined in this process. (USBR)
W69-02910

SYSTEMS APPROACH TO WATER QUALITY IN THE GREAT LAKES.
For primary bibliographic entry see Field 02H.
For abstract, see .
W69-03059

REGRESSION MODELS FOR PREDICTING ON-SITE RUNOFF FROM SHORT-DURATION CONVECTIVE STORMS,
Agricultural Research Service, Tucson Ariz. Southwest Watershed Research Center.
H. A. Schreiber, and D. R. Kincaid.
Water Resources Res, Vol 3, No 2, pp 389-395, 1967. 7 p, 1 fig, 4 tab, 6 ref.

Descriptors: *Rainfall-runoff relationships, *Thunderstorms, *Regression analysis, Vegetation, Trees, Soil moisture, Runoff, Surface runoff, Subsurface runoff, Hydrographs, Histograms, Hyetographs, Arizona, Watersheds (Basins).
Identifiers: Walnut Gulch Experimental Watershed.

On-site runoff resulting from summer convective thunderstorms was studied in the Walnut Gulch Experimental Watershed, Arizona, using 6- by 12-ft plots at 2 locations, based on 5 location-years of data from 34 storms. Average runoff increased as precipitation quantity increased, decreased as crown spread of vegetation increased, and decreased as antecedent soil moisture increased. In a stepwise multiple linear regression equation, these independent variables accounted for, respectively, 72, 3, and 0.5% of the prediction variance. Considering regression equations for any one location-year, storm amount or intensity always was significant, crown spread usually was significant, and antecedent soil moisture rarely was significant. In simple correlations, antecedent soil moisture was never related significantly to runoff. The equations developed appear valid for a set of thunderstorms with at least one-sixth of maximum 5-min intensities exceeding 3.7 in. per hr.
W69-03103

SOME ERROR PROPERTIES OF SEGMENTED HYDROLOGIC FUNCTIONS,
Georgia Inst. of Tech., Atlanta.
For primary bibliographic entry see Field 07C.
For abstract, see .
W69-03105

A LAPLACE TRANSFORM PROOF OF THE THEOREM OF MOMENTS FOR THE INSTANTANEOUS UNIT HYDROGRAPH,
Technion Israel Inst. of Tech., Haifa.
M. H. Diskin.
Water Resources Res, Vol 3, No 2, pp 385-388, 1967. 4 p, 1 fig, 3 ref.

Descriptors: *Hydrograph analysis, *Unit hydrographs, *Mathematical studies, Floods, Streamflow, Hyetographs, Runoff, Surface runoff.
Identifiers: Moment equations, Laplace transforms.

Laplace transforms are used to derive a general relationship for the moments about the origin of the three functions that appear in the convolution integral. The resulting equation can be used for the successive evaluation of the unknown moments of the instantaneous unit hydrograph from the known moments of the rainfall excess hyetograph and of the direct surface runoff hydrograph. Simplified forms of the moments equations are given for the moments of lowest orders.
W69-03120

SYSTEMS APPROACH TO WATER RESOURCE MANAGEMENT.
TRW Systems Group, San Bernardino, Calif. Resource Management Dept.

Res Activity Rep, Vol 2, 63 p, April 1968. 8 fig, 5 append. OWRR No 14-01-0001-1579.

Descriptors: *Systems analysis, *Water resources, *Municipal water, *Water management (Applied), Administration, Planning, Methodology, Social aspects, Economics.
Identifiers: Santa Ana River (California), Alternative solutions.

The systems approach was used to model the management process for urban water resources, using the upper Santa Ana River watershed, California, as a source of data for the model and for testing hypotheses. The systems approach used was intended to survey the entire problem in context with the physical, social, and economic forces involved, to recognize dynamic relationships of parts to the whole, and use a multiple-disciplinary method of study. Published reports were used to compile hydrological data for the Santa Ana Basin. Interviews and questionnaires gathered social, economic, and management data. A management handbook describes methods for gathering sufficient information to make decisions and the methods to arrive at and check for correct decisions. Systems management study methods and some applications of systems methods to water resources needing study are outlined, and plans for such studies are presented. (Knapp-USGS)
W69-03122

SOME EVIDENCE ON THE SMALL SAMPLE PROPERTIES OF DISTRIBUTED LAG ESTIMATORS IN THE PRESENCE OF AUTOCORRELATED DISTURBANCES,
Carnegie Inst. of Tech., Pittsburgh, Pa.
Thomas J. Sargent.
Rev Econ and Stat, Vol XLX, No 1, pp 87-95, February 1968. 9 p, 14 tab, 15 ref.

Descriptors: Least squares method, Monte Carlo method.
Identifiers: *Distributed lag, Small sample properties, Autocorrelated disturbances, Estimators, Three pass least squares.

The paper presents Monte Carlo results for several estimators for a simple geometrically declining lag scheme with an infinite tail. The estimators studies include: least squares applies to the autoregressive form of the model, three pass least squares, an instrumental variable technique, a scheme for iterating on a serial correlation parameter, and Klein's maximum likelihood technique which deals directly with the distributed lag form of the model. It is found that the ranking of the estimators depends to some extent on where one is in the parameter space and on the serial properties of the disturbances. Overall, the iterative technique and Klein's method out-perform the others. (Loeb-Rutgers)
W69-03124

A FUNCTIONAL APPROACH TO PROBLEMS OF WATER RESOURCE DEVELOPMENT AND WATER USE,
Nevada Univ., Reno.
H. Clay Little.
Proceedings of the Third Annual American Water Resources Conference (American Water Resources Assn; Urbana, Ill), c 1967, pp 664-669. 6 p.

Descriptors: *Water resource development, Water utilization, Decision making, Planning.
Identifiers: *Functional approach.

The functional approach is a method of bringing various technical skills to bear upon resource related problems in a comprehensive and systematic manner by directing attention to the uses man makes of the resource. Keys to the effective use of this approach are (1) problem identification, (2) building the research model around uses made of the resource, and (3) cooperation and communication between individuals in different professions due to the number of interrelationships of use involved and the length of time required between beginning work and producing a proposed solution. (Winn-Rutgers)
W69-03134

APPLICABILITY OF REMOTE SENSING AND SYSTEMS ANALYSIS TECHNIQUES TO RIVER BASIN PLANNING,
Purdue Univ., Lafayette, Ind.

. F. Baumgardner, R. B. MacDonald, L. F.
ıggins, and R. M. Peart.
oceedings of the Third Annual American Water
:sources Conference (American Water
:sources Assn; Urbana, Ill), c 1967, pp 456-465.
) p, 3 fig, 2 chart, 6 ref.

escriptors: *River basin development, Planning,
temote sensing, *Systems analysis, Model stu-
es, Data processing.
entifiers: Mathematical simulation, Remote mul-
pectral scanning, Laboratory for Agricultural
:mote Sensing, Purdue University.

ıe general problem of formulating plans for the
:velopment of all the resources of a large river
ısin is extremely complex. The techniques of
stems analysis and mathematical simulation offer
rational approach to solving these problems. Not
l of the technical capability required to imple-
ent these techniques on a large scale watershed is
ırrently available. Suitable mathematical models
e not available for many of the subsystems out-
ıed in a flow diagram. However, research on the
:velopment of suitable component models and on
e automatic data acquisitions systems capable of
:onomically providing the vast quantities of data
:sential to such models is rapidly making such stu-
es feasible. (Winn-Rutgers)
'69-03145

PTIMIZATION BY DYNAMIC PRO-RAMMING OF HYDROELECTRIC PLANT PERATION REGIME DURING INITIAL ILLING PERIOD OF MULTIANNUAL REGU-ATION RESERVOIR,
. N. Korobova.
ranslation from Gidrotekhnicheskoe Stroitelstvo,
o 5, pp 35-38, May 1968. Hydrotechnical Con-
ruction, No 5, pp 421-425, May 1968. 5 p, 7 ref.

escriptors: *Dynamic programming, *Reservoir
peration, Mathematical models, *Hydroelectric
lants, Reservoir construction, River regulation,
conomic efficiency, Constraints.
dentifiers: Siberia, USSR, Reservoir filling.

sing dynamic programming, a system of rules for
eservoir releases during the initial filling period
ere determined, given the system firm energy de-
ıand, the plant capacity, the non-power required
eleases, and assuming that long-term flow
orecasts were not available. The method assumed
ıat the length of the filling period and final volume
ere known. The object was to minimize the ex-
enses to the power system during the filling
eriod. Navigation and irrigation constraints
laced limits on the possible ranges of reservoir
evels each year. An example of the technique was
pplied to a group of Siberian hydroelectric plants.
Gysi-Cornell)
W69-03155

THE LEONTIEF INPUT-OUTPUT SYSTEM AND TS APPLICATION TO ANALYSIS AND PRO-ECTION FOR WATER RESOURCES 'LANNING,
California Univ., Berkeley.
Everard M. Lofting.
Proc, IBM Sci Computing Symp Water Air
Resource Manage, Thomas J. Watson Res Center,
Yorktown Heights, N. Y., pp 291-315, Oct 1967.
25 p, 59 ref, 1 append.

Descriptors: Analytical techniques, *Data collec-
ions, Input-output analysis, *Leontief Models,
Planning, *Water resources development, Regional
nalysis, Industrial water, Productivity, Interstate,
*Water requirements, *Economic prediction, In-
erstate, Planning.
Identifiers: Multiregional analysis, National econo-
ny, Interindustry, Water content matrix.

The background and theory of Leontief input-out-
put models for the purpose of projecting regional
or national water requirments for the future was
presented. A brief history of the development of
systems analysis in water resources planning, with
emphasis on input-output methods was given. An
interindustry water content Leontief model was
developed illustrating the similarities between a
general linear programming system and the Leon-
tief system. Present methods of water use data and
productivity accounting data collections were
discussed, and the possible adaptations of this data
to productivity estimates for water requirements
suggested. It was proposed that regional water-con-
tent matrices for economic projection purposes
could then be translated from these estimates.
(Gysi-Cornell)
W69-03156

THE INTERINDUSTRY WATER CONTENT MATRIX: APPLICATIONS ON A MULTIRE-GIONAL BASIS,
California Univ., Berkeley.
Everard M. Lofting, and H. Craig Davis.
Water Resources Res, Vol 4, No 4, pp 689-695,
Aug 1968. 7 p, 25 ref.

Descriptors: Analytical techniques, *Data collec-
tions, Input-output analysis, *Leontief Models,
Planning, *Water resources development, *Re-
gional analysis, Industrial water, Industrial produc-
tion, Interstate, Decision making, Water require-
ments.
Identifiers: Western states, Multiregional analysis,
Interindustry, Water content matrix.

The applicability of a 'water content' matrix (based
on the 'Leontief' or 'input-output' system) for re-
gional planning studies of future interindustry
water requirements was discussed. An interindustry
or input-output model represents the structural in-
terdependence of a regional economy. The inverse
matrix ('factor content' matrix) of the model
reveals the amount (dollars, man-hours, acre-feet)
of a given commodity necessary for a unit output of
a product to final demand. Some of the specific
uses of a water content matrix constructed from a
western states multiregional input-output model
and a vector of water use coefficients were
discussed. Suggestions for improvement of present
water use data and future data collections, and the
applicability of these data to regional water
planning were made. (Gysi-Cornell)
W69-03157

WATER QUALITY ANALYSIS OF THE DELAWARE RIVER ESTUARY,
Manhattan Coll., Bronx, N. Y.; and Hydroscience,
Inc., Leonia, N. J.
Donald J. O'Conner, John P. St. John, and Dominic
M. DiToro.
Proc Amer Soc Civil Eng, Vol 94, No SA6, pp
1225-1252, Dec 1968. 28 p, 11 fig, 2 tab, 16 ref, 2
append.

Descriptors: Low-flow augmentation, Nitrification,
*River basin, *Waste water treatment, Streamflow
improvement, Biochemical oxygen demand, Dis-
solved oxygen, *Water quality control, Estuaries,
Mathematical models, Data collections, Standards,
Analytical techniques.
Identifiers: Delaware River, Sensitivity analysis,
Basin-wide collection.

A mathematical model was developed for the
Delaware River which assesses the efficiency of
various proposals for water quality improvement.
The analysis highlighted the importance of nitrifi-
cation in the river that may become intensified by
future reduction in carbonaceous demand due to
increased treatment. It also indicated good correla-
tion of observed DO distributions assuming oxida-
tion of carbonaceous BOD to be the only active de-
mand on the winter system. The system sensitivity
analysis indicated that low-flow augmentation did
not appear feasible for increasing DO levels, but
demonstrated a pronounced effect between waste
loading location and water quality. It was con-
cluded that basin-wide collection and treatment
facilities with downstream disposals may be a prac-
tical alternative. (Gysi-Cornell)
W69-03158

STREAM RESPONSES AND SYSTEM ANALY-SIS IN WATER QUALITY MANAGEMENT,
Oklahoma Univ., Norman.
George W. Reid.
Water and Wastes Eng, Vol 5, No 3, pp 56-59, Mar
1968. 4 p, 2 fig, 3 tab.

Descriptors: *Water quality control, Water
management (Applied), Water resources develop-
ment, Water policy, Decision making, *Linear pro-
gramming, Standards, Constraints, Stream im-
provement, River basins, River basin commissions,
Damages, Mathematical models, Public benefits.

A basin-wide approach to water quality control
using linear programming techniques was proposed
as a feasible method of dealing with increased fu-
ture demands on river systems. It was suggested
that present independent treatment of waste or
uniform standards may not be possible under future
conditions. A hypothetical example illustrated how
a basin-wide linear programming model could be
used to find optimal (least-cost) treatment solu-
tions. (Gysi-Cornell)
W69-03159

OPTIMIZATION OF TIDAL POWER GENERA-TION,
M. C. Swales, and E. M. Wilson.
Water Power, Vol 20, No 3, pp 109-114, Mar
1968. 6 p, 11 fig, 2 ref.

Descriptors: *Optimization, *Tidal powerplants,
Hydroelectric power, Economic efficiency,
*Hydraulic design, Digital computers, Mathemati-
cal models, Comparative benefits, Sluicegates,
Hydraulic turbines.
Identifiers: Knik Arm, Alaska, Design head.

A method for determining the optimum design of
an ebb-generation tidal power station was
presented. The method required partial enumera-
tion of alternatives in the searching technique and
hence a computer program was used to solve the
large number of computations. The equations for a
specific design operating on a sinusoidal tide were
developed, and the procedure for optimization of
operation conditions of the plant were outlined.
The optimization of design then followed a specific
enumeration procedure, with some alternatives
eliminated because of engineering considerations,
and others from the graphical analysis of results.
For analysis, the 'single-tide method' was used (i.e.
energy generation for single tides multiplied by
histogram values gave annual energy figures).
Results for the Knik Arm, Alaska station were
shown. (Gysi-Cornell)
W69-03160

SYSTEMS ANALYSIS AND SIMULATION IN WATER QUALITY MANAGEMENT,
Manhattan Coll., Bronx, N. Y.
For primary bibliographic entry see Field 05G.
For abstract, see .
W69-03161

RESULTS FROM A SYSTEMS ANALYSIS AP-PROACH TO THE OPTIMUM CONTROL OF ESTUARINE WATER QUALITY,
Federal Water Pollution Control Administration,
Philadelphia, Pa.
For primary bibliographic entry see Field 05G.
For abstract, see .
W69-03162

DESIGN SENSITIVITY OF POLLUTION CON-TROL RESERVOIRS,
Federal Water Pollution Control Administration,
Washington, D. C.
For primary bibliographic entry see Field 05G.
For abstract, see .
W69-03163

A PROPOSAL FOR A SYSTEMS ENGINEERING STUDY OF WATER POLLUTION ABATEMENT,
Johnson (Bernard) Engineers, Inc., Houston, Tex.
For primary bibliographic entry see Field 05G.
For abstract, see .
W69-03164

SIMULATION OF REGIONAL ECONOMIC IMPACTS OF WATER RESOURCE DEVELOPMENT,
Duke Univ., Durham, N. C. Dept. of Economics.
For primary bibliographic entry see Field 06B.
For abstract, see .
W69-03176

WHEN IS IT SAFE TO EXTEND A PREDICTION EQUATION--AN ANSWER BASED UPON FACTOR AND DISCRIMINANT FUNCTION ANALYSIS,
Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.
James R. Wallis.
Water Resources Res, Vol 3, No 2, pp 375-384, 1967. 10 p, 2 fig, 5 tab, 10 ref.

Descriptors: *Evaluation, *Statistical methods, *Estimating, *Forecasting, Streamflow forecasting, Floods, Hydrologic aspects.
Identifiers: Principal components analysis, Linear discriminant functions, Prediction equation relevance.

Prediction equations for hydrologic events developed from one population of observations (watersheds) are often solved for another population that is removed either in time or in space. Predictions of this kind are never certainties, although some predictions are obviously more uncertain than others. This paper proposes an empirical uncertainty classification that may be found useful for separating probably successful from probably unsuccessful extensions of prediction equations. The classification system is illustrated by a prediction equation for suspended sediment discharge developed from some watersheds in California, and by a discriminant function for marine versus nonmarine sediments based upon microelements.
W69-03183

AN ELECTRICAL RESISTIVITY PROFILE FROM MAHUKONA TO KAWAIHAE, HAWAII,
Hawaii State Dept. of Land and Natural Resources, Honolulu. Div. of Water and Land Development; Hawaii Univ., Honolulu. Water Resources Research Center; and Hawaii Inst. of Geophysics, Honolulu.
William M. Adams.
Water Resources Res Center Tech Rep No 23, HIG Ser, HIG-WRCC-1, Nov 1968. 32 p, 11 fig, 5 tab, 6 ref, 2 append.

Descriptors: *Resistivity, *Surveys, Groundwater, Hawaii, Electrical studies, Geophysics, Fresh water, Profiles.
Identifiers: Wenner spread configuration, Insular environments.

An electrical resistivity survey to locate the relatively optimum drilling sites for fresh water exploration was conducted along the Mahukona-Kawaihae Road on the west flank of the Kohala Mountain, Hawaii. A profile of 209 stations was run using the Wenner spread configuration. A procedure, which is probably uniquely applicable to insular environments, was developed for removing the elevation effect from observed apparent resistivity. Because the interpretation of profile data is not absolute, the definite location of fresh-water reservoirs is not determinable directly from these data. However, four relatively optimum sites for additional exploration were determined. (Steinhilber-USGS)
W69-03184

6B. Evaluation Process

ESTIMATED USE OF WATER IN THE UNITED STATES, 1965,
Geological Survey, Washington, D. C.
C. Richard Murray.
U S Geol Surv Circular 556, 1968. 53 p, 14 fig, 32 tab, 71 ref.

Descriptors: *Water utilization, *Groundwater, *Surface water, *Fresh water, *Saline water, Cooling water, Duty of water, Non-consumptive use, Population, Precipitation (Atmospheric), Reclaimed water, River basins, United States, Water management (Applied), Water reuse, Water supply, Withdrawal, Regions.
Identifiers: Hydroelectric, Off channel, Industrial, Irrigation, Rural domestic and livestock, Thermoelectric, Public supply, Average annual.

A 15% increase in off-channel water use from 1960 to 1965 resulted in an average of 310 billion gallons per day (bgd) being withdrawn for public supply, rural domestic and livestock, irrigation, and industrial uses; that is, 1,600 gallons per capita per day. About 75% of total industrial water was used for cooling purposes in thermoelectric power plants, where fresh water use since 1960 increased about 25% and saline water 33%. Hydroelectric withdrawals, a within-channel nonconsumptive use, increased 15% to 2,300 bgd. Water actually consumed averaged 78 bgd, a 28% increase in 5 years. Groundwater supplied 61 bgd (0.5 bgd saline) and surface water 250 bgd (44 bgd saline) for off-channel use. Reclaimed sewage supplied 2/3 bgd to irrigation and industry. The average annual U. S. streamflow is 1,200 bgd, 4 times the off-channel use and 15 times the consumption. However, the estimated dependable, fresh water supply is only about half the total; and in many river basins, water must be withdrawn repeatedly; and in some basins, more than half the dependable supply is consumed. Water-use data is tabulated by States, water-use regions, and by Water Resources Council regions. (Murray-USGS)
W69-02840

THE CALIFORNIA WATER PROJECT: IS PUBLIC DECISION-MAKING BECOMING MORE EFFICIENT,
Washington Univ., Seattle.
Gardner Brown, Jr.
Water Resources Research, Vol. 4, No. 3, 1968, pp 463-469, 27 ref.

Descriptors: Discount rate, Interest rate, Cost-benefit ratio, Economic evaluation, *Economic efficiency, Non-structural alternatives, Pricing, Investment, Public utilities, *Water allocation, *Decision making, *State governments, Water resource development, Institutional constraints.
Identifiers: California State Water Project.

It is argued that various published conclusions about the economic performance of the State Water Project are invalid, either because the analysis is internally inconsistent, the scholarship careless, or, although some conclusions are correct, the underlying reasoning is wrong. The argument of superiority of alternative sources of water is discussed, and shown to be in error. Incorrect use of the discount rate, the application of procedures that overestimate net benefits, and the failure to charge a scarcity price for water are inappropriate arguments against the value of the California State Water Project. However, the project can be legitimately criticized from two vantage points: (1) the choice of this particular investment relative to alternative public investment options; (2) lack of efficiency because of the questionable assumptions planners must have made about technological progress and future costs of desalinization. As we move from a narrower to a broader frame of reference, the economic virtues of the State Water Project progressively decline. The State's water pricing policy encourages more efficient resource allocation than that of the Federal Government, but there are plausible grounds for believing that further improvement is possible. (Gargola-Chicago)
W69-02841

FIELD LEVEL PLANNING OF WATER RESOURCE SYSTEMS,
Harvard Univ., Cambridge, Mass. Harvard Water Program.
Maynard F. Hufschmidt.
Water Resources Research, Vol. 1, No. 2, 1965, pp 147-165, 27 ref.

Descriptors: *Water resource planning, *Decision making, Investment, Project planning, Formulation, Flood damages, Systems analysis, Models, Analytical techniques, Design data, Input-output analysis, *Optimum development plans, Regional analysis, Linear programming, *Simulation analysis.
Identifiers: *Field level planning.

An examination is made of the process of comprehensive water resource planning from the point of view of how new knowledge can best be brought to bear on the major planning tasks under way. Water resource planning, or water resource system design, is specifically a technique of public investment decision making. An idealized form of the overall planning process consists of four related steps: (1) specifying the objectives of design; (2) translating these objectives into design criteria; (3) using the criteria to formulate specific designs of development and management for water resource systems that fulfill the criteria to the highest degree; and (4) evaluating the consequences of the designs that have been developed. The third step, field level planning, is analyzed from three points of view: (1) underlying theory of field level planning; (2) the process of field level planning; and (3) the techniques of analysis used in field level planning. Mayor new techniques of analysis, typically computer oriented, include: (1) optimal scheduling methods for the planning task; (2) regional input output analysis; (3) improved theoretical and practical models of data analysis; (4) linear programming and rough simulation techniques for screening alternatives; and (5) detailed simulation analysis and response surface sampling. (Gargola Chicago)
W69-02843

BROAD HORIZONS IN WATER RESOURCE PLANNING AND INVESTMENT,
Resources for the Future, Inc., Washington, D. C.
Charles W. Howe.
Water Resources Research, Vol. 2, No. 4, 1966, p 843-849, 1 tab, 7 ref.

Descriptors: Investment, *Project planning, *No structural alternatives, Economic efficiency, Interest rate, Financing, *Water resource management, Water use, Navigable waterways, Cost.
Identifiers: Private investment, Public secto Economic interdependence.

Three ways of broadening the horizons in thinkir of water resources policy seem worthy of co sideration: (1) a geographical broadening th recognizes not merely the physical interdepe dence in water systems, but the extent of econom interdependence; (2) a sectoral broadening of o perspective that recognizes explicitly the interd pendence between the private and public sectors our economy; and (3) a broadening of the range policy alternatives that are considered in solvi water problems. These points are discussed wi emphasis on the broadening of alternatives. It is i portant to proceed beyond traditional methods problem solving and institutional arrangemen This should also apply to alternatives that relate water transportation. It is suggested that rail a barge transportation be coordinated to bring ea region acceptable service at minimum cost rath than extending each mode to every region. (G gola-Chicago)

W69-02845

THE DYNAMICS OF PUBLIC ROLES IN THE SELECTION OF REVENUE SOURCES IN LOCAL WATER ADMINISTRATION,
Colorado State Univ., Fort Collins.
Charles L. Garrison, and Duane W. Hill.
Water Resources Research, Vol. 3, No. 4, 1967, pp 949-962, 5 tab, 24 ref.

Descriptors: *Decision making, Political aspects, Attitudes, *Behavior, Social values, Sociological aspects, *Local governments, Methodology, Financing, Institutional constraints, Water resource management.
Identifiers: Water resource administration, Public roles.

One of the largest voids in the information available to local decision makers on water use is the knowledtge of limits placed upon the policy makers opinions by the respective publics. Results from an effort to classify orientations toward debt-retirement policy alternatives of a special rural-domestic water district's public demonstrated: (1) that persons who would grant flexibility in policy making were lower social status newcomers with a low rate of political participation but a relatively high political efficacy, an urban outlook, high personal rigidity, and high deference toward authority; (2) that the restrictiveness of the resister who comes primarily from the high income, participant-oriented upper middle class is probably a function of his ideological framework and a consistent level of activity that gives him high potential for limiting the policy makers' decision-making options; and (3) that the complaint medium is a viable component for measuring and classifying political behavior. (Gargola-Chicago)
W69-02847

URBAN AND BASIN PLANNING,
Wisconsin Dept. of Resource Development, Madison.
Donald F. Wood.
Water Resources Research, Vol. 3, No. 1, 1967, pp 279-283.

Descriptors: *Urbanization, *River basin planning, Aesthetics, Water resource planning, Future planning, *Project planning, Water pollution, Legal aspects, Political aspects, Land use.
Identifiers: Waterfront development.

There are many relationships between urban planning and basin planning. A similarity is that in both areas many of the problems are caused by man's misuse of his land and water resources. Urban renewal programs can be used to enhance the waterfront and destroy sources of pollution that affect entire river basins. Other areas where investigation may indicate relationships are: (1) aesthetics - new interest has been shown in achieving urban beauty and preserving natural beauty; (2) a study of a sociological or political nature which would examine the various groups within the basin and how improvement proposals might affect them; (3) a determination of whether basinwide waterfront land use plans can be drawn and implemented; (4) consideration of the extent to which various alterations to the shoreline or in the streamflow can or should be made; and (5) study of a legal nature which would consider riparian law and whether changes in it are needed. (Gargola-Chicago)
W69-02851

PROGRAM FOR COOPERATIVE STUDY FOR COMPREHENSIVE WATER RESOURCE DEVELOPMENT,
New York State Department of Conservation.
Frank J. Keller.
Wa-Ont-Ya Basin Regional Water Resources Planning and Development Board, 1966, 12 pp, 23 append, 3 fig.

Descriptors: *Formulation, *River basin development, Administrative decisions, Interagency cooperation, Water resource management, Project planning, State governments, Land use, Financing, Water supply, *Multipurpose projects, Long term planning, Non-structural alternatives. Programs.
Identifiers: Wa-Ont-Ya Basin Regional Water Resource Planning and Development Board, Oswego Basin, New York.

The formation of the Wa-Ont-Ya Basin Regional Water Resources Planning and Development Board has provided the basis for the formulation of a comprehensive plan for development and management of the water and related land resources of the Western Oswego Basin. Future demands of the water resources of the Oswego Basin are expected to increase and other types of uses will develop into major importance. Because of this, the Board believes that comprehensive planning and multiple-purpose development is required if the demands are to be met and resources equitably apportioned. This study is directed toward coordinated multiple-purpose planning and development. The technical scope of the study involves evaluation of all known factors pertinent to the utilization of the water and land resources. A detailed physical description of the basin is given along with a comprehensive outline of the organizational direction of the study. 23 tasks, covering all possible aspects, from water quality to financial feasibility, are discussed and the work outlines for each given. The coordination of activities of all of the agencies participating in the cooperative study is shown through a stated organizational diagram. (Gargola-Chicago).
W69-02854

OPPORTUNITIES FOR REGIONAL RESEARCH ON WATER RESOURCES PROBLEMS.
Iowa Univ., Iowa City. Agricultural Law Center.
D. T. Massey, and G. D. Rose.
Opportunities for regional research on water resources problems (Sept 1968) 141 p, 175 ref.

Descriptors: *Interstate commissions, *Research + development, *Water resources development, *Regional analysis, Geographical regions, Information retrieval, Data storage and retrieval, Interbasin transfers, Interstate compacts, Long term planning, Multi-purpose projects, Resources allocation, Indirect benefits, Project feasibility, Project planning, Economics, Legal aspects, Regions, Water conservation, Area development.
Identifiers: *North central region.

This report is a compilation and an analysis of several papers presented at a seminar sponsored jointly by the Water Resources Research Subcommittee, North Central Land Tenure Committee, and the North Central Region Research. Project NC-57, March 26-27, 1968. The purpose of the seminar was to analyze the whole area of regional water research projects, to assess viable opportunities for regional research on water resources in the north central states, to furnish a basis for improvement of regional water research, and to lay a foundation for a long term program of regional research on water. Some of the papers presented analyzed the character and structure of regional research projects, stressing, as a necessary condition, research for the purpose of filling information gaps not indigenous to a single state. Other papers concentrated on the promulgation of new projects and directions for regional water research projects. The impact of water research on other fields was explored and, in particular, the influence on the economic development of areas within the region. A paper was also presented which explained data and information retrieval systems adaptable to water resources. (Sisserson-Fla)
W69-02872

IVANHOE IRRIGATION DIST V MCCRACKEN.
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-02896

NEW TRENDS IN MANAGEMENT OF WATER RESOURCES PROJECTS,
Bureau of Reclamation, Denver, Colo.
B. P. Bellport.
Eighth Reg Conf Water Resour Develop Econ Comm Asis Far East, Bangkok, Thailand, Nov 1968. 49 p, 26 ref.

Descriptors: *Water management (Applied), Water resources, Current meters, Agriculture, Irrigation, Operation and maintenance, Irrigation practices, Irrigation efficiency, Water measurement, Water quality, Conveyances, Dam failure, Drainage, Laser, Flow measurement, Foreign countries, Bibliographies, Water utilization, Flowmeters.
Identifiers: Bureau of Reclamation, Economic Commission for Asia, Acoustic method, Dilution method.

New trends in several major aspects of management of water resources developed projects and their significance to ECAFE countries are discussed. Operation and maintenance of water resources projects for irrigated agriculture are emphasized. ECAFE's review of water resources development in the ECAFE region from 1953-1963 stressed opportunities for greater agricultural production through improved managerial techniques. Several elements of management emphasized in the review and their possible impact on water resources development in the ECAFE region are considered. In particular, the paper discusses new trends in use of water on irrigation projects, water measurement, evaluation of quality of water in irrigation development, conveyance of water, and new developments in safety of dams. Also summarized are progress in drainage and several new trends in research influencing management of water resources developments. Although the discussions reflect Bureau of Reclamation progress in operation and maintenance of its water resources projects, the intent of this paper is to highlight those innovations that will be of particular interest and value to ECAFE countries. (USBR)
W69-02944

THE NATION'S WATER RESOURCES SUMMARY REPORT.
Water Resources Council, Washington, D. C.

First Nat Assessment Water Resour Counc, Washington, D. C., 1968. 32 p, 21 fig, 2 tab.

Descriptors: *Water resources, Water Resources Planning Act, Water utilization, Land resources, River basins, Water management (Applied), Watershed management, Consumptive use, Water transfer, International compacts, Drainage basins, Salinity, Sediments, Flood damage, United States, Soil erosion, Bank erosion, Wetlands.
Identifiers: Reports, Federal-state cooperation, Groundwater depletion.

Existing and future water management problems in the 20 geographical regions of the United States are summarized in a rating chart showing relative severity of 10 common problems. These problems include: adequacy of average natural runoff; ground-water storage depletion; water quality (wastes, heat, salinity, and sediment); flood damages; watershed lands; beach, shore, and riverbank erosion; and wetlands. The estimated average annual fresh water supply in each region is compared with current and projected annual withdrawal and consumptive uses. Because of the present nd projected inadequacy over the next 50 yr of available water supplies in several regions, alternative means of alleviating such water shortages should be identified and considered. Any study of such alternative means should include: consideration of transfer of water between basins, interstate and international terms and conditions of such possible transfers, protection of areas of origin, economic alternatives available to areas of need, and the national interest of areas of origin and need. (USBR)
W69-02953

MODERN MANAGEMENT TECHNIQUES,
Royal Inst. of Public Administration, London (England). Staffordshire Potteries Water Board.
F. L. Ardern, and N. J. Kavanagh.
J Inst Water Eng, Vol 22, No 6, pp 415-465, Aug 1968. 51 p, 5 fig, 7 tab, 10 ref, disc.

Descriptors: Management, Decision making, Organizations, Labor, Human behavior, Psychology, Motivation, Reviews, Behavior (Psychology), Labor unions, Wages, Leadership, Environment, Communication, Standards, Work, Mathematical analysis, Analysis, *Personnel management, Methodology, Benefit-cost ratios, Measurement, Economics, Multiple purpose.
Identifiers: Management engineering, *Water resources management, Managerial skills, Problem solving.

Water resources management can benefit from quantitative techniques developed as management tools and now used in industry. These include work studies and incentives in personnel management, economic-engineering models to aid decisionmaking, and benefit-cost analyses in capital budgeting. Management can improve employees' will to work by proper motivation based on psychological needs; such a system must give management increased productivity and reduced costs and employees more money or satisfaction. Work measurement, incentive bonuses, labor union help to smooth grievances, and team approach to work will yield net financial benefits. To improve his decisions, the manager can use economic-engineering models, treating human and technological variables in the same logical framework. This quantitative model forms a system of equations and inequalities, defining the organization objectives in terms of decisionmaking variables, expressed as a mathematical function. The manager must choose the activity level (given certain constraints) at which costs will be minimum and profits/benefits maximum. Capital budgeting balances the present value against future benefits to assure that future capital goods are worth present consumption sacrifices. (USBR)
W69-02954

STATE WATER PLANNING: GOALS AND ANALYTICAL APPROACHES,
Utah Agricultural Experiment Station, Logan.
Delworth B. Gardner.
Utah Agr. Exp. Stat., Utah State Univ. Bulletin 463, Nov 1966, pp 1-38. 39 p, 6 fig, 33 ref.

Descriptors: *Water demand, *Economic efficiency, Input-output analysis, Recreation demand.
Identifiers: Economics, *Project planning.

The goals and approaches for state water planning and resource development are focused on Utah's policies and problems and to the entire Western United States. Goals in relation to water law, water legislation, and public welfare are discussed. Second, the criteria for determining economic efficiency are given. Efficiency of water allocation is achieved when water is allocated between alternative uses and users in such a way as to maximize the total production of goods and services. The selection of empirical techniques is discussed. The third section discusses the productivity of water in household use, in agriculture, in industry, and in recreation. (Grossman-Rutgers)
W69-02963

WATER RESOURCES AND ECONOMIC DEVELOPMENT: THE CHALLENGE TO KNOWLEDGE,
Council of State Governments; and the Southern Land Economic Research Committee.
S. V. Ciriacy-Wantrup.
Water Resources and Economic Development in the South, Agr. Policy Inst., North Carolina State University, August 1965, pp 1-10. 10 p, 12 ref.

Descriptors: River basin development, *Social needs, *Management, *Resources.
Identifiers: Economics, *Water policy.

One aspect of water policy is the impact of public investment in water resources on the regional and national economies. The term water policy refers to action of governments at various levels and in various branches affecting the development, allocation, and quality of water resources. In the United States, water is largely developed, allocated, and polluted through decentralized decision making of self-supplying farms, industrial corporations, and non-profit organizations. Therefore, water policy is concerned with the laws, regulations, and administrative structures under which these self-supplying firms make their decisions. Water policy should help to optimize social welfare. (Grossman-Rutgers)
W69-02964

CONTROL LEVELS FOR QUANTITATIVE EVALUATION OF WEATHER MODIFICATION ATTAINMENTS,
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 02A.
For abstract, see .
W69-03113

THE OPPORTUNITY COSTS OF PUBLIC INVESTMENT: COMMENT,
Massachusetts Inst. of Tech., Cambridge.
Peter Diamond.
Quart Jour Econ, Vol LXXXII, No 4, pp 683-688, November 1968, 7 p.

Descriptors: *Taxes, Benefits, *Consumptive use.
Identifiers: *Social rate of discount, Shadow price, *Social utility function, *Public investment, Government production.

In considering rules for public investment to maximize a social welfare function, Marglin has argued for calculations based on a discount rate reflecting the social rate of discount combined with a shadow price of capital. Marglin first presented a simple model and then introduced various complications which did not interfere with its validity. Diamond's approach is the reverse, he starts with a very general model and introduces assumptions which lead to the same conclusion. This approach places in perspective the assumptions leading to the conclusion, for these assumptions appear to the author to be too restrictive to be employed as a basis for policy. The argument is completed with a look at the impact of government taxes and benefits on a consumer with a life-cycle consumption function in a world of perfect foresight. This is shown to create a significant restriction to the assumption that savings depend solely on income, and this, therefore, seems an inappropriate assumption to employ, since the impact of government benefits on private investment is one of the key variables in this problem. (Sokoloff-Rutgers)
W69-03125

BENEFIT-COST ANALYSIS AND THE NATIONAL OCEANOGRAPHIC PROGRAM,
Washington Univ., Seattle; Clark Univ., Worcester, Mass.; and Victoria Univ., Toronto (Ontario).
James A. Crutchfield, Robert W. Kates, and W. R. Derrick Sewell.
Natural Resources Journal, Vol 7, No 3, pp 361-375, July 1967. 15 p.

Descriptors: *Cost-benefit analysis, *Commercial fishing, Benefits, Alternative costs, National income, *Oceanography, Research and development, *Sewage disposal, *Weather forecasting.
Identifiers: Mineral production, *Outdoor recreation, Market prices.

The basic problems of establishing the appropriate level of oceanographic research and its proper allocation among constituent elements of the program will not be resolved by benefit-cost analysis as undertaken in the 1964 National Academy of Sciences study. This area remains one of many in which the economic evaluation of the end products of research and development expenditures cannot yet be done with precision comparable to that achieved in other types of water development. Yet the very process of forcing the agencies concerned to isolate and examine the outputs and associated costs resulting from their activities may lead to an internal reordering of programs in the direction of greater efficiency. Some improvement can be realized immediately but only if the benefit-cost criteria are applied correctly and consistently. (Sokoloff-Rutgers)
W69-03126

PROBLEMS OF BIAS IN INPUT PRICING FOR BENEFIT COST ANALYSIS: A REPLY,
Federal Reserve System, Washington, D. C.
Robert M. Dunn, Jr.
Southern Econ Jour, Vol XXXIV, No 4, p 571, April 1968. 1 p.

Descriptors: Marginal productivity, Marginal income, *Cost-benefit analysis.
Identifiers: *Input pricing, Producer surplus, *Consumer surplus, *Externalities, Factor costs, Alternative uses.

Professor Solo's comment has an unusually broad definition of externalities, which includes both the usual aspects of the term and consumer surplus. Having combined consumer surplus and various 'distant and diffused' externalities in one category, Professor Solo suggests that because it is impossible to allow for all externalities, the exclusion of consumer surplus aspect of costs does not create a bias. The answer to this argument is basically one of symmetry; exclusion does create a bias because the consumer surplus aspect of the benefits is included. Since the costs of a project are the benefits that could have been derived from alternative uses of the resources, there is a theoretical comparability between items on the two sides of a benefit-cost ratio; as a minimum, therefore, the use of benefit-cost analysis would require allowance for costs which are analogous to include benefits. (Sokoloff-Rutgers)
W69-03128

THE SOCIAL RATE OF DISCOUNT AND THE OPTIMAL RATE OF INVESTMENT,
Harvard Univ., Cambridge, Mass.
Stephen A. Marglin.
Quart Jour Econ, Vol 77, No 1, pp 95-111, February 1963. 17 p.

Descriptors: Consumptive use, *Investment, *Growth rates.
Identifiers: Saving, Public decisions, Utility function, *Social welfare function, Income distribution, *Social rate of discount.

Is the social, collective calculus of saving vs consumption decisions different, or rather should it be different from the individual calculus. Two traditional affirmative answers are evaluated; (1) the authoritarian argument which asserts that individuals do not know what is good for them, and (2) the 'schizophrenia' argument which suggests that an individual acting in collective political capacity is for relevant intents a different person from the same individual acting in the unilateral context of the market. A new argument is then presented which distinguishes the social calculus of investment from the individual calculus on grounds that only the former allows interdependencies (externalities) to be adequately reflected. Market-determined rates of interest, investment and economic growth need have no normative significance, for they do not reflect the interdependence between one individual's consumption and another's utility. The optimal level of investment is the level at which the marginal productivity of investment equals the marginal social rate of discount incorporating this interdependence. (Sokoloff-Rutgers)
W69-03129

PARETO AND THE MARSHALLIAN CONSTANCY ASSUMPTION,
Texas Univ., Austin.

Gerald Higgins, and H. H. Liebhafsky.
Southern Econ Jour, Vol XXXV, No 2, pp 167-175, October 1968. 9 p.

Descriptors: Demand, Supply, Marginal utility.
Identifiers: *Fundamental Equation, *Income effect, Price elasticity, *Residual variation, *Relative price changes, Money income, Numeraire.

This paper attempts to explain and analyze Pareto's interpretation of the Marshallian constant utility of money assumption, as well as to compare Pareto's interpretation with the Hicksian interpretation which seems currently to be the most-widely accepted one. Many analysts have followed Hick's lead and failed to come to grips, in terms of Slutsky's analysis with the assumption they have discussed. It is to be emphasized that Pareto's interpretation of constancy with respect to all prices does not produce an income term equal to zero in the fundamental equation and that clarity requires the analyst to specify the variable with respect to which he supposes the marginal utility of money to be constant. (Sokoloff-Rutgers)
W69-03130

EXTERNALITY,
Virginia Univ., Charlottesville.
James M. Buchanan, and Wm. Craig Stubblebine.
Economica, New Series, Vol 29, No 116, pp 371-384, November 1962. 14 p, 2 fig.

Descriptors: Welfare, *Equilibrium.
Identifiers: Utility, *Pareto relevant, Pecuniary, *Potentially relevant, *Technological externalities, *Inframarginal externalities.

Externality is central to the neo-classical critique of market organization. Despite its importance and emphasis, the concept has not been defined rigorously and precisely. This paper attempts such a definition, and interesting implications emerge from the analysis. Specifically, distinctions are made between marginal and inframarginal external effects, between potentially relevant and irrelevant external effects, and between Pareto-relevant and Pareto-irrelevant external effects. The orthodox usage of the term 'externality' is shown to apply only to the Pareto-relevant classification. The analysis demonstrates that external effects may remain even when the necessary conditions for Pareto-optimality are satisfied. Several of the standard propositions stemming from the widely-accepted Pigovian treatment of external effects are shown to be misleading. (Sokoloff-Rutgers)
W69-03132

WHAT IS PRODUCER'S SURPLUS,
London School of Economics and Political Science (England).
E. J. Mishan.
The American Economic Review, Vol LVIII, No 5, pp 1269-1282, December 1968. 14 p, 2 fig, 13 ref, append.

Descriptors: Profit, Economic rent, Rent, *Welfare economics, Supply, Elasticity of supply.
Identifiers: *Producer's surplus, Consumer's surplus.

Since Marshall's coining of the term, producer's surplus has been used ambiguously in the literature: sometimes to indicate rent or quasi-rent to a factor, sometimes to indicate profits to an industry. Therefore, this paper suggests that the term producer's surplus be struck from the economist's vocabulary. We already have definitions of profits and rents. No new concept is introduced by producer's surplus. Moreover, the familiar measurement of producer's surplus as the area between the supply curve and the price may be taken as a measure of rent only in cases where one factor is inelastic in supply and all other factors are perfectly elastic in supply and fixed in price. In the common example of an upward-sloping supply curve that is the result of variation in the prices of two or more factors which are inelastic in supply, the area in question does not measure rent to any one or all of the factors and it does not measure profits to the industry. (Winn-Rutgers)
W69-03133

RECREATIONAL USE OF MUNICIPAL RESERVOIRS,
Cornell Univ., Ithaca, N. Y.; and Michigan State Univ., East Lansing.
Lawrence S. Hamilton, and Emmanuel T. Van Nierop.
Proceedings of the Third Annual American Water Resources Conference (American Water Resources Assn; Urbana, Ill), c 1967, pp 443-455. 13 p, 3 photo, 23 ref.

Descriptors: *Recreation, Public health, Reservoirs, *Reservoir management, Water management, Costs, Legal aspects, Administration.
Identifiers: *Municipal reservoirs, Entrance fees.

The American Water Works Association now recognizes the inevitability of some degree of recreational use of certain kinds of reservoirs. In deciding whether or not to admit the recreating public to their water supply areas, municipalities should consider cleaning their water fronts and developing new impoundments in which recreation can occupy an exclusive or prominent place. Each situation should be examined independently with regard to the nature and scope of recreation services needed, the intensity of use anticipated, and closeness to urban communities. There are also legal and economic considerations and the authors favor the retention of recreation supervision by the water supply utility. (Winn-Rutgers)
W69-03136

MATHEMATICAL MODELS FOR EXPRESSING THE BIOCHEMICAL OXYGEN DEMAND IN WATER QUALITY STUDIES,
Iowa State Univ., Ames.
For primary bibliographic entry see Field 05G.
For abstract, see .
W69-03138

LOCAL PARTICIPATION AND WATERSHED DEVELOPMENT: A COMPARATIVE STUDY OF TWO COMMUNITIES,
Mississippi State Univ., State College.
Satadal Dasgupta, and Kenneth P. Wilkinson.
Proceedings of the Third Annual American Water Resources Conference (American Water Resources Assn; Urbana, Ill), c 1967, pp 396-404. 9 p, 1 tab.

Descriptors: Social aspects, *Social participation, Water resources development, Attitudes, Motivation, Government, State governments.
Identifiers: Soil Conservation Service, Interactional theory approach.

The main objective of this study was to examine the relationship between participation of local residents and success of watershed development programs. The authors concluded that watershed development projects differ from many other kinds of community projects in (1) the level of technical expertise required for planning and implementation and (2) the degree to which authority for all phases of the project is formally invested in an extra-local agency. Commitment on the part of this agency to involve local citizens and to gear the program to needs felt locally may entail certain risks from a technical standpoint, but may be required from a sociological standpoint if successful implementation of the project is to be assured. (Winn-Rutgers)
W69-03139

CONSUMER RESPONSES TO PRICES OF RESIDENTIAL WATER,
Georgia Univ., Athens.
Ronald M. North.
Proceedings of the Third Annual American Water Resources Conference (American Water Resources Assn; Urbana, Ill), c 1967, pp 651-663. 13 p, 5 tab, 1 fig, 5 ref.

Descriptors: Water demand, Demand, Water utilization, Water allocation, Water distribution, *Pricing, Water rates, Elasticity of demand, Income, Prices.
Identifiers: Income elasticity, Price elasticity, *Consumer response.

Consumers do adjust their domestic water use levels for differences in income levels and for higher or lower prices whenever the variable prices and minimum charges are such that the consumers have a choice of how much water to use. Because of the inelastic demand for water, there is a great opportunity to reduce residential water use through increased prices without reducing total revenue to the utility. Knowledge of the consumer's behavior in the water market should be a useful tool for more accurate water system planning as well as for increased economic efficiency and better distributional effects within each water supply area. (Winn-Rutgers)
W69-03140

THE INCOME REDISTRIBUTION EFFECTS OF RESERVOIR CONSTRUCTION IN APPALACHIA,
Kentucky Univ., Lexington.
L. Douglas James.
Proceedings of the Third Annual American Water Resources Conference (American Water Resources Assn; Urbana, Ill), c 1967, pp 641-50. 10 p, 3 tab, 14 ref.

Descriptors: Value, Income, Reservoirs, Appalachian Mountain Region, Kentucky, Social value, Welfare (Economics), *Economic efficiency, Benefits, Costs, Flood control, Recreation.
Identifiers: *Income redistribution, Dewey Reservoir, Equimarginal sacrifice, Utility analysis.

On the basis of empirical data collected for Dewey Reservoir site construction was found to redistribute income from high to low income groups. Recreation as a project purpose was more effective in achieving this redistribution than flood control. Flood control benefits were found to be relatively greatest for the middle income group. The lower income groups own less damageable real property. The upper income groups pay such a large share of the taxes that the larger share of the flood benefits they realize by owning more property is more than offset. Recreation benefits were relatively greatest for the lowest income group. As income increases, the share of taxes paid increases more rapidly than recreation visitation. (Winn-Rutgers)
W69-03142

PROJECTION OF AGRICULTURAL WATER AND LAND USE FOR LONG RANGE WATER RESOURCES IN TEXAS,
Texas A and M Univ., College Station.
For primary bibliographic entry see Field 03F.
For abstract, see .
W69-03144

OPTIMIZATION AND RANGE OF APPLICATION OF NUCLEAR REACTORS AND FLASH EVAPORATORS FOR SEA WATER DESALINATION,
Technion-Israel Inst. of Tech., Haifa.
For primary bibliographic entry see Field 03A.
For abstract, see .
W69-03147

OPTIMAL WASTE TREATMENT AND POLLUTION ABATEMENT BENEFITS ON A CLOSED RIVER SYSTEM,
Toronto Univ., Ontario.
For primary bibliographic entry see Field 05D.
For abstract, see .
W69-03150

COMPUTER SIMULATION MODELS FOR RIVER-BASIN ANALYSIS AND PLANNING,
Battelle Memorial Inst., Columbus, Ohio.
Henry R. Hamilton.
Battelle Memorial Institute Reprint, 1968. 18 p, 3 fig, 1 tab, 3 ref.

Descriptors: *Simulation analysis, River basins, Computer models, *Decision making, *River basin development, Planning, *Regional analysis, Human population, Economic prediction, Water policy, Water resources development, Water quality, Water demand, Systems analysis, Recreation, Employment, Dissolved oxygen.
Identifiers: *Susquehanna River Basin, *Feedback relationship, Demographic sector, Critical point concept.

A simulation model of the Susquehanna River Basin was constructed and the results and conclusions from the study were discussed in order to show the advantages of a simulation approach to complex system modelling with feedback characteristics. The model was comprised of three major sectors, the demographic (or population change) sector, the economic activity sector and the water sector. The sectors were interlinked, with changes in economic activity affecting population migration, and both affecting water quality and quantity, which could in turn affect economic activity. These feedback relationships were discussed and diagrammed. The water sector specified the water demand, quality (DO), pollutant discharge amounts, and flow levels at critical points. Results of the Susquehanna study were shown. It was concluded that simulation models should be flexible in order to study policy alternatives, and redirect efforts in discovered critical areas. (Gysi-Cornell)
W69-03153

OPTIMIZATION BY DYNAMIC PROGRAMMING OF HYDROELECTRIC PLANT OPERATION REGIME DURING INITIAL FILLING PERIOD OF MULTIANNUAL REGULATION RESERVOIR,
For primary bibliographic entry see Field 06A.
For abstract, see .
W69-03155

THE INTERINDUSTRY WATER CONTENT MATRIX: APPLICATIONS ON A MULTIREGIONAL BASIS,
California Univ., Berkeley.
For primary bibliographic entry see Field 06A.
For abstract, see .
W69-03157

WATER QUALITY ANALYSIS OF THE DELAWARE RIVER ESTUARY,
Manhattan Coll., Bronx, N. Y.; and Hydroscience, Inc., Leonia, N. J.
For primary bibliographic entry see Field 06A.
For abstract, see .
W69-03158

DESIGN OF OPTIMAL WATER DISTRIBUTION SYSTEMS,
Technion - Israel Inst. of Tech., Haifa.
David Karmeli, Y. Gadish, and S. Meyers.
Proc Amer Soc Civil Eng, Vol 94, No PL1, pp 1-10, Oct 1968. 10 p, 2 fig, 3 tab, 2 ref, 2 append.

Descriptors: *Water distribution (Applied), *Linear programming, *Optimization, Hydraulic gradient, Network design, Pressure, Digital computers.

A linear programming solution was presented for the problem of selecting optimal pipe diameters and heads for a water distribution network. The water discharge and pressure requirements at all points in the system were assumed to be known and constant, and the network configuration was assumed given. The objective was to find the minimum capital and annual costs for the system. A numerical example was presented. The method was only suitable for branched networks (i.e. systems without loops). The problem was solved by use of a digital computer. (Gysi-Cornell)
W69-03165

RESEARCH ON COMPREHENSIVE PLANNING OF WATER-RESOURCE SYSTEMS SYMPOSIUM,
North Carolina Univ., Chapel Hill.
Maynard M. Hufschmidt.
Natural Resources Journal, Vol 5, No 2, pp 223-235, October 1965. 13 p.

Descriptors: Federal project policy, *Water resources development, Research and development, *Design criteria, Alternative costs, Regional analysis, Economic prediction, Analytical techniques, Optimization.
Identifiers: *Harvard Water Program, Comprehensive planning, Design objectives.

Water resource research is classified according to one of the processes used by man to control and adapt water resources: comprehensive water resource planning or water-resource system design. The paper discusses research needed and research in water-resource system design in progress at Harvard. Research needs are related to three steps of the planning process: establishing the objectives of design; translating objectives into design criteria; and designing the system. Problems in establishing objectives of design include the development of workable criteria by government and the competing objectives of different levels of government. Topics discussed under translating objectives into design criteria include standards and criteria of the political process, the role of benefits in plan formulation, definition of the planning region and the scope of planning. The system design includes the full range of studies and analyses involved in regional plan preparation: techniques for regional economic projections; derivation of water-resource benefit functions; deriving the technological function; preliminary screening techniques for system design; techniques for studies leading to optimization; and the process as a whole, e.g., selection of test areas and evaluation of case studies. (Abodeely-Chicago)
W69-03166

SOME PHYSICAL, TECHNOLOGICAL, AND ECONOMIC CHARACTERISTICS OF WATER AND WATER RESOURCE SYSTEMS: IMPLICATIONS FOR ADMINISTRATION,
New Mexico Univ., Albuquerque. Dept. of Civil Engineering.
Blair T. Bower.
Natural Resources Journal, Vol. 3, No. 2, pp 215-238, October, 1963, 24 p, 6 fig.

Descriptors: *Administrative agencies, Non-structural alternatives, Input-output analysis, Economies of scale, Surface water, Ground water, Water quality, *Water resources development, Areal profiles, Water supply, Water demand, Reservoirs.
Identifiers: *Water resources system, Alternative plans.

In the future water resources administration will be more concerned with the use of developed supplies than the development of new supplies. Water resources administration is defined as a collectivity of functions which may be grouped as follows: making the investment decision; constructing structural facilities and organizing nonstructural measures and operating the system. A water resource system is defined as a configuration of structural and non-structural measures and procedures which transforms water into outputs of products and services. The physical nature of the inputs and outputs of the production process, and the technology available, set limits on the organizational structure for water resource administration. The study of water resource systems suggest an administrative agency with the following characteristics: is unitary; has jurisdiction over the quantity and quality of surface and ground water; is regional; is flexible over time with respect to areal jurisdiction and outputs provided; is integrated and large enough for economies of scale; has responsibility for the range of outputs; is required to consider a range of alternatives; and is responsible for planning, design, and operation. (Abodeely-Chicago)
W69-03167

WATER RESOURCE MANAGEMENT IN MT. PROSPECT: A SURVEY OF THE ENVIRONMENT, PROBLEMS, AND OPPORTUNITIES,
Sheaffer (John R.) and Associates, Wheaton, Ill.
John R. Sheaffer, Emil Oelberg, and James E. Hackett.
Wheaton, Ill., December 1968, 30 p, 9 fig, 1 tab, 2 ref.

Descriptors: Flood plain zoning, Detention reservoirs, Multiple-purpose reservoirs, Consumptive use, Flood forecasting, Non-structural alternatives, *Regional analysis, Administrative agency, Aquifers, *Urbanization.
Identifiers: Mt. Prospect (Ill), Northeastern Illinois region.

A series of chronic water problems which included sewer back-up, flooding, pollution in the channels and falling water levels in the municipal wells reached serious proportions in a heavy storm in June 1967. A Drainage and Clean Streams Commission was organized to correct the problems and to examine the water resource opportunities available to Mt. Prospect. An analysis of the physical setting reveals a tendency to avoid using the shallow aquifer with the resultant underdevelopment of the ground water source in the region. Urbanization has altered to a large degree the physical environment in the Mt. Prospect area. The most significant effects of urbanization has been caused by the sewerage and drainage system and development in flood prone areas. The study proposes a comprehensive program of water resource management based upon structural and non-structural alternatives and compatible with programs of ongoing municipalities and regional agencies. Recommendations include: (1) flood plain management; (2) water use management; (3) flood water storage; (4) construction of a multi-purpose lake as detention reservoirs and recreational and esthetic purposes; and (5) an increase in the flow potential of Weller Creek, on of Mt. Prospects' natural drainage outlets. (Starr-Chicago)
W69-03168

ROOKERY BAY AREA PROJECT: A DEMONSTRATION STUDY IN CONSERVATION AND DEVELOPMENT, NAPLES, FLORIDA.
Conservation Foundation, Washington, D. C.

Washington: Conservation Foundation, 1968, 61 p, 11 photo, 4 tab, 5 illus.

Descriptors: *Land use, Topography, Administrative agency, Channels, Water pollution control, Recreation demand, Fish management, *Multiple-purpose projects, Water resources development, *Project planning.
Identifiers: Centralization, Ecological balance, Naples (Florida), Rookery Bay (Florida).

Development pressures in the area between Naples and Marco Island, Florida are increasing enough to warrant concern over the possibility of losing some of the area's natural values and damaging the quality of the environment. Achieving the dual objectives of profitable development and protection of the natural resources will require coordination of both the public and private sectors. Five recommendations are made: (1) Creation of a single coordinating development mechanism; (2) Development of a plan that will include a water pollution control program and a system of navigable waterways; (3) Development of a land use plan that will provide for a variety of uses; (4) Innovation in planning and design techniques to include such practices as cluster and open space communi-

ty development; and, (5) Setting aside appropriate areas for recreational and resort use that would utilize the area's natural resources and topography. (Starr-Chicago)
W69-03169

WATER RESOURCES MANAGEMENT IN MARYLAND.
Maryland Dept. of Water Resources, Annapolis.

Maryland Univ: Water Resources Study Committee, August, 1967, 87 p, 7 fig, 3 tab, 75 ref, 4 append.

Descriptors: *Administrative agencies, Flood plain, Pollution abatement, Reservoir sites, *Water resources development, Water quality, Information retrieval, Education, Water rights, Legal aspects, Maryland.
Identifiers: Environmental quality.

The report is concerned with clarifying the role and identifying the responsibilities of the newly designated Maryland Water Resources Department. Recommendations of the report include a statement of state policy and a plan for water resource development, a computerized data system, pollution control and regulation of flood plains and reservoir sites, regulations of non-domestic water use, the establishment of specific posts and facilities, and the execution of various other suggestions for educational programs procedures, and internal staffing. The role of the State--present and future--is presented as a philosophy of state control of the development and management of water recources. Excellence in water resources management is cited as the key to environmental quality in the State. Problems of growth and program management and some opportunities in public awareness and scientific and governmental capabilities are identified. Water rights developed through court decisions as part of Common Law and some of their limitations are reviewed. Responsibilities of a State Department of Water Resources are outlined and discussed. (Abodeely-Chicago)
W69-03170

MARYLAND'S ROLE IN WATER RESOURCES DEVELOPMENT.
Maryland Univ., College Park. Water Resources Study Committee.

Maryland Univ: Water Resources Study Committee, February 1967, 85 p, 1 fig, 26 ref, 2 append.

Descriptors: State jurisdiction, Administrative agencies, *Population growth rates, *Water demand, Withdrawal, Reservoirs, Dams, *Water resource development, Interstate compacts, Research and development, Potential aspects, Federal budgets, Sewerage facilities, Maryland.
Identifiers: METRO MARYLAND, Interstate waters.

The emerging water problems in Maryland can be understood in terms of two factors: the need for government involvement in water resources and changing patterns of relations among various levels of government in local development. The water situation in Maryland is assessed in light of problems relevant to new or redirected programs. The main problem of water in relation to development is one of population concentrations rather than absolute shortage. Metro-Maryland and three non-metropolitan regions -- Southern Maryland, Eastern Shore, and Western Maryland -- are identified and characterized with respect to water problems. Three general types of responsibility in water use and development are suggested: (1) to prosecute Maryland's interest in interstate waters; (2) to assure optimal use and development of natural waters under its jurisdiction; (3) to assure efficiency in the provision of water and sewerage service in the overlapping metropolitan areas. Ten 'next steps' suggested to fulfill the three responsibilities are documented. (Abodeely-Chicago)
W69-03171

WATER RESOURCES: A REPORT TO THE COMMITTEE ON NATURAL RESOURCES OF THE NATIONAL ACADEMY OF SCIENCES - NATIONAL RESEARCH COUNCIL,
National Academy of Sciences-National Research Council, Wash., D. C., Committee on Natural Resources.
Abel Wolman.
Washington: National Academy of Sciences - National Research Council Pub. 1000-B, 1962, 35 pp, 1 fig, 1 tab.

Descriptors: *Research and development, Use, Water allocation, Water supply, Water demand, Withdrawal, Data, Storage and retrieval, Evapotranspiration, Humid areas, Semi-arid climates.
Identifiers: Interdisciplinary training.

The purpose of the report is to identify some significant problems in the water resource field and indicate some areas of scientific research needed as a basis for beter planning and policy formulation. The hydrologic cycle is described and some aspects of water resource requirements in the United States are discussed. Research needs in the area of resource management and water resource development are identified. Suggested areas of research are cited as those directed to problems of improved and more productive water-resource devolopment and use in arid and semi-arid basins, in humid basins, and all areas, and longer range and more specific research areas with potentially large payoffs. Examples of recommended research are presented for each category. Areas for multidisciplinary investigation, with suggested priorities, are outlined. Summary conclusions list the following areas of research for urgent consideration: interdisciplinary training of personnel; research relevant to ground water supplies; research in systems for development of water resources; research with regard to evaporation suppression and transpiration control; and research aimed at developing water-purification methods and forecasting the effects of pollution damage. (Abodeely-Chicago)
W69-03172

WATER RESOURCES STUDY, COMPREHENSIVE PLANNING PROGRAM, JEFFERSON COUNTY.
Jefferson County Regional Planning Commission, Steubenville, Ohio.

Steubenville, Ohio, September 1968, 47 p, 2 fig, 13 tab, 2 append.

Descriptors: Ohio River, Industrial wastes, Land development, Flood control, *Water demand, Water quality, *Water resources development, Water pollution, Organic wastes, Sewage treatment.
Identifiers: Jefferson County (Ohio), Water quality criteria.

The Ohio River provides the major mode of transportation of raw materials and products to and from the region, and it is still the only source of water for the two largest cities in the county. Industrial, residential, and commercial development along the river has been related to the water resource. A combination of factors has created conditions of blight along the waterfront which should be addressed. Sources of water available to Jefferson County are discussed: the Ohio River, its tributaries, and alluvial deposits. Demand in the three-county region is based mainly on domestic, commercial and public use. Other uses are for recreation, waterborne commerce, and waste disposal. Water pollution control is handled by several governmental jurisdictions from a state to a federal level. Flood control structures along the Ohio River protect against all but major floods of rare occurrence. An inventory of surface and ground waters in Jefferson County is presented in text and tables. Factors affecting surface and ground water quality in the county are cited, and water quality in the county is appraised. A final section relates water resources to land development. (Abodeely-Chicago)
W69-03174

SIMULATION OF REGIONAL ECONOMIC IMPACTS OF WATER RESOURCE DEVELOPMENT,
Duke Univ., Durham, N. C. Dept. of Economics.
John C. Meadows, and Thomas H. Naylor.
Report No. 16, Water Resources Research Institute of the University of North Carolina, Jan 1969. 16 p, 2 fig, 34 ref. OWRR Project A-024-NC.

Descriptors: *Economic impact, Input-output analysis, *Simulation analysis, *Water resources development, Water yield.
Identifiers: Economic base studies, Dynamic computer simulation models.

This report summarizes the results of a project concerned with evaluating the impact of water and timber availability on regional economic development in the Southeast. Several alternative techniques are considered for accomplishing this objective including input-output models, economic base studies, and dynamic computer simulation models. These techniques are compared and critically evaluated in the light of the goals of this study. The impact of water availability on regional economic growth in the Southeast was found to be indirect, and it was demonstrated that water is such a small fraction of total industrial production costs that it is unlikely to be critical in plant location decisions. The authors recommended that policymakers should consider more carefully the trade-offs between land use for timber production and land use for water production.
W69-03176

ARKANSAS WATER RESOURCES: SUPPLY, USE, AND RESEARCH NEEDS,
Arkansas Univ., Fayetteville. Dept. of Economics.
Jared Sparks.
Arkansas Water Resources Research Center. Research Project Technical Completion Report, December 1966. 100 p, 10 tab, 15 fig. OWRR Project A-006-Ark.

Descriptors: *Research and development, Multiple purpose reservoirs, *Water supplies, Chemicals, Sediments, *Water pollution, Flood, *Surface water, *Ground water, *Water utilization, Water balance, *Economics, *Water management, *Hydrologic data, Groundwater recharge, Limnology.

The purpose of this study is to identify Arkansas' water resources research needs against an economic backdrop of water supply and use conditions existing in the state. In the aggregate Arkansas has an abundance of high quality water relative to present use. There are local conditions that give rise to water problems, but, in general, critical water problems in Arkansas are emergent and potential rather than actual. The causes of these problems are to be found, in large part, in the economic, legal, and social institutions surrounding water use--and particularly in the economic institutions. Research designed to improve economic efficiency criteria and to develop methods of applying such criteria to water resources planning, to water resources allocation, and to quality of water control would do much to mitigate the problems of water management in the future. Research of this nature requires considerably more water data concerning supply, use, and costs associated with water use than are now available. Other promising areas of research include basic research on the nature of water and the water cycle, and applied research in areas of flood control, artificial recharge, the measurement of pollution damage and costs, the identification and treatment of pollution, the limnology of artificial lakes, and the role of water resources in industry location.
W69-03199

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

APPROPRIATIONS FOR CONSTRUCTION OF WATER AND SEWER LINES.
N C Gen Stat sec 153-11.2 (1964).

Descriptors: *North Carolina, *Legislation, Cities, Taxes, *Conduits, Pipes, Sewerage, Sewers, *Public health, Mills, Industries, Industrial plants, Legal aspects.

The board of county commissioners in any county in North Carolina is authorized and empowered to appropriate, make available, and spend, from any surplus funds or any funds not derived from tax sources which are available to the board, or amount which, in the discretion of the board, is to be used for the purpose of building water and sewer lines from the corporate limits of any municipality in the county to communities or locations outside the city. These water lines shall be built and constructed for the general public health for promotion of public health in communities and locations in the State where large groups of employees live in and around factories and mills, and for industrial development. (Watson-Fla)
W69-02894

THE ECONOMIST'S ROLE IN WATER PRICING POLICY,
California Univ., Davis.
W. E. Johnston.
Proc Water Pricing Policy Conf, Univ California, Los Angeles, pp 28-41, Mar 1968. 14 p, 5 fig, 8 ref.

Descriptors: *Economics, *Water costs, *Policy matters, Prices, Water, Water resources development, *Pricing, Cost-benefit analysis, Indirect benefits, Water resources, Water utilization, Direct benefits, Economic feasibility, Water demand, Economic justification, Benefit-cost ratios.
Identifiers: Allocations, Price system theory.

The economist has taken a minor role in the development of water resources. He is well qualified to be a full participant along with the engineer, lawyer, auditor, political scientist, and water user, but his role has been that of a critic after the fact rather than a strong voice in actually determining water pricing policies. Economic feasibility and benefit-cost studies have called for the economist to evaluate previously selected projects for their economic merit. Few calls have been extended for economists to aid in selecting projects to meet a desired development objective. Reasons why economists have been excluded (or have excluded themselves) from exerting a strong voice in water resource development and use are discussed. Other subjects reviewed include: (1) price as an allocator, (2) cost responsive pricing, (3) water as a heterogeneous commodity, (4) short-run elasticities and long-run investments, (5) political economy, and (6) price structures of retailing agencies. (USBR)
W69-02906

A CONTRIBUTION TO THE THEORY OF THERMO-ECONOMICS,
California Univ., Los Angeles.
Robert Evans.
Water Resources Center contribution No 56, Department of Engineering, University of California, Los Angeles, August 1962. 125 p, 10 fig, 3 tab, 5 append, 26 ref.

Descriptors: Environment, Entropy, Diffusion, Sea water, *Enthalpy, Free energy.
Identifiers: Production region, *Energy cost, Steady state, Design of production plants, *Available energy function, *Thermodynamics.

A rigorous derivation is given for a new thermodynamic property herein called the 'available-energy function'. This function represents a generalization of Keenan's availability concept. However, the available-energy-function proposed is free from certain restrictions which limit the use of Keenan's availability function in thermo-economics (this term signifies the simultaneous application of thermodynamics and economics). This concept is shown to provide a unified approach to all energy cost problems. For example, it is the available-energy content of a fuel, not its energy content, which is of economic importance. Any energy cost equation takes on its simplest form when it is expressed in terms of available-energy costs. A general equation for the minimum cost of fresh-water from the sea is then given in terms of available-energy costs. The general equation was applied to specific cases in which it gave essentially the same results that have been reported by others for vapor-compression distillation, multi-stage flash-distillation, and electro-dialysis. (Sokoloff-Rutgers)
W69-03131

WATER SHORTAGES AND PRICING,
Cornell Univ., Ithaca, N. Y.
Louis Michael Falkson.
Proceedings of the Third Annual American Water Resources Conference (American Water Resources Association; Urbana, Ill), c 1967, pp 254-260. 7 p, 3 fig, 7 ref.

Descriptors: *Water allocation, *Pricing, Water shortage, Water demand, Marginal cost, Welfare (Economics), Marginal benefits, Water rates.
Identifiers: Utility analysis.

Many public water supply systems levy a flat rate service charge rather than billing their customers on the basis of the quantity of water which they consume. The loss in welfare from this practice results from the fact that the marginal value in use might not be equal for all consumers if the water system is not able to supply the entire market demand at a zero price. Various methods should be considered to increase the probability that the more urgent demands for water are satisfied. The enforcement of any rationing scheme involves some cost. A pricing mechanism is often the least expensive rationing device to insure that scarce resources are allocated to uses with the greatest value. (Winn-Rutgers)
W69-03135

DESIGN OF OPTIMAL WATER DISTRIBUTION SYSTEMS,
Technion - Israel Inst. of Tech., Haifa.
For primary bibliographic entry see Field 06B.
For abstract, see .
W69-03165

A STUDY IN THE ECONOMICS OF WATER QUALITY MANAGEMENT,
Federal Water Pollution Control Administration, Washington, D. C.
For primary bibliographic entry see Field 05G.
For abstract, see .
W69-03173

6D. Water Demand

ESTIMATED USE OF WATER IN THE UNITED STATES, 1965,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 06B.
For abstract, see .
W69-02840

POPULATION GROWTH AND THE DEMAND FOR WATER,
Council of State Governments; and Southern Land Economic Research Committee.
Clarence M. Conway.
Water Resources and Economic Development in the South, Agr. Policy Inst., North Carolina State University, Aug 1965, pp 11-16, 6 p.

Descriptors: *Forecasting, Population, Water policy.
Identifiers: Economics, *Water demand.

By the year 2000 the population in the South will probably have doubled. This increase in population will not put impossible demands on the water resources of the area, except for some urban areas where population is concentrated. Water pollution is depleting our usable supplies of water. By 2000 the daily per capita demand for water is projected to be 200 to 225 gallons. Use of water for municipal, industrial, pollution abatement, navigation, wildlife preservation, and recreation purposes are also expected to increase greatly by the year 2000. The problem with which we are confronted is the efficient use of the water available. New water supplies must be opened, the use of ground water without mining must be expanded, water must be reused as many times as possible, and the polluted lakes and streams must be cleaned up. There are needs for equitable water rights legislation, enforceable water quality controls, and education of the public in the conservation and uses of water. (Grossman-Rutgers)
W69-02962

6E. Water Law and Institutions

POLITICS AND ORGANIZATION IN WATER RESOURCE ADMINISTRATION: A COMPARATIVE STUDY OF DECISIONS,
Syracuse Univ., N. Y.
Frank Munger, and Ann Houghton.
Water Resources Research, Vol. 1, No. 3, pp 337-47, Third Quarter 1965. 11 p, 1 tab, 11 ref.

Descriptors: *Decision making, *Administrative agencies, Administrative decisions, Water resource management, Local governments, State governments, Federal governments, Hydroelectric power, Single purpose projects, Political aspects, Public benefits, Flood control.
Identifiers: Private development, Corps of Engineers, Bureau of Reclamation.

The paper is concerned with the relationship between political forces and the choice between private and public administration of control of surface water flows. Using data from the USGS, patterns of control of usable storage are analyzed in 16 major river valleys and a sample of 145 reservoirs is employed to analyze the distinctions between public and private development; among the local, state, and federal levels of government, and among the particular federal development agencies involved. The study indicates that private development is associated with hydroelectric power generation and single purpose development and is favored in eastern states, and public development is replacing private development. The level of government involved is related to political context and functional purposes, with local government most active in water supply, special districts with reimbursable functions, state agencies with nonreimbursable functions, federal government with nonreimbursable functions and federal government with flood control projects. The Corps of Engineers is the main federal development agency with the Bureau of Reclamation operating only in reclamation states. (Abodeely-Chicago)
W69-02849

THE MUSKINGUM WATERSHED CONSERVANCY DISTRICT: A STUDY OF LOCAL CONTROL,
Lyle E. Craine.
Law and Contemporary Problems, Vol. 22, No. 3, 1957, pp 378-404, 16 ref, 1 map.

Descriptors: *Local governments, State governments, Water resource management, Flood control, Legislation, Legal aspects, Financing, Land use, Drainage districts, *River basin development, Institutional constraints, Interagency cooperation, Decision making.

Identifiers: Conservancy Act, Muskingum Watershed Conservancy District.

The study and appraisal of various efforts in drainage basin development are fundamental to a better understanding of the requirements for effective administration of water resources effort. The Muskingum Watershed Conservancy District (MWCD) is unique in the fact that it was one of the first instances of cooperation between the United States government and a local subdivision of a state government in such work. Certain facets of MWCD's experience are explored, in an attempt to evaluate that agency's success in planning and carrying out a land and water development program. Four problems are discussed: (1) How effective has the MWCD been in developing and maintaining a comprehensive program of land and water development in the Muskingum basin; (2) How effective has the MWCD been in maintaining local direction and control of the development program; (3) What are the forces which have played upon the MWCD in its effort to maintain a comprehensive program and to retain local direction and control of the basin's development; and (4) What does the MWCD's success and failures suggest as to the role of a small agency for drainage basin development. A description and history of the conservancy district organization is given; originally, it was aimed only at flood control. (Gargola-Chicago)
W69-02852

ROLE OF LOCAL GOVERNMENT IN WATER LAW,
Andre Saltoun.
Wisconsin Law Review, Jan. 1959, 25 pp.

Descriptors: *Legal aspects, *Local governments, Navigable waterways, Well permits, Riparian rights, Zoning, Regulation, Public utility, Water law, Municipal water supply, Water quality control, Distribution, Legislation, Jurisdiction, State governments.
Identifiers: Wisconsin law.

The extent to which local government plays a part in shaping private and public rights to use water in Wisconsin is examined. It is the opinion of the author that no study of water law is complete which does not consider the impact and effect of local governments. In an attempt to explore this problem, various roles of local governments are discussed. The local government as a public utility and its means of regulation are considered. Municipal regulation of water use by sprinkling ordinance, private well permits, restrictive service and compulsory connections are presented and the legal ramifications of these actions are explored. The second discussion concerns the role of local governments in the administration of the public trust in navigable waters. The source of the 'trust doctine' and the legal aspects of the power, authority, and regulations that accompany it are outlined. The third role is that of riparian zoning. This is the principal factor that affects water rights. By zoning riparian land, local governments can regulate the use of water, thereby limiting riparian rights. Discussed are: (1) zoning and conflicting group interests, (2) constitutional issues, (3) public vs. private interest, and (4) relevant court decisions. (Gargola-Chicago)
W69-02853

EMINENT DOMAIN - PONDS, DAMS, RESERVOIRS - PUBLIC UTILITIES.

N C Gen Stat sec 62-183 (1946).

Descriptors: *North Carolina, *Legislation, *Eminent domain, Mills, Electric powerplants, Right-of-way, Condemnation, Easements, Pipes, Powerplants, Reservoirs, Dams, Ponds, Diversion, Ditches, Conduits, Channels, Flumes, *Hydroelectric plants, Obstruction to flow, Legal aspects, Compensation.

Telegraph, telephone, electric power or lighting companies are entitled, upon making just compensation to the owner, to take such lands as may be necessary for the establishment of their reservoirs, ponds, and dams. Such companies also have the right to divert the water from such ponds or reservoirs and to conduct it, in any manner, to the point of use for the generation of power. This water must be returned to its proper channel after use. However, if the above mentioned activities interfere with any mill, power plant, or other water power facility already in operation, a court order approving the condemnation must be secured. The court order will be issued only when: (1) the electric power company is unable to agree with the owners for the purchase, and (2) the taking of such mill or water power will be greatly more to the benefit of the public than the continued present use. (Watson-Fla)
W69-02857

STATE V LANZA (EMINENT DOMAIN).
48 N J Super 362, 137 A 2d 622-632 (1957).

Descriptors: Judicial decisions, Legal aspects, *New Jersey, *Eminent domain, *Water supply, Water policy, Condemnation, Legislation, Water resources development, State governments, Administrative agencies.

The State of New Jersey sought to condemn certain lands of the plaintiff for future establishment of a water supply system pursuant to a legislative enactment. The act authorized the Commissioner of Conservation and Economic Development to acquire 'such part of the area... which in the judgment of the Commissioner is appropriate and useful.' The Constitution places limitations on the legislative power of eminent domain. The act authorizing the Commissioner to use his judgement in selecting certain lands for the future establishment of a water supply system was not an unconstitutional delegation of power. The act was sufficiently definite to serve as a constitutionally adequate guide for the Commissioner. (Molica-Fla)
W69-02860

HAMMETT V ROSENSOHN (ACTION TO DETERMINE EFFECT OF RESTRICTIONS IN DEED).
46 N J Super 527, 135 A 2d 6-14 (App Div N J 1957).

Descriptors: *New Jersey, Judicial decisions, *Scenic easements, Legal aspects, *Lake shores, Land use, Ponds, Beaches, Easements, Relative rights, *Recreation, Contracts.
Identifiers: Deeds, Restrictive covenants.

Plaintiff conveyed a portion of his land to a corporation. The parties agreed to protect their respective properties and to maintain them as country estates, with a country home and wide view of the countryside, together with a pond for recreation. They agreed to restrict the use of their properties and to establish easements (these easements being specifically set out in the deed). Defendant later acquired title to the corporation's parcel of land by deed which recited that the conveyance was subject to the earlier restrictions and agreements. Defendant wished to change the existing shore line of the pond, create a beach, and build a boathouse which was to have other recreational facilities. All these undertakings were in violation of the said agreements. In an action to determine the respective rights of the parties and the effect of the earlier agreements, the lower court upheld the restrictions. The Court ruled that they were definite, reasonable, not against public policy, capable of enforcement, and had not been waived by the plaintiff. The Court disregarded Defendant's argument that the agreements were personal between the parties to the earlier deed. The Supreme Court of New Jersey affirmed. (Wheeler-Fla)
W69-02861

CUGLAR V POWER AUTHORITY (EMINENT DOMAIN BY POWER AUTHORITY TO FORM POWER POOL).

4 A D 2d 801, 164 N Y S 2d 686-688 (Sup Ct 1957).

Descriptors: *New York, Judicial decisions, *Eminent domain, *Administrative agencies, Administrative decisions, Condemnation, Islands, Dams, Reservoirs, *Hydroelectric power, Legal aspects.

Plaintiffs sought to enjoin the Power Authority of the State of New York from initiating eminent domain proceedings against the land. This land would be transformed into an island after a proposed power pool was formed. Plaintiffs alleged that such a taking was not essential to public use in that the Power Authority intended to redevelop the property for residences, parks, and other community uses. The complaint included brochures published by the Power Authority stating this intention. On appeal from a judgment dismissing the complaint, the Supreme Court, Appellate Division, affirmed. The court recognized that even if the lands in question were leased to others, it would remain within the ownership and control of the Power Authority. It held that it was necessary for the Authority to control the land in question. The facts of the case are fully set forth in the lower court opinion, 163 N Y S 2d 902 (Sup Ct 1957) (Abstract No 1821). (Williams-Fla)
W69-02863

CONNECTICUT WATER LAW: JUDICIAL ALLOCATION OF WATER RESOURCES.
Connecticut Univ., Storrs. Inst. of Water Resources.

Connecticut Water Law: Judicial Allocation of Water Resources (1967), 215 pp, 557 ref.

Descriptors: *Connecticut, Water law, Judicial decisions, Riparian rights, Water pollution, Surface waters, Ponds, Reasonable use, Diversion, Municipal water, Relative rights, Navigable waters, Non-navigable water, Riparian waters, Navigation, Channeling, Recreation, Access routes, Cities, Improvements, Dams, Legal aspects, Public rights, Riparian land, Ground water, Usufructuary right.

This study was initiated by necessity; arising because of the absence of any recent work devoted to Connecticut Water law and the specific need that such a work be compiled by an interdisciplinary study of water resource allocation. The author studied more than two hundred court decisions in preparing the work. This method aids in the development of rules of use and ownership, and it isolates the most recurring forms of conflict within the state. Reis recognized four distinct categories of water which the courts have developed: (1) surface waters flowing in a definite channel - public; (2) surface waters flowing in a definite channel - private; (3) ground water; and, (4) diffuse surface waters. The study is divided into four parts. The first, and most extensive, is entitled 'Riparian Rights in Nonnavigable Waters.' This part discusses the nature of riparian rights, the reasonable use doctrine, some specific reasonable use controversies (such as division and detention), municipal water supply, and various aspects of pollution. Part two deals with the doctrines of public and private rights in navigable waters. Included in this part is a discussion of the development and application of rules distinguishing navigable and nonnavigable waters. Part three, on ground water, and part four, on surface water, are short, and deal with the development of law peculiar to each area. The study is a thorough examination of the water law problems of Connecticut. (Sisserson-Fla)
W69-02866

NORWALK TRUCK LINE CO V VINY (RESERVATION OF RIPARIAN RIGHTS).
137 N E 2d 713 (Ct App Ohio 1956).

Descriptors: *Ohio, Judicial decisions, Legal aspects, Riparian rights, *Riparian land.
Identifiers: Reservation of water rights.

Plaintiff's warranty deed from defendant granted full rights of egress and ingress to the property over any of the riparian and littoral rights of defendant. The giving of such rights is inconsistent with the claimed littoral rights reserved by defendant; the planned removal and leveling of land by defendant is an interference with the rights granted to plaintiff. (Molica-Fla)
W69-02867

NORWALK TRUCK LINE CO V VINY (LITTORAL RIGHTS).

137 N E 2d 706 (C P Ohio 1955).

Descriptors: Judicial decisions, *Ohio, Legal aspects, *Riparian land, Riparian rights, Lakes, Gradation.
Identifiers: Uplands.

Defendant executed a deed to plaintiffs which reserved riparian and littoral rights in the grantors. The plaintiffs sought a declaratory decree as to the littoral rights appurtenant to their upland property bordering a lake. The court held that the littoral rights are in the person having fee simple title to the land, and such rights run with the land. The reservation of the rights was not effective to defeat the littoral rights in the plaintiffs, and the defendants cannot remove land which would alter the grade elevation of the property from that existing at the time of the transfer. (Molica-Fla)
W69-02868

NAVIGATION – BUOYS, BEACONS, FLOODGATES, AND DUMPING MUD OR REFUSE.

N J Stat Ann tit 2A, Para 128-2, 128-4, 128-5 (1968) 3 p.

Descriptors: *New Jersey, *Legislation, Water law, *Navigation, Navigable waters, Boats, Ships, *Buoys, Warning systems, Floodgates, Sluices, Rivers, Channels, Canals, Water pollution, Mud, Wastes, Gravels, Rocks, Legal aspects.
Identifiers: Beacon.

Any person who moors a vessel to a buoy or beacon placed in the waters of New Jersey by any lawful authority, or willfully removes, damages, or destroys such buoy or beacon, is guilty of a misdemeanor. Likewise, any person who willfully or maliciously opens or draws up any floodgate or sluice, or does any other injury or mischief to a navigable river or canal with the intent to obstruct or prevent navigation, is guilty of a misdemeanor. Any person who deposits any mud, earth, soil, ashes, gravel, refuse, rock, or other solid substance or material into the waters of the Delaware River below the head of navigation, or into the Hudson River at any point within the state, is guilty of a misdemeanor, unless the material is deposited behind a bulkhead line or is otherwise approved by the State. (Watson-Fla)
W69-028 /0

OPPORTUNITIES FOR REGIONAL RESEARCH ON WATER RESOURCES PROBLEMS.
Iowa Univ., Iowa City. Agricultural Law Center.
For primary bibliographic entry see Field 06B.
For abstract, see .
W69-02872

STATE V BROOKS (PROOF OF ADVERSE POSSESSION TO MARSHLAND).

162 S E 2d 579-582 (N C Ct App 1968).

Descriptors: *North Carolina, Judicial decisions, *Coastal marshes, *Land tenure, Navigable waters, Legal aspects.
Identifiers: Adverse possession.

The parties stipulated that a map on record described the property subject to title dispute in this action. The question presented was the sufficiency of the evidence with respect to defendants' claim of 30 years adverse possession. Three witnesses testified to the defendants' long, open and notorious use of certain marshland for grazing livestock, fishing and gathering shellfish. Also, a dock had been constructed for commercial purposes that extended into what is now the inland waterway. The court held that evidence at trial was sufficient to support a jury verdict for defendants and that the State was not entitled to a directed verdict on the additional complaint seeking removal of objects placed in the navigable stream. (MacMillan-Fla)
W69-02873

FILLING LOW, SWAMP, AND WASTE LANDS.

N Y Village Law sec 166-b (McKinney 1966).

Descriptors: *New York, *Legislation, Water law, Cities, *Swamps, Marshes, *Landfills, Financing, Assessments, Legal aspects, Land reclamation, Local governments, Cost-benefit theory, Benefits.

The board of trustees of a village may, by ordinance, require the filling of low, swamp and waste lands within the village. If the landowner does not fill the land within the time set by the ordinance, the board of trustees will have the land filled and assess the cost against the property benefited. (Watson-Fla)
W69-02875

BAILEY V ARKANSAS GAME AND FISH COMM'N (STATE REGULATION OF GAME FISH SALES).
310 S W 2d 231-239 (Ark 1958).

Descriptors: *Arkansas, Judicial decisions, *Fish hatcheries, Sport fish, Commercial fish, Fish conservation, Administration, Non-navigable waters, Relative rights, Riparian rights, Fish management, Legal aspects, *Administrative decisions, Permits, *Regulation.
Identifiers: Constitutional law.

Plaintiff fish farmers brought this action to determine the validity of the defendant State Game and Fish Commission's regulation that forbade the sale of game fish raised along with domestic fish by plaintiffs in ponds wholly situated upon property owned by the plaintiffs. The plaintiffs also questioned the validity of a commission regulation that outlawed letting any edible portion of a game fish go to waste. The commission argued that both regulations were needed to effectively perform its duty of preserving the wildlife of the state. The Chancery Court ruled for the commission in both matters. This court, in a divided opinion, sustained the judgment with modification. The court argued that unlimited sale of privately raised game fish would work to make impossible the commission's duty to see whether or not its limits were being respected by game fishermen. Fish and fishing rights in waters entirely within private property, without means to migrate, belong to that owner; but the owner's property right is not absolute, and must yield to the state's ownership and title, held for the purpose of the regulation and preservation for public use. The commission does not, however, enjoy unlimited powers. Thus the commission may not regulate the abandonment or waste of game fish raised and taken in privately owned waters. (Blunt-Fla)
W69-02886

MCDOWELL V TRUSTEES OF THE INTERNAL IMPROVEMENT FUND (OWNERSHIP OF BEDS OF A NAVIGABLE LAKE).

90 So 2d 715-718 (Fla 1956).

Descriptors: *Florida, Judicial decisions, *Riparian rights, Dredging, Lakes, Lake beds, Navigable waters, *Ownership of beds, Legal aspects, Soils, Riparian land, Banks, Meanders, State governments, *Reclamation, Public rights.
Identifiers: Title, Sovereignty lands, Peninsula.

This is an action to enjoin the dredging of soil from a lake and to require removal of soil already dredged and used to create a peninsula. It was determined that the lake was navigable. The State holds title to lands under a navigable, meandered lake in trust for the people of the state. Owners of land bordering a navigable, meandered lake cannot acquire title to sovereignty lands under the waters of the lake by extending their land through dredging. Any lands so created are sovereignty lands. However, the refusal to grant a mandatory injuction requiring the removal of such soil was not an abuse of discretion since there was no injury to the public. (Childs-Fla)
W69-02890

STRUCK V CITY OF MIAMI (CONDEMNATION OF A RIGHT OF WAY TO A PRIVATELY OWNED LAKE).

90 So 2d 600-603 (Fla 1956).

Descriptors: *Florida, Judicial decisions, Local governments, Cities, *Condemnation, *Right of way, Eminent domain, Boating, Fishing, Lakes, Ponds, *Non-navigable waters, Legal aspects.
Identifiers: Private ownership, Public purpose.

The owner of a tract of land brought suit to enjoin a county from condemning a right of way to non-navigable lakes lying entirely within the boundaries of his property. The alleged purpose of the condemnation proceeding was to enable the public to boat and fish on the lakes. The Court held that privately owned, non-navigable lakes and ponds are not subject to any right of the public to boat or fish. A lake or pond entirely within the boundaries of a single tract of land belongs to the owner of the land. Private property can be condemned only when it will serve a public purpose and will not be permitted to encourage a trespass. The county was enjoined from further prosecuting the condemnation suit. (Childs-Fla)
W69-02891

BAKER V STATE (TEST FOR NAVIGABILITY OF WATERS).

87 So 2d 497-499 (Fla 1956).

Descriptors: *Florida, Judicial decisions, *Navigable waters, Non-navigable waters, Streams, Intermittent streams, Meanders, Water levels, Public rights, *Water law, Testing, Measurement, Competing uses, Water rights, Legal aspects.
Identifiers: *Navigable in fact, Navigable in law.

Plaintiff sued in his capacity as citizen for a declaration that he be premitted to navigate, fish, and boat on the waters of lands leased by defendants from the state. Defendants denied that the waters were navigable. The trial court held that the waters were navigable in fact. The Supreme Court reversed. The court mentioned both the federal and Florida rules relating to the navigability of waters. The federal rule is that a river is navigable in fact when it is used, or is susceptible of being used, in its natural and ordinary condition as a high-way for commerce, over which trade and travel are, or may be, conducted in the customary modes of trade and travel on water. The Florida test is that to be navigable a body of water must be permanent in character, of sufficient size, and so situated that it may be used for purposes common or useful to the public in the locality. The fact that the waters in question were meandered when the government surveys were made in 1824 does not, without more, establish navigability, especially where there is evidence tending to show that it is a small, and sometimes dry, strand. (Blunt-Fla)
W69-02892

MUNICIPAL CORPORATIONS: SEWER SYSTEMS.
For primary bibliographic entry see Field 05D.
For abstract, see .
W69-02895

IVANHOE IRRIGATION DIST V MCCRACKEN.

357 U S 275, 78 S Ct 1174-1188 (1958).

Descriptors: *Federal governments, Legislation, Judicial decisions, Water supply, *Federal reclamation law, Water reuse, Arid lands, Irrigation, Federal jurisdiction, Multiple-purpose projects, *Contracts, California, Water rights, *Water utilization, Legal aspects.
Identifiers: Constitutional law.

This case involved a dispute between landowners in California and the combined state and federal governments. The appellants, California landowners, contested the validity of certain contracts in connection with the huge Central Valley Project, a joint federal-state effort. The United States held the water rights in this area and entered contracts to furnish water to irrigation districts and a county agency for a period of 40 years. Pursuant to Sec 5 of the Reclamation Act of 1902, the contracts provided that water from the project could not be supplied to tracts in excess of 160 acres held by the same landowner. The contracts also provided for repayment of part of the project costs to the federal government. The landowners relied on a provision of federal law stating that the Reclamation Act was not to be construed as interfering with state law, and contended that the statute, as it was applied to the making of the contracts, was unconstitutional as a denial of due process and equal protection. The United States Supreme Court held that the provision relied upon by the landowners applied only to the acquisition of water rights and that Congress was the sole judge of the administration of projects it creates. The United States can not be compelled to deliver water upon conditions imposed by a state. (Williams-Fla)
W69-02896

U S V 1,000 ACRES OF LAND (CONDEMNATION FOR WATERWAY CONNECTION).

162 F Supp 219-224 (E D La 1958).

Descriptors: *United States, Federal governments, Louisiana, *Eminent domain, *Seepage, Levees, Channels, Judicial decisions, Condemnation, *Rivers and Harbors Act, Drainage districts, Taxes, Legal aspects.

The United States brought this proceeding to condemn a strip of land for an alternate wayerway connection. A commission was appointed pursuant to Federal Rule of Civil Procedure 71 A (H) to take testimony and fix the value of the property condemned. The landowners filed objectives to the commission's report. The district court held that the section of the Rivers and Harbors Appropriation Act requiring that special and direct benefits to the remainder of the lot, parcel, or tract, arising from the government improvement for which the land was taken, be considered by way of reducing the amount of compensation or damages awarded, does not violate the provision of the Fifth Amendment to the Federal Constitution that private property shall not be taken for public use without just compensation. The court also held that evidence of future seepage through the levees to be erected to contain the waterway was conjectural and entitled to no weight in determining the just compensation of the landowners. (Watson-Fla)
W69-02897

STATE V ADAMS (OWNERSHIP OF BEDS).
89 N W 2d 661-688 (Minn 1957).

Descriptors: *Minnesota, Water law, Legal aspects, *Ownership of beds, Lakes, Streams, Navigation, *Navigable waters, Federal government, Judicial decisions, State governments, State jurisdiction, Surveys.
Identifiers: *Meandering (Legal aspects).

The State of Minnesota brought an action against several landowners to determine adverse claims to the beds of a lake and a connecting stream. On appeal, the Minnesota Supreme Court held that the evidence established that neither the lake nor the stream were navigable, and therefore title was not in the state. The court stated that upon admission to the Union, the state received title to the beds of all navigable waters, but title to the beds of non-navigable waters remained in the federal government. Federal law is to be used to determine navigability, and under such law a river is navigable if, under ordinary and natural conditions, it is susceptible to use as a highway for commerce. The fact that artificial aids must be used to make the river suitable for navigation will not necessarily mean the river is non-navigable. Also, the meandering of a lake does not determine the question of navigability, since surveyors do not have the power to determine navigability. (Williams-Fla)
W69-02899

WATER-POWER COMPANIES.

Ala Code tit 10, secs 178-188 (1958).

Descriptors: *Hydroelectric power, *Alabama, *Power plants, *Condemnation, Legislation, Dams, Damsites, Right-of-way, Legal aspects, Eminent domain, Roads, Trees, State governments, Public utilities, Public rights.
Identifiers: Ferries.

Water-power corporations operating sites in excess of 1 acre, which were not acquired by condemnation, have the power to acquire by condemnation, additional lands and rights necessary for operation and expansion. This power extends to the acquisition of land for substations and transmission lines, but, in this respect, it is limited by conflicting rights of residence owners and other power corporations. Such corporations may also acquire by condemnation the right to flood ferries and roads, rights of way for power poles and construction roads, and the right to remove timber from rights of way. In addition, any dams constructed in accordance with this article are considered authorized by the Legislature. Such water-power corporations also have all the rights of public utility corporations. Any corporation exercising the rights conferred by this article is under a duty to manufacture and sell power to the public. (Kahle-Fla)
W69-02900

FLORIO V STATE (WATER SKIING NUISANCE).

119 So 2d 305-310 (2d D C A Fla 1960).

Descriptors: *Florida, Judicial decisions, Lakes, Recreation, *Reasonable use, *Riparian rights, *Water skiing.
Identifiers: *Nuisance.

Riparian lake owners sought to enjoin the operation of a water ski school by lessees of another riparian owner as a public nuisance. The court found that the complaint was sufficient and that the evidence established the maintenance of a nuisance. Water skiing is not a nuisance per se. Each riparian owner is entitled to reasonable use of the lake, however, and wherean owner's lawful use is unreasonable interfered with, he is entitled to injunctive relief. However, because the injunctive order was too broad and because it was not founded upon service on the members of an unincorporated association individually, the case was remanded. (MacMillan-Fla)
W69-02903

OLIN GAS TRANSMISSION CORP V HARRISON (OWNERSHIP OF BEDS OF NON-NAVIGABLE WATERS).

132 So 2d 721-733 (La Ct App 1961).

Descriptors: *Louisiana, Judicial decisions, *Non-navigable waters, *Ownership of beds, Oil wells, Royalties, State governments, *Navigable waters, Land tenure, Patents, Leases, Lakes, Lake beds, Canals, Riparian rights.

In concursus proceeding against the State for royalties from the sale of oil produced from wells located in a lake bed, the question of ownership of the lake bed was determinative. Louisiana contended that the lake was navigable in 1812 (date of statehood), or had since become so, and therefore the beds were owned by the State by virtue of its inherent sovereignty. Claimants traced their title to patents issued in 1901 and argued non-navigability. To be navigable at law, water must be navigable in fact, that is, used or susceptible of being used in its ordinary and natural condition as a highway of commerce. The State failed to establish navigability in 1812. Court evaluation of trial testimony affirmed the holding that the lake had not been navigable in 1812 and was not now navigable. Man-made canals in the area did not effect the question. Dicta summarized Louisiana law on aspects of bed ownership: if a body of water is navigable and has never been validly patented to an individual, the bed belongs to the State by virtue of its inherent sovereignty; if water is navigable and patented, and the patent has not been assailed pursuant to Act 62 of 1912, the bed belongs to the present title holder of record so long as the patent issued prior to the La Constitution of 1921; however, the State may acquire title when lands owned under a valid patent are inundated by navigable water. (MacMillan-Fla)
W69-02904

POPULATION GROWTH AND THE DEMAND FOR WATER,
Council of State Governments; and Southern Land Economic Research Committee.
For primary bibliographic entry see Field 06D.
For abstract, see .
W69-02962

PEOPLE V KRAEMER (TRESPASSING ON LANDS SUBMERGED UNDER NAVIGABLE WATERS).

164 NYS 2d 423-435 (Pol Ct 1957).

Descriptors: *New York, *Ownership of beds, Judicial decision, Beds, Navigable waters, *Public rights, Water law, Legal aspects, *Navigation, Harbors, Boating, Legislation, Riparian land.
Identifiers: Uplands.

Defendants were charged with violating a village trespassing ordinance by anchoring their boats over submerged land of a resident of the village, and entering on the foreshore. The area involved was a man made harbor which for years had been used by pleasure craft. Complainant alleged a violation of the ordinance based on his ownership of the uplands and land under the waters of the harbor. Defendants based their defense on two grounds: (1) that the submerged land belonged to the State, since it had never been reconveyed after cession from the crown, and (2) that, regardless of ownership, the waters are navigable and therefore subject to the public right of navigation, including anchorage and entry on the foreshore. The court rejected the first ground but accepted the second ground in part, holding that the waters were navigable, and therefore there existed a public right of navigation regardless of who owned the bed. This right of navigation is dominant. The complainant, by opening up the harbor, conferred upon the public the right of navigation. However, the court stated that entry on the foreshore was only allowable to the extent necessary to exercise the right of navigation. The one defendant who entered upon the foreshore was found guilty of a violation of the ordinance. (Williams-Fla)
W69-02991

CUGLAR V POWER AUTHORITY (EMINENT DOMAIN BY POWER AUTHORITY TO FORM POWER POOL).
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-02993

SNEED V WEBER (RIGHT OF UNITED STATES TO REMOVE OBSTRUCTIONS TO NAVIGATION COULD NOT INURE TO ANY MEMBER OF THE PUBLIC).

307 S W 2d 681-692 (Mo Ct App 1957).

Descriptors: *Missouri, Judicial decisions, United States, Pontoons, Bridges, Lakes, *Non-navigable waters, *Condemnation, *Easements, Dams, Mississippi River, Ditches, Excavation, Barriers, Public rights, Legal aspects.
Identifiers: Obstruction to navigation, Standing to sue.

Plaintiff sought to enjoin the defendants from maintaining a pontoon bridge over a lake, contending that the lake was navigable, where the United States had never exercised its right of removing obstructions to navigation on defendant's land, plaintiff, an adjoining landowner, had no cause of action concerning obstructions to navigation since the right could not inure to benefit of plaintiff or any other member of the public. The test of navigability of a watercourse is whether it is susceptable of being used, in its ordinary condition, as a highway for commerce. The burden of proving navigability is on the plaintiff. The court declared the non-navigable where a small boat could be navigated from the lake into the Mississippi River only by way of a tortuous course requiring extreme dexterity. (Childs-Fla)
W69-02995

MEXICO BEACH CORP V ST JOE PAPER CO (TITLE TO LANDS GAINED BY ACCRETION).

97 So 2d 708-711 (1st DCS Fla 1957).

Descriptors: *Florida, Judicial decisions, *Accretion (Legal aspects), *Boundaries (Property), Gulf of Mexico, Surveys, Navigable waters, Legal aspects, State governments.
Identifiers: Plats, Land conveyance.

Plaintiff brought action to quiet title to lands formed by accretion. The trial court, in a summary decree, held for the plaintiff. The description of the land in question dated back to a federal government survey in 1833, which designated the Gulf of Mexico as one-half of the southern border of fractional section 15. Since 1833 land had formed by accretion along that border in the Golf of Mexico. Defendant claimed that the land formed by accretion belonged to the State of Florida, the owner of fractional section 15 when the new land was formed, since Plaintiff's deed only conveyed the original fractional section 15. The court held that the Gulf of Mexico, as set forth in the original plat, still formed part of the southern boundary, and that fractional section 15 included the new land added by accretion. The court further stated that Florida follows the common-law rule which vests title to soil found along navigable waters by accretion in the owners of abutting lands. (Sisserson-Fla)
W69-02998

DELAUNE V BOARD OF COMMISSIONERS (APPLICABILITY OF STATUTES RELATING TO RIVERS TO LAKE PROPERTY).

87 So 2d 749-754 (La 1956).

Descriptors: Louisiana, Judicial decisions, *Lake shores, Condemnation, Compensation, Eminent domain, Public rights, Water law, Land tenure, Legislation, *Levees, Flood control, River regulation, Land classification, Legal aspects.

Plaintiff landowners sued the defendant levee board to recover the value of certain lakefront lands which were appropriated by defendant for construction of a flood control levee. The board filed an exception of no cause of action to the plaintiffs' petition which the trial court accepted. On appeal the board based its exception on the premise that the plaintiffs' property was burdened with a public servitude for levee construction and repair under the Louisiana Civil Code. The board further asserted that the only compensation payable for the taking of such lands was the assessed value for the preceeding year. The exception of no cause of action was filed because of the failure of the plaintiffs to set forth such assessed value. This court reversed and remanded for a trial on the questions. The court held that the statute providing that public servitudes relate to the space which is to be left for public use by adjacent proprietors on navigable rivers for making and repairing levees was applicable only to navigable rivers and streams; not to lakes, as in the present case. However, the servitude imposed under the statute cited by the board is not limited to the land bordering on the river shore; rather, it covers all adjoining lands necessary to be covered for adequate flood control. How far it is from any navigable stream to the plaintiffs' lakefront land is neither averred in the petition nor shown by way of exhibit; therefore, it is impossible to ascertain whether there is a servitude for levee purposes. The payment of compensation at a rate equal to the assessed value of the land does not establish a yardstick of compensation for such lands. It is a mere gratuity, since the state has the power to take such lands without compensation. (Blunt-Fla)
W69-03000

LEAVING UNUSED WELL OPEN AND EXPOSED.
N C Gen Stat sec 14-287 (1967).

Descriptors: *North Carolina, *Legislation, Farms, *Wells, *Well regulations, Landfills, Legal aspects.

It is unlawful in North Carolina for any person, firm, or corporation to leave a well open and exposed after discontinuing the use of it. The well must be carefully and securely filled after the use has been discontinued. This statute does not apply to wells on farms, provided the well is protected by curbing or board walls. Any person who violates this statute is guilty of a misdemeanor and, upon conviction, may be either fined or imprisoned, in the discretion of the court. (Watson-Fla)
W69-03002

ERECTING ARTIFICIAL ISLANDS AND LUMPS IN PUBLIC WATERS.
N C Gen Stat sec 14-133 (1967).

Descriptors: *North Carolina, *Legislation, *Islands, Water, Railroads, *Spoil banks.

In North Carolina, by statute, if any person erects artificial islands or lumps in any of the waters of the State east of the Atlantic Coast Line Railroad, running from Wilmington to Weldon by way of Burgaw, Warsaw, Goldsboro, Wilson, Rocky Mount, and Halifax and running from Weldon to the North Carolina-Virginia State boundary by way of Garysburg and Pleasant Hill, he will be guilty of a misdemeanor. (Watson-Fla)
W69-03003

DUTY AS TO BRIDGES OF MILLOWNERS ON, OR PERSONS DITCHING OR ENLARGING DITCHES ACROSS, HIGHWAYS.
N C Gen Stat sec 136-73 (1964).

Descriptors: *North Carolina, Legislation, *Bridges, Mill dams, Highways, *Mills, *Drainage, Ditches, Culverts, Canals, Legal aspects, Drains.

The owner of a water mill situated on any public road, and any person who constructs any ditch, drain, or canal across any public road, must, at their own expense, construct and keep in good repair all necessary bridges. This act does not apply when the public road was constructed subsequently to the creation of the mill. (Childs-Fla)
W69-03004

NORTH CAROLINA SEASHORE COMMISSION.
N C Gen Stat sec 143-384, 143-388 (1964).

Descriptors: *North Carolina, *Legislation, *Administrative agencies, *Seashores, Shores, Coasts, Recreational facilities, Federal government, Recreation, Industries, Tourism, Conservation, State governments, Local governments.

The North Carolina Seashore Commission studies the development of the seacoast areas and recommends policies which will promote the preservation of the seacoast and the development of the coastal area. Particular emphasis is placed upon the development of the scenic and recreational resources of the seacoast. The Commission advises and confers with various individuals, organizations, and agencies which are interested in the development of the seacoast area, and uses its facilities in planning, developing, and carrying out programs for the development of the area as a whole. The Commission also acts as liaison between agencies of the state, local, and federal government concerned with the development of the seacoast region. The Commission is composed of 20 members and a chairman, all appointed by the Governor. (Watson-Fla)
W69-03005

WHITEHALL CONSTRUCTION CO V WASHINGTON SUBURBAN SANITARY COMM'N (REQUIREMENTS FOR TRESPASS ACTION).
165 F Supp 730-738 (D Md 1958).

Descriptors: *Maryland, Judicial decisions, United States, Paving, Damages, *Diversion to flow, *Surface waters, Sewers, Legal aspects, Surface runoff.
Identifiers: *Trespass, *Private nuisance.

Plaintiff brought an action for damages to paving which collapsed because of the artificial diversion of surface waters by defendant in the course of installing a sewer. Under Maryland law, the interest interfered with in the case of 'trespass' is the exclusive possession of land, whereas in the case of 'private nuisance' it is the use and enjoyment of land. Under Maryland law, the fact that an invasion is a nuisance does not preclude it from also being a trespass. Hence the absence of an allegation that the diversion was intentional or negligent did not make the complaint subject to dismissal. The defenses of Act of God or unavoidable accident must be both pleaded and proved in order to have the complaint dismissed for failure to state a claim on which relief could be granted. The court held that the complaint was sufficient to state a cause of action. (Childs-Fla)
W69-03007

NADLER FOUNDRY AND MACHINE CO, INC V UNITED STATES (LIABILITY FOR CAVE-IN CAUSED BY DREDGING).

164 F Supp 249-252 (Ct Cl 1958).

Descriptors: *United States, *Retaining walls, *Bank stability, *Soil stability, Judicial decisions, Legal aspects, Bulkheads, Dredging, Navigation, Streams, Boundaries, Flooding, Channels, Damages.
Identifiers: Statute of limitations, Cave-in, Lateral support.

Plaintiff sued to recover just compensation for the taking of its land by the United States. It is alleged that the property was taken when a ship channel was dredged in a bayou so close to the low water

mark, the boundary of plaintiff's land under the law of Louisiana, that the plaintiff's soil caved into the bayou, some of its land became submerged, and the stability of other land became so endangered that the plaintiff had to build a bulkhead to preserve its stability. In dismissing plaintiff's petition, it was held that an extensive cave-in of plaintiff's land occuring in 1934 and the building by plaintiff of a bulkhead in 1935 to prevent further cave-in indicated that plaintiff at that time was aware of what would happen in the course of time. An action commenced in 1954 was therefore barred by the six year statute of limitations, even if the government's removal of lateral support prior to 1934 by dredging the channel was the cause of the cave-in. It was additionally noted that the doctrine that a private owner along a stream owns to its thread does not affect the government's easement of navigation. (Childs-Fla)
W69-03008

BEAN V UNITED STATES (BENEFICIAL USE OF WATER GIVES NO VESTED RIGHT).

163 F Supp 838-846 (Ct Cl 1958).

Descriptors: *United States, Judicial decisions, *Water rights, Legal aspects, Rio Grande, Interstate rivers, Legislation, Administrative agencies, *Beneficial use, Reclamation, Federal reclamation law, Riparian rights, Appropriation, *Water contracts.

Plaintiffs sue for the taking by the United States of rights they claim in the waters of the Rio Grande River. Their properties are in the Hudspeth County Conservation and Reclamation District No. 1. The question is whether plaintiffs have any water rights with respect to the waters of the Rio Grande River which have been taken by the United States acting through the Bureau of Reclamation of the Department of Interior. The court held that waters of the Rio Grande River were delivered pursuant to contracts with the Hudspeth District that gave no vested rights to the use of the water. A beneficial use of waters gives the user no vested right. The Bureau of Reclamation had both control and the right to prescribe the use of seepage waters from lands within the Rio Grande Irrigation Project. Abandoning seepage waters does not mean that the right to use such waters in the future has been abandoned. Where, under the original contract, the Hudspeth District was given the right to use waters not used on lands of the Rio Grande Irrigation Project, and where it was not stated whether waters were unused or seepage waters and the original contract applied to seepage and drainage, no rights were acquired to those waters. (Childs-Fla)
W69-03009

STEAMTUG ALADDIN, INC V CITY OF BOSTON (FEDERAL LIABILITY FOR BRIDGE AS NAVIGATIONAL HAZARD).
163 F Supp 499-502 (D Mass 1958).

Descriptors: *Massachusetts, Judicial decisions, United States, *Damages, *Navigation, Hazards, Navigable waters, *Bridges, Admiralty, Water law, Legal aspects.
Identifiers: *Navigational obstruction.

The owner of the Steam tug Aladdin alleged that 'timber proceeding from the main part of the abutment' of the Chelsea Swing bridge struck the tug while it 'was proceeding in the Mystic River,' and that prior to that date the bridge was 'abandoned' by the City of Boston to the United States, which was 'in control of the bridge and under a duty to properly maintain, light and equip it with proper aids to navigation.' The collision was allegedly caused by the failure to display proper lights on the abutment and to remove loose planks protruding from the abutment. The court found that there was no statutory duty of the United States to maintain, light or guard against loose planks protruding from a bridge under its control. However, there is a duty imposed both at common law and in admiralty upon persons in control of a bridge to exercise care that loose planks do not menace navigation. But, absent a statute, this duty cannot be imposed upon the United States. A civil action could be maintained under the Federal Tort Claims Act. An opportunity to amend the complaint was granted. (Childs-Fla)
W69-03010

SANS V RAMSEY GOLF AND COUNTRY CLUB (USE OF LAKE ON GOLF COURSE).

50 N J Super 127, 141 A 2d 335-340 (Super Ct 1958).

Descriptors: *New Jersey, Judicial decisions, *Lakes, Riparian rights, Land use, *Golf courses, *Recreation, Non-consumptive use.

The main question in this case was whether one of the tees of defendant golf course was placed in such a manner as to unreasonably interfere with plaintiff's enjoyment of his property, thereby constituting a private nuisance. This question was resolved in favor of the plaintiff. However, plaintiff also contended that his recreational rights in a lake on the golf course were interfered with because the lake was part of a water hazard hole. The court held that where plaintiff's rights did not stem from riparian ownership, but merely from his deed, and were the same recreational rights granted to all golf course members, incidental interference with his recreational use of the lake was not actionable. It was not unreasonable for defendant to include the lake within the lay-out of its golf course. (Williams-Fla)
W69-03012

WATER AND POWER RESOURCES BOARD V GREEN SPRINGS COMPANY (CONSTITUTIONALITY OF DAM PERMIT ACT).
394 Pa 1, 145 A 2d 178-187 (1958).

Descriptors: *Pennsylvania, Judicial decisions, Legislation, *Administrative agencies, *Permits, Obstruction to flow, *Dams, Streams, Non-navigable waters, State jurisdiction, State government, Streamflow, Natural flow, Dam construction, Regulation.
Identifiers: Constitutional objections.

The Green Springs Company, a fish hatchery, increased the height of its existing dam on a non-navigable stream without the consent of the Water and Power Resources Board, as was required by the Water Obstructions Act. The Board brought suit against the company for injunctive relief to force it to remove its addition to the dam and refrain from interfering with the natural flow of the stream as it had existed prior to such addition. The company defended on the ground that the Water Obstructions Act, giving the board the power to issue or withhold permits for construction of dams was an unconstitutional delegation of legislative power by the general assembly. From an adverse ruling, the board appealed. The Pennsylvania Supreme Court reversed, and held the act constitutional. The court found that the act contained sufficient guidelines or criteria for the board to follow when making its decisions on applications for permits. The court emphasized the necessity for regulation of obstructions on the stream of the state, and the fact that the legislature could not make an independent determination as to the propriety of each proposed dam. The court found that the act was passed to protect the people of the state. (Williams-Fla)
W69-03013

GREENWICH WATER CO V ADAMS (EMINENT DOMAIN).

145 Conn 535, 144 A 2d 323-327 (1958).

Descriptors: *Connecticut, Judicial decisions, Legal aspects, *Dam construction, State governments, Flooding, Rivers, Riparian rights, *Public utilities, Interstate rivers, Water allocation (Policy), Water distribution (Applied), *Eminent domain, Diversion structures, Reservoirs, Reservoir storage, Reservoir field.
Identifiers: Ultra vires acts.

Plaintiff, a public service water company, sought to obtain, by eminent domain, the right to divert water from a river adjacent to defendants' land in order to increase its reservoir capacity according to a plan approved by the Public Service Commission. The contract between plaintiff and a N Y water company wherein plaintiff agreed to supply water resulting from the diversion of the river to the company for 75 years is not ultra vires. The contracting parties have not attempted to allocate the waters of the interstate river for the life of the contract. They have merely made a distribution of such waters as may be impounded at the reservoir. The defendants failed to show that the contract will jeopardize the water supply of the inhabitants of Connecticut. (Molica-Fla)
W69-03015

CAMP CLEARWATER V PLOCK (EASEMENT TO USE PRIVATE LAKE).

52 N J Super 583, 146 A 2d 527-540 (1958).

Descriptors: *New Jersey, Judicial decisions, *Ownership of beds, *Easements, Water law, *Prescriptive rights, Lakes, Relative rights, Public rights, Boating, Fishing, Legal aspects.

Plaintiff claimed to be fee simple owner of the bed of a small natural lake and brought suit against defendants to enjoin their use of the lake, obtain a declaration of the rights of the parties, and to recover damages for trespass to the lake. A deed to a tract bordering on the lake granted to defendants' predecessors rights to fishing and boating on the lake. Plaintiff's predecessors, owners of the dominant estate, subsequently obtained title to the servient estate, thereby marging title in the same person. Later, plaintiff's predecessors conveyed the old dominant estate to defendant's predecessors. The defendants claimed to have the same fishing and boating rights as were contained in the old deed granting the easement to their predecessors. The court held for plaintiff, stating that the merger of the dominant and servient estates extinguished the easement, and it was not revived by a subsequent conveyance of the property. Since this was a private lake, there were no public rights therein. The court stated that defendants did not gain an easement by prescription since their use was not adverse or hostile, rather being permitted by plaintiff. (Williams-Fla)
W69-03016

POWERS AND DUTIES OF THE DELAWARE RIVER BASIN COMMISSION.
NY Conserv Law Sec 801, Art 3, 3.1, 3.2, 3.3, 3.4, 3.5, 3.6 (b) (c) (d) (McKinney 1967).

Descriptors: *New York, Legislation, Administrative agencies, *Delaware River Basin Commissions, *Interstate compacts, Water resources development, Delaware River, State governments, Competing uses, *River basin development, Prior appropriation, Legal aspects, Ground water.

These provisions are part of the Delaware River Basin Compact and deal with the powers and duties of the Delaware River Basin Commission. As a broad policy, the Commission shall provide for uniform and coordinated planning, development, and financing of water resources projects in the Basin. The Commission is to adopt a long range and comprehensive water resources plan and program. Water resources needs, quantitative and qualitative, are to be included. The Commission is to allocate the basin's water among the states of the compact and their political subdivisions. However, except in emergencies, it may not take any action to effect the allocation plan set up in the court decree in New Jersey v New York, 347 U S 995 (1954), unless unanimous consent of the parties to

such action is obtained. No allocation by the Commission is to constitute a prior appropriation, or apportionment of water. Jurisdiction of courts to hear different types of appeals from Commission orders is provided for. The signatory states waive their right to apply to the U S Supreme Court for a modification of the decree in New Jersey v New York, supra, except in a specified situation. Except as specifically provided, nothing in the compact is to be construed as impairing the decree. Various limitations on the Commission are set out. The Commission may maintain projects and establish standards therefore, conduct research, establish a system of stream and groundwater forecasting, and perform various other specified functions. (Williams-Fla)
W69-03026

RIVER IMPROVEMENT DISTRICTS.
N Y Conserv Law sec 611 (1) (McKinney 1967).

Descriptors: *New York, Civil law, Legislation, State governments, Conservation, Administrative agencies, *Water resources, *River basin commissions, Eminent domain, Assessments, Watershed management, Legal aspects.

River improvement districts are public corporations with perpetual existence. They shall have the power to own, buy, or sell necessary real estate or other property; to sue and be sued; to incur contract liabilities; to exercise the rights of eminent domain, assessment, and taxation; and do all other things necessary to accomplish the purposes of this article. The governing body of the district shall be the Commission. Any watershed or part thereof may be created into a river improvement district. The debts, liabilities, and obligations of the district shall not be construed as those of the state; nor shall any member of the commission be personally liable for them. (Scott-Fla)
W69-03027

DISCHARGE OF SEWAGE INTO WATERS (PERMITS REQUIRED).
N Y Public Health Law sec 1160, 1161, 1162, 1163, 1164, 1165, 1166, 1167 (McKinney 1954).

Descriptors: *Sewage disposal, Sewage, Waste disposal, Riparian rights, Industrial wastes, Administrative agencies, Regulations, *Permits, State governments, *New York, *Legislation, Inspection, Legal aspects, Public health, Sewers, Conduits, Effluents, Water pollution sources, Waste water (Pollution), Pipes, Streams.

The Commissioner of Public Health is empowered to issue permits allowing discharge of sewage into any waters of the State. Plans for such sewage systems must be submitted and approved by the Department. The Commissioner can issue permits for the discharge of refuse or waste matter from factories and industrial establishments into any waters of the State. One desiring to construct a conduit or discharge pipe for discharging waste matter into the State's waters is required to submit to the Commissioner a statement of purpose and plans for the conduit. If approved, a permit is issued. All of the above permits are revocable by the Commissioner upon notice, following an investigation and hearing. Each local board of health shall have a record of all permits issued in its area, and the board shall conduct inspections to insure that the limitations of sec. 1150 are adhered to. Violations are reported to the Commissioner, who, after a hearing and a determination that a violation exists, can bring an action in the name of the State against the violator. Monetary fines and penalties are provided. None of these statutes alter any common law rights of riparian owners in the quality of waters of streams covered by such rights. Sec 1168, N Y Public Health Law (McKinney Supp 1968), states that secs 1160-1167 shall be in force only until April 1, 1969. (Sisserson-Fla)
W69-03029

LIABILITY RESULTING FROM ARTIFICIAL BODIES OF WATER.
Iowa Univ., Iowa City.

Iowa L Rev, Vol 148 No 4 pp 939-954 Summer 1963. 15 p, 80 ref.

Descriptors: *Judicial decisions, *Legal aspects, Artificial watercourses, *Iowa, Damages.
Identifiers: Artificial bodies of water, Trespasser, *Attractive nuisance, Liability.

A discussion of the development of the attractive nuisance doctrine is given. Case precedents are cited to show the conceptual difficulties encountered by the states in adopting a doctrine such as foreseeability and duty of care owed to a trespasser. The concepts of artificial instrumentalities (as opposed to natural) and common objects (as opposed to uncommon), used by the courts when the doctrine is raised, are the basis' on which Iowa's laws of attractive nuisances involving artificial bodies of water have developed. The influence which the Restatement of Torts has had on the doctrine is discussed. In Iowa, as a matter of law, natural and artificial bodies of water are not within the scope of the attractive nuisance doctrine. (Molica-Fla)
W69-03030

ACTIONS BY MUNICIPALITIES TO PREVENT DISCHARGE OF SEWAGE INTO WATERS.
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-03031

ORDER TO DISCONTINUE POLLUTION OF WATERS.

N Y Pub Health Law Sec 1156 (McKinney 1954).

Descriptors: *New York, *Water pollution sources, *Water pollution control, Legislation, Legal aspects, Administrative agencies, Sewage, Domestic wastes, Water pollution, Public health, Pollution abatement, Waste disposal, Effluents, Inspection, Water analysis.

The Commissioner may order one discharging garbage, offal or any decomposable or putrescible matter into any waters of the state, when such discharge is polluting the waters so as to create a menace to public health or a nuisance, to show cause why such discharge should not be discontinued. A public hearing will be conducted, at which time evidence regarding the polluting activities may be presented. Following the hearing, the Commissioner may issue an order specifying the period of time after which such discharge should be discontinued and an approved method of waste disposal should be installed and in operation. The order is not valid until signed by either the Governor or the Attorney General. Section 1268, N Y Pub Health Law (McKinney Supp 1968), states that sec 1156 shall be in force only until April 1, 1969. (Sisserson-Fla)
W69-03032

NAVIGATION AND FLOOD CONTROL IMPROVEMENTS IN COOPERATION WITH THE FEDERAL GOVERNMENT.
N Y Gen Mun Law sec 72 L (McKinney 1965).

Descriptors: *New York, Legislation, *Rivers and Harbors Act, *Flood control, *Navigation, Watersheds, Channels, Federal government, Contracts, Easements, Right-of-way, Cities, Local governments, State governments, Dredging, Operation and maintenance.

A municipality may cooperate with the federal government in connection with the improvement of navigation and flood control or improvement and control of watersheds and waterways within its boundaries. They may furnish up to one half of the cost of such improvements. They may furnish, at no cost to the federal government, all lands, easements, rights of way and spoil disposal areas for new work. These may be acquired through any procedure prescribed by any law relating to acquisition of real property by a municipality. They may contract with the federal government, and they may apply for grants or other financial assistance from the state or county. (Shevin-Fla)
W69-03033

THE WATER-IS-DIFFERENT SYNDROME OR WHAT IS WRONG WITH THE WATER INDUSTRY,
Arizona Univ., Tucson.
Maurice M. Kelso.
Proceedings of the Third Annual American Water Resources Conference (The American Water Resources Association; Urbana, Ill), c 1967, pp 176-83. 8 p, 3 ref.

Descriptors: *Water policy, Legal aspects, Water properties, Water supply, Water allocation, Administration, Education, Social aspects, Institutions, Water shortage, Pricing.
Identifiers: Public policy, Water images.

The water industry is ailing because its policies and institutions do not permit it to perform at the optimum of overall economic efficiency or in a manner which comes even tolerably close to best serving the public interest. The rigid, unresponsive and clumsy actions of administrative practice often hinder attempts for flexibility in water allocation. The water-is-different philosophy is the principle cause of the water industry's ailments. The image that water is unique arises in part because water is different from other resources. But the water-is-different argument ascribes to water peculiarities that go far beyond its objective idiosyncrasies. These false images help determine public policies. For example, they are largely responsible for insulating water allocation from the market mechanism. The necessary legal and governmental changes are possible only through education of the electorate and professional counselors. (Winn-Rutgers)
W69-03137

SOME PHYSICAL, TECHNOLOGICAL, AND ECONOMIC CHARACTERISTICS OF WATER AND WATER RESOURCE SYSTEMS: IMPLICATIONS FOR ADMINISTRATION,
New Mexico Univ., Albuquerque. Dept. of Civil Engineering.
For primary bibliographic entry see Field 06B.
For abstract, see .
W69-03167

WATER RESOURCES MANAGEMENT IN MARYLAND.
Maryland Dept. of Water Resources, Annapolis.
For primary bibliographic entry see Field 06B.
For abstract, see .
W69-03170

6F. Nonstructural Alternatives

AN ECONOMIC APPROACH TO COPING WITH FLOOD DAMAGE,
Resources for the Future, Inc., Washington, D. C.
John V. Krutilla.
Water Resources Research, Vol. 2, No. 2, 1966, pp 183-190, 2 ref.

Descriptors: Flood damages, *Flood plain insurance, Economic efficiency, Risk, Legislation, Regulation, Financing, *Economic feasibility, Nonstructural alternatives, *Flood protection, Flood plains.
Identifiers: Federal flood control policy.

It would appear that a significant part of the increase in the damage potential in urban flood plains is in response to the construction of work envisaged

as the primary means of flood control in the 1936 legislation. To a certain degree the benefits now claimed in justifying flood control projects are the reduction of damages to properties anticipated to be in place in the flood plain in the future. A compulsory flood loss insurance scheme would act to alleviate the existing situation in which the costs of flood damage are not distributed among those who take the risk. It would confront every individual prospect for a flood plain location, explicitly with the cost that flood plain location would entail. Insurance premiums proportional to risk and equal to both the private and social cost of flood plain occupance would serve as a rationing device, eliminating unwarranted uses of flood plain lands, while not prohibiting uses for which a flood plain location has merit. In addition, reduction of flood loss insurance premiums can serve as a standard to measure the economic increments in scale of protective works or other non-structural flood control measures. (Gargola-Chicago)
W69-02844

SIMILARITIES BETWEEN FLOOD CONTROL PROBLEMS AND OTHER ASPECTS OF WATER MANAGEMENT IN THE UNITED STATES,
Virginia Polytechnic Inst., Blacksburg. Water Resources Research Center.
William Walker.
Water Resources Research, Vol. 3, No. 1, 1967, pp 11-13.

Descriptors: Water quality control, *Water resource management, Non-structural alternatives, *Flood control, Federal government, *Institutional constraints, Federal project policy, Administrative decisions, Pollution abatement, *Economic evaluation, Guidelines.

In spite of the money spent on flood control, damages continue to increase every year. It has been said that the cause of it is the insistence upon building flood structures and the failure to give sufficient attention to other possible alternatives. Two major reasons for this lack of interest in alternatives are: (1) the state, local government and individuals have abdicated their responsibility in this area to the federal government; and (2) several federal agencies have vested interests in promoting and maintaining large construction programs. In the area of pollution control, these same reasons hold for the lack of consideration of alternatives. A possible solution to the problems presented in the two areas is likewise very similar. An economic evaluation should be made of the various alternatives and combinations on a basin wide plan. It thus appears that the least part of the problems associated with general water management are closely allied to the individual segments of the total picture. The approach to one phase of the water problem may provide guidelines for, or have application to, the total situation. (Gargola-Chicago)
W69-02848

07. RESOURCES DATA

7A. Network Design

METHODOLOGICAL PREREQUISITES FOR CONDUCTING NETWORK OBSERVATIONS OF THE CHANNEL PROCESS,
N. Ye. Kondrat'yev, and I. V. Popov.
Translated from Trudy Gos Gidrol Inst, No 144, pp 118-150, 1967. Soviet Hydrol Selec Pap (AGU), No 3, pp 273-297, 1967. 25 fig, 2 tab, 6 ref.

Descriptors: *Network design, *Hydrologic data, *Channel erosion, *Channel morphology, Meanders, Streamflow, Sediment load, Bed load, Suspension, Model studies, Hydraulic models.
Identifiers: *USSR, State Hydrological Institute.

Recent work in the USSR on the channel processes of natural meandering streams is briefly reviewed and a system for gathering data for new studies is proposed. Theoretical and field principles are given for planning observation networks, and model studies of channel processes are outlined. (Knapp-USGS)
W69-02807

ANALYSIS OF WATER AND WATER-RELATED RESEARCH REQUIREMENTS IN THE GREAT LAKES REGION.
Michigan Univ., Ann Arbor.

Counc on Econ Growth, Technol, and Public Policy of the Comm on Inst Coop, 104 p, June 1968. 3 fig, 8 append.

Descriptors: *Research and development, *Water resources development, *System analysis, *Great Lakes Region, Population, Demand, Economics, Management.
Identifiers: Research needs.

Requirements for research in water and water-related fields in the Great Lakes Region, particularly in applications of systems analysis and modeling, were appraised on a regional scale. A water-quantity model of the entire Great Lakes system is necessary and feasible. Subregional, subsystem groupings are also suggested. A regional economic-growth model, water-related information systems, and a gaming-simulation model for research on institutions are also needed. Appendixes contain papers contributed to the study, conference proceedings, names of participants, and responses to a questionnaire on the research activities needed in the Great Lakes Region. (Knapp-USGS)
W69-03079

RIVER MILEAGE MEASUREMENT,
Water Resources Council, Washington, D. C. Hydrology Committee.

Water Resources Counc Hydrol Comm Bull No 14 (rev Oct 1968), 17 p, 3 fig, 2 append.

Descriptors: *Rivers, *Measurement, *Standards, Data collections, Water management (Applied), Maps.
Identifiers: *River mileage, Nomenclature.

River mileage measurements have become increasingly important as reference points in planning and in later operations. A technique is presented for river mileage measurements that should provide a uniform approach to the determination of references. This technique has been adopted by the Water Resources Council for use in all Federal planning involving water and related land resources. Guidelines for the use of this technique by Federal agencies is also presented. Two appendices that show satisfactory formats for recording river mileages are included. (Steinhilber-USGS)
W69-03100

7B. Data Acquisition

AN ELECTRIC HYGROMETER APPARATUS FOR MEASURING WATER-VAPOUR LOSS FROM PLANTS IN THE FIELD,
Western Australia Univ., Nedlands; and Botanic Gardens, St. Louis, Mo.
For primary bibliographic entry see Field 02D.
For abstract, see .
W69-02968

APPLICATION OF THE FINITE ELEMENT METHOD TO TRANSIENT FLOW IN POROUS MEDIA,
California Univ., Berkeley.
For primary bibliographic entry see Field 08B.
For abstract, see .
W69-03064

DETECTION OF SATURATED INTERFLOW IN SOILS WITH PIEZOMETERS,
Tennessee Valley Authority, Knoxville.
R. P. Betson, J. B. Marius, and R. T. Joyce.
Soil Sci Soc of Amer Proc, Vol 32, No 4, pp 602-604, July-Aug 1968. 3 p, 1 fig, 1 tab, 3 ref.

Descriptors: *Soil water movement, *Saturated flow, *Subsurface runoff, *Piezometers, Observation wells, Water levels.
Identifiers: Soil water interflow.

Piezometers were used as saturated interflow detection devices in a study of partial watershed contribution to storm runoff. Saturated interflow was detected along the AB-horizon interface in clay loam soils with shallow A horizons. The results of the study showed that at least under some soil conditions piezometers can be useful in determining the extent of saturated flow within a watershed. The occurrence of this flow will normally be confined to the shallow A-horizon regions. (Knapp-USGS)
W69-03074

A SIMPLE EVAPORIMETER FOR USE IN COLD AREAS,
Department of Agriculture, Summerland (British Columbia). Research Station.
J. C. Wilcox.
Water Resources Res, Vol 3, No 2, pp 433-436, 1967. 4 p, 3 fig, 2 ref.

Descriptors: *Instrumentation, *Cold resistance, *Antifreeze, Alcohols, Water, Air-water interfaces, Moisture content.
Identifiers: *Evaporimeters.

An evaporimeter that uses a porous carborundum block for an evaporation surface was designed for use in cold areas where other evaporimeters freeze. The evaporating liquid is 22% methanol and 78% water and freezes at about 0 deg F. The liquid is fed by suction to a polyethylene bottle which holds the evaporation block. The instrument is suitable for use in high cold areas with difficult access. Its performance compares well with standard evaporimeters. Automatic water-level recorders permit long unattended use. (Knapp-USGS)
W69-03115

MOVEMENT OF WATER FROM CANALS TO GROUNDWATER TABLE,
Idaho Univ., Moscow. Dept. of Civil Engineering; and Idaho Univ., Moscow. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 02G.
For abstract, see .
W69-03179

NON-DARCY FLOW CHARACTERISTICS OF WATER AS INFLUENCED BY CLAY CONCENTRATION,
Illinois Univ., Urbana. Dept. of Agronomy.
For primary bibliographic entry see Field 02G.
For abstract, see .
W69-03195

7C. Evaluation, Processing AND Publication

ELECTRIC-ANALOG AND DIGITAL-COMPUTER MODEL ANALYSIS OF STREAM DEPLETION BY WELLS,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 02F.
For abstract, see .
W69-02976

PRECISION LYSIMETRY FOR DIRECT MEASUREMENT OF EVAPORATIVE FLUX,
Agricultural Research Service, Tempe, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 02G.
For abstract, see .
W69-02981

SOME COMMENTS ON THE USE OF FACTOR ANALYSES,
Geological Survey, Arlington, Va.
N. C. Matalas, and Barbara J. Reiher.
Water Resources Res, Vol 3, No 1, pp 213-223, 1967. 11 p, 1 tab, 26 ref.

Descriptors: *Statistical methods, *Correlation analysis, *Research and development, Regression analysis, Forecasting.
Identifiers: *Multivariate analysis, *Factor analysis.

Factor analysis is a technique that purports to explain observed relations among several variates in terms of simpler relations that provide insight into the underlying structure of the variates. The analysis, however, is technically underdeveloped, and its usefulness for studying interrelated hydrologic variates is questionable because of the inherent indeterminacies in the factor model, the lack of knowledge about the sampling properties of the factor loadings, the fact that the factors are not directly observable, and the inability to use the results of factor analyses in other analytic studies. (Knapp-USGS)
W69-03050

MOMENTS OF THE INPUT, OUTPUT, AND IMPULSE RESPONSE FUNCTIONS OF LINEAR SYSTEMS ABOUT ARBITRARY POINTS,
Technion-Israel Inst. of Tech., Haifa; and Water Planning for Israel Ltd., Tel-Aviv.
For primary bibliographic entry see Field 02A.
For abstract, see .
W69-03089

REGRESSION MODELS FOR PREDICTING ON-SITE RUNOFF FROM SHORT-DURATION CONVECTIVE STORMS,
Agricultural Research Service, Tucson Ariz. Southwest Watershed Research Center.
For primary bibliographic entry see Field 06A.
For abstract, see .
W69-03103

SOME ERROR PROPERTIES OF SEGMENTED HYDROLOGIC FUNCTIONS,
Georgia Inst. of Tech., Atlanta.
Willard M. Snyder.
Water Resources Res, Vol 3, No 2, pp 359-373, 1967. 15 p, 4 fig, 12 tab, 6 ref.

Descriptors: *Mathematical studies, *Analytical techniques, *Hydrological data, *Least squares method, Hydrographs, Unit hydrographs, Water yield, Rainfall-runoff relationships, Hydrograph analysis.
Identifiers: Hydrologic systems, Curve fitting.

Unknown but mathematically continuous functions can be approximated by connected linear segments. The magnitude of the largest error between segmented and continuous forms is shown to be about 2/3 of the maximum difference between arc and chord of the continuous function. This magnitude decreases rapidly with increasing number of segments. Unknown operational hydrologic functions, such as unit hydrographs or water-yield recessions, can be derived directly from observational data by the method of least squares, and the solutions for fixed segmented systems can be standardized. The form-free segmented functions are shown to be capable of better representation of data than incorrectly assumed continuous forms.
W69-03105

SOME USES OF A DIGITAL GRAPH PLOTTER IN HYDROLOGY,
Department of Energy, Mines and Resources, Ottawa (Canada). Inland Waters Branch.
G. W. Kite
Inland Waters Br, Dep of Energy, Mines and Res Tech Bull 11, 1968. 82 p, 6 fig.

Descriptors: *Computer programs, *Data processing, Hydrologic data, Great Lakes region, Digital computers, Duration curves, Backwater, State-discharge relations, Surface waters, Flood routing.
Identifiers: *Digital graph plotter.

Detailed information is presented on the use of the digital graph plotter to give plotted output of hydrologic data. Programs, instructions for data input job set-up, plotter subroutines, and examples are given for obtaining graphic output for the following types of data compilation and analyses: (1) reservoir flood routing, (2) stage-discharge curve, (3) lake outflow, (4) backwater curve, (5) duration analysis, and (6) crustal movement. The first four programs are designed for use on the IBM 360-65 and Calcomp 663 computer-plotter combination; the last two are for the CDC 3100 and Calcomp 563 combination. A listing of additional programs being developed and a brief cost analysis are also included. (Steinhilber-USGS)
W69-03112

SCHEMES FOR HANDLING INCONSISTENT MATRICES,
Harvard Univ., Cambridge, Mass.
Myron B. Fiering.
Water Resources Res, Vol 4, No 2, pp 291-297, April 1968. 7 p, 2 append.

Descriptors: *Statistical methods, *Data processing, Hydrologic data, Monte Carlo method, Methodology, Analytical techniques.
Identifiers: Multivariate analysis, Algorithms, Eigenspace.

The increasing role of multivariate statistical techniques, a trend based on the growing availability of computers and on pressures for streamlined representation of multidimensional arrays of data, carries with it the responsibility for using efficient techniques to manipulate matrices and arrays. It frequently happens that all records in a multivariate system (of flow records, quality measurements, or whatever) are not equally long, and that some subsets of these records do not present a consistent pattern of correlation when the entire bivariate correlation matrix is reconstructed. If one or more estimate is such that the entire correlation matrix is rendered inconsistent, repairs must be effected before continuing the multivariate analysis. Two algorithms for systematically finding a set of adjustments that satisfy the requirements of consistency are given.
W69-03117

A LAPLACE TRANSFORM PROOF OF THE THEOREM OF MOMENTS FOR THE INSTANTANEOUS UNIT HYDROGRAPH,
Technion Israel Inst. of Tech., Haifa.
For primary bibliographic entry see Field 06A.
For abstract, see .
W69-03120

COLOR-INFRARED AERIAL PHOTOGRAPHIC INTERPRETATION AND NET PRIMARY PRODUCTIVITY OF A REGULARLY-FLOODED NORTH CAROLINA SALT MARSH,
North Carolina State Univ., Raleigh. Dept. of Botany.
For primary bibliographic entry see Field 02I.
For abstract, see .
W69-03177

WHEN IS IT SAFE TO EXTEND A PREDICTION EQUATION--AN ANSWER BASED UPON FACTOR AND DISCRIMINANT FUNCTION ANALYSIS,
Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.
For primary bibliographic entry see Field 06A.
For abstract, see .
W69-03183

08. ENGINEERING WORKS

8A. Structures

THE FARAHNAZ PAHLAVI PROJECT.

Water Power, Vol 20, No 8, pp 305-314, Aug 1968. 10 p, 12 fig, 1 ref.

Descriptors: *Multiple-purpose projects, River regulation, Irrigation, Flood control, *Foreign construction, Foreign design practices, Domestic water, Seismic design, Seismic investigations, *Buttress dams, Concrete dams, Hydroelectric power, Foundations, Outlet works, Spillways, Peak power.
Identifiers: Iran, Farahnaz Pahlavi Dam (Iran), *Seismic tests, Foreign testing.

An Iranian project designed to meet the demands of urban water supply, peak hydropower, and river regulation for irrigation is described. The Farahnaz Pahlavi Dam, a concrete buttress structure located 25 km northeast of Tehran, impounds waters of the Jaj-e Rud and Lavarak Rud flowing south from the Alborz Mountains. Topography of the site and foundation rock formations dictated design requirements o the dam. Since the dam is located in an earthquake area, much model testing was done to study behavior under seismic conditions. A powerplant, located on the toe of the dam, has one 22.5-mw generator installed with provisions for another. Downstream irrigation water must be delivered at a uniform rate throughout the day, but electric power is needed for only a 2-hr peaking period. The project is designed to permit release of the daily irrigation water requirement through the turbines during the peaking period, for storage in a small downstream pond and continuous release as needed for irrigation. (USBR)
W69-02911

PRELIMINARY SECTION OF SHAPE IN THE DESIGN OF CELLULAR DAMS,
M. D. Glezin.
Hydrotech Constr, No 8, pp 733-737, Aug 1967. 5 p, 7 fig, 3 ref.

Descriptors: *Cellular structures, *Dams, *Cells, Stress, *Buttress dams, Design, Charts, Vertical loads, Volume, *Dam design, Stability, Gravity dams, Foreign design practices, Concrete dams.
Identifiers: Formulas, USSR.

Formulas and graphs are given for an approximation of the overall shape, stress conditions, and concrete volume of cellular dams and buttress dams with cellular buttresses, with or without soil fill in the cells. Graphs show: (1) the vertical pressure of fill transmitted to cell walls as related to cell heights and their horizontal dimensions; (2) inclination of dam faces, normal stresses at the faces, principal stresses on the downstream face, and volume of concrete for cells without fill; (3) inclination of dam faces, normal and principal stresses at the downstream face, and concrete volumes for dams with filled cells; (4) minimum principal stresses in the body of the dam with filled and nonfilled cells; and (5) isostats of minimum principal stresses with filled and nonfilled cells. (USBR)
W69-02917

RECENT DEVELOPMENTS IN OPTIMAL STRUCTURAL DESIGN,
California Univ., San Diego, La Jolla.
C. Y. Sheu, and W. Prager.
Appl Mech Rev, Vol 21, No 10, pp 985-992, Oct 1968. 8 p, 146 ref.

Descriptors: *Optimum design, *Structural design, Bibliographies, Live loads, Dead loads, Design criteria, Stress, Constraints, Buckling, Loads (Forces), Plasticity, Reinforced concrete,

Prestressed concrete, Numerical method, *Reviews.
Identifiers: Plastic design, Design assumptions, Dynamic loads.

A general but comprehensive review of literature on optimal structural design from 1963 through 1967 is given. This is an updating of a previous state-of-the-art paper published in Applied Mechanics Reviews in May 1963. The present review includes: (1) the general background of structural optimization, (2) contributions to the general methodology of the field, (3) solutions of specific problems, and (4) relevant books and expository articles. The increasing knowledge in this field is demonstrated by the fact that the present paper, covering only 5 yr, has more than half the number of references included in the first review, covering the period from Galileo to the end of 1962. (USBR)
W69-02932

STRUCTURAL DESIGN--GRAND COULEE THIRD POWERPLANT,
Bureau of Reclamation, Denver, Colo.
H. Walter Anderson.
Preprint 747, Amer Soc Civ Eng Annual Meet Nat Meet Struct Eng, Pittsburgh, Pa, Sept/Oct 1968. 38 p, 17 fig, 5 ref.

Descriptors: *Structural design, *Structural analysis, Design, Design tools, Structural stability, Computer programming, Hydrostatic pressure, Digital computers, *Stability analysis, Dead loads, Reinforced concrete, Live loads, Deformation, *Powerplants.
Identifiers: *Computer-aided design, Computer printouts, Time sharing, Problem-oriented languages, Grand Coulee Powerplant (Wash).

Structural design studies are currently underway for the largest hydroelectric powerplant in the world. Design of the Third Powerplant structure requires a wide variety of structural analyses. Virtually all of these analyses are being performed with the assistance of digital computers by a design team of structural engineers well versed in computer programming. Time-sharing computers are used to perform, in minutes, studies similar in scope to those once performed manually in days. Comprehensive analyses that consider the behavior of the entire structure are being performed that could not be accomplished without the availability of of large-scale computer systems. The scope of these studies and the digital computer programs being used to accomplish them are described. Results drawn by an indeterminate structural analysis program on a cathode-ray-tube are shown for a comprehensive analysis of the downstream galleries and piers. Computer programming techniques, including a program used to write programs, are discussed. (USBR)
W69-02939

NUCLEAR REACTORS: STATUS AND FUTURE TRENDS,
Atomic Energy Commission, Washington, D. C.; and United Engineers and Constructors, Inc., Philadelphia, Pa.
F. E. Rutt, and W. C. Siler.
Preprint 732, Amer Soc Civ Eng Annual Meet Nat Meet Struct Eng, Pittsburgh, Pa, Sept/Oct 1968. 21 p, 3 fig.

Descriptors: *Nuclear powerplants, Planning, Nuclear reaction, Design, Construction, *Electric power production, Electric power costs, Electric power, Electric power demand, Atmospheric pollution, Water pollution, Safety, Radioactivity, Thermal radiation, Aesthetics, Peak power, Cost comparisons, Capital costs, Cooling water, *Nuclear reactors.
Identifiers: Electric utilities, Fossil fuels, Nuclear fuels, *Nuclear technology, *Nuclear safety.

Power reactor construction is placing a strain on the utility, manufacturing, and construction industries as well as on Federal and state regulatory agencies. Utility companies are required to make increasingly complex decisions as to type, size, and location of new generating facilities. Larger plants and escalating costs require that special attention be given to financial planning. Organizations engaged in design and construction of nuclear- and fossil-fueled powerplants are experiencing pressures on their resources. Design of many large-size units is placing a critical strain on the supply of experienced power-plant engineers, designers, and draftsman. Increasingly complex state and Federal regulatory requirements also demand additional engineering work. Increased demand and escalating quality control requirements are placing greater pressures on field construction forces and skilled labor categories. Projections of future demand for electric-generating capacity require special attention by various segments of private industry and government, directed toward developing advanced concepts and new power sources. The status of development of several advanced concepts and future power sources are reviewed. (USBR)
W69-02940

SAFETY FACTORS AND PROBABILITY IN STRUCTURAL DESIGN,
Illinois Univ., Urbana.
Alfredo H. S. Ang, and Mohammad Amin.
Preprint 708, Amer Soc Civ Eng Annual Meet Nat Meet Struct Eng, Pittsburgh, Pa, Sept/Oct 1968. 28 p, 6 fig, 2 tab, 16 ref, 4 append.

Descriptors: *Safety factors, *Structural design, *Safety, Structures, Probability, Structural engineering, Structural models, Design, Design criteria, Structural stability, Structural behavior, Reliability, Mathematical analysis, Evaluation, Bibliographies.
Identifiers: Design assumptions.

An alternative formulation of structural safety is proposed, and its associated basis for designing safe structures is described. The proposed formulation combines certain aspects of the conventional design method with an extended reliability theory in such a manner as to capitalize on the best features of each method. In so doing, the major shortcomings and difficulties previously associated with existing methods, including the critical problem of choosing an acceptable probability level for design, can be resolved more easily. Practical significance includes the feasibility of developing workable design procedures based on the reliability concept but retaining the simplicity of the conventional method. The proposed approach is described in its most basic form and illustrated with simple examples. This presents the fundamentals of the new approach more clearly. Ramifications, and possibly extensions, of the basic formulation will be necessary to implement the proposed safety concept in practical design situations; studies for this purpose are in progress. (USBR)
W69-02941

STRESS AND STRAIN ANALYSIS ON MODELS,
Lazar Jovanovic.
Saopstenja, Vol 14, No 41-42, pp 69-82, 1967. 14 p, 14 fig, 15 ref.

Descriptors: *Model tests, *Structural models, Models, *Structural behavior, *Stress analysis, *Structural analysis, Hydraulic structures, Dams, Dam foundations, Abutments, Buttress dams, Gravity dams, Arch dams, Concrete dams, Concrete structures, Foreign design practices, *Photoelasticity, Strain gages, Tensiometers, Bibliographies.
Identifiers: Yugoslavia, Photoviscoelasticity, Bajina Basta Dam (Yugoslavia), Idbar Dam (Yugoslavia), Modrac Dam (Yugoslavia).

Model testing of dams and hydroelectric structures at the Jaroslav Cerni Institute is surveyed. Developments in model testing are being made primarily in photoelasticity, tensiometry, and brittle coatings. Photoelastic studies are described on the 2-dimensional problem of weakening of gravity dams by galleries, 3-dimensional stress analysis of dams and foundations, fissured and anisotropic dam foundations, and analysis of concrete structures. Developments in the use of photoviscoelastic materials, photothermoelastic studies, and photoelastic coatings are discussed. Tensiometric models of dams and the dam terrain complex are given for Bajina Basta buttress dam, Idbar arch dam, and Modrac multiple-arch buttress dam. Brittle coatings are used as a preliminary method of determining stress trajectories for locating strain gages in tensiometric testing and also in dynamic tests of parts subjected to impacts. Experiment stress and strain analysis is accepted as a necessity and has become a permanent practice in constructing important structures in hydroengineering and other branches of civil engineering. (USBR)
W69-02948

CONCRETE RESERVOIR DESIGN,
Montgomery (James M.) Construction Engineers, Inc., Pasadena, Calif.
Russel C. Kenmir.
J Amer Water Works Ass, Vol 60, No 10, pp 1181-1194, Oct 1968. 14 p, 14 fig, 1 tab.

Descriptors: *Reservoir design, *Reservoir construction, *Underdrains, Aesthetics, Design criteria, Reservoir leakage, *Reservoirs, Prestressed concrete, Construction joints, Maintenance costs, Reservoir sites, Water storage, Linings, Precast concrete, Reinforced concrete, Costs, Post tensioning, Cost comparisons, Foundation investigations.
Identifiers: Concrete linings, Concrete properties.

Concrete reservoirs involve a multitude of details that must be designed and constructed properly. These details, which can cause costly maintenance problems, include: location of construction joints, installation of water stops, vibration and curing of concrete, and design and construction of underdrains. Concrete reservoir walls may be nonprestressed, prestressed, or post-tensioned. The roof may be either cast-in-place or precast design. Aesthetics and relation of the site elevation are important factors in selecting the reservoir type. Some general precautions are given to reduce the possibility of trouble with wire-wrapped prestressed reservoirs. Buried reservoirs are becoming more attractive to water utility agencies because of rising cost of land and savings in maintenance expense. A tabulation of construction cost data on various types of concrete reservoirs is given. The need for a foundation investigation, including underdrains, is discussed. Construction joints should be spaced about 20-30 ft in reinforced concrete and 10-12 ft in unreinforced concrete. The quality of concrete necessary to obtain a watertight and maintenance-free reservoir is discussed. (USBR)
W69-02952

8B. Hydraulics

INFLUENCE OF SIDE SPILLING FLOW IN A COLLECTING CHANNEL,
Georgije Hajdin.
Saopstenja, Vol 14, No 43, pp 5-12, 1967. 8 p, 7 fig, 1 tab, 3 ref.

Descriptors: Channels, *Water collection systems, Open channel flow, *Open channels, Hydraulic structures, Foreign design practices, Fluid flow, Hydraulics, Vortices, Fluid mechanics, Canal design, Submergence, Spilling, Flood control, Floodwater, Inflow, *Spillways, Spillway crests.
Identifiers: *Side channel spillways, Channel design, Yugoslavia.

Floodwater is commonly evacuated by side spilling into a collecting channel. This type of inflow can make solution of the linear flow problem impossible because longitudinal flow may be disturbed by inflows and, therefore, cannot be considered linear. Conditions were determined for longitudinal flow

in a collecting channel without unpermissible lateral influences. Two cases of side spilling inflow include: nonsubmerged spill stream penetrating the collecting channel and forming 2 vortices which nearly expend the kinetic energy of the spill; and submerged spill stream quickly advancing as a surface wave, which increases discharge while the return wave submerges the spill downstream. Spill submerging should be prevented. The transverse cross section of the channel can be determined to be sufficiently large for damping the lateral inflow only under conditions of nonsubmerged spilling. The practical problems analyzed are: (1) cross-section conditions of the channel allowing longitudinal flow without great disturbance from lateral inflow, (2) extra height required on the nonspilling side, and (3) conditions for preventing spill submergence. Instructions are given for designing collecting channels with side spill inflows. (USBR)
W69-02945

MEASUREMENT OF HYDRAULIC AND SEDIMENT TRANSPORT VARIABLES IN A SMALL RECIRCULATING FLUME,
Geological Survey, Fort Collins, Colo.
For primary bibliographic entry see Field 02J.
For abstract, see .
W69-03056

APPLICATION OF THE FINITE ELEMENT METHOD TO TRANSIENT FLOW IN POROUS MEDIA,
California Univ., Berkeley.
Iraj Javandel, and P. A. Witherspoon.
Soc of Petrol Eng J, Vol 8, No 3, pp 241-252, Sept 1968. 12 p, 9 fig, 34 ref, 1 append.

Descriptors: *Unsteady flow, *Porous media, *Mathematical studies, Digital computers, Approximation method, Hydraulic conductivity.
Identifiers: *Fluid flow, Finite element method, Layered systems.

The extension of the finite element method (which was developed to handle stress distribution problems in airframe construction) to problems of transient flow in porous media is described. The method provides a new approach to problems of transient fluid flow in complex systems. In this approach, the continuum is replaced by a system of finite elements. By employing the variational principle, one can obtain time dependent solution for the potential at every point in the system by minimizing a potential energy functional. The theory of the method is reviewed. To demonstrate its validity, nonsteady-state results obtained by the finite element method are compared with those of typical boundary value problems for which rigorous analytical solutions are available. To demonstrate the power of this approach, solutions for the more complex problem of transient flow in layered systems with crossflow are also presented. The generality of this approach with respect to arbitrary boundary conditions and changes in rock properties provides a new method of handling problems of fluid flow in complex systems. (Knapp-USGS)
W69-03064

DESIGN OF STABLE CHANNELS IN ALLUVIAL MATERIALS,
Kansas State Univ., Manhattan; and Colorado State Univ., Fort Collins.
R. M. Haynie, and D. B. Simons.
ASCE Proc, J Hydraul Div, Vol 94, No Hy6, Pap 6217, pp 1399-1420, Nov 1968. 22 p, 14 fig, 3 tab, 42 ref

Descriptors: *Alluvial channels, *Canals, *Design criteria, Roughness (Hydraulic), Channel morphology, Bed load, Sediment discharge, Reynolds number, Stokes law, Settling velocity, Mississippi River.
Identifiers: *Stable channels.

Data from flume experiments, river sediment discharge observations, and canal operation observations were used to compile design criteria for stable alluvial channels. The suggested design method considers bed roughness, flow resistance, bed load discharge and channel geometry. An alluvial channel is designed using discharge, fall diameter, type and geometry of bed material, and water temperature data. (Knapp-USGS)
W69-03066

DEPOSITIONAL BEHAVIOR OF KAOLINITE IN TURBULENT FLOW,
Massachusetts Inst. of Tech., Cambridge; and State Univ. of New York, Buffalo.
For primary bibliographic entry see Field 02J.
For abstract, see .
W69-03067

RUNOFF HYDROGRAPHS FOR MATHEMATICAL WATERSHED MODEL,
Minnesota Univ., St Paul. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 02E.
For abstract, see .
W69-03070

AN EXPERIMENTAL RAINFALL-RUNOFF FACILITY,
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 02A.
For abstract, see .
W69-03076

OPTIMIZATION OF PRESSURE CONDUIT SIZES,
D. I. H. Barr.
Water Power, Vol 20, No 5, pp 193-196, May 1968. 4 p, 7 fig, 13 ref.

Descriptors: *Optimization, *Pressure conduits, Size, Analytical techniques, Water conveyance, Hydraulic design, Hydraulic gradient, Pumping, Head loss, Roughness (Hydraulic), Costs.

Various methods of determining pressure conduit sizes were reviewed and discussed. The methods used graphical techniques based on several mathematical approaches (e.g. Lagrange's method of undetermined multipliers). Most of the methods determined the optimum diameter by finding the minimum total 'pumping' plus 'conduit' costs, hydraulic friction losses being computed by the Manning Equation. (Gysi-Cornell)
W69-03148

8C. Hydraulic Machinery

THE INFORMATION BACKGROUND IN THE FIELD OF BIOLOGICAL DETERIORATION OF NONMETALLIC MATERIALS,
Thompson (John I.) and Co, Washington, D. C.
Carl J. Wessel.
Mater Res Stand, Vol 8, No 9, pp 11-17, Sept 1968. 7 p, 8 fig, 7 tab, 1 ref.

Descriptors: *Deterioration, Directories, Documentation, *Information retrieval, Materials, Materials stability, *Nonmetals, Tropical regions, Biocontrol, Organic compounds, Microorganisms, Bibliographies, Inorganic compounds, *Biodegradation, Biological treatment, *Corrosion, Corrosion control, Fungi.
Identifiers: Microbes, Information centers, Technical papers.

The background and development of the field of biological deterioration of nonmetallic materials are reviewed. Sources of literature on biodeterioration are discussed, including the literature collection of the Prevention of Deterioration Center. Documentary materials are classified as primary materials, secondary sources, and information center sources. A list is given of primary journals, announcement bulletins, abstracting and indexing journals, and information centers. These information sources are important to the needs of research, development, test, and evaluation in the biodeterioration field. (USBR)
W69-02905

TUBULAR TURBINES,
Washington State Univ., Pullman.
Robert A. Sutherland.
Washington State Univ, Bull 309, 1968. 49 p, 23 fig, 1 tab, 69 ref.

Descriptors: Hydroelectric power, *Tidal powerplants, *Bulb turbines, Efficiencies, *Tube turbines, Economics, Pump turbines, Bibliographies, Mechanical engineering, Hydraulic turbines, Kaplan turbines, Turbines, History, Thrust bearings, Electric generators, Hydraulic machinery.
Identifiers: Rance Tidal Project (France), Moselle River, *Low-head hydro plants.

The tubular turbine was invented in the United States but has been largely developed in Europe. It has many advantages for the economical development of low-head hydropower up to a head of approximately 60 ft and a power of 35 mw. Flow is nearly straight through, resulting in improved efficiency and reduced lateral and vertical dimensions as compared with conventional turbine-generator units. The generator is usually located in a bulb-shaped enclosure supported within the water passage, but with appropriate access. Another design locates the generator outside the water passage, with the disadvantage of a longer shaft. In either design the generator may be gear driven at a higher speed than the turbine. The tubular turbine generally uses a Kaplan-type runner, and in several cases has been used for pump and turbine services. It is well suited for tidal power and is the basis of the Rance tidal development in France. Charts are given for finding the approximate runner diameter; rules of thumb are applied to determine approximate dimensions of a complete unit for comparison with a conventional unit. A table lists characteristics of 94 worldwide tube turbine installations. (USBR)
W69-02907

CAVITATION TESTS OF A MODEL OF THE RADIAL GATE OF THE BOTTOM OUTLET OF THE KRASNOYARSK HYDROELECTRIC STATION DAM,
Yu A. Grivnin.
Hydrotech Constr, No 8, pp 704-709, Aug 1967. 6 p, 9 fig, 1 tab, 9 ref.

Descriptors: *Radial gates, *Cavitation, *Outlet works, Model tests, Foreign research, Hydraulic structures, Hydraulic design, Pressure head, Stainless steel, Experimental data, Flow, Velocity.
Identifiers: Cavitation noise, Cavitation resistance, Cavitation index, USSR, Krasnoiarsk Dam (USSR), Gate guides, Gate sills.

Cavitation tests were conducted on models of the bottom outlet radial gates at Krasnoiarsk Dam. Tests showed that all modes of gate operation were accompanied by cavitation in the corners of the drop, and that intensity increased with rise of the upper pool level and an increased gate opening. Cavitation erosion appeared to be greatest at the corners of the drop, the gate guides, the sill, and the floor of the conduit behind the sill. Cavitation erosion could be decreased by: (1) rounding the edge of the gate drop, (2) introducing air into the zone behind the sill, and (3) lining gate guides with stainless steel. Because of little knowledge of the scale effect, cavitation under field conditions in prototype gates will be more intense than in the model tests. Results of model tests are reported. (USBR)
W69-02914

HORIZONTAL BORING TECHNOLOGY: A STATE-OF-THE-ART-STUDY,
Bureau of Mines, Minneapolis, Minn.

James Paone, William E. Bruce, and Roger J. Morrell.
Bur Mines, Inform Circ 8392, Sept 1968. 86 p, 63 fig, 14 tab, 69 ref, append.

Descriptors: Boreholes, *Boring machines, Borings, Tunneling, Drills, *Tunneling machines, Tunnels, Rock excavation, Drill holes, Transmission (Electrical), *Drilling equipment, Auger borings, Augers, *Transmission lines, Bibliographies, Reviews, Rocks, Soils, Direction finding, Drives, Surveying, Plowing, Trenches, Excavation, Reamers, Penetration.
Identifiers: *Underground cables, *Underground transmission lines, *Buried cables.

Horizontal boring technology for underground power transmission is reviewed in this state-of-the-art report prepared by the Bureau of Mines. Machines and methods are described for augering, impacting, pushing, drilling, and machine tunneling of horizontal holes through soil and rock. Borehole survey and guidance tools and applicable techniques are reviewed. Nonboring methods for emplacing power distribution and transmission lines are covered. Horizontal boring techniques for burying power distribution lines are adequate for industry requirements, particularly for short distances in soil or soft rock. Horizontal boring methods are not as well advanced for burying power transmission lines, particularly in hard rock and over relatively long distances. Research and development and economic incentives to equipment manufacturers could substantially improve the state of the art. Obstacle detection and guidance systems for directing boreholes need major improvements to meet power industry requirements for underground burial of distribution and transmission lines. The report gives a technical forecast, an analytical summary of the state of the art, and recommendations based on power industry needs. (USBR)
W69-02923

EVALUATION OF SPACERS FOR BUNDLED CONDUCTOR TRANSMISSION LINES,
Bureau of Reclamation, Denver, Colo.
R. A. Krahn, and M. B. Bessler.
No 69 CP 8-PWR, Inst Elec Electron Eng Winter Power Meet, New York, N Y, Jan 1969, Oct 1968. 5 p, 6 fig, 1 ref.

Descriptors: Extra high voltage, *Bundled conductors, *Spacers, Field tests, *Transmission lines, Dampers, Vibrations, Materials engineering, Abrasion, Test procedures, Arizona, Laboratory tests, Reliability.
Identifiers: *Transmission line hardware, Electric conductors, Test results, Antelope Hills Test Area, Product evaluation.

The increasing use of bundled conductors on ehv transmission lines requires close scrutiny of spacer reliability and effectiveness. A transmission line hardware test section was established on an operating circuit to evaluate new spacer and damper designs. Results have revealed problems of conductor abrasion and the loss of clamping force in spacer clamps. Preliminary results of a continuing test program are discussed, with emphasis on significant questions yet to be answered. Evaluation of line hardware may become more important with the evolution of multibundle, uhv transmission lines that follow the trends of present design. An intense appraisal of today's hardware design problems will aid in a better-engineered product to meet the rigors of increased loadings, lightweight materials design, and the complex nature of transmission line vibration. (USBR)
W69-02943

OPTIMIZATION OF TIDAL POWER GENERATION,
For primary bibliographic entry see Field 06A.
For abstract, see .
W69-03160

8D. Soil Mechanics

DYNAMIC LOADINGS,
D'Appolonia (E.) Consulting Engineers, Inc., Pittsburgh, Pa.
E. D'Appolonia.
Amer Soc Civ Eng Spec Conf, Massachusetts Inst Tech, Cambridge, Aug 1968. 46 p, 14 fig, 4 tab, 53 ref.

Descriptors: Dynamics, *Soil dynamics, Soil liquefaction, Strain, Soil treatment, *Soil density, Settlement, Bibliographies, Earthquakes, Earth dams, Design criteria, *Foundations, Embankments, Soil mechanics, Shear stress, Drainage, Relative density, Granular materials, Shear strength.
Identifiers: *Dynamic loads, *Dynamic response, Confining pressure, Soil-structure interaction.

Criteria for placing and improving soil required to sustain dynamic loadings should be determined for each specific case from an evaluation of the soil and structure response to ground motion. Soil density and confining pressure are the 2 most important considerations for fill supporting structures other than fluid impounding embankments. In the latter case, drainage, density, and confining pressure are the most important aspects, in that order. High-magnitude ground motions of short duration cause little distress to structures. Soil for machinery foundations should be compacted to a depth 1.5 times the average width of the foundation and in an annular distance around the foundation equal to at least one-half the average foundation width. To reduce the risk of liquefaction, granular soil should be densified to a relative density of 85% in the upper portion of the deposit and 70% within the zone of influence of the foundation. To preclude liquefaction at all depths, the cyclic stress required to produce initial liquefaction should be at least 1.5 times the dynamic shear stress caused by the design earthquake; cyclic stress required to produce liquefaction at 10% strain should be at least equal to the dynamic stress from the maximum credible earthquake. (USBR)
W69-02908

TWO-DIMENSIONAL ANALYSIS OF STRESS AND STRAIN IN SOILS, REPORT 5; PLANE-STRAIN LOADING OF A STRAIN-HARDENING SOIL,
Massachusetts Inst. of Tech., Cambridge.
W. H. Tang, and Kaare Hoeg.
Army Eng Waterways Exp Sta Contract Rep No 3-129, Mar 1968. 84 p, 26 fig, 2 tab, 9 ref, 4 append.

Descriptors: *Footings, Strain, Mathematical analysis, Soil mechanics, Mathematical models, Numerical analysis, Stress-strain curves, *Flexible foundations, Stress circle, Stress distribution, *Settlement, Elasticity modulus, Plastic deformation, Elastic deformation, Foundations, Computer programming, Internal friction, Soil dynamics, Cohesion, *Live loads.
Identifiers: *Strain hardening, Plane strain, Dynamic response, Dynamic loads.

Idealized stress-strain relationships for a strain-hardening soil are formulated and discussed. The method was applied to a flexible 5-ft-wide strip footing resting on frictional material with a unit weight of 119 lb/cu ft. To perform the numerical computations, the soil continuum was replaced by a lumped parameter model. If plastic volume change of the soil element takes place during virgin loading, the element is work-hardened. Upon subsequent reloading, no plastic straining will occur until a stress state is reached, bringing the stress up to the previous yield surface. Analysis of the strip footing statically loaded to 35.8 psi indicated that a failure pattern was developing. Decrease in settlement was proportional to the increase in elastic modulus. Because of the inertia of the assumed 2-ft-thick concrete footing, the ratio of peak response to peak applied footing pressure during impulse loads is about 1.35 and occurs after 45 msec. As friction angle and cohesion are increased, displacements are increased, indicating an inadequacy in the present formulation of strain-hardening behavior. (USBR)
W69-02912

EVALUATION OF VIBRATORY ROLLERS ON THREE TYPES OF SOILS,
J. W. Hall.
Army Eng Waterways Exp Sta Tech Memo No 3-271, Mar 1968. 39 p, 9 plate, 5 tab.

Descriptors: Vibrations, Compacted soils, *Compaction, *Rollers, Soil density, *Compaction equipment, *Compaction tests, Frequency, Moisture content, Sands, Clays, Crushed stones, Lifts (Construction), Evaluation, *Soil compaction, *Construction equipment, Soil mechanics.
Identifiers: *Vibratory compaction.

Compactive effort of 3 vibratory rollers is compared to that of a 50-ton rubber-tired roller. Operating frequencies of the 3 rollers encompass the range over which present vibratory rollers operate. Each of the 3 rollers was used to compact 3 soil types: lean clay, crushed limestone, and clean sand. Each soil was compacted wet of, dry of, and at optimum moisture content. Density in sand compacted with vibratory rollers appears to be a cyclic function of coverages. The lowest frequency compactor performed the best in sand. Densities in limestone and lean clay generally increased in direct proportion to the deadweight of vibratory rollers. Except in limestone, vibratory rollers will not produce densities to significantly greater depth than rubber-tired rollers. For comparable lift thickness of compaction, much lighter vibratory rollers may be substituted for heavy rubber-tired rollers; however, there is a limit to the amount of weight reduction that can be achieved using vibratory rollers. (USBR)
W69-02915

FIELD INVESTIGATIONS OF SEEPAGE ON EXISTING DAMS,
O. N. Nosova, and G. M. Zadvornyi.

Descriptors: *Seepage, *Dams, Field investigations, *Underseepage, Percolation, Foundation investigations, Pervious soils, Piezometers, Tracers, Foreign design practices, Sedimentation, Radioisotopes.
Identifiers: Piping (Erosion), USSR.

A discussion is given of investigation and treatment of underseepage problems in general and, in particular, those occurring at the Ust'-Kamenogorsk, Kama, Uch-Kurgansk hydroelectric dams in the USSR. Dams can be constructed safely on porous foundations, provided proper foundation treatment is given to prevent underseepage or piping. When planning a dam on a river carrying a large amount of sediment, the possibility should be considered of forming (by sedimentation) a natural apron in the riverbed and reservoir bottom upstream from the dam. The cost of seepage control can be reduced by this measure. (USBR)
W69-02921

LOAD TRANSFER--BEARING CAPACITY FOR SINGLE PILES AND PILE CLUSTERS,
D'Appolonia (E.) Consulting Engineers, Inc., Pittsburgh, Pa.
E. D'Appolonia.
Amer Soc Civ Eng, Soil Mech Found Div, Illinois Sect, Apr 1968. 78 p, 31 fig, 3 tab, 74 ref.

Descriptors: Bearing capacities, *Pile groups, *Pile foundations, Pile lateral loads, Negative friction, Ultimate loads, Bibliographies, Safety factors, Pile spacing, Pile friction, *Pile (Foundations), *Pile bearing capacities, Pile extraction, Load distribution, Design criteria, Skin friction, Instrumentation, Foundations.

Identifiers: Pile tests, Loading tests, Pile-driving formulas.

Apparent success with pile foundations has not resulted from knowledge of pile-soil behavior but is a consequence of a conservative approach to design and installation. The design of a pile group is based on experience with similar pile installations and load deformation behavior of a single pile. Applications and limitations of pile driving formulae are discussed. Theoretical load transfer assumes that the pile remains linearly elastic throughout the entire range of loading and that it is embedded in a semi-infinite elastic solid. If strains are small (comparable to those of elastic shortening of the pile), techniques based on compatibility of deformations and linear stress-strain relations can be used to predict load transfer from a pile and movement of its tip. Factors of safety should be applied to skin resistance and end bearing capacity. Two examples are given of tension-compression tests used to determine end bearing capacity and skin friction of piles. The relation between ultimate load capacity and settlement of single piles and pile groups is discussed. (USBR)
W69-02922

MECHANICAL PROPERTIES OF COMPACTED SOILS,
Ohio State Univ., Columbus.
Charles A. Pagen, and Banad N. Jagannath.
Highw Res Rec, No 235, pp 13-26, 1968. 14 p, 9 fig, 1 tab, 12 ref.

Descriptors: *Compacted soils, Unconfined compression, Soil mechanics, Rheology, *Compaction, *Mechanical properties, *Soil compaction, Elastic deformation, Soil compression tests, Soil density, Soil properties, Soil strength, Subgrade, Deformation, Stress-strain curves, Moisture content, Thixotropy, Elasticity modulus, Creep.
Identifiers: Subgrade modulus, Viscoelasticity.

At low stress and strain levels, compacted soils can be described as linear viscoelastic materials. Response of highway subgrade materials is described by fundamental strength properties that can be utilized to evaluate changes in strength and deformation characteristics of soils produced by the type and amount of compaction energy applied. Four soils representative of the natural soils used for highway subgrades were investigated. Experiments were performed to investigate the application of the linear viscoelastic theory and mechanistic models to unsaturated soils and to determine limitations of such approaches to highway compaction problems. Three to 5 levels of impact compaction energy were used to prepare test specimens over a range of molding water contents. The unconfined constant-load creep test investigated mechanical properties of compacted soils on the phenomenological level. Failure tests were performed to evaluate modulus of deformation and ultimate unconfined compressive strength. The study utilized the electric-mechanical analogy and concept of complex elastic modulus to define mechanical properties of compacted soils. Data were obtained to validate the evaluation of soil compaction by rheological strength parameters. (USBR)
W69-02925

EVALUATION OF DEEP IN-SITU SOIL STABILIZATION BY HIGH-PRESSURE LIME-SLURRY INJECTION,
Swindell-Dressler Co., Pittsburgh, Pa.
H. L. Lundy, Jr., and B. J. Greenfield.
Highw Res Rec, No 235, pp 27-35, 1968. 11 p, 9 fig, 4 photo, 13 ref

Descriptors: *Soil stabilization, *Shear strength, Moisture content, Soil physical properties, *Soil treatment, *Slurries, Atterberg limits, *Lime soil mixtures, Lime, Glacial deposits, Glacial soils, Silts, Soil mechanics, Foundations, pH, Soil engineering, Injection
Identifiers: Soil plasticity.

A soft glacial clayey silt deposit was pressure-injected with a hydrated lime slurry to depths of 20 ft to determine the effects of lime stabilization on the foundation beneath a 40-ft highway embankment. Treated and untreated lime samples taken up to 1 yr after the injection are discussed. The slurry was a mixture of 30% lime and 70% water by weight and was injected at pressures of 300 and 600 psi. Eight to 12 gal of slurry were injected every 8-1/2 in. of depth. Slurry loss around the injection rod indicated that the lime did not penetrate softer soil to the extent that it did the harder postglacial material. Sampling programs showed that the slurry penetrated the postglacial soil in horizontal and vertical patterns up to 5 ft from the injection holes. The method was only moderately successful in penetrating the glacial deposit. Plasticity index of the treated postglacial deposit soil was slightly reduced. Appreciable shear strength increases were noted in samples from both materials that did not contain lime seams. The method appears to be quite successful in soil stabilization, provided equipment and additives can be developed to aid penetration and migration of the slurry. (USBR)
W69-02930

COMPARISON OF FIELD AND LABORATORY MEASUREMENTS OF MODULUS OF DEFORMATION OF A CLAY,
Sheffield Univ., (England); and Hydro-Electric Power Commission of Ontario, Toronto.
Thomas H. Hanna, and John I. Adams.
Highw Res Rec, No 243, pp 12-22, 1968. 11 p, 10 fig, 2 tab, 10 ref.

Descriptors: *Deformation, Stress-strain curves, *Clays, Laboratory tests, Field tests, Soil physical properties, Strain, Stress, Measuring instruments, Shear stress, Instrumentation, *Settlement, Consolidation, Soil mechanics.
Identifiers: *Deformation modulus, In situ tests, Undrained tests, Plate load tests, Undrained shear strength.

The deformability of a natural clay under undrained loading conditions was studied in field and laboratory tests. Laboratory-determined modulus of deformation is very sensitive to the test load system used, the stress level applied, and the magnitude of undrained strength. The modulus decreases as the stress ratio increases because of the elastic-plastic behavior of soils. Moduli determined from the loading and unloading part of the stress-strain relationship are different, the unloading value being larger. Data inferred from field movements show a similar trend. Moduli of deformation determined in place by plate loading tests and inferred from in-place ground movements caused by construction work generally were different from, and in most cases, greater than laboratory-determined values. Constant-stress testing provides moduli values greater than constant-strain testing; the former is in better agreement with mass behavior than the latter. (USBR)
W69-02933

IN SITU PERMEABILITIES FOR DETERMINING RATES OF CONSOLIDATION,
Weber (W. G.) and Associates, Inc., Sacramento, Calif.
William G. Weber, Jr.
Highw Res Rec, No 243, pp 49-61, 1968. 13 p, 10 fig, 4 tab, 7 ref.

Descriptors: *Consolidation, Settlement, *Permeability, *Piezometers, Pore pressure, Pore water pressures, Sand drains, Hydrostatic pressure, Foundations, Field tests, *Field permeability tests, Embankments, Soil mechanics, Instrumentation, *Permeameters.
Identifiers: *In situ tests, *Permeability tests.

Variable-head permeameters measuring in situ permeabilities are used to predict the consolidation rate of foundation soil. The permeameters are nonmetallic, porous, tube-type piezometers that serve a dual purpose of measuring excess hydrostatic pressures during construction. Better results are obtained by using the rising head test instead of the falling head test. Test procedures and methods of data analysis are described. Sources of error in performing the test are discussed. In situ permeameters measure primarily horizontal permeabilities of foundation soils. Generally, they indicate a larger permeability than data from consolidation tests. Measured rates of settlement were in good agreement with the settlement rate determined from in situ permeabilities, indicating that either considerable horizontal drainage was occurring or in situ permeabilities were primarily affected by vertical permeability. Five projects are described where instrumentation was installed to illustrate reliability of the method. (USBR)
W69-02934

DENSIFICATION OF GRANULAR SOILS BY VIBRATIONS,
D'Appolonia (E.) Consulting Engineers, Inc., Pittsburgh, Pa.
E. D'Appolonia.
Michigan Univ Eng Summer Conf, June 1968. 91 p, 40 fig, 64 ref, append.

Descriptors: Density, *Granular materials, *Foundations, *Sands, *Soil density, *Soil compation, *Soil dynamics, Soil stability, Settlement, Lifts (Construction), Compaction, Compacted soils, Stress-strain curves, Compaction tests, Relative density, Void ratio, Moisture content, Soil mechanics, Bibliographies.
Identifiers: Soil-structure interaction, *Vibratory compaction.

Design and construction of sandfills to prevent settlement involve selecting the sand density required to prevent unsatisfactory performance of the fill and the compaction technique best suited to achieve the required density. The first problem involves developing methods for predicting the settlement of sand deposits under various vibratory loading conditions; the second problem involves establishing guidelines for selecting vibratory compaction equipment and compaction procedures. The first part of this presentation develops rational techniques for predicting settlement of foundations on granular soils subjected to vibratory loadings. Experimental research on the relationship between density and vibration parameters is reviewed. Methods for applying research findings to predict machine foundation settlements are discussed. The second part of the paper reviews results of recent field experiments with vibratory rollers. During these experiments, influence of roller size and operating frequency, lift height, and number of roller coverages on compacted density were investigated. Settlements of footings on compacted sand are compared with predicted settlements and are considerably smaller than expected. (USBR)
W69-02935

EQUILIBRIUM LIMITS OF EMBANKMENTS AND EARTH DAMS,
J. Biarez.
Trans from Ann Inst Tech Batiment Trav Publics, Vol 18, No 211-212, pp 1017-1030, July-Aug 1965. Bur Reclam Transl 644, Sept 1967. 33 p, 14 fig, 3 tab, 39 ref, append.

Descriptors: *Equilibrium, Soils, Foundations, Soil moisture, Moments, Foundation investigations, Soil physical properties, *Embankments, Soil stability, *Earth dams, Stability analysis, Interstices, Safety factors, Friction, Cohesion, Soil pressure, Drawdown, Soil mechanics, Slip-circle methods, Slopes, *Mohr circle, *Slope stability, Bibliographies.
Identifiers: Coulomb law, *Limit analysis.

The author examines one of the problems presented by embankments and earth dams--estimating the safety of a structure with respect to failure, taking into account the uncertainty of the data and the methods of calculation used. The problem consists of seeking, by 2 groups of calculation methods, the slip surface that gives the smal-

lest safety factor. The first group of methods assumes plasticity in an extensive volume; the other group assumes that such volume is reduced to a thin area. For the second group, the author considers first the case of a homogeneous soil, and then that of a heterogeneous soil. The appendix covers a study of a dam on a foundation of very limited strength, and determination of the maximum surcharge on the edge of an embankment. (USBR)
W69-02949

THE STRENGTH ALONG STRUCTURAL DISCONTINUITIES IN STIFF CLAYS,
Imperial Coll. of Science and Technology, London (England).
A. W. Skempton, and D. J. Petley.
Proc Geotech Conf Oslo 1967, Vol 2, pp 29-46, 1968. 18 p, 33 fig, 2 tab, 17 ref.

Descriptors: *Clays, Clay shales, Soil stability, Bibliographies, Soil tests, Shear strength, Shear tests, *Discontinuities, Joints, Slipping, Fractures, Mechanical properties, Deformation, Shear planes, Landslides, Cleavage, Internal friction, *Soil mechanics, Joints (Geology).
Identifiers: *Residual strength, *Slip surface, Foreign testing, Great Britain, Slip planes.

Field and laboratory tests are described for measuring shear strength along principal slip surfaces, minor shears, and joint surfaces in clay strata. The clays were overconsolidated, with liquidity indices ranging from plus 0.1 to minus 0.4. Along principal slip surfaces (in landslides and tectonic shear zones), the strength is at or near the residual strength, typically 95% or more of peak strength. Test results show that this relation holds even where no renewal of movement has occurred during the past 10,000 yr. Minor shears, with irregular surfaces having small relative movements, show a strength appreciably above the residual strength. Joint surfaces display a brittle fracture texture with zero or exceedingly small movements along these surfaces. Tests available on London clay joint surfaces indicate that the fracture producing the joint virtually destroyed the cohesion intercept of the clay, but reduced the value of the effective angle of internal friction only 1.5 deg. Movements of less than 5 mm are sufficient to polish the surface and lower the strength along the joint to the residual strength. These discontinuities are all surfaces of weakness that reduce the strength of the clay mass far below the strength of the intact material. (USBR)
W69-02950

8E. Rock Mechanics AND Geology

POSSIBILITIES AND LIMITATIONS OF GEOPHYSICAL METHODS APPLIED TO CIVIL ENGINEERING,
Electricite de France, Paris.
P. Duffaut.
Trans from Bull Tech Suisse Romande, No 9, pp 3-12, May 1967. Bur Reclam Transl 783, Oct 1968. 22 p, 9 fig, 11 ref.

Descriptors: *Geophysics, Geophones, Subsurface investigations, Civil engineering, Foreign projects, Exploration, Geologic investigations, *Engineering geology, *Seismic investigations, Rocks, Alluvial deposits, *Seismic properties, Seismic waves, Bedrock, Mechanical properties, Rock properties, Elasticity modulus, Structural geology, Damsites.
Identifiers: Cavernous rock, Electrical logging, Electrical prospecting, France, Gravimetric prospecting, *Geophysical prospecting.

The main objective of geophysical exploration is to determine the shape, size, and position of concealed geological structures. The striking constrast between the generally acknowledged effectiveness of geophysical methods in oil exploration and the variety of opinions encountered in the field of civil engineering is attributed to the occasional client experiencing either a first failure or first success and the oil man's averaging of failures with a greater number of successes. For the geophysicist, there is no difference in principle between the study of an oil structure and the investivagion of buried bedrock. The underlying reason for success or failure is found in the very nature of things, the geological content of the terrain. The report discusses the study of concealed structures, properties of subsurface materials, mechanical interpretation of geophysical parameters, and diagnosis of seismic velocity variations with time in rock masses. Examples of some French and other European experiences are given. (USBR)
W69-02916

ROCK BREAKAGE BY CRUSHING, BLASTING, AND DRILLING,
Rice Univ., Houston, Tex.
J. B. Cheatham, Jr.
Eng Geol Int J, Vol 2, No 5, pp 293-314, Aug 1968. 22 p, 22 fig, 2 tab, 39 ref.

Descriptors: Rocks, *Rock excavation, Rock mechanics, *Cratering, Rock properties, Craters, *Drilling, *Crushing, *Grinding, Fractures, Energy, *Fragmentation, Energy dissipation, Bibliographies, Reviews, Rock crushers.
Identifiers: Rock breakage, Brittle fracture theory.

Observations have provided empirical means for predicting energy requirements for rock fragmentation in crushing, blasting, and drilling, although the fundamental principles are not well understood. The state of knowledge of rock fracturing processes is surveyed and practical applications are discussed in rock comminution, cratering, and drilling. In most cases, an almost negligible amount of the total energy expended in rock breakage goes into useful work; most of the energy is dissipated as kinetic or thermal energy. Data analyses indicate that: (1) crushing uses several hundred times the energy actually required as surface energy, (2) blasting requires energy one order of magnitude greater than crushing, (3) and roller-bit drilling requires at least as much energy as blasting. In view of the limited energy directed toward actual rock fragmentation, rock breakage processes could be much more efficient. Empirical equations presently are used for equipment design and prediction of results. A better understanding of brittle fracture is needed to provide a more valid basis for comminution studies. (USBR)
W69-02920

HORIZONTAL BORING TECHNOLOGY: A STATE-OF-THE-ART-STUDY,
Bureau of Mines, Minneapolis, Minn.
For primary bibliographic entry see Field 08C.
For abstract, see .
W69-02923

A CONTRIBUTION TO THE DEVELOPMENT OF ROCK MECHANICS,
Belgrade Univ. (Yugoslavia).
Branislav Kujundzic.
Saopstenja, Vol 14, No 41-42, pp 83-102, 1967. 20 p, 30 fig, 27 ref.

Descriptors: *Rock mechanics, Test procedures, Deformation, Grouting, Field investigations, *Field tests, Rocks, Hydraulic jacks, Stress, Rock properties, Seismic investigations, Seismic properties, Stress analysis, *Shear tests, Shear strength, Sliding, Tunnel pressures, Elasticity modulus.
Identifiers: *In situ tests, *Jacking tests, Foreign testing, Rock pressures, Yugoslavia, Dilatometers, Borehole deformation gage.

Developments in rock mechanics at the Jaroslav Cerni Institute are reviewed. Test procedures developed include: (1) the hydraulic jack method, (2) the double jack method, (3) the radial press, (4) the borehole dilatometer, (5) a seismic method for determining the relationship between dynamic modulus of elasticity and static modulus of deformation, (6) field shear tests, and (7) determination of stress underground. Each method is described. Rock is a heterogeneous, anisotropic, and discontinuous medium and must be investigated as a mass by large-scale in situ tests. Laboratory testing of small rock samples has little practical or theoretical value in rock mechanics. (USBR)
W69-02947

SHEAR STRENGTH OF ROCK,
Coyne et Bellier, Bureau d'Ingenieurs Conseils, Paris (France).
Pierre Londe.
Proc Geotech Conf Oslo 1967, Vol 2, pp 91-99 and 223-259, 1968. 46 p, 105 fig, 37 ref, disc.

Descriptors: *Rock mechanics, Rock foundations, Shear failures, Voids, *Rocks, *Shear strength, Shear tests, Reviews, Bibliographies, Stability analysis, *Rupturing, Field tests, Laboratory tests, Brittle failures, Tensile strength, Rock properties, Foreign research, Joints (Geology).
Identifiers: *Rock slope stability, Brittle fracture theory, France, Finite element method, Griffith theory.

Important unsolved problems in the shear strength of rock are discussed by the General Reporter of the 1967 Oslo Conference. Analysis of all rock strength problems is divided into 2 parts: (1) determining possible large-scale failure patterns, with the help of theories based on observations; and (2) considering the strength of rock as measured by tests that attempt to reproduce actual rupture conditions. Theories on large-scale rupture are discussed with views on influence of rock mass structure, influence of time, evaluation of stresses, variations of voids, action of underground water, various phases of rock mass rupture, and theories of rupture. Strength tests are reviewed for the purposes of rock classification, similitude for establishing theories, and measurement of strength characteristics valid on the scale of the rock mass. Discussions by panel members cover topics on shear strength of rock masses, shear rupture patterns, shear failure in jointed rock, finite element analysis, and field and laboratory rock test procedures. (USBR)
W69-02951

8F. Concrete

A SYSTEMS APPROACH TO ANALYSIS OF HARDENED CONCRETE,
Pennsylvania State Univ., University Park.
T. D. Larson, and P. D. Cady.
Mater Res Stand, Vol 8, No 10, pp 8-16, Oct 1968. 8 p, 12 fig, 5 tab, 9 ref.

Descriptors: Concretes, Concrete mixes, Concrete structures, *Concrete technology, *Concrete testing, *Deterioration, Microscopy, *Petrographic investigations, Analysis, Air void ratio, Water-cement ratio, Cracking, Sampling, Aggregates, Frost action.
Identifiers: Cement paste, Concrete properties, Bridge decks, Freeze-thaw durability.

A procedure is described for examining hardened concrete specimens and evaluating concrete deterioration. The method combines microscopic linear traverse measurements of air void parameters, percent cement paste, and percent aggregate; determination of original water-traverse measurements are made on polished concrete specimens following ASTM Designation C 457-67T, and data processed on a digital electronic computer. The analysis of concrete core specimens, coupled with field observations, provides information for evaluating causes of concrete deterioration. The mode of deterioration often depends upon conditions and characteristics of the concrete in its early life, and since there are secondary and contributory effects, the fundamental causes may be difficult to identify after deterioration becomes obvious. The procedure for analyzing hardened concrete permits separation of basic and contributory mechanisms.

An example of analysis of concrete bridge deck deterioration is given. (USBR)
W69-02909

THE THEORY OF THE STRIP METHOD FOR DESIGN OF SLABS,
Building Research Station, Watford (England); and Warwick Univ., Coventry (England).
R. H. Wood, and G. S. T. Armer.
Proc Inst Civ Eng, Vol 41, pp 285-311, Oct 1968. 27 p, 25 fig, 7 tab, 14 ref, append.

Descriptors: *Reinforced concrete, *Slabs, Design, Design criteria, Design tools, Structural analysis, *Structural design, Reinforcement, Limit design, Stress, Stress analysis, Moments.
Identifiers: Design analysis, Ultimate strength design, Yield line theory, Concentrated loading, Limit analysis, *Strip method.

The strip method of Arne Hillerborg provides a powerful alternative to yield-line theory for ultimate-load design of reinforced-concrete slabs. The designer chooses the reinforcement layout as calculations progress, rather than by the trial and error method used in yield-line design. A critical examination of the strip method shows the original method to be remarkably simple to apply, but later developments are too complicated to be readily acceptable. The original method provides an exact (not a lower-bound) solution for the collapse load of a slab carrying distributed load if reinforcement were made to fit ideally. Point loads may be treated as local concentrations of distributed load. Although there is almost unlimited freedom of choice in placing reinforcement, the design chosen should be similar to that expected in elastic design. Shapes of discontinuities may be chosen favoring simple evaluation of reinforcement in distinct bands. Two rigorous and simplified alternatives are given to Hillerborg's advanced strip method which cause discontinuities in placing reinforcement. (USBR)
W69-02918

ULTIMATE LOAD TESTS OF SLABS DESIGNED BY THE STRIP METHOD,
Building Research Station, Watford (England).
G. S. T. Armer.
Proc Inst Civ Eng, Vol 41, pp 313-331, Oct 1968. 19 p, 17 fig, 2 tab, 6 ref.

Descriptors: *Reinforced concrete, *Slabs, *Model tests, Design, Limit design, Design tools, Structural analysis, *Structural design, Cracking, Reinforcement, Deflection, Shear stress, Failures, Structural behavior, Stress, *Ultimate loads.
Identifiers: Ultimate strength design, Yield line theory, *Strip method, Limit analysis.

Tests were performed on half-scale model slabs designed by an ultimate load method known as the strip method. The method provides a safe design for ultimate load; slab behavior in terms of deflections and cracking at working loads is satisfactory. Models with punching shear failures showed considerable curtailment of the flatter section of the load-deflection curve. In some cases, ultimate load is grossly under-load-deflection curve. In some cases, ultimate load is grossly underestimated because flexural behavior is assumed to be all-important in determining such loads. There is little difference in the load-carrying efficiency of designs made using variations of the strip method. A compressive membrane effect was observed around the center support column. Resistance to punching is decreased by extensive cracking caused by yield lines, but may be aided by compressive membrane action. Punching shear is partially dependent on flexural strength; apparent flexural strength is dependent on the degree of compressive membrane action. Designs based on the strip method produce layouts of reinforcements very different from those based on the yield-line theory or Code of Practice. (USBR)
W69-02919

MECHANISMS OF SHEAR RESISTANCE OF CONCRETE BEAMS,
Mott, Hay and Anderson, (Gt. Brit.); and Canterbury Univ., Christchurch, (New Zealand).
R. C. Fenwick, and Thomas Paulay.
Proc Amer Soc Civ Eng, J Struct Div, Vol 94, No ST10, pp 2325-2350, Oct 1968. 26 p, 14 fig, 10 ref, 2 append.

Descriptors: Reinforcement, *Shear resistance, Shear, Shear cracks, Shear failures, *Shear strength, *Beams (Structural), Cantilevers, Shear tests, *Reinforced concrete, Cracking, Shear stress, Dowels, Structural behavior, Flexural strength, Failure (Mechanics).
Identifiers: Shear distribution, *Arch action, Bond strength, Diagonal tension, Compressive stress.

Study of the nature of shear resistance of reinforced concrete beams shows that shear may be resisted by beam and arch action. Essential structural elements of beam action are concrete blocks (formed between flexural cracks of the shear span) that behave as cantilevers restrained by the compression zone of the beam. Beam action breaks down at the diagonal cracking load of the shear span. Arch action cannot develop to an appreciable extent prior to diagonal cracking unless the beam contains prestressed reinforcement. About 60% of the strength of beam action results from the mechanism of shear transfer across the crack by interlocking of aggregate particles and about 20% results from dowel action of the reinforcement. Direct tests on aggregate interlocking action show that this shear transfer increases with concrete strength and reduction in crack width. Dowel capacity of bottom bars is considerably greater than that of top bars. Beam tests illustrate contradictions of these different mechanisms. (USBR)
W69-02927

STRENGTH, DURABILITY, AND SHRINKAGE OF INCOMPLETELY COMPACTED CONCRETE,
Newcastle Univ., (Australia).
B. S. Heaton.
J Amer Concr Inst, No 10, Proc V 65, pp 846-850, Oct 1968. 5 p, 3 fig, 2 tab, 3 ref.

Descriptors: *Concretes, *Concrete mixes, *Concrete placing, *Concrete technology, *Workability, Concrete structures, Concrete testing, Voids, Compressive strength, Water-cement ratio, Reinforced concrete, Slump, *Compaction, Shrinkage, Durability.
Identifiers: Concrete slabs, Vibratory compaction, Australia, Foreign testing.

The effects of compactive effort of concrete on compressive strength, durability, and shrinkage were determined over a range of workabilities. Workable concrete obviously requires less effort for compaction, and compacted concrete is stronger than incompletely compacted concrete. The strength of low-workability concrete is reduced by voids from incomplete compaction. Increasing the workability of a given mix by adding water potentially weakens the concrete because of the increased water-cement ratio. The important question is whether the strength losses are greater from incomplete compaction of low-workability concrete or from high water-cement ratio of high-workability concrete. Tests of low-workability concrete at low levels of compactive effort show that increasing the water content may increase strength, produce a slight increase in shrinkage, possible decrease durability, and improve the finish of formed surfaces. (USBR)
W69-02931

CONSTRUCTING 500-KV TRANSMISSION LINES ON A SWAMPY RIVER FLOOD PLAIN,
N. I. Marfin.
Trans from Elek Sta, No 9, p 90, 1966. Bur Reclam Transl 553, Aug 1967. 4 p, 1 fig.

Descriptors: Transmission lines, *Swamps, *Transmission towers, Spans, Cold weather construction, Foreign construction, Flood plains, Rivers, *Crossings, Pile foundations, Ice, *Footings, Precast concrete, *Foundations.
Identifiers: USSR, Grillage footings.

In the USSR, a 500-kv transmission line was constructed across the swampy flood plain of a river located in a severe climate area. The design length of the span was 410 m. Intermediate towers were erected on islands of imported soil, built up above flood level, and sown with grass to prevent wind erosion. The 1:2 slopes of the islands, sodded to prevent water or ice damage, continue beyond swamp level as clay-cement cutoffs. The heavy construction work was done in the winter since the swamp was impassable to heavy equipment at any other time. A foundation of precast footings was constructed on reinforced concrete piles, vibro-driven deep into the subsoil. The piles were interconnected just below swamp level by a monolithic, frost-resistant, reinforced concrete grillage foundation. The reinforcing mesh of the grillage was welded to the longitudinal reinforcement of the piles before concreting. This type of foundation is recommended for 330- to 750-kv transmission lines crossing swampy areas. (USBR)
W69-02936

ANCHORED FOOTINGS FOR TRANSMISSION TOWERS,
Bureau of Reclamation, Denver, Colo.
Richard S. Saliman, and Robert H. Schaefer.
Preprint 753, Amer Soc Civ Eng Annual Meet Nat Meet Struct Eng, Pittsburgh, Pa, Sept/Oct 1968. 28 p, 14 fig.

Descriptors: *Transmission towers, Anchors, Bars, Failure (Mechanics), Reinforcing steel, *Footings, Rock foundations, Grouting, Soil physical properties, Experimental data, Field tests, Drill holes, Safety factors, Deflection, Foundation investigations, *Anchored towers, Foundations.
Identifiers: *Anchored footings, Uplift footings, In situ tests, *Rock footings, *Pull-out tests, Belled anchors, Auger-type footings.

Anchor bar footings consist of a formed reinforced concrete cap into which the leg or stub angle extension of the leg of a transmission line tower is embedded and which is anchored into rock or soil by grouting reinforcing bars into drilled holes. This paper reviews pullout tests conducted by the Bureau of Reclamation on anchor bars grouted into rock or soil. Results of these tests have been used as a basis for designing transmission line footings. Development of rock-type footings designed for use in sound rock and adaptation of these footings for use in various soils are presented. Field tests on full-scale anchor bar footings are discussed. Additional footing tests are planned. (USBR)
W69-02938

CONCRETE RESERVOIR DESIGN,
Montgomery (James M.) Construction Engineers, Inc., Pasadena, Calif.
For primary bibliographic entry see Field 08A.
For abstract, see .
W69-02952

8G. Materials

RAWCLIFFE BRIDGE IN YORKSHIRE,
West Riding County Council, Yorkshire (England).
F. A. Sims, and S. Woodhead.
Civ Eng Pub Works Rev, Vol 63, No 741, pp 385-391, Apr 1968. 5 p, 10 fig.

Descriptors: *Concrete technology, *Epoxy resins, Beams (Structural), Bridge design, Bridge construction, Test procedures, *Highway bridges, Shear tests, Joints (Connections), Stress, Reinforced concrete, Precast concrete, Prestressed concrete, Strain gages, *Bridges.
Identifiers: Great Britain, *Rawcliffe Bridge (Great Britain), Test results, Compression tests, Bend tests.

oxy resin joints in segmental-beam construction
bridges were first used in England on the Raw-
fe Bridge in Yorkshire. Difficult approach aline-
nts, the existence of residential property ad-
ent to the approaches, and the River Board's
ngent limitations on use of temporary staging in
fast-flowing tidal river dictated using balanced-
ntilever and suspended-span construction when
uilding this bridge. The contractor proposed
mental construction of the 4 main beam units
t were precast on site in 5 segments, each
ighing 10 to 12 tons and cast one against the
er to give matching interfaces. These sections
re transferred from the casting beds to tempora-
staging between the main supporting columns
l the river bank, launched to an intermediate
sition, and jointed with an epoxy resin adhesive.
el cleats with bolted connections anchored to
base of the segments were used to apply pres-
e to the epoxy joints by clamping the units
ether. Results of preliminary tests and the ap-
arance of finished beams that have been in posi-
n for over 9 mo are discussed. Specially treated
tical joints are not visible after weathering and
ams appear to have been cast as complete
nolithic units. (USBR)
69-02926

CRUSTATION IN WATER PIPELINES,
reau of Reclamation, Boulder City, Nev.
onroe O. Moore.
oc Amer Soc Civ Eng, J Pipline Div, Vol 94, No
1, pp 37-47, Oct 1968. 11 p. 8 fig, 3 tab, append.

scriptors: *Water pipes, Water supply systems,
pelines, *Pipes, *Protective coatings, *Steel
pes, *Coal tar coating, Enamels, *Iron bacteria,
croorganisms, Costs, Pump testing, Municipal
ter, *Fouling, Linings, Operation and main-
nance, Maintenance.
entifiers: *Pipe linings, *Incrustation, Pumping
ts, Microbes, *Cast iron pipe, Corrosion en-
onments.

e water supply system at Boulder City, Nev., was
spected and tested with respect to problems
used by bacterial incrustation in portions of the
stem's pipelines. Observations of pipeline incrus-
tions and pumping test results are discussed.
aboratory analysis identified the incrustation as
iron bacteria, Gallionella ferruginea, which
eds on iron and manganese in solution. Uncon-
olled incrustations build up and reudce carrying
pacity, increase pumping and maintenance costs,
d provide conditions conducive to corrosion-
oducing bacteria. Cleaning or pipeline replace-
ent will be required eventually. Those portions of
e pipeline lined with coal-tar enamel are in good
ndition because the bacteria have difficulty
coming attached to the smooth lining. Coal-tar
amel also resists microbial attack. Analysis of
ectrical energy costs for pumping indicate that
vings in 1 year would exceed the cost of treating
e pipe with coal-tar enamel. (USBR)
69-02928

ROSPECTS FOR USE OF NONMETALLIC EINFORCEMENT,
N. Smirnov.
rans from Avtomat Dorogi, Vol 26, No 12, pp 18-
3, 1963. Bur Reclam Transl 575, 1967. 8 p, 1 tab,
ref.

Descriptors: *Plastics, Precast concrete, Tensile strength, Stressing cables, *Prestressed concrete, *Reinforced concrete, Reinforcing steel, *Reinforcing, Compressive strength, Pavements, *Glass fibers, Elasticity (Mechanical), Elasticity modulus, *Synthetic fibers, Deformation, Slabs, Elastic deformation, Foreign research, Relaxation, Stress.
Identifiers: *Reinforcing materials, USSR.

Soviet researchers are advocating further development of glass-fiber reinforcement for precast, prestressed paving slabs and bridge elements. Analysis of available domestic plastic-reinforcing materials and binders showed 2 types developed by the Belorussian Academy of Sciences to have the greatest strength and best bond with concrete. One type was 7- micron-dia glass fibers made in coils from noncaustic alumoborosilicate and epoxy resin; the other was a noncaustic nonboric fiberglass composition with epoxyphenol resin. The strength of the latter is near that of high-strength steels and its bond resistance in concrete reaches 70 kg/sq cm, exceeding that of equal-diameter deformed steel strands. Available forms are smooth and deformed rods, ribbons, and prefabricated shapes made by twisting glass fibers and coating them with resins and polymers. Because of lighter unit weight, resistance to corrosion, and lower stress losses to shrinkage and creep of concrete (5 to 6 times less than high-strength steel), using plastic reinforcing is recommended for many structures. However, present cost is high because of lack of industrial manufacturing methods and high price of raw materials. The lower toughness of plastic reinforcement relative to steel introduces problems in selecting tensioning devices. (USBR)
W69-02937

RECENT DEVELOPMENTS IN PLASTIC DESIGN PRACTICE,
Lehigh Univ., Bethlehem, Pa.
Lynn S. Beedle, Le-Wu Lu, and Lee Chong Lim.
Preprint 752, Amer Soc Civ Eng Annual Meet Nat Meet Struct Eng, Pittsburgh, Pa, Sept/Oct 1968. 41 p, 1 fig, 6 tab, 80 ref, append.

Descriptors: *Structural design, Structural steel, Plasticity, Load factors, *Continuous frames, Structural engineering, Loads (Forces), Design criteria, Frames, Bracings, Optimum design, Buildings, Research and development, *Plastic theory, *Continuous beams, Buckling, Steel structures, Structural analysis, Bibliographies.
Identifiers: *Plastic design, *Design practices, High strength alloys, *Multistory buildings.

Considerable new information has become available in the last decade concerning research results on inelastic behavior of steel structures and experience gained from design applications. This information is being used for plastic design, allowable-stress design, and seismic design. Increased interest is being shown in the significance and magnitude of load factors and in the possible use of multiple-load factors in design. The Second Edition of the Plastic Design Commentary will reflect the latest knowledge. Specifications are reflecting these changes also--for example, the American Railway Engineering Association and the American Institute of Steel Construction specifications. Areas of additional study to make possible further improvements in the design of steel structures, are identified. Topics such as local and lateral buckling, inelastic rotation requirements, composite and box members, space frameworks, and evaluation of structural safety can profit from additional examination. These studies will make possible a more complete use of the strength of steel in the plastic range. (USBR)
W69-02942

COMPARISON OF THREE COMMERCIAL DRAIN TILES IN A HEAVY CLAY SOIL OF IMPERIAL VALLEY,
California Univ., Davis. Dept. of Water Science and Engineering.
F. E. Robinson, and J. N. Luthin.
Calif Agr, Vol 22, No 8, pp 10-11, Aug 1968. 2 p, 2 fig, 4 tab.

Descriptors: Tiles, Tile drains, Water loss, Salinity, Leaching, Ponds, Soil types, Drainage systems, Clays, Evaporation, Flooding, Flow rates, Effluents, Electrical conductance, Hydraulic conductivity, On-site tests, Seepage, Saturation.
Identifiers: Imperial Valley (California).

In January 1964, pairs of clay, concrete, and bituminous-fibre tiles were installed in a 40-acre field at the Imperial Valley Field Station. Initial tests of these three materials were conducted in 1966 and are reported in this paper. No evidence was found in these tests of real differences in performance between clay, concrete or bituminous-fibre tiles. Soil variation and not tile performance was responsible for differences in tile outflow. Little actual change in salinity resulted from the leaching operation in the body of soil between the tiles. In most cases as much, and often more, water was lost through seepage as was removed by the tile. (Affleck-Arizona)
W69-02977

09. MANPOWER, GRANTS AND FACILITIES

9C. Research Facilities

WATER POLLUTION RESEARCH 1967.
Water Pollution Research Steering Committee, London (England).
For primary bibliographic entry see Field 05G.
For abstract, see .
W69-03065

10. SCIENTIFIC AND TECHNICAL INFORMATION

THE INFORMATION BACKGROUND IN THE FIELD OF BIOLOGICAL DETERIORATION OF NONMETALLIC MATERIALS,
Thompson (John I.) and Co, Washington, D. C.
For primary bibliographic entry see Field 08C.
For abstract, see .
W69-02905

SUBJECT INDEX

ACCRETION(LEGAL ASPECTS)
MEXICO BEACH CORP V ST JOE PAPER CO (TITLE TO LANDS GAINED BY ACCRETION).
W69-02998 06E

ACID MINE WATER
COMPOSITION OF WATER DISCHARGED FROM BITUMINOUS COAL MINES IN NORTHERN WEST VIRGINIA,
W69-02804 05B

ADMINISTRATIVE AGENCIES
POLITICS AND ORGANIZATION IN WATER RESOURCE ADMINISTRATION A COMPARATIVE STUDY OF DECISIONS,
W69-02849 06E

CUGLAR V POWER AUTHORITY (EMINENT DOMAIN BY POWER AUTHORITY TO FORM POWER POOL).
W69-02863 06E

NORTH CAROLINA SEASHORE COMMISSION.
W69-03005 06E

WATER AND POWER RESOURCES BOARD V GREEN SPRINGS COMPANY (CONSTITUTIONALITY OF DAM PERMIT ACT).
W69-03013 06E

SOME PHYSICAL, TECHNOLOGICAL, AND ECONOMIC CHARACTERISTICS OF WATER AND WATER RESOURCE SYSTEMS IMPLICATIONS FOR ADMINISTRATION,
W69-03167 06B

WATER RESOURCES MANAGEMENT IN MARYLAND.
W69-03170 06B

ADMINISTRATIVE DECISIONS
BAILEY V ARKANSAS GAME AND FISH COMM'N (STATE REGULATION OF GAME FISH SALES).
W69-02886 06E

APPLICATION OF THE TOWN OF WATERFORD (VALIDITY OF STREAM CLASSIFICATION).
W69-02990 05D

CITY OF GALLIPOLIS V STATE EX REL WATER POLLUTION CONTROL BD (DENIAL OF PERMIT TO DISCHARGE SEWAGE INTO RIVER).
W69-03034 05B

ADSORPTION
AQUEOUS TRANSPORT OF DIELDRIN RESIDUES IN SOILS,
W69-02801 05B

VIRUS MOVEMENT IN GROUNDWATER,
W69-02824 05B

ADSORPTION OF PHOSPHORUS BY LAKE SEDIMENT,
W69-03075 02H

AERIAL PHOTOGRAPHY
COLOR-INFRARED AERIAL PHOTOGRAPHIC INTERPRETATION AND NET PRIMARY PRODUCTIVITY OF A REGULARLY-FLOODED NORTH CAROLINA SALT MARSH,
W69-03177 02I

AGRICULTURE
THE CONCEPT OF POTENTIAL EVAPOTRANSPIRATION IN ARID ZONE AGRICULTURE,
W69-02967 02D

PROJECTION OF AGRICULTURAL WATER AND LAND USE FOR LONG RANGE WATER RESOURCES IN TEXAS,
W69-03144 03F

ALABAMA
WATER-POWER COMPANIES.
W69-02900 06E

ALGAE
ONONDAGA LAKE, NEW YORK, AN UNUSUAL ALGAL ENVIRONMENT,
W69-02961 02H

NUTRIENT SOURCES FOR ALGAE AND AQUATIC WEEDS,
W69-03185 05B

SOME FACTORS IN THE COMPETITION OR ANTAGONISM BETWEEN BACTERIA, ALGAE, AND AQUATIC WEEDS,
W69-03188 05C

ALGAL TOXINS
SOME FACTORS IN THE COMPETITION OR ANTAGONISM BETWEEN BACTERIA, ALGAE, AND AQUATIC WEEDS,
W69-03188 05C

ALLUVIAL CHANNELS
BED FORMS IN THE LOWER RED DEER RIVER, ALBERTA,
W69-02816 02J

THE EFFECT OF SILT-LADEN WATER ON INFILTRATION IN ALLUVIAL CHANNELS,
W69-02988 02J

DESIGN OF STABLE CHANNELS IN ALLUVIAL MATERIALS,
W69-03066 08B

HYDRAULIC AND MICROMORPHOLOGICAL PROPERTIES OF STREAM CHANNEL SEDIMENTS,
W69-03108 02J

ALLUVIUM
WATER AND SEDIMENT IN THE NORRIS GLACIER OUTWASH AREA, UPPER TAKU INLET, SOUTHEASTERN ALASKA,
W69-03093 02J

HYDRAULIC AND MICROMORPHOLOGICAL PROPERTIES OF STREAM CHANNEL SEDIMENTS,
W69-03108 02J

ALTERATION OF FLOW
WEIMER V CAUBLE (ACTION TO ENJOIN DIVERSION OF SURFACE WATERS ONTO PLAINTIFF'S LAND IN HARMFUL MANNER).
W69-02902 04A

ALUMINUM
GRAPHICAL METHODS FOR STUDIES OF AQUEOUS ALUMINUM HYDROXIDE, FLUORIDE, AND SULFATE COMPLEXES,
W69-02834 01B

ANALOG COMPUTERS
ELECTRIC-ANALOG AND DIGITAL-COMPUTER MODEL ANALYSIS OF STREAM DEPLETION BY WELLS,
W69-02976 02F

ANALYTICAL TECHNIQUES
SOME ERROR PROPERTIES OF SEGMENTED HYDROLOGIC FUNCTIONS,
W69-03105 07C

ANCHORED FOOTINGS
ANCHORED FOOTINGS FOR TRANSMISSION TOWERS,
W69-02938 08F

ANTIFREEZE
A SIMPLE EVAPORIMETER FOR USE IN COLD AREAS,
W69-03115 07B

AQUARIA
SOME FACTORS IN THE COMPETITION OR ANTAGONISM BETWEEN BACTERIA, ALGAE, AND AQUATIC WEEDS,
W69-03188 05C

AQUATIC PRODUCTIVITY
AN EVALUATION OF ARTIFICIAL SUBSTRATES FOR MEASURING PERIPHYTON PRODUCTION,
W69-02955 05C

AQUATIC WEEDS
SOME FACTORS IN THE COMPETITION OR ANTAGONISM BETWEEN BACTERIA, ALGAE, AND AQUATIC WEEDS,
W69-03188 05C

AQUIFERS
GROUNDWATER FLOW SYSTEMS IN THE CRYSTALLINE ROCKS OF THE OKANAGAN HIGHLAND, BRITISH COLUMBIA,
W69-02826 02F

THE PERCHED WATER TABLE IN THE UPPER LIMESTONE AQUIFER OF MALTA,
W69-02833 02F

STRATIFICATION OF FRESH AND SALT WATER ON BARRIER ISLANDS AS A RESULT OF DIFFERENCES IN SEDIMENT PERMEABILITY,
W69-03058 02F

AQUITARDS
STRATIFICATION OF FRESH AND SALT WATER ON BARRIER ISLANDS AS A RESULT OF DIFFERENCES IN SEDIMENT PERMEABILITY,
W69-03058 02F

ARCH ACTION
MECHANISMS OF SHEAR RESISTANCE OF CONCRETE BEAMS,
W69-02927 08F

ARID CLIMATES
THE CONCEPT OF POTENTIAL EVAPOTRANSPIRATION IN ARID ZONE AGRICULTURE,
W69-02967 02D

ARID LANDS
HYDROGEOLOGY OF DESERT BASINS,
W69-02924 02F

INVESTIGATIONS ON THE IRRIGATION REQUIREMENTS OF HYBRID MAIZE CROP IN ARID REGION OF PUNJAB,
W69-02973 03F

ARKANSAS
NAYLOR V EAGLE (DAMAGE FROM BACKWATER OF DAM).
W69-02883 04A

BAILEY V ARKANSAS GAME AND FISH COMM'N (STATE REGULATION OF GAME FISH SALES).
W69-02886 06E

ADAMS V ADAMS (DAMAGE FROM OBSTRUCTING DRAINAGE DITCH).
W69-02996 04A

ARTESIAN WELLS
DRAWDOWN IN A WELL OF LARGE DIAMETER,
W69-03049 02F

ATTRACTIVE NUISANCE
LIABILITY RESULTING FROM ARTIFICIAL BODIES OF WATER.
W69-03030 06E

AVAILABLE ENERGY FUNCTION
A CONTRIBUTION TO THE THEORY OF THERMO-ECONOMICS,

W69-03131 06C

BACKWATER
HILTON V DUKE POWER CO (DAM ADDITIONS CAUSED FLOODING OF UPSTREAM LAND).
W69-03006 04A

BANK STABILITY
NADLER FOUNDRY AND MACHINE CO, INC V UNITED STATES (LIABILITY FOR CAVE-IN CAUSED BY DREDGING).
W69-03008 06E

BANKFULL FREQUENCY
STATISTICAL TESTS FOR COMMON BANKFULL FREQUENCY IN RIVERS,
W69-03096 02E

BASE FLOW
LOW STREAMFLOW IN THE MYAKKA RIVER BASIN AREA IN FLORIDA,
W69-02808 02E

BAYS
A MODEL OF MIXING AND DISPERSION IN SAN FRANCISCO BAY,
W69-02831 05B

BEAMS(STRUCTURAL)
MECHANISMS OF SHEAR RESISTANCE OF CONCRETE BEAMS,
W69-02927 08F

BED LOAD
BED FORMS IN THE LOWER RED DEER RIVER, ALBERTA,
W69-02816 02J

RESEARCH ON BED-LOAD,
W69-03043 02J

DEPOSITIONAL BEHAVIOR OF KAOLINITE IN TURBULENT FLOW,
W69-03067 02J

BEHAVIOR
THE DYNAMICS OF PUBLIC ROLES IN THE SELECTION OF REVENUE SOURCES IN LOCAL WATER ADMINISTRATION,
W69-02847 06B

BENEFICIAL USE
RECLAIMED WATER FOR INDUSTRY,
W69-02806 03E

BEAN V UNITED STATES (BENEFICIAL USE OF WATER GIVES NO VESTED RIGHT).
W69-03009 06E

BIOASSAY
ONONDAGA LAKE, NEW YORK, AN UNUSUAL ALGAL ENVIRONMENT,
W69-02961 02H

BIOASSAY SYSTEM
ACTIVITY PATTERNS OF FISH EXPOSED TO TOXIC MATERIAL,
W69-03194 05C

BIOCHEMICAL OXYGEN DEMAND
SIGNIFICANCE OF NITRIFICATION IN STREAM ANALYSIS--EFFECTS ON THE OXYGEN BALANCE,
W69-03077 05B

MATHEMATICAL MODELS FOR EXPRESSING THE BIOCHEMICAL OXYGEN DEMAND IN WATER QUALITY STUDIES,
W69-03138 05G

BIODEGRADATION
THE INFORMATION BACKGROUND IN THE FIELD OF BIOLOGICAL DETERIORATION OF NONMETALLIC MATERIALS,
W69-02905 08C

BIOINDICATORS
ONONDAGA LAKE, NEW YORK, AN UNUSUAL ALGAL ENVIRONMENT,
W69-02961 02H

BLACK NEEDLERUSH
COLOR-INFRARED AERIAL PHOTOGRAPHIC INTERPRETATION AND NET PRIMARY PRODUCTIVITY OF A REGULARLY-FLOODED NORTH CAROLINA SALT MARSH,
W69-03177 02I

BORING MACHINES
HORIZONTAL BORING TECHNOLOGY A STATE-OF-THE-ART-STUDY,
W69-02923 08C

BOUNDARIES(PROPERTY)
MEXICO BEACH CORP V ST JOE PAPER CO (TITLE TO LANDS GAINED BY ACCRETION).
W69-02998 06E

SHEPHEARD V BOGGS (LAND EXTENSION BY RIPARIAN LANDOWNER BLOCKING STREAM).
W69-03037 04A

BOUNDARY DISPUTES
PRESCOTT V HERRING (BOUNDARY DISPUTE).
W69-02882 04C

CORDOVANA V VIPOND (INJUNCTION TO REMOVE FENCE WHICH DENIED RIPARIAN RIGHTS).
W69-03038 04A

BRIDGES
DUTY AS TO BRIDGES OF MILLOWNERS ON, OR PERSONS DITCHING OR ENLARGING DITCHES ACROSS, HIGHWAYS.
W69-03004 06E

STEAMTUG ALADDIN, INC V CITY OF BOSTON (FEDERAL LIABILITY FOR BRIDGE AS NAVIGATIONAL HAZARD).
W69-03010 06E

BULB TURBINES
TUBULAR TURBINES,
W69-02907 08C

BULKHEADS
TRUSTEES OF INTERNAL IMPROVEMENT FUND V CLAUGHTON (THE RIGHT TO FILL SUBMERGED LANDS GRANTED BY THE TRUSTEES DOES NOT EXTEND BEYOND THE BOUNDARIES ACTUALLY CONVEYED).
W69-02999 04A

BUNDLED CONDUCTORS
EVALUATION OF SPACERS FOR BUNDLED CONDUCTOR TRANSMISSION LINES,
W69-02943 08C

BUOYS
NAVIGATION -- BUOYS, BEACONS, FLOODGATES, AND DUMPING MUD OR REFUSE.
W69-02870 06E

BURIED CABLES
HORIZONTAL BORING TECHNOLOGY A STATE-OF-THE-ART-STUDY,
W69-02923 08C

BURNING
CHAPARRAL FIRES CHANGE SOIL MOISTURE DEPLETION PATTERNS,
W69-02979 02G

BUTTRESS DAMS
THE FARAHNAZ PAHLAVI PROJECT.
W69-02911 08A

PRELIMINARY SECTION OF SHAPE IN THE DESIGN OF CELLULAR DAMS,
W69-02917 08A

CALIBRATIONS
NEUTRON MOISTURE METER CALIBRATION FOR USE IN SALINE SOILS,
W69-02965 02G

CALIFORNIA
HYDROLOGIC DATA 1967 - VOLUME IV SAN JOAQUIN VALLEY.
W69-03068 02E

CANADA
SEASONAL CHANGES OF SLOUGH AND LAKE WATER CHEMISTRY IN SOUTHERN SASKATCHEWAN (CANADA),
W69-02838 02H

CANALS
DESIGN OF STABLE CHANNELS IN ALLUVIAL MATERIALS,
W69-03066 08B

CARBON RADIOISOTOPES
CARBON 14 AGES AND FLOW RATES OF WATER IN CARRIZO SAND, AT ATASCOSA COUNTY, TEXAS,
W69-03082 02F

CARLSBAD(NEW MEXICO)
FLOOD OF AUGUST 1966 AT CARLSBAD, NEW MEXICO,
W69-02820 02E

CAST IRON PIPE
INCRUSTATION IN WATER PIPELINES,
W69-02928 08G

CAVITATION
CAVITATION TESTS OF A MODEL OF THE RADIAL GATE OF THE BOTTOM OUTLET OF THE KRASNOYARSK HYDROELECTRIC STATION DAM,
W69-02914 08C

CELLS
PRELIMINARY SECTION OF SHAPE IN THE DESIGN OF CELLULAR DAMS,
W69-02917 08A

CELLULAR STRUCTURES
PRELIMINARY SECTION OF SHAPE IN THE DESIGN OF CELLULAR DAMS,
W69-02917 08A

CHANNEL EROSION
METHODOLOGICAL PREREQUISITES FOR CONDUCTING NETWORK OBSERVATIONS OF THE CHANNEL PROCESS,
W69-02807 07A

CHANNEL MORPHOLOGY
METHODOLOGICAL PREREQUISITES FOR CONDUCTING NETWORK OBSERVATIONS OF THE CHANNEL PROCESS,
W69-02807 07A

BED FORMS IN THE LOWER RED DEER RIVER, ALBERTA,
W69-02816 02J

CHAPARRAL
CHAPARRAL FIRES CHANGE SOIL MOISTURE DEPLETION PATTERNS,
W69-02979 02G

CHEMICAL STRATIFICATION
CHEMICAL AND ISOTOPIC BALANCES FOR A MEROMICTIC LAKE,
W69-03088 02H

CHEMICAL TRANSPORT
MISCIBLE DISPLACEMENT IN AN UNSATURATED GLASS BEAD MEDIUM,
W69-02810 02G

CHENANGO RIVER BASIN(NY)
FLOODS ON CHENANGO RIVER AND CANASAWACTA CREEK AT NORWICH, NEW YORK,
W69-02839 02E

CHINOOK SALMON

WATER QUALITY AS RELATED TO THE SURVIVAL OF SALMON EGGS AND LARVAE,
W69-03190 05C

CHLOROPHYTA
FIELD AND LABORATORY EVALUATIONS OF BIOASSAYS FOR NITROGEN AND PHOSPHORUS WITH ALGAE AND AQUATIC WEEDS,
W69-03186 05A

CITIES
CITY OF MURPHYSBORO V SANITARY WATER BOARD OF ILLINOIS (POLLUTION ABATEMENT).
W69-02869 05B

HILLHOUSE V CITY OF AURORA (ACTION FOR DAMAGES BROUGHT BY FARM OWNER FOR POLLUTION OF CREEK BY CITY SEWER SYSTEM).
W69-02898 05B

CITY OF MADISON V STATE (PUBLIC BUILDINGS ON FILLED LAKE LAND).
W69-03022 04C

STATE V CITY OF DEFIANCE (CONSTITUTIONALITY OF STATUTE REQUIRING CITIES TO FURNISH OUTSIDERS WITH WATER).
W69-03035 04A

CLAYS
COMPARISON OF FIELD AND LABORATORY MEASUREMENTS OF MODULUS OF DEFORMATION OF A CLAY,
W69-02933 08D

THE STRENGTH ALONG STRUCTURAL DISCONTINUITIES IN STIFF CLAYS,
W69-02950 08D

HYDRAULIC AND MICROMORPHOLOGICAL PROPERTIES OF STREAM CHANNEL SEDIMENTS,
W69-03108 02J

NON-DARCY FLOW CHARACTERISTICS OF WATER AS INFLUENCED BY CLAY CONCENTRATION,
W69-03195 02G

CLEAR-CUTTING
RADIATION AND SNOWMELT ON A CLEARCUT WATERSHED,
W69-03078 02C

CLIMATIC DATA
DETERMINING CONSUMPTIVE USE FOR PLANNING WATER DEVELOPMENTS,
W69-02970 02I

CLIMATOLOGY
EFFECTS OF CLIMATOLOGIC AND BASIN CHARACTERISTICS ON ANNUAL RUNOFF,
W69-03055 02A

CLOSED BASINS
FLOW OF GROUNDWATER ADJACENT TO SMALL, CLOSED BASINS IN GLACIAL TILL,
W69-03119 02F

COAL TAR COATING
INCRUSTATION IN WATER PIPELINES,
W69-02928 08G

COASTAL MARSHES
STATE V BROOKS (PROOF OF ADVERSE POSSESSION TO MARSHLAND).
W69-02873 06E

COLD RESISTANCE
A SIMPLE EVAPORIMETER FOR USE IN COLD AREAS,
W69-03115 07B

COLIFORMS
A STUDY OF THE SURVIVAL OF BACTERIAL INDICATORS OF POLLUTION IN NATURAL WATERS,
W69-03181 05B

COMMERCIAL FISHING
BENEFIT-COST ANALYSIS AND THE NATIONAL OCEANOGRAPHIC PROGRAM,
W69-03126 06B

COMPACTED SOILS
MECHANICAL PROPERTIES OF COMPACTED SOILS,
W69-02925 08D

COMPACTION
EVALUATION OF VIBRATORY ROLLERS ON THREE TYPES OF SOILS,
W69-02915 08D

MECHANICAL PROPERTIES OF COMPACTED SOILS,
W69-02925 08D

STRENGTH, DURABILITY, AND SHRINKAGE OF INCOMPLETELY COMPACTED CONCRETE,
W69-02931 08F

COMPACTION EQUIPMENT
EVALUATION OF VIBRATORY ROLLERS ON THREE TYPES OF SOILS,
W69-02915 08D

COMPACTION TESTS
EVALUATION OF VIBRATORY ROLLERS ON THREE TYPES OF SOILS,
W69-02915 08D

COMPENSATION
STATE V SIMS (ACTION TO COMPEL PAYMENT OUT OF ALLOCATED FUNDS FOR FLOOD DAMAGE CAUSED BY A STATE AGENCY).
W69-02881 04C

ALBURY V CENTRAL AND SOUTH FLORIDA FLOOD CONTROL DIST (NO COMPENSATION ALLOWED FOR CONSTRUCTION OF A DRAINAGE CANAL).
W69-02889 04A

COMPETING USES
MENNE V CITY OF FOND DU LAC (RIGHT OF WATER REMOVAL TO NON-CONTIGUOUS LANDS).
W69-02855 04B

COMPUTER PROGRAMS
ECONOMIC ANALYSIS OF ALTERNATIVE FLOOD CONTROL MEASURES,
W69-03111 04A

SOME USES OF A DIGITAL GRAPH PLOTTER IN HYDROLOGY,
W69-03112 07C

COMPUTER-AIDED DESIGN
STRUCTURAL DESIGN--GRAND COULEE THIRD POWERPLANT,
W69-02939 08A

CONCRETE MIXES
STRENGTH, DURABILITY, AND SHRINKAGE OF INCOMPLETELY COMPACTED CONCRETE,
W69-02931 08F

CONCRETE PLACING
STRENGTH, DURABILITY, AND SHRINKAGE OF INCOMPLETELY COMPACTED CONCRETE,
W69-02931 08F

CONCRETE TECHNOLOGY
A SYSTEMS APPROACH TO ANALYSIS OF HARDENED CONCRETE,
W69-02909 08F

RAWCLIFFE BRIDGE IN YORKSHIRE,
W69-02926 08G

STRENGTH, DURABILITY, AND SHRINKAGE OF INCOMPLETELY COMPACTED CONCRETE,
W69-02931 08F

CONCRETE TESTING
A SYSTEMS APPROACH TO ANALYSIS OF HARDENED CONCRETE,
W69-02909 08F

CONCRETES
STRENGTH, DURABILITY, AND SHRINKAGE OF INCOMPLETELY COMPACTED CONCRETE,
W69-02931 08F

CONDEMNATION
STRUCK V CITY OF MIAMI (CONDEMNATION OF A RIGHT OF WAY TO A PRIVATELY OWNED LAKE).
W69-02891 06E

WATER-POWER COMPANIES.
W69-02900 06E

SNEED V WEBER (RIGHT OF UNITED STATES TO REMOVE OBSTRUCTIONS TO NAVIGATION COULD NOT INURE TO ANY MEMBER OF THE PUBLIC).
W69-02995 06E

CONDEMNATION VALUE
GRAVITY DRAINAGE DISTRICT NO 1 V KEY (CONDEMNATION PROCEEDING FOR DRAINAGE DITCH CONSTRUCTION).
W69-02888 04A

CONDUITS
APPROPRIATIONS FOR CONSTRUCTION OF WATER AND SEWER LINES.
W69-02894 06C

CONNECTICUT
CONNECTICUT WATER LAW JUDICIAL ALLOCATION OF WATER RESOURCES.
W69-02866 06E

GREENWICH WATER CO V ADAMS (EMINENT DOMAIN).
W69-03015 06E

CONSERVATION
CONSERVATION DECISION-MAKING A RATIONALIZATION,
W69-03127 04C

CONSOLIDATION
IN SITU PERMEABILITIES FOR DETERMINING RATES OF CONSOLIDATION,
W69-02934 08D

CONSULTING ENGINEERS
THE FUNCTION OF FEASIBILITY REPORTS,
W69-02910 06A

CONSUMER RESPONSE
CONSUMER RESPONSES TO PRICES OF RESIDENTIAL WATER,
W69-03140 06B

CONSUMER SURPLUS
PROBLEMS OF BIAS IN INPUT PRICING FOR BENEFIT COST ANALYSIS A REPLY,
W69-03128 06B

CONSUMPTIVE USE
DETERMINING CONSUMPTIVE USE FOR PLANNING WATER DEVELOPMENTS,
W69-02970 02I

INVESTIGATIONS ON THE IRRIGATION REQUIREMENTS OF HYBRID MAIZE CROP IN ARID REGION OF PUNJAB,
W69-02973 03F

THE OPPORTUNITY COSTS OF PUBLIC INVESTMENT COMMENT,
W69-03125 06B

CONTINUOUS FRAMES
RECENT DEVELOPMENTS IN PLASTIC DESIGN PRACTICE,
W69-02942 08G

CONTRACTS
IVANHOE IRRIGATION DIST V MCCRACKEN.
W69-02896 06E

CONTROLLED RELEASE EFFECTS IN RESERVOIRS
AN INVESTIGATION OF THE EFFECT OF CONTROLLED RELEASES ON THE PHYSICAL, CHEMICAL AND BACTERIOLOGICAL CHARACTERISTICS OF FORT LOUDOUN RESERVOIR,
W69-03180 05C

CORDGRASS
COLOR-INFRARED AERIAL PHOTOGRAPHIC INTERPRETATION AND NET PRIMARY PRODUCTIVITY OF A REGULARLY-FLOODED NORTH CAROLINA SALT MARSH,
W69-03177 02I

CORN(FIELD)
INVESTIGATIONS ON THE IRRIGATION REQUIREMENTS OF HYBRID MAIZE CROP IN ARID REGION OF PUNJAB,
W69-02973 03F

CORRELATION ANALYSIS
SOME COMMENTS ON THE USE OF FACTOR ANALYSES,
W69-03050 07C

SIMILITUDE THEORY APPLIED TO CORRELATION OF FLUME SEDIMENT TRANSPORT DATA,
W69-03095 02J

CORROSION
THE INFORMATION BACKGROUND IN THE FIELD OF BIOLOGICAL DETERIORATION OF NONMETALLIC MATERIALS,
W69-02905 08C

COST-BENEFIT ANALYSIS
BENEFIT-COST ANALYSIS AND THE NATIONAL OCEANOGRAPHIC PROGRAM,
W69-03126 06B

PROBLEMS OF BIAS IN INPUT PRICING FOR BENEFIT COST ANALYSIS A REPLY,
W69-03128 06B

COTTON
PSYCHROMETRIC MEASUREMENT OF SOIL WATER POTENTIAL IN SITU UNDER COTTON PLANTS,
W69-02980 02G

CRATERING
ROCK BREAKAGE BY CRUSHING, BLASTING, AND DRILLING,
W69-02920 08E

CROSSINGS
CONSTRUCTING 500-KV TRANSMISSION LINES ON A SWAMPY RIVER FLOOD PLAIN,
W69-02936 08F

CRUSHING
ROCK BREAKAGE BY CRUSHING, BLASTING, AND DRILLING,
W69-02920 08E

CRYSTALLINE ROCKS
GROUNDWATER FLOW SYSTEMS IN THE CRYSTALLINE ROCKS OF THE OKANAGAN HIGHLAND, BRITISH COLUMBIA,
W69-02826 02F

CULVERTS
GRAVITY DRAINAGE DISTRICT NO 1 V KEY (CONDEMNATION PROCEEDING FOR DRAINAGE DITCH CONSTRUCTION).
W69-02888 04A

ROSKIN BROS, INC V STATE (LIABILITY OF STATE FOR NEGLIGENT MAINTENANCE OF CULVERT).
W69-02992 04C

FRYE V PENNSYLVANIA RR (ACTION BY LANDOWNERS FOR DAMAGES FROM FLOODING CAUSED BY CLOGGED DRAINAGE PIPE UNDER DEFENDANTS RAILROAD).
W69-03014 04A

CITY OF ASHLAND V KITTLE (LIABILITY OF A CITY FOR FLOODING CAUSED BY INADEQUATE CULVERT).
W69-03040 04A

CYANOPHYTA
DWINDLING LAKES,
W69-02956 02H

CYCLING NUTRIENTS
NUTRIENT SOURCES FOR ALGAE AND AQUATIC WEEDS,
W69-03185 05B

FIELD AND LABORATORY EVALUATIONS OF BIOASSAYS FOR NITROGEN AND PHOSPHORUS WITH ALGAE AND AQUATIC WEEDS,
W69-03186 05A

DAIRY INDUSTRY
POLLUTION OF WATER ON LANDS USED FOR DAIRY PURPOSES.
W69-02893 05B

DAM CONSTRUCTION
HUTHER V UNITED STATES (DAMAGE CLAIM DUE TO RISING LAKE WATERS).
W69-02865 04A

GREENWICH WATER CO V ADAMS (EMINENT DOMAIN).
W69-03015 06E

DAM DESIGN
PRELIMINARY SECTION OF SHAPE IN THE DESIGN OF CELLULAR DAMS,
W69-02917 08A

DAMAGES
RINALDI V STATE (DAMAGE FROM STANDING WATERS).
W69-02994 04C

ADAMS V ADAMS (DAMAGE FROM OBSTRUCTING DRAINAGE DITCH).
W69-02996 04A

STEAMTUG ALADDIN, INC V CITY OF BOSTON (FEDERAL LIABILITY FOR BRIDGE AS NAVIGATIONAL HAZARD).
W69-03010 06E

SPAUGH V CITY OF WINSTON-SALEM (DAMAGES FOR POLLUTION).
W69-03011 05B

NEWMAN V CITY OF EL DORADO SPRINGS (ACTION FOR POLLUTION CAUSED BY CITY'S SEWAGE SYSTEM).
W69-03039 05B

DAMS
CRAIG V BOROUGH OF EBENSBURG (DAMS).
W69-02859 04A

LOMBARDI V BAILEY (SUIT FOR FLOOD DAMAGES UNDER MILL ACT).
W69-02878 04A

NAYLOR V EAGLE (DAMAGE FROM BACKWATER OF DAM).
W69-02883 04A

PRELIMINARY SECTION OF SHAPE IN THE DESIGN OF CELLULAR DAMS,
W69-02917 08A

FIELD INVESTIGATIONS OF SEEPAGE ON EXISTING DAMS,
W69-02921 08D

INJURIES TO DAMS AND WATER CHANNELS OF MILLS AND FACTORIES.
W69-03001 04A

HILTON V DUKE POWER CO (DAM ADDITIONS CAUSED FLOODING OF UPSTREAM LAND).
W69-03006 04A

WATER AND POWER RESOURCES BOARD V GREEN SPRINGS COMPANY (CONSTITUTIONALITY OF DAM PERMIT ACT).
W69-03013 06E

CENTRAL MAINE POWER CO V PUBLIC UTIL COMM'N (RIPARIAN LAND PURCHASE TO AVOID LIABILITY FOR DAM OPERATION).
W69-03017 04A

BOARD OF SUPERVISORS OF LOUDOUN CITY V TOWN OF FAIRFAX (APPLICATION TO ERECT DAM FOR MUNICIPAL WATER SUPPLY).
W69-03036 04A

DATA COLLECTION
SPECIFIC YIELD-COMPILATION OF SPECIFIC YIELDS FOR VARIOUS MATERIALS,
W69-02828 02F

DATA COLLECTIONS
HYDROLOGIC STUDIES OF SMALL WATERSHEDS IN AGRICULTURAL AREA OF SOUTHERN MICHIGAN,
W69-03045 02A

HYDROLOGIC DATA 1967 - VOLUME IV SAN JOAQUIN VALLEY.
W69-03068 02E

FLOOD OF JUNE 7, 1967, IN THE WAPSINONOC CREEK BASIN, IOWA,
W69-03085 02E

THE LEONTIEF INPUT-OUTPUT SYSTEM AND ITS APPLICATION TO ANALYSIS AND PROJECTION FOR WATER RESOURCES PLANNING,
W69-03156 06A

THE INTERINDUSTRY WATER CONTENT MATRIX APPLICATIONS ON A MULTIREGIONAL BASIS,
W69-03157 06A

DATA PROCESSING
SOME USES OF A DIGITAL GRAPH PLOTTER IN HYDROLOGY,
W69-03112 07C

SCHEMES FOR HANDLING INCONSISTENT MATRICES,
W69-03117 07C

DECISION MAKING
THE CALIFORNIA WATER PROJECT IS PUBLIC DECISION-MAKING BECOMING MORE EFFICIENT,
W69-02841 06B

FIELD LEVEL PLANNING OF WATER RESOURCE SYSTEMS,
W69-02843 06B

THE DYNAMICS OF PUBLIC ROLES IN THE SELECTION OF REVENUE SOURCES IN LOCAL WATER ADMINISTRATION,
W69-02847 06B

POLITICS AND ORGANIZATION IN WATER RESOURCE ADMINISTRATION A COMPARATIVE STUDY OF DECISIONS,
W69-02849 06E

CONSERVATION DECISION-MAKING A RATIONALIZATION,
W69-03127 04C

REGIONAL MANAGEMENT OF WATER QUALITY - A SYSTEMS APPROACH,
W69-03146 05G

COMPUTER SIMULATION MODELS FOR RIVER-BASIN ANALYSIS AND PLANNING,
W69-03153 06B

DECISION-MAKING
FORMAL MODELS IN THE DESIGN OF WATER RESOURCE SYSTEMS,
W69-02846 06A

DEFORMATION
COMPARISON OF FIELD AND LABORATORY MEASUREMENTS OF MODULUS OF DEFORMATION OF A CLAY,
W69-02933 08D

DEFORMATION MODULUS
COMPARISON OF FIELD AND LABORATORY MEASUREMENTS OF MODULUS OF DEFORMATION OF A CLAY,
W69-02933 08D

DELAWARE RIVER BASIN COMMISSIONS
POWERS AND DUTIES OF THE DELAWARE RIVER BASIN COMMISSION.
W69-03026 06E

DEMONSTRATION WATERSHED
RADIATION AND SNOWMELT ON A CLEARCUT WATERSHED,
W69-03078 02C

DENDROCHRONOLOGY
USE OF THE COTTONWOOD IN AN INVESTIGATION OF THE RECENT HISTORY OF A FLOOD PLAIN,
W69-02836 02J

DEPOSITION(SEDIMENTS)
DEPOSITIONAL BEHAVIOR OF KAOLINITE IN TURBULENT FLOW,
W69-03067 02J

DESALINATION PLANTS
OPTIMIZATION AND RANGE OF APPLICATION OF NUCLEAR REACTORS AND FLASH EVAPORATORS FOR SEA WATER DESALINATION,
W69-03147 03A

DESERTS
HYDROGEOLOGY OF DESERT BASINS,
W69-02924 02F

DESIGN CRITERIA
DESIGN OF STABLE CHANNELS IN ALLUVIAL MATERIALS,
W69-03066 08B

RESEARCH ON COMPREHENSIVE PLANNING OF WATER-RESOURCE SYSTEMS SYMPOSIUM,
W69-03166 06B

DESIGN PRACTICES
RECENT DEVELOPMENTS IN PLASTIC DESIGN PRACTICE,
W69-02942 08G

DETERIORATION
THE INFORMATION BACKGROUND IN THE FIELD OF BIOLOGICAL DETERIORATION OF NONMETALLIC MATERIALS,
W69-02905 08C

A SYSTEMS APPROACH TO ANALYSIS OF HARDENED CONCRETE,
W69-02909 08F

DIATOMS
AN EVALUATION OF ARTIFICIAL SUBSTRATES FOR MEASURING PERIPHYTON PRODUCTION,
W69-02955 05C

DIELDRIN
AQUEOUS TRANSPORT OF DIELDRIN RESIDUES IN SOILS,
W69-02801 05B

DIGITAL COMPUTERS
ELECTRIC-ANALOG AND DIGITAL-COMPUTER MODEL ANALYSIS OF STREAM DEPLETION BY WELLS,
W69-02976 02F

ACCURACY OF DISCRETE MODELS USED TO PREDICT ESTUARY POLLUTION,
W69-03107 05B

DIGITAL GRAPH PLOTTER
SOME USES OF A DIGITAL GRAPH PLOTTER IN HYDROLOGY,
W69-03112 07C

DISCONTINUITIES
THE STRENGTH ALONG STRUCTURAL DISCONTINUITIES IN STIFF CLAYS,
W69-02950 08D

DISPERSION
A MODEL OF MIXING AND DISPERSION IN SAN FRANCISCO BAY,
W69-02831 05B

DISSOLVED OXYGEN
THE TEMPORAL AND SPATIAL DISTRIBUTION OF DISSOLVED OXYGEN IN STREAMS,
W69-02809 05A

PREDICTING DISSOLVED OXYGEN CONCENTRATION IN A LAKE COVERED WITH EVAPORATION SUPPRESSANT,
W69-02825 02D

SIGNIFICANCE OF NITRIFICATION IN STREAM ANALYSIS--EFFECTS ON THE OXYGEN BALANCE,
W69-03077 05B

DISTRIBUTED LAG
SOME EVIDENCE ON THE SMALL SAMPLE PROPERTIES OF DISTRIBUTED LAG ESTIMATORS IN THE PRESENCE OF AUTOCORRELATED DISTURBANCES,
W69-03124 06A

DIVERSION TO FLOW
WHITEHALL CONSTRUCTION CO V WASHINGTON SUBURBAN SANITARY COMM'N (REQUIREMENTS FOR TRESPASS ACTION).
W69-03007 06E

DRAINAGE
INTERRELATIONSHIP BETWEEN PHYSIOGRAPHY, HYDROLOGY, SEDIMENTATION, AND SALINIZATION OF THE LODDON RIVER PLAINS, AUSTRALIA,
W69-02817 02B

GEIS V BOHRER (RIGHT OF NATURAL DRAINAGE).
W69-02877 04A

DUTY AS TO BRIDGES OF MILLOWNERS ON, OR PERSONS DITCHING OR ENLARGING DITCHES ACROSS, HIGHWAYS.
W69-03004 06E

SOIL STUDY FOR WATER ECONOMICS,
W69-03042 02G

DRAINAGE DISTRICT
ALBURY V CENTRAL AND SOUTH FLORIDA FLOOD CONTROL DIST (NO COMPENSATION ALLOWED FOR CONSTRUCTION OF A DRAINAGE CANAL).
W69-02889 04A

DRAINAGE DISTRICTS
CURTIS V LOUISVILLE AND JEFFERSON COUNTY METROPOLITAN SEWER DISTRICT (ASSESSMENT FOR DRAINAGE IMPROVEMENT).
W69-02887 04A

DRAINAGE EFFECTS
EICKSTEDT V SEIFERT (NEGLIGENCE IN DRAINING ARTIFICIAL RESERVOIR).
W69-02856 04A

DRAINAGE ENGINEERING
DRAINAGE THEORY FOR REMOVAL OF EXCESS WATER FROM IRRIGATED LANDS,
W69-03189 04A

DRAINAGE SYSTEMS
GRAVITY DRAINAGE DISTRICT NO 1 V KEY (CONDEMNATION PROCEEDING FOR DRAINAGE DITCH CONSTRUCTION).
W69-02888 04A

DRAINAGE THEORY
DRAINAGE THEORY FOR REMOVAL OF EXCESS WATER FROM IRRIGATED LANDS,
W69-03189 04A

DRAWDOWN
DRAWDOWN IN A WELL OF LARGE DIAMETER,
W69-03049 02F

DREDGING
SENCO V LACROSSE DREDGING CORP (DEFINITION OF NAVIGABLE WATERS).
W69-02879 04A

FAIRCHILD V KRAEMER (ACCESS TO ARTIFICIALLY CREATED BASIN).
W69-03018 04A

DRILLING
ROCK BREAKAGE BY CRUSHING, BLASTING, AND DRILLING,
W69-02920 08E

DROUGHT
SOCIAL IMPACT OF METEOROLOGICAL DROUGHT IN ILLINOIS,
W69-03193 02B

DROUGHT RESISTANCE
ROOT DEVELOPMENT IN RELATION TO PLANT POPULATION AND FERTILITY LEVELS IN SOYBEAN,
W69-02985 02I

DROUGHTS
LOW STREAMFLOW IN THE MYAKKA RIVER BASIN AREA IN FLORIDA,
W69-02808 02E

DYE RELEASES
PONTACYL BRILLIANT PINK AS A TRACER DYE IN THE MOVEMENT OF WATER IN PHREATOPHYTES,
W69-03047 02I

DYNAMIC LOADS
DYNAMIC LOADINGS,
W69-02908 08D

DYNAMIC PROGRAMMING
OPTIMIZATION OF THE OPERATION OF A MULTIPURPOSE RESERVOIR BY DYNAMIC PROGRAMMING,
W69-02842 06A

OPTIMIZATION BY DYNAMIC PROGRAMMING OF HYDROELECTRIC PLANT OPERATION REGIME DURING INITIAL FILLING PERIOD OF MULTIANNUAL REGULATION RESERVOIR,
W69-03155 06A

DYNAMIC RESPONSE
DYNAMIC LOADINGS,
W69-02908 08D

EARTH DAMS
EQUILIBRIUM LIMITS OF EMBANKMENTS AND EARTH DAMS,
W69-02949 08D

EARTH MATERIALS
SPECIFIC YIELD-COMPILATION OF SPECIFIC YIELDS FOR VARIOUS MATERIALS,
W69-02828 02F

EASEMENTS
DANIELS V BETHLEHEM MINES CORP (RIPARIAN EASEMENTS).
W69-02858 5G

SNEED V WEBER (RIGHT OF UNITED STATES TO REMOVE OBSTRUCTIONS TO NAVIGATION COULD NOT INURE TO ANY MEMBER OF THE PUBLIC).
W69-02995 06E

CAMP CLEARWATER V PLOCK (EASEMENT TO USE PRIVATE LAKE).
W69-03016 06E

DUNCAN V GHEEN (ENFORCEMENT OF EASEMENT GRANTING RIGHT TO SPRING WATER).
W69-03023 04B

ECONOMIC EFFICIENCY
THE CALIFORNIA WATER PROJECT IS PUBLIC DECISION-MAKING BECOMING MORE EFFICIENT,
W69-02841 06B

STATE WATER PLANNING GOALS AND ANALYTICAL APPROACHES,
W69-02963 06B

ECONOMIC ANALYSIS OF ALTERNATIVE FLOOD CONTROL MEASURES,
W69-03111 04A

ECONOMIC EVALUATION
SIMILARITIES BETWEEN FLOOD CONTROL PROBLEMS AND OTHER ASPECTS OF WATER MANAGEMENT IN THE UNITED STATES,
W69-02848 06F

ECONOMIC FEASIBILITY
AN ECONOMIC APPROACH TO COPING WITH FLOOD DAMAGE,
W69-02844 06F

ECONOMIC IMPACT
SIMULATION OF REGIONAL ECONOMIC IMPACTS OF WATER RESOURCE DEVELOPMENT,
W69-03176 06B

ECONOMIC PREDICTION
THE LEONTIEF INPUT-OUTPUT SYSTEM AND ITS APPLICATION TO ANALYSIS AND PROJECTION FOR WATER RESOURCES PLANNING,
W69-03156 06A

ECONOMICS
THE ECONOMIST'S ROLE IN WATER PRICING POLICY,
W69-02906 06C

ARKANSAS WATER RESOURCES SUPPLY, USE, AND RESEARCH NEEDS,
W69-03199 06B

EDDIES
A NOTE CONCERNING THE EDDY TRANSFER COEFFICIENTS OF MOMENTUM AND WATER VAPOR UNDER NEAR-ADIABATIC CONDITIONS,
W69-03051 02D

EFFICIENCIES
OPTIMAL WASTE TREATMENT AND POLLUTION ABATEMENT BENEFITS ON A CLOSED RIVER SYSTEM,
W69-03150 05D

EFFLUENT IRRIGATION
THE HYDROLOGIC REGIME DUE TO SPRINKLER IRRIGATION OF TREATED MUNICIPAL EFFLUENT ON SLOPING LAND,
W69-03109 05G

EFFLUENTS
A STUDY IN THE ECONOMICS OF WATER QUALITY MANAGEMENT,
W69-03173 05G

ELECTRIC POWER PRODUCTION
NUCLEAR REACTORS STATUS AND FUTURE TRENDS,
W69-02940 08A

ELECTRICAL EQUIPMENT
AN ELECTRIC HYGROMETER APPARATUS FOR MEASURING WATER-VAPOUR LOSS FROM PLANTS IN THE FIELD,
W69-02968 02D

ELEVATION
RAINFALL INTENSITY AND ELEVATION IN SOUTHWESTERN IDAHO,
W69-03087 02B

EMBANKMENTS
EQUILIBRIUM LIMITS OF EMBANKMENTS AND EARTH DAMS,
W69-02949 08D

EMINENT DOMAIN
EMINENT DOMAIN - PONDS, DAMS, RESERVOIRS - PUBLIC UTILITIES.
W69-02857 06E

STATE V LANZA (EMINENT DOMAIN).
W69-02860 06E

CUGLAR V POWER AUTHORITY (EMINENT DOMAIN BY POWER AUTHORITY TO FORM POWER POOL).
W69-02863 06E

ATLANTIC CRUSHED COKE CO V UNITED STATES (FLOOD DAMAGE).
W69-02864 04A

HUTHER V UNITED STATES (DAMAGE CLAIM DUE TO RISING LAKE WATERS).
W69-02865 04A

MUNICIPAL CORPORATIONS SEWER SYSTEMS.
W69-02895 05D

U S V 1,000 ACRES OF LAND (CONDEMNATION FOR WATERWAY CONNECTION).
W69-02897 06E

CUGLAR V POWER AUTHORITY (EMINENT DOMAIN BY POWER AUTHORITY TO FORM POWER POOL).
W69-02993 04A

BINO V CITY OF HURLEY (CONSTITUTIONALITY OF ORDINANCE DENYING RIPARIAN RIGHTS WITHOUT COMPENSATION).
W69-03021 04A

ENERGY BUDGET
EVAPORATION FROM LARGE DEEP LAKES,
W69-03083 02D

ENERGY COST
A CONTRIBUTION TO THE THEORY OF THERMO-ECONOMICS,
W69-03131 06C

ENGINEERING GEOLOGY
POSSIBILITIES AND LIMITATIONS OF GEOPHYSICAL METHODS APPLIED TO CIVIL ENGINEERING,
W69-02916 08E

ENTEROCOCCI
A STUDY OF THE SURVIVAL OF BACTERIAL INDICATORS OF POLLUTION IN NATURAL WATERS,
W69-03181 05B

ENTHALPY
A CONTRIBUTION TO THE THEORY OF THERMO-ECONOMICS,
W69-03131 06C

ENZYMES
NUTRIENT SOURCES FOR ALGAE AND AQUATIC WEEDS,
W69-03185 05B

FIELD AND LABORATORY EVALUATIONS OF BIOASSAYS FOR NITROGEN AND PHOSPHORUS WITH ALGAE AND AQUATIC WEEDS,
W69-03186 05A

EPOXY RESINS
RAWCLIFFE BRIDGE IN YORKSHIRE,
W69-02926 08G

EQUILIBRIUM
EQUILIBRIUM LIMITS OF EMBANKMENTS AND EARTH DAMS,
W69-02949 08D

EXTERNALITY,
W69-03132 06B

EQUILIBRIUM CALCULATIONS
GRAPHICAL METHODS FOR STUDIES OF AQUEOUS ALUMINUM HYDROXIDE, FLUORIDE, AND SULFATE COMPLEXES,
W69-02834 01B

EROSION
RUNOFF AND HILLSLOPE EROSION RESULTING FROM A HIGH-INTENSITY THUNDERSTORM NEAR MACK, WESTERN COLORADO,
W69-03052 02A

EROSION CONTROL
EVALUATION OF ZINGG CONSERVATION BENCH TERRACES ON AMARILLO FINE SANDY LOAM SOIL.
W69-02971 02E

PROCESSES AND EXTENT OF EROSION AND ITS EFFECTS ON LAND USE IN THE CENTRAL LUNI BASIN, WESTERN RAJASTHAN,
W69-02987 02J

ESSENTIAL NUTRIENTS
NUTRIENT SOURCES FOR ALGAE AND AQUATIC WEEDS,
W69-03185 05B

FIELD AND LABORATORY EVALUATIONS OF BIOASSAYS FOR NITROGEN AND PHOSPHORUS WITH ALGAE AND AQUATIC WEEDS,
W69-03186 05A

ESTIMATING
WHEN IS IT SAFE TO EXTEND A PREDICTION EQUATION--AN ANSWER BASED UPON FACTOR AND DISCRIMINANT FUNCTION ANALYSIS,
W69-03183 06A

ESTUARIES
WATER AND SEDIMENT IN THE NORRIS GLACIER OUTWASH AREA, UPPER TAKU INLET, SOUTHEASTERN ALASKA,
W69-03093 02J

ACCURACY OF DISCRETE MODELS USED TO PREDICT ESTUARY POLLUTION,
W69-03107 05B

RESULTS FROM A SYSTEMS ANALYSIS APPROACH TO THE OPTIMUM CONTROL OF ESTUARINE WATER QUALITY,
W69-03162 05G

EUTROPHICATION
DWINDLING LAKES,
W69-02956 02H

FERTILIZATION OF NATURAL LAKES IN MICHIGAN,
W69-02957 02H

PRIMARY PRODUCTIVITY STUDIES IN ONONDAGA LAKE, NEW YORK,
W69-02959 05C

ONONDAGA LAKE, NEW YORK, AN UNUSUAL ALGAL ENVIRONMENT,
W69-02961 02H

ADSORPTION OF PHOSPHORUS BY LAKE SEDIMENT,
W69-03075 02H

THE PRODUCTIVITY OF A LAKE POLLUTED BY ORGANIC WASTES DERIVED PRIMARILY FROM SEPTIC TANKS,
W69-03192 05C

EVALUATION
CONTROL LEVELS FOR QUANTITATIVE EVALUATION OF WEATHER MODIFICATION ATTAINMENTS,
W69-03113 02A

WHEN IS IT SAFE TO EXTEND A PREDICTION EQUATION--AN ANSWER BASED UPON FACTOR AND DISCRIMINANT FUNCTION ANALYSIS,
W69-03183 06A

EVAPORATION
SEASONAL CHANGES OF SLOUGH AND LAKE WATER CHEMISTRY IN SOUTHERN SASKATCHEWAN (CANADA),
W69-02838 02H

PRECISION LYSIMETRY FOR DIRECT MEASUREMENT OF EVAPORATIVE FLUX,
W69-02981 02G

A NOTE CONCERNING THE EDDY TRANSFER COEFFICIENTS OF MOMENTUM AND WATER VAPOR UNDER NEAR-ADIABATIC CONDITIONS,
W69-03051 02D

EVAPORATION FROM LARGE DEEP LAKES,
W69-03083 02D

RELATIONSHIP BETWEEN PRECIPITATION, EVAPORATION, AND RUNOFF IN TROPICAL-EQUATORIAL REGIONS,
W69-03092 02A

RELATION OF SOIL PROPERTIES TO THE EVAPORATION OF WATER FROM SOILS,
W69-03175 02D

EVAPORATION CONTROL
USE OF MONOMOLECULAR FILMS TO REDUCE EVAPORATION FROM THE SURFACE OF BODIES OF WATER,
W69-02805 03B

PREDICTING DISSOLVED OXYGEN CONCENTRATION IN A LAKE COVERED WITH EVAPORATION SUPPRESSANT,
W69-02825 02D

EFFECTS OF A MONOLAYER ON RESERVOIR TEMPERATURE AND EVAPORATION,
W69-03054 03B

EVAPORATION PANS
THE CONCEPT OF POTENTIAL EVAPOTRANSPIRATION IN ARID ZONE AGRICULTURE,
W69-02967 02D

EVAPORIMETERS
A SIMPLE EVAPORIMETER FOR USE IN COLD AREAS,
W69-03115 07B

EVAPOTRANSPIRATION
THE CONCEPT OF POTENTIAL EVAPOTRANSPIRATION IN ARID ZONE AGRICULTURE,
W69-02967 02D

DETERMINING CONSUMPTIVE USE FOR PLANNING WATER DEVELOPMENTS,
W69-02970 02I

PONTACYL BRILLIANT PINK AS A TRACER DYE IN THE MOVEMENT OF WATER IN PHREATOPHYTES,
W69-03047 02I

THE EFFECT OF APPLIED INTERCEPTION ON TRANSPIRATION RATES OF POTTED PONDEROSA PINE,
W69-03116 02I

CORRELATING SOIL MOISTURE CONDITIONS AND MICROCLIMATE WITH EVAPORATION LOSSES AND WATER REQUIREMENTS OF PLANTS,
W69-03198 02D

EXCESSIVE PRECIPITATION
ROSKIN BROS, INC V STATE (LIABILITY OF STATE FOR NEGLIGENT MAINTENANCE OF CULVERT).
W69-02992 04C

EXPERIMENTAL RAINFALL-RUNOFF PLOT
AN EXPERIMENTAL RAINFALL-RUNOFF FACILITY,
W69-03076 02A

EXPROPRIATION
GRAVITY DRAINAGE DISTRICT NO 1 V KEY (CONDEMNATION PROCEEDING FOR DRAINAGE DITCH CONSTRUCTION).
W69-02888 04A

EXTERNALITIES
PROBLEMS OF BIAS IN INPUT PRICING FOR BENEFIT COST ANALYSIS A REPLY,
W69-03128 06B

FACTOR ANALYSIS
SOME COMMENTS ON THE USE OF FACTOR ANALYSES,
W69-03050 07C

FARM PONDS
A SURVEY AND EVALUATION OF SMALL ARTIFICIAL RECREATIONAL PONDS IN CENTRAL MASSACHUSETTS,
W69-03086 02H

FEASIBILITY STUDIES
THE FUNCTION OF FEASIBILITY REPORTS,
W69-02910 06A

FEDERAL GOVERNMENTS
ATLANTIC CRUSHED COKE CO V UNITED STATES (FLOOD DAMAGE).
W69-02864 04A

IVANHOE IRRIGATION DIST V MCCRACKEN.
W69-02896 06E

FEDERAL RECLAMATION LAW
IVANHOE IRRIGATION DIST V MCCRACKEN.
W69-02896 06E

FEEDBACK RELATIONSHIP
COMPUTER SIMULATION MODELS FOR RIVER-BASIN ANALYSIS AND PLANNING,
W69-03153 06B

FERTILIZATION
FERTILIZATION OF NATURAL LAKES IN MICHIGAN,
W69-02957 02H

FIELD CROPS
SPRINKLER AND SURFACE IRRIGATION OF VEGETABLE AND FIELD CROPS IN AN ARID ENVIRONMENT,
W69-02974 03F

FIELD LEVEL PLANNING
FIELD LEVEL PLANNING OF WATER RESOURCE SYSTEMS,
W69-02843 06B

FIELD PERMEABILITY TESTS
IN SITU PERMEABILITIES FOR DETERMINING RATES OF CONSOLIDATION,
W69-02934 08D

FIELD TESTS
A CONTRIBUTION TO THE DEVELOPMENT OF ROCK MECHANICS,
W69-02947 08E

FINANCING
THE DYNAMICS OF PUBLIC ROLES IN THE SELECTION OF REVENUE SOURCES IN LOCAL WATER ADMINISTRATION,
W69-02847 06B

FISH HATCHERIES
BAILEY V ARKANSAS GAME AND FISH COMM'N (STATE REGULATION OF GAME FISH SALES).
W69-02886 06E

FISH MANAGEMENT
WATER QUALITY AS RELATED TO THE SURVIVAL OF SALMON EGGS AND LARVAE,
W69-03190 05C

FITTING TECHNIQUE
ANALYTICALLY DERIVED UNIT GRAPH AND RUNOFF,
W69-03069 02A

FLEXIBLE FOUNDATIONS
TWO-DIMENSIONAL ANALYSIS OF STRESS AND STRAIN IN SOILS, REPORT 5 PLANE-STRAIN LOADING OF A STRAIN-HARDENING SOIL,
W69-02912 08D

FLOOD CONTROL
SIMILARITIES BETWEEN FLOOD CONTROL PROBLEMS AND OTHER ASPECTS OF WATER MANAGEMENT IN THE UNITED STATES,
W69-02848 06F

NAVIGATION AND FLOOD CONTROL IMPROVEMENTS IN COOPERATION WITH THE FEDERAL GOVERNMENT.
W69-03033 06E

ECONOMIC ANALYSIS OF ALTERNATIVE FLOOD CONTROL MEASURES,
W69-03111 04A

SIMULATION OF FLOOD FLOW DIVERSION FROM A LAKE SYSTEM,
W69-03143 04A

FLOOD DAMAGE
LOMBARDI V BAILEY (SUIT FOR FLOOD DAMAGES UNDER MILL ACT).
W69-02878 04A

BECK V CITY OF NEW YORK (OVERFLOWING SEWERS).
W69-03020 04A

CITY OF ASHLAND V KITTLE (LIABILITY OF A CITY FOR FLOODING CAUSED BY INADEQUATE CULVERT).
W69-03040 04A

FLOOD PLAIN INFORMATION, HARPETH RIVER, FRANKLIN, TENNESSEE.
W69-03041 02E

ECONOMIC ANALYSIS OF ALTERNATIVE FLOOD CONTROL MEASURES,
W69-03111 04A

FLOOD DAMAGES
BARTOW COUNTY V DARNELL (REQUIREMENTS FOR STATING A CAUSE OF ACTION FOR FLOOD DAMAGE).
W69-02880 04C

ADAMS V ADAMS (DAMAGE FROM OBSTRUCTING DRAINAGE DITCH).
W69-02996 04A

FLOOD FLOW DIVERSION
SIMULATION OF FLOOD FLOW DIVERSION FROM A LAKE SYSTEM,
W69-03143 04A

FLOOD PLAIN INSURANCE
AN ECONOMIC APPROACH TO COPING WITH FLOOD DAMAGE,
W69-02844 06F

FLOOD PLAINS
USE OF THE COTTONWOOD IN AN INVESTIGATION OF THE RECENT HISTORY OF A FLOOD PLAIN,
W69-02836 02J

FLOOD PROFILES
FLOODS ON CHENANGO RIVER AND CANASAWACTA CREEK AT NORWICH, NEW YORK,
W69-02839 02E

FLOOD PROTECTION
AN ECONOMIC APPROACH TO COPING WITH FLOOD DAMAGE,
W69-02844 06F

FLOOD PLAIN INFORMATION, HARPETH RIVER, FRANKLIN, TENNESSEE.
W69-03041 02E

FLOODING
STATE V SIMS (ACTION TO COMPEL PAYMENT OUT OF ALLOCATED FUNDS FOR FLOOD DAMAGE CAUSED BY A STATE AGENCY).
W69-02881 04C

HILTON V DUKE POWER CO (DAM ADDITIONS CAUSED FLOODING OF UPSTREAM LAND).
W69-03006 04A

FRYE V PENNSYLVANIA RR (ACTION BY LANDOWNERS FOR DAMAGES FROM FLOODING CAUSED BY CLOGGED DRAINAGE PIPE UNDER DEFENDANTS RAILROAD).
W69-03014 04A

FLOODS
FLOODS IN WAIMANALO AREA, OAHU, HAWAII,
W69-02818 02E

FLOOD OF AUGUST 1966 AT CARLSBAD, NEW MEXICO,
W69-02820 02E

FLOODS ON CHENANGO RIVER AND CANASAWACTA CREEK AT NORWICH, NEW YORK,
W69-02839 02E

FLOOD PLAIN INFORMATION, HARPETH RIVER, FRANKLIN, TENNESSEE.
W69-03041 02E

FLOOD OF JUNE 7, 1967, IN THE WAPSINONOC CREEK BASIN, IOWA,
W69-03085 02E

STATISTICAL TESTS FOR COMMON BANKFULL FREQUENCY IN RIVERS,
W69-03096 02E

FLORIDA
LOW STREAMFLOW IN THE MYAKKA RIVER BASIN AREA IN FLORIDA,
W69-02808 02E

ALBURY V CENTRAL AND SOUTH FLORIDA FLOOD CONTROL DIST (NO COMPENSATION ALLOWED FOR CONSTRUCTION OF A DRAINAGE CANAL).
W69-02889 04A

MCDOWELL V TRUSTEES OF THE INTERNAL IMPROVEMENT FUND (OWNERSHIP OF BEDS OF A NAVIGABLE LAKE).
W69-02890 06E

STRUCK V CITY OF MIAMI (CONDEMNATION OF A RIGHT OF WAY TO A PRIVATELY OWNED LAKE).
W69-02891 06E

BAKER V STATE (TEST FOR NAVIGABILITY OF WATERS).
W69-02892 06E

FLORIO V STATE (WATER SKIING NUISANCE).
W69-02903 06E

MEXICO BEACH CORP V ST JOE PAPER CO (TITLE TO LANDS GAINED BY ACCRETION).
W69-02998 06E

TRUSTEES OF INTERNAL IMPROVEMENT FUND V CLAUGHTON (THE RIGHT TO FILL SUBMERGED LANDS GRANTED BY THE TRUSTEES DOES NOT EXTEND BEYOND THE BOUNDARIES ACTUALLY CONVEYED).
W69-02999 04A

HYDROLOGIC EFFECTS OF PUMPING FROM THE FLORIDAN AQUIFER IN NORTHWEST HILLSBOROUGH, NORTHEAST PINELLAS, AND SOUTHWEST PASCO COUNTIES, FLORIDA,
W69-03063 02F

FLOW
TRANSPORT IN SOILS THE BALANCE OF MOMENTUM,
W69-03071 02G

FLOW FREQUENCY METHODS
METHODS OF FLOW FREQUENCY ANALYSIS,
W69-03102 02E

FLOW RATES
CARBON 14 AGES AND FLOW RATES OF WATER IN CARRIZO SAND, AT ATASCOSA COUNTY, TEXAS,
W69-03082 02F

FLUID FLOW
APPLICATION OF THE FINITE ELEMENT METHOD TO TRANSIENT FLOW IN POROUS MEDIA,
W69-03064 08B

FLUMES
THE EFFECT OF SILT-LADEN WATER ON INFILTRATION IN ALLUVIAL CHANNELS,
W69-02988 02J

MEASUREMENT OF HYDRAULIC AND SEDIMENT TRANSPORT VARIABLES IN A SMALL RECIRCULATING FLUME,
W69-03056 02J

FLUXES
SOIL WATER FLUX BELOW A RYEGRASS ROOT ZONE,
W69-02975 02G

FOOTINGS
TWO-DIMENSIONAL ANALYSIS OF STRESS AND STRAIN IN SOILS, REPORT 5 PLANE-STRAIN LOADING OF A STRAIN-HARDENING SOIL,
W69-02912 08D

CONSTRUCTING 500-KV TRANSMISSION LINES ON A SWAMPY RIVER FLOOD PLAIN,
W69-02936 08F

FORECASTING
HYDROLOGIC FORECASTS, PREDICTION PERIODS, RELIABILITY AND EXPERIENCE USING THEM IN WATER RESOURCES SYSTEMS,
W69-02802 06A

POPULATION GROWTH AND THE DEMAND FOR WATER,
W69-02962 06D

WHEN IS IT SAFE TO EXTEND A PREDICTION EQUATION--AN ANSWER BASED UPON FACTOR AND DISCRIMINANT FUNCTION ANALYSIS,
W69-03183 06A

FOREIGN CONSTRUCTION
THE FARAHNAZ PAHLAVI PROJECT.
W69-02911 08A

FORESTS
INFLUENCE OF THE FOREST ON PRECIPITATION,
W69-02803 02B

FORMULATION
OPTIMIZATION OF THE OPERATION OF A MULTIPURPOSE RESERVOIR BY DYNAMIC PROGRAMMING,
W69-02842 06A

FORMAL MODELS IN THE DESIGN OF WATER RESOURCE SYSTEMS,
W69-02846 06A

PROGRAM FOR COOPERATIVE STUDY FOR COMPREHENSIVE WATER RESOURCE DEVELOPMENT,
W69-02854 06B

FOULING
INCRUSTATION IN WATER PIPELINES,
W69-02928 08G

FOUNDATIONS
DYNAMIC LOADINGS,
W69-02908 08D

DENSIFICATION OF GRANULAR SOILS BY VIBRATIONS,
W69-02935 08D

CONSTRUCTING 500-KV TRANSMISSION LINES ON A SWAMPY RIVER FLOOD PLAIN,
W69-02936 08F

FRAGMENTATION
ROCK BREAKAGE BY CRUSHING, BLASTING, AND DRILLING,
W69-02920 08E

FREEZING WATERWAYS
CARACTERIZAREA HIDROLOGICA A ANULUI 1966 (HYDROLOGICAL CHARACTERIZATION OF 1966),
W69-02815 02E

FREQUENCY ANALYSIS
RAINFALL INTENSITY AND ELEVATION IN SOUTHWESTERN IDAHO,
W69-03087 02B

STATISTICAL TESTS FOR COMMON BANKFULL FREQUENCY IN RIVERS,
W69-03096 02E

METHODS OF FLOW FREQUENCY ANALYSIS,
W69-03102 02E

FRESH WATER
ESTIMATED USE OF WATER IN THE UNITED STATES, 1965,
W69-02840 06B

SEC 452 WATER SUPPLY TO OTHER STATES.
W69-03028 04A

FROST
INFILTRATION, OVERLAND FLOW, AND SOIL MOVEMENT ON FROZEN AND SNOW-COVERED PLOTS,
W69-03060 02A

FROZEN GROUND
INFILTRATION, OVERLAND FLOW, AND SOIL MOVEMENT ON FROZEN AND SNOW-COVERED PLOTS,
W69-03060 02A

FUNCTIONAL APPROACH
A FUNCTIONAL APPROACH TO PROBLEMS OF WATER RESOURCE DEVELOPMENT AND WATER USE,
W69-03134 06A

FUNDAMENTAL EQUATION
PARETO AND THE MARSHALLIAN CONSTANCY ASSUMPTION,

W69-03130 06B

URROWS
FURROW SIZE, PLACEMENT, AND GRASS CULTURE EFFECTS ON VINEYARD IRRIGATION,
W69-02978 03F

ASES
MATHEMATICAL MODEL FOR UNDERGROUND DISCHARGE OF RADIOACTIVE GASES,
W69-02813 05B

SOIL-WATER MOVEMENT IN VAPOUR AND LIQUID PHASES,
W69-02966 02G

EOCHEMISTRY
THE CHEMISTRY OF LAKE SEDIMENTS FROM INDIAN TIBET,
W69-02960 02H

EOMORPHOLOGY
SEDIMENT SURVEYS IN CANADA,
W69-03123 02J

EOPHYSICAL PROSPECTING
POSSIBILITIES AND LIMITATIONS OF GEOPHYSICAL METHODS APPLIED TO CIVIL ENGINEERING,
W69-02916 08E

EOPHYSICS
POSSIBILITIES AND LIMITATIONS OF GEOPHYSICAL METHODS APPLIED TO CIVIL ENGINEERING,
W69-02916 08E

EORGIA
BARTOW COUNTY V DARNELL (REQUIREMENTS FOR STATING A CAUSE OF ACTION FOR FLOOD DAMAGE).
W69-02880 04C

PRESCOTT V HERRING (BOUNDARY DISPUTE).
W69-02882 04C

WEIMER V CAUBLE (ACTION TO ENJOIN DIVERSION OF SURFACE WATERS ONTO PLAINTIFF'S LAND IN HARMFUL MANNER).
W69-02902 04A

ERMINATION
GERMINATION OF PROMISING DESERT GRASS SEEDS UNDER DIFFERENT DEPTHS OF SOWING IN SANDY SOIL,
W69-02972 02G

GERMINATION IN LOWER OSMOTIC POTENTIAL AS AN INDEX OF DROUGHT RESISTANCE IN CROP PLANTS - A REVIEW,
W69-02984 02I

LACIAL DRIFT
WATER AND SEDIMENT IN THE NORRIS GLACIER OUTWASH AREA, UPPE TAKU INLET, SOUTHEASTERN ALASKA,
W69-03093 02J

FLOW OF GROUNDWATER ADJACENT TO SMALL, CLOSED BASINS IN GLACIAL TILL,
W69-03119 02F

LASS FIBERS
PROSPECTS FOR USE OF NONMETALLIC REINFORCEMENT,
W69-02937 08G

OLF COURSES
SANS V RAMSEY GOLF AND COUNTRY CLUB (USE OF LAKE ON GOLF COURSE).
W69-03012 06E

RANULAR MATERIALS
DENSIFICATION OF GRANULAR SOILS BY VIBRATIONS,
W69-02935 08D

RAPHICAL METHODS
GRAPHICAL METHODS FOR STUDIES OF AQUEOUS ALUMINUM HYDROXIDE, FLUORIDE, AND SULFATE COMPLEXES,
W69-02834 01B

RASSED WATERWAYS
FURROW SIZE, PLACEMENT, AND GRASS CULTURE EFFECTS ON VINEYARD IRRIGATION,
W69-02978 03F

RASSES
EFFECTS OF MOISTURE AND NITROGEN FERTILIZER ON GROWTH AND WATER USE BY NATIVE GRASS,
W69-02969 02I

GERMINATION OF PROMISING DESERT GRASS SEEDS UNDER DIFFERENT DEPTHS OF SOWING IN SANDY SOIL,
W69-02972 02G

RAVITY STUDIES
APPLICATION OF THE GRAVITY SURVEY METHOD TO WATERSHED HYDROLOGY,
W69-02982 04D

REAT LAKES
SYSTEMS APPROACH TO WATER QUALITY IN THE GREAT LAKES.
W69-03059 02H

REAT LAKES REGION
ANALYSIS OF WATER AND WATER-RELATED RESEARCH REQUIREMENTS IN THE GREAT LAKES REGION.
W69-03079 07A

REEN LAKE(N
CHEMICAL AND ISOTOPIC BALANCES FOR A MEROMICTIC LAKE,
W69-03088 02H

GRINDING
ROCK BREAKAGE BY CRUSHING, BLASTING, AND DRILLING,
W69-02920 08E

GROUND WATER
TRACE AND TRACER ELEMENTS IN GROUND WATER,
W69-03197 02F

ARKANSAS WATER RESOURCES SUPPLY, USE, AND RESEARCH NEEDS,
W69-03199 06B

GROUNDWATER
AVAILABILITY OF GROUND WATER IN THE PARTS OF THE ARLINGTON AND WICKLIFFE SW QUADRANGLES IN JACKSON PURCHASE REGION, KENTUCKY,
W69-02822 02A

GROUND-WATER WITHDRAWAL IN THE ODESSA AREA, ADAMS, GRANT, AND LINCOLN COUNTIES, WASHINGTON,
W69-02823 02F

WATER RESOURCES OF THE MUSTINKA AND BOIS DE SIOUX RIVERS WATERSHED WEST-CENTRAL MINNESOTA,
W69-02829 02F

THE PERCHED WATER TABLE IN THE UPPER LIMESTONE AQUIFER OF MALTA,
W69-02833 02F

ESTIMATED USE OF WATER IN THE UNITED STATES, 1965,
W69-02840 06B

HYDROGEOLOGY OF DESERT BASINS,
W69-02924 02F

HYDRO-GEOLOGY OF QUATERNARY FORMATION FROM RIVER LUNI AND ITS TRIBUTARIES CATCHMENT.
W69-02983 02F

GROWTH AND DECAY OF GROUNDWATER-MOUNDS IN RESPONSE TO UNIFORM PERCOLATION,
W69-03048 02F

DRAWDOWN IN A WELL OF LARGE DIAMETER,
W69-03049 02F

RESPONSE OF A FINITE-DIAMETER WELL TO AN INSTANTANEOUS CHARGE OF WATER,
W69-03057 02F

STRATIFICATION OF FRESH AND SALT WATER ON BARRIER ISLANDS AS A RESULT OF DIFFERENCES IN SEDIMENT PERMEABILITY,
W69-03058 02F

HYDROLOGIC EFFECTS OF PUMPING FROM THE FLORIDAN AQUIFER IN NORTHWEST HILLSBOROUGH, NORTHEAST PINELLAS, AND SOUTHWEST PASCO COUNTIES, FLORIDA,
W69-03063 02F

GROUND-WATER OCCURRENCE AND STRATIGRAPHY OF UNCONSOLIDATED DEPOSITS, CENTRAL PIERCE COUNTY, WASHINGTON,
W69-03081 02F

INVESTIGATION OF THE INFLUENCE OF WASTE DISPOSAL PRACTICES ON GROUNDWATER QUALITIES,
W69-03178 05B

MOVEMENT OF WATER FROM CANALS TO GROUNDWATER TABLE,
W69-03179 02G

GROUNDWATER BASINS
HYDRO-GEOLOGY OF QUATERNARY FORMATION FROM RIVER LUNI AND ITS TRIBUTARIES CATCHMENT.
W69-02983 02F

GROUNDWATER FLOW
RADIUS OF INFLUENCE OF A WELL,
W69-02946 02F

GROUNDWATER GEOLOGY
HYDROGEOLOGY OF DESERT BASINS,
W69-02924 02F

GROUNDWATER MANAGEMENT
SYSTEMS ANALYSIS FOR GROUND WATER BASIN MANAGEMENT,
W69-03200 04B

GROUNDWATER MINING
OPTIMAL GROUNDWATER MINING,
W69-03114 04B

GROUNDWATER MOVEMENT
VIRUS MOVEMENT IN GROUNDWATER,
W69-02824 05B

GROUNDWATER FLOW SYSTEMS IN THE CRYSTALLINE ROCKS OF THE OKANAGAN HIGHLAND, BRITISH COLUMBIA,
W69-02826 02F

CARBON 14 AGES AND FLOW RATES OF WATER IN CARRIZO SAND, AT ATASCOSA COUNTY, TEXAS,
W69-03082 02F

FLOW OF GROUNDWATER ADJACENT TO SMALL, CLOSED BASINS IN GLACIAL TILL,
W69-03119 02F

GROUNDWATER RECHARGE
WASTE WATER RENOVATION FOR REUSE KEY TO OPTIMUM USE OF

WATER RESOURCES,
W69-02929 05D

RADIUS OF INFLUENCE OF A WELL,
W69-02946 02F

GROWTH RATES
THE SOCIAL RATE OF DISCOUNT AND THE OPTIMAL RATE OF INVESTMENT,
W69-03129 06B

HARBORS
SOME HYDROLOGICAL OBSERVATIONS IN AUCKLAND AND OTAGO HARBOURS,
W69-02835 02L

HARVARD WATER PROGRAM
RESEARCH ON COMPREHENSIVE PLANNING OF WATER-RESOURCE SYSTEMS SYMPOSIUM,
W69-03166 06B

HAWAII
FLOODS IN WAIMANALO AREA, OAHU, HAWAII,
W69-02818 02E

HIGHWAYS
BARTOW COUNTY V DARNELL (REQUIREMENTS FOR STATING A CAUSE OF ACTION FOR FLOOD DAMAGE).
W69-02880 04C

HILLSLOPE HYDRAULICS
THE HYDRAULICS OF OVERLAND FLOW ON HILLSLOPES,
W69-03110 02E

HYDRAULIC CONDUCTIVITY
HYDRAULIC AND MICROMORPHOLOGICAL PROPERTIES OF STREAM CHANNEL SEDIMENTS,
W69-03108 02J

HYDRAULIC DESIGN
OPTIMIZATION OF TIDAL POWER GENERATION,
W69-03160 06A

HYDRAULIC MODELS
MEASUREMENT OF HYDRAULIC AND SEDIMENT TRANSPORT VARIABLES IN A SMALL RECIRCULATING FLUME,
W69-03056 02J

HYDROELECTRIC PLANTS
EMINENT DOMAIN - PONDS, DAMS, RESERVOIRS - PUBLIC UTILITIES.
W69-02857 06E

OPTIMIZATION BY DYNAMIC PROGRAMMING OF HYDROELECTRIC PLANT OPERATION REGIME DURING INITIAL FILLING PERIOD OF MULTIANNUAL REGULATION RESERVOIR,
W69-03155 06A

HYDROELECTRIC POWER
CUGLAR V POWER AUTHORITY (EMINENT DOMAIN BY POWER AUTHORITY TO FORM POWER POOL).
W69-02863 06E

WATER-POWER COMPANIES.
W69-02900 06E

CUGLAR V POWER AUTHORITY (EMINENT DOMAIN BY POWER AUTHORITY TO FORM POWER POOL).
W69-02993 04A

HYDROGEOLOGICAL CONDITIONS
EXPERIENCE IN BURIAL OF LIQUID RADIOACTIVE WASTES IN DEEP GEOLOGICAL FORMATIONS,
W69-03061 05E

HYDROGEOLOGY
HYDROGEOLOGY OF DESERT BASINS,
W69-02924 02F

APPLICATION OF THE GRAVITY SURVEY METHOD TO WATERSHED HYDROLOGY,
W69-02982 04D

HYDRO-GEOLOGY OF QUATERNARY FORMATION FROM RIVER LUNI AND ITS TRIBUTARIES CATCHMENT.
W69-02983 02F

HYDROGRAPH ANALYSIS
A LAPLACE TRANSFORM PROOF OF THE THEOREM OF MOMENTS FOR THE INSTANTANEOUS UNIT HYDROGRAPH,
W69-03120 06A

HYDROGRAPHS
DERIVATION OF BASIN HYDROGRAPHS,
W69-02811 02E

HYDROLOGIC BUDGET
RELATIONSHIP BETWEEN PRECIPITATION, EVAPORATION, AND RUNOFF IN TROPICAL-EQUATORIAL REGIONS,
W69-03092 02A

HYDROLOGIC CYCLE
CARACTERIZAREA HIDROLOGICA A ANULUI 1966 (HYDROLOGICAL CHARACTERIZATION OF 1966),
W69-02815 02E

HYDROLOGIC DATA
METHODOLOGICAL PREREQUISITES FOR CONDUCTING NETWORK OBSERVATIONS OF THE CHANNEL PROCESS,
W69-02807 07A

WATER RESOURCES RESEARCH ASPECTS OF A REGIONAL STUDY IN THE HUNTER VALLEY, NEW SOUTH WALES,
W69-02819 02E

WATER RESOURCES OF THE MUSTINKA AND BOIS DE SIOUX RIVERS WATERSHED WEST-CENTRAL MINNESOTA,
W69-02829 02F

HYDROLOGIC DATA 1967 - VOLUME IV SAN JOAQUIN VALLEY.
W69-03068 02E

THE HYDROLOGIC REGIME DUE TO SPRINKLER IRRIGATION OF TREATE MUNICIPAL EFFLUENT ON SLOPING LAND,
W69-03109 05G

ARKANSAS WATER RESOURCES SUPPLY, USE, AND RESEARCH NEEDS,
W69-03199 06B

HYDROLOGICAL DATA
SOME ERROR PROPERTIES OF SEGMENTED HYDROLOGIC FUNCTIONS,
W69-03105 07C

HYDROLOGY
APPLICATION OF THE GRAVITY SURVEY METHOD TO WATERSHED HYDROLOGY,
W69-02982 04D

HYDROLOGY AND WATER RESOURCES OF THE HOUSATONIC RIVER BASIN MASSACHUSETTS,
W69-03101 02A

HYGROMETRY
AN ELECTRIC HYGROMETER APPARATUS FOR MEASURING WATER-VAPOUR LOSS FROM PLANTS IN THE FIELD,
W69-02968 02D

PSYCHROMETRIC MEASUREMENT OF SOIL WATER POTENTIAL IN SITU UNDER COTTON PLANTS,
W69-02980 02G

IDAHO
RAINFALL INTENSITY AND ELEVATION IN SOUTHWESTERN IDAHO,
W69-03087 02B

ILLINOIS
CITY OF MURPHYSBORO V SANITARY WATER BOARD OF ILLINOIS (POLLUTION ABATEMENT).
W69-02869 05B

GEIS V ROHRER (RIGHT OF NATURAL DRAINAGE).
W69-02877 04A

SENCO V LACROSSE DREDGING CORP (DEFINITION OF NAVIGABLE WATERS).
W69-02879 04A

SOCIAL IMPACT OF METEOROLOGICAL DROUGHT IN ILLINOIS,
W69-03193 02B

IMPACT(RAINFALL)
DETACHMENT OF SOIL PARTICLES IN SIMULATED RAINFALL,
W69-02832 04D

IMPOUNDED WATERS
BLYDENBURGH V AMELUNG (DAMAGES FOR ARTIFICIALLY IMPOUNDING AND DISCHARGING WATER ON NEIGHBOR'S LAND).
W69-02997 04A

IMPULSE RESPONSE FUNCTIONS
MOMENTS OF THE INPUT, OUTPUT, AND IMPULSE RESPONSE FUNCTIO OF LINEAR SYSTEMS ABOUT ARBITRARY POINTS,
W69-03089 02A

IN SITU TESTS
IN SITU PERMEABILITIES FOR DETERMINING RATES OF CONSOLIDATION,
W69-02934 08D

A CONTRIBUTION TO THE DEVELOPMENT OF ROCK MECHANICS,
W69-02947 08E

INCOME EFFECT
PARETO AND THE MARSHALLIAN CONSTANCY ASSUMPTION,
W69-03130 06B

INCOME REDISTRIBUTION
THE INCOME REDISTRIBUTION EFFECTS OF RESERVOIR CONSTRUCTIC IN APPALACHIA,
W69-03142 06B

INCRUSTATION
INCRUSTATION IN WATER PIPELINES,
W69-02928 08G

INDIA
THE CHEMISTRY OF LAKE SEDIMENTS FROM INDIAN TIBET,
W69-02960 02H

INDUCED INFILTRATION
DEPLETION OF FLOW IN RIGHT-ANGLE STREAM BENDS BY STEADY WELLS,
W69-03094 02A

INDUSTRIAL PLANTS
INJURIES TO DAMS AND WATER CHANNELS OF MILLS AND FACTORIE
W69-03001 04A

INFILTRATION
THE EFFECT OF SILT-LADEN WATER ON INFILTRATION IN ALLUVIA CHANNELS,
W69-02988 02J

STEPS TOWARD A BETTER UNDERSTANDING OF URBAN RUNOFF PROGRESS,
W69-03097 04C

SLOPE LENGTH OF CLAYPAN SOIL AFFECTS RUNOFF,
W69-03106 02A

HYDRAULIC AND MICROMORPHOLOGICAL PROPERTIES OF STREAM CHANNEL SEDIMENTS,
W69-03108 02J

INFORMATION RETRIEVAL
THE INFORMATION BACKGROUND IN THE FIELD OF BIOLOGICAL DETERIORATION OF NONMETALLIC MATERIALS,
W69-02905 08C

INFRAMARGINAL EXTERNALITIES
EXTERNALITY,
W69-03132 06B

INHIBITION
SOME FACTORS IN THE COMPETITION OR ANTAGONISM BETWEEN BACTERIA, ALGAE, AND AQUATIC WEEDS,
W69-03188 05C

INJECTION
RESPONSE OF A FINITE-DIAMETER WELL TO AN INSTANTANEOUS CHARGE OF WATER,
W69-03057 02F

INJECTION WELLS
EXPERIENCE IN BURIAL OF LIQUID RADIOACTIVE WASTES IN DEEP GEOLOGICAL FORMATIONS,
W69-03061 05E

INLETS
FAIRCHILD V KRAEMER (ACCESS TO ARTIFICIALLY CREATED BASIN).
W69-03018 04A

INPUT PRICING
PROBLEMS OF BIAS IN INPUT PRICING FOR BENEFIT COST ANALYSIS A REPLY,
W69-03128 06B

INPUT-OUTPUT ANALYSIS
SYSTEMS ANALYSIS AND SIMULATION IN WATER QUALITY MANAGEMENT,
W69-03161 05G

INSTITUTIONAL CONSTRAINTS
SIMILARITIES BETWEEN FLOOD CONTROL PROBLEMS AND OTHER ASPECTS OF WATER MANAGEMENT IN THE UNITED STATES,
W69-02848 06F

INSTRUMENTATION
TRACER MEASUREMENT OF STREAM REAERATION. II. FIELD STUDIES,
W69-02821 02E

MEASUREMENT OF HYDRAULIC AND SEDIMENT TRANSPORT VARIABLES IN A SMALL RECIRCULATING FLUME,
W69-03056 02J

A SIMPLE EVAPORIMETER FOR USE IN COLD AREAS,
W69-03115 07B

INTERCEPTION
THE EFFECT OF APPLIED INTERCEPTION ON TRANSPIRATION RATES OF POTTED PONDEROSA PINE,
W69-03116 02I

INTERSTATE COMMISSIONS
OPPORTUNITIES FOR REGIONAL RESEARCH ON WATER RESOURCES PROBLEMS.
W69-02872 06B

INTERSTATE COMPACTS
POWERS AND DUTIES OF THE DELAWARE RIVER BASIN COMMISSION.
W69-03026 06E

INVESTMENT
THE SOCIAL RATE OF DISCOUNT AND THE OPTIMAL RATE OF INVESTMENT,
W69-03129 06B

IOWA
LIABILITY RESULTING FROM ARTIFICIAL BODIES OF WATER.
W69-03030 06E

FLOOD OF JUNE 7, 1967, IN THE WAPSINONOC CREEK BASIN, IOWA,
W69-03085 02E

IRON BACTERIA
INCRUSTATION IN WATER PIPELINES,
W69-02928 08G

IRRIGATION
GROUND-WATER WITHDRAWAL IN THE ODESSA AREA, ADAMS, GRANT, AND LINCOLN COUNTIES, WASHINGTON,
W69-02823 02F

SOIL STUDY FOR WATER ECONOMICS,
W69-03042 02G

SLOPE LENGTH OF CLAYPAN SOIL AFFECTS RUNOFF,
W69-03106 02A

IRRIGATION EFFECTS
SPRINKLER AND SURFACE IRRIGATION OF VEGETABLE AND FIELD CROPS IN AN ARID ENVIRONMENT,
W69-02974 03F

THE HYDROLOGIC REGIME DUE TO SPRINKLER IRRIGATION OF TREATED MUNICIPAL EFFLUENT ON SLOPING LAND,
W69-03109 05G

IRRIGATION EFFICIENCY
DETERMINING CONSUMPTIVE USE FOR PLANNING WATER DEVELOPMENTS,
W69-02970 02I

FURROW SIZE, PLACEMENT, AND GRASS CULTURE EFFECTS ON VINEYARD IRRIGATION,
W69-02978 03F

IRRIGATION PRACTICES
INTERRELATIONSHIP BETWEEN PHYSIOGRAPHY, HYDROLOGY, SEDIMENTATION, AND SALINIZATION OF THE LODDON RIVER PLAINS, AUSTRALIA,
W69-02817 02B

IRRIGATION WATER
FURROW SIZE, PLACEMENT, AND GRASS CULTURE EFFECTS ON VINEYARD IRRIGATION,
W69-02978 03F

AN ANALYSIS OF TEMPERATURE BEHAVIOR IN IRRIGATED SOIL PROFILES,
W69-03053 02G

ISLANDS
ERECTING ARTIFICIAL ISLANDS AND LUMPS IN PUBLIC WATERS.
W69-03003 06E

STRATIFICATION OF FRESH AND SALT WATER ON BARRIER ISLANDS AS A RESULT OF DIFFERENCES IN SEDIMENT PERMEABILITY,
W69-03058 02F

ISOTOPIC BALANCE
CHEMICAL AND ISOTOPIC BALANCES FOR A MEROMICTIC LAKE,
W69-03088 02H

JACKING TESTS
A CONTRIBUTION TO THE DEVELOPMENT OF ROCK MECHANICS,
W69-02947 08E

JUDICIAL DECISIONS
LIABILITY RESULTING FROM ARTIFICIAL BODIES OF WATER.
W69-03030 06E

KAOLINITE
DEPOSITIONAL BEHAVIOR OF KAOLINITE IN TURBULENT FLOW,
W69-03067 02J

KENTUCKY
AVAILABILITY OF GROUND WATER IN THE PARTS OF THE ARLINGTON AND WICKLIFFE SW QUADRANGLES IN JACKSON PURCHASE REGION, KENTUCKY,
W69-02822 02A

WOLFF V LOUISVILLE WATER CO (DENIAL OF WATER MAIN EXTENSION REQUEST).
W69-02884 04A

CURTIS V LOUISVILLE AND JEFFERSON COUNTY METROPOLITAN SEWER DISTRICT (ASSESSMENT FOR DRAINAGE IMPROVEMENT).
W69-02887 04A

CITY OF ASHLAND V KITTLE (LIABILITY OF A CITY FOR FLOODING CAUSED BY INADEQUATE CULVERT).
W69-03040 04A

KINEMATIC WAVE THEORY
THE INITIAL PHASE OF THE RISING HYDROGRAPH OF TURBULENT FREE SURFACE FLOW WITH UNSTEADY LATERAL INFLOW,
W69-02837 02E

LAKE ERIE
SYSTEMS APPROACH TO WATER QUALITY IN THE GREAT LAKES.
W69-03059 02H

LAKE ONTARIO
HUTHER V UNITED STATES (DAMAGE CLAIM DUE TO RISING LAKE WATERS).
W69-02865 04A

LONG-TERM CHANGES IN WATER CHEMISTRY AND ABUNDANCE OF PLANKTON AT A SINGLE SAMPLING LOCATION IN LAKE ONTARIO,
W69-02958 02H

LAKE SHORES
HAMMETT V ROSENSOHN (ACTION TO DETERMINE EFFECT OF RESTRICTIONS IN DEED).
W69-02861 06E

DELAUNE V BOARD OF COMMISSIONERS (APPLICABILITY OF STATUTES RELATING TO RIVERS TO LAKE PROPERTY).
W69-03000 06E

LAKE STAGES
THE CHEMISTRY OF LAKE SEDIMENTS FROM INDIAN TIBET,
W69-02960 02H

LAKES
PREDICTING DISSOLVED OXYGEN CONCENTRATION IN A LAKE COVERED WITH EVAPORATION SUPPRESSANT,
W69-02825 02D

SEASONAL CHANGES OF SLOUGH AND LAKE WATER CHEMISTRY IN SOUTHERN SASKATCHEWAN (CANADA),
W69-02838 02H

DWINDLING LAKES,
W69-02956 02H

FERTILIZATION OF NATURAL LAKES IN MICHIGAN,
W69-02957 02H

THE CHEMISTRY OF LAKE SEDIMENTS FROM INDIAN TIBET,
W69-02960 02H

SANS V RAMSEY GOLF AND COUNTRY CLUB (USE OF LAKE ON GOLF COURSE).
W69-03012 06E

ADSORPTION OF PHOSPHORUS BY LAKE SEDIMENT,
W69-03075 02H

EVAPORATION FROM LARGE DEEP LAKES,
W69-03083 02D

CHEMICAL AND ISOTOPIC BALANCES FOR A MEROMICTIC LAKE,
W69-03088 02H

LAND FILLS
TRUSTEES OF INTERNAL IMPROVEMENT FUND V CLAUGHTON (THE RIGHT TO FILL SUBMERGED LANDS GRANTED BY THE TRUSTEES DOES NOT EXTEND BEYOND THE BOUNDARIES ACTUALLY CONVEYED).
W69-02999 04A

LAND MANAGEMENT
CONSERVATION DECISION-MAKING A RATIONALIZATION,
W69-03127 04C

LAND RECLAMATION
INTERRELATIONSHIP BETWEEN PHYSIOGRAPHY, HYDROLOGY, SEDIMENTATION, AND SALINIZATION OF THE LODDON RIVER PLAINS, AUSTRALIA,
W69-02817 02B

LAND TENURE
STATE V BROOKS (PROOF OF ADVERSE POSSESSION TO MARSHLAND).
W69-02873 06E

LAND USE
ROOKERY BAY AREA PROJECT A DEMONSTRATION STUDY IN CONSERVATION AND DEVELOPMENT, NAPLES, FLORIDA.
W69-03169 06B

LANDFILL
INVESTIGATION OF THE INFLUENCE OF WASTE DISPOSAL PRACTICES ON GROUNDWATER QUALITIES,
W69-03178 05B

LANDFILLS
FILLING LOW, SWAMP, AND WASTE LANDS.
W69-02875 06E

CITY OF MADISON V STATE (PUBLIC BUILDINGS ON FILLED LAKE LAND).
W69-03022 04C

LEAST SQUARES METHOD
SOME ERROR PROPERTIES OF SEGMENTED HYDROLOGIC FUNCTIONS,
W69-03105 07C

LEAVES
AN ELECTRIC HYGROMETER APPARATUS FOR MEASURING WATER-VAPOUR LOSS FROM PLANTS IN THE FIELD,
W69-02968 02D

LEGAL ASPECTS
ROLE OF LOCAL GOVERNMENT IN WATER LAW,
W69-02853 06E

BABTOW COUNTY V DARNELL (REQUIREMENTS FOR STATING A CAUSE OF ACTION FOR FLOOD DAMAGE).
W69-02880 04C

LIABILITY RESULTING FROM ARTIFICIAL BODIES OF WATER.
W69-03030 06E

LEGISLATION
EMINENT DOMAIN - PONDS, DAMS, RESERVOIRS - PUBLIC UTILITIES.
W69-02857 06E

NAVIGATION -- BUOYS, BEACONS, FLOODGATES, AND DUMPING MUD OR REFUSE.
W69-02870 06E

TAPPING, INTERFERING WITH, OR DAMAGING SEWERAGE WORKS - RUNNING WATER INTO MINES.
W69-02871 05G

RESERVOIRS.
W69-02874 05B

FILLING LOW, SWAMP, AND WASTE LANDS.
W69-02875 06E

PRIVATE SEWERS.
W69-02876 05G

POLLUTION OF WATER ON LANDS USED FOR DAIRY PURPOSES.
W69-02893 05B

APPROPRIATIONS FOR CONSTRUCTION OF WATER AND SEWER LINES.
W69-02894 06C

INJURIES TO DAMS AND WATER CHANNELS OF MILLS AND FACTORIES.
W69-03001 04A

LEAVING UNUSED WELL OPEN AND EXPOSED.
W69-03002 06E

ERECTING ARTIFICIAL ISLANDS AND LUMPS IN PUBLIC WATERS.
W69-03003 06E

NORTH CAROLINA SEASHORE COMMISSION.
W69-03005 06E

SEC 452 WATER SUPPLY TO OTHER STATES.
W69-03028 04A

DISCHARGE OF SEWAGE INTO WATERS (PERMITS REQUIRED).
W69-03029 06E

LEONTIEF MODELS
THE LEONTIEF INPUT-OUTPUT SYSTEM AND ITS APPLICATION TO ANALYSIS AND PROJECTION FOR WATER RESOURCES PLANNING,
W69-03156 06A

THE INTERINDUSTRY WATER CONTENT MATRIX APPLICATIONS ON A MULTIREGIONAL BASIS,
W69-03157 06A

LEVEES
DELAUNE V BOARD OF COMMISSIONERS (APPLICABILITY OF STATUTES RELATING TO RIVERS TO LAKE PROPERTY).
W69-03000 06E

LIME SOIL MIXTURES
EVALUATION OF DEEP IN-SITU SOIL STABILIZATION BY HIGH-PRESSURE LIME-SLURRY INJECTION,
W69-02930 08D

LIMIT ANALYSIS
EQUILIBRIUM LIMITS OF EMBANKMENTS AND EARTH DAMS,
W69-02949 08D

LIMNOLOGY
A SURVEY AND EVALUATION OF SMALL ARTIFICIAL RECREATIONAL PONDS IN CENTRAL MASSACHUSETTS,
W69-03086 02H

LINEAR PROGRAMMING
REGIONAL MANAGEMENT OF WATER QUALITY - A SYSTEMS APPROACH,
W69-03146 05G

RESULTS FROM A SYSTEMS ANALYSIS APPROACH TO THE OPTIMUM CONTROL OF ESTUARINE WATER QUALITY,
W69-03162 05G

DESIGN OF OPTIMAL WATER DISTRIBUTION SYSTEMS,
W69-03165 06B

LINEAR TIME INVARIANT SYSTEMS
MOMENTS OF THE INPUT, OUTPUT, AND IMPULSE RESPONSE FUNCTIONS OF LINEAR SYSTEMS ABOUT ARBITRARY POINTS,
W69-03089 02A

LIQUIDS
SOIL-WATER MOVEMENT IN VAPOUR AND LIQUID PHASES,
W69-02966 02G

LIVE LOADS
TWO-DIMENSIONAL ANALYSIS OF STRESS AND STRAIN IN SOILS, REPORT 5 PLANE-STRAIN LOADING OF A STRAIN-HARDENING SOIL,
W69-02912 08D

LOAM
EVALUATION OF ZINGG CONSERVATION BENCH TERRACES ON AMARILLO FINE SANDY LOAM SOIL.
W69-02971 02E

LOCAL GOVERNMENTS
THE DYNAMICS OF PUBLIC ROLES IN THE SELECTION OF REVENUE SOURCES IN LOCAL WATER ADMINISTRATION,
W69-02847 06B

THE MUSKINGUM WATERSHED CONSERVANCY DISTRICT A STUDY OF LOCAL CONTROL,
W69-02852 06E

ROLE OF LOCAL GOVERNMENT IN WATER LAW,
W69-02853 06E

LOUISIANA
GRAVITY DRAINAGE DISTRICT NO 1 V KEY (CONDEMNATION PROCEEDING FOR DRAINAGE DITCH CONSTRUCTION).
W69-02888 04A

OLIN GAS TRANSMISSION CORP V HARRISON (OWNERSHIP OF BEDS OF NON-NAVIGABLE WATERS).
W69-02904 06E

LOW FLOW
LOW STREAMFLOW IN THE MYAKKA RIVER BASIN AREA IN FLORIDA,
W69-02808 02E

LOW WATER MARK
SHEPHEARD V BOGGS (LAND EXTENSION BY RIPARIAN LANDOWNER BLOCKING STREAM).
W69-03037 04A

LOW-FLOW AUGMENTATION
DESIGN SENSITIVITY OF POLLUTION CONTROL RESERVOIRS,
W69-03163 05G

LYSIMETERS
PRECISION LYSIMETRY FOR DIRECT MEASUREMENT OF EVAPORATIVE FLUX,
W69-02981 02G

MAINE
CENTRAL MAINE POWER CO V PUBLIC UTIL COMM'N (RIPARIAN LAND

PURCHASE TO AVOID LIABILITY FOR DAM OPERATION).
W69-03017 04A

MALTA
THE PERCHED WATER TABLE IN THE UPPER LIMESTONE AQUIFER OF MALTA,
W69-02833 02F

MANAGEMENT
WATER RESOURCES AND ECONOMIC DEVELOPMENT THE CHALLENGE TO KNOWLEDGE,
W69-02964 06B

MARYLAND
WHITEHALL CONSTRUCTION CO V WASHINGTON SUBURBAN SANITARY COMM'N (REQUIREMENTS FOR TRESPASS ACTION).
W69-03007 06E

BOARD OF HEALTH V CREW (STATE'S RIGHT TO ORDER WELL CLOSING).
W69-03024 05G

MASSACHUSETTS
LOMBARDI V BAILEY (SUIT FOR FLOOD DAMAGES UNDER MILL ACT).
W69-02878 04A

STEAMTUG ALADDIN, INC V CITY OF BOSTON (FEDERAL LIABILITY FOR BRIDGE AS NAVIGATIONAL HAZARD).
W69-03010 06E

A SURVEY AND EVALUATION OF SMALL ARTIFICIAL RECREATIONAL PONDS IN CENTRAL MASSACHUSETTS,
W69-03086 02H

MATHEMATICAL MODEL
MATHEMATICAL MODEL FOR UNDERGROUND DISCHARGE OF RADIOACTIVE GASES,
W69-02813 05B

MATHEMATICAL MODELS
DERIVATION OF BASIN HYDROGRAPHS,
W69-02811 02E

UNSTEADY FLOW IN OPEN CHANNELS,
W69-03044 02E

ANALYTICALLY DERIVED UNIT GRAPH AND RUNOFF,
W69-03069 02A

RUNOFF HYDROGRAPHS FOR MATHEMATICAL WATERSHED MODEL,
W69-03070 02E

ACCURACY OF DISCRETE MODELS USED TO PREDICT ESTUARY POLLUTION,
W69-03107 05B

MATHEMATICAL MODELS FOR EXPRESSING THE BIOCHEMICAL OXYGEN DEMAND IN WATER QUALITY STUDIES,
W69-03138 05G

OPTIMIZATION AND RANGE OF APPLICATION OF NUCLEAR REACTORS AND FLASH EVAPORATORS FOR SEA WATER DESALINATION,
W69-03147 03A

OPTIMAL WASTE TREATMENT AND POLLUTION ABATEMENT BENEFITS ON A CLOSED RIVER SYSTEM,
W69-03150 05D

MATHEMATICAL STUDIES
THE TEMPORAL AND SPATIAL DISTRIBUTION OF DISSOLVED OXYGEN IN STREAMS,
W69-02809 05A

GRAPHICAL METHODS FOR STUDIES OF AQUEOUS ALUMINUM HYDROXIDE, FLUORIDE, AND SULFATE COMPLEXES,
W69-02834 01B

APPLICATION OF THE FINITE ELEMENT METHOD TO TRANSIENT FLOW IN POROUS MEDIA,
W69-03064 08B

METHODS OF FLOW FREQUENCY ANALYSIS,
W69-03102 02E

SOME ERROR PROPERTIES OF SEGMENTED HYDROLOGIC FUNCTIONS,
W69-03105 07C

A LAPLACE TRANSFORM PROOF OF THE THEOREM OF MOMENTS FOR THE INSTANTANEOUS UNIT HYDROGRAPH,
W69-03120 06A

MEANDERING(LEGAL ASPECTS)
STATE V ADAMS (OWNERSHIP OF BEDS).
W69-02899 06E

MEASURE OF DAMAGES
ADAMS V ADAMS (DAMAGE FROM OBSTRUCTING DRAINAGE DITCH).
W69-02996 04A

NEWMAN V CITY OF EL DORADO SPRINGS (ACTION FOR POLLUTION CAUSED BY CITY'S SEWAGE SYSTEM).
W69-03039 05B

MEASUREMENT
PSYCHROMETRIC MEASUREMENT OF SOIL WATER POTENTIAL IN SITU UNDER COTTON PLANTS,
W69-02980 02G

RIVER MILEAGE MEASUREMENT,
W69-03100 07A

MECHANICAL PROPERTIES
MECHANICAL PROPERTIES OF COMPACTED SOILS,
W69-02925 08D

MELT WATER
WATER AND SEDIMENT IN THE NORRIS GLACIER OUTWASH AREA, UPPER TAKU INLET, SOUTHEASTERN ALASKA,
W69-03093 02J

MEROMIXIS
CHEMICAL AND ISOTOPIC BALANCES FOR A MEROMICTIC LAKE,
W69-03088 02H

METEOROLOGICAL DATA
THE CONCEPT OF POTENTIAL EVAPOTRANSPIRATION IN ARID ZONE AGRICULTURE,
W69-02967 02D

MICHIGAN
FERTILIZATION OF NATURAL LAKES IN MICHIGAN,
W69-02957 02H

BURKE V FREY (SURFACE WATER DRAINAGE).
W69-03019 04A

HYDROLOGIC STUDIES OF SMALL WATERSHEDS IN AGRICULTURAL AREAS OF SOUTHERN MICHIGAN,
W69-03045 02A

MICROMORPHOLOGICAL PROPERTIES
HYDRAULIC AND MICROMORPHOLOGICAL PROPERTIES OF STREAM CHANNEL SEDIMENTS,
W69-03108 02J

MICROORGANISMS
EVALUATION OF THE EFFECT OF TRACE ELEMENTS ON THE ACTIVITY OF MICROORGANISMS,
W69-03196 05C

MILL ACT
CENTRAL MAINE POWER CO V PUBLIC UTIL COMM'N (RIPARIAN LAND PURCHASE TO AVOID LIABILITY FOR DAM OPERATION).
W69-03017 04A

MILL ACTS
LOMBARDI V BAILEY (SUIT FOR FLOOD DAMAGES UNDER MILL ACT).
W69-02878 04A

MILLS
DUTY AS TO BRIDGES OF MILLOWNERS ON, OR PERSONS DITCHING OR ENLARGING DITCHES ACROSS, HIGHWAYS.
W69-03004 06E

MINE WASTES
BUMBARGER V WALKER (CONTAMINATION OF SPRING BY MINE DRAINAGE).
W69-02901 05G

MINING
TAPPING, INTERFERING WITH, OR DAMAGING SEWERAGE WORKS - RUNNING WATER INTO MINES.
W69-02871 05G

MINNESOTA
WATER RESOURCES OF THE MUSTINKA AND BOIS DE SIOUX RIVERS WATERSHED WEST-CENTRAL MINNESOTA,
W69-02829 02F

STATE V ADAMS (OWNERSHIP OF BEDS).
W69-02899 06E

MISCIBLE DISPLACEMENT
MISCIBLE DISPLACEMENT IN AN UNSATURATED GLASS BEAD MEDIUM,
W69-02810 02G

MISSOURI
FERGUSON V UNION ELECTRIC COMPANY (SUIT FOR DAMAGES CAUSED BY IMPROPER OPERATION OF A DAM).
W69-02885 04A

HILLHOUSE V CITY OF AURORA (ACTION FOR DAMAGES BROUGHT BY FARM OWNER FOR POLLUTION OF CREEK BY CITY SEWER SYSTEM).
W69-02898 05B

SNEED V WEBER (RIGHT OF UNITED STATES TO REMOVE OBSTRUCTIONS TO NAVIGATION COULD NOT INURE TO ANY MEMBER OF THE PUBLIC).
W69-02995 06E

BLYDENBURGH V AMELUNG (DAMAGES FOR ARTIFICIALLY IMPOUNDING AND DISCHARGING WATER ON NEIGHBOR'S LAND).
W69-02997 04A

NEWMAN V CITY OF EL DORADO SPRINGS (ACTION FOR POLLUTION CAUSED BY CITY'S SEWAGE SYSTEM).
W69-03039 05B

MIXING
MISCIBLE DISPLACEMENT IN AN UNSATURATED GLASS BEAD MEDIUM,
W69-02810 02G

A MODEL OF MIXING AND DISPERSION IN SAN FRANCISCO BAY,
W69-02831 05B

MODEL STUDIES
MEASUREMENT OF HYDRAULIC AND SEDIMENT TRANSPORT VARIABLES IN A SMALL RECIRCULATING FLUME,
W69-03056 02J

AN EXPERIMENTAL RAINFALL-RUNOFF FACILITY,
W69-03076 02A

THE HYDRAULICS OF OVERLAND FLOW ON HILLSLOPES,
W69-03110 02E

SIMULATION OF FLOOD FLOW DIVERSION FROM A LAKE SYSTEM,
W69-03143 04A

MODEL TESTS
ULTIMATE LOAD TESTS OF SLABS DESIGNED BY THE STRIP METHOD,
W69-02919 08F

STRESS AND STRAIN ANALYSIS ON MODELS,
W69-02948 08A

MOHR CIRCLE
PERMEABILITY OF ORTHOTROPIC POROUS MEDIUMS,
W69-02812 02F

EQUILIBRIUM LIMITS OF EMBANKMENTS AND EARTH DAMS,
W69-02949 08D

MOISTURE AVAILABILITY
EFFECTS OF MOISTURE AND NITROGEN FERTILIZER ON GROWTH AND WATER USE BY NATIVE GRASS,
W69-02969 02I

MOISTURE CONTENT
AN ELECTRIC HYGROMETER APPARATUS FOR MEASURING WATER-VAPOUR LOSS FROM PLANTS IN THE FIELD,
W69-02968 02D

PSYCHROMETRIC MEASUREMENT OF SOIL WATER POTENTIAL IN SITU UNDER COTTON PLANTS,
W69-02980 02G

PRECISION LYSIMETRY FOR DIRECT MEASUREMENT OF EVAPORATIVE FLUX,
W69-02981 02G

MOISTURE DEFICIT
CHAPARRAL FIRES CHANGE SOIL MOISTURE DEPLETION PATTERNS,
W69-02979 02G

ANTI-TRANSPIRANTS AS A RESEARCH TOOL FOR THE STUDY OF THE EFFECTS OF WATER STRESS ON PLANT BEHAVIOUR,
W69-02986 03F

MOISTURE STRESS
ANTI-TRANSPIRANTS AS A RESEARCH TOOL FOR THE STUDY OF THE EFFECTS OF WATER STRESS ON PLANT BEHAVIOUR,
W69-02986 03F

MOMENTUM EQUATION
TRANSPORT IN SOILS THE BALANCE OF MOMENTUM,
W69-03071 02G

MONOMOLECULAR FILMS
USE OF MONOMOLECULAR FILMS TO REDUCE EVAPORATION FROM THE SURFACE OF BODIES OF WATER,
W69-02805 03B

PREDICTING DISSOLVED OXYGEN CONCENTRATION IN A LAKE COVERED WITH EVAPORATION SUPPRESSANT,
W69-02825 02D

EFFECTS OF A MONOLAYER ON RESERVOIR TEMPERATURE AND EVAPORATION,
W69-03054 03B

MONOMOLECULAR MODEL
MATHEMATICAL MODELS FOR EXPRESSING THE BIOCHEMICAL OXYGEN DEMAND IN WATER QUALITY STUDIES,
W69-03138 05G

MOUNTAINS
GROUNDWATER FLOW SYSTEMS IN THE CRYSTALLINE ROCKS OF THE OKANAGAN HIGHLAND, BRITISH COLUMBIA,
W69-02826 02F

RAINFALL INTENSITY AND ELEVATION IN SOUTHWESTERN IDAHO,
W69-03087 02B

MULTIPLE-PURPOSE PROJECTS
THE FARAHNAZ PAHLAVI PROJECT.
W69-02911 08A

ROOKERY BAY AREA PROJECT A DEMONSTRATION STUDY IN CONSERVATION AND DEVELOPMENT, NAPLES, FLORIDA.
W69-03169 06B

MULTIPLE-PURPOSE RESERVOIRS
A SURVEY AND EVALUATION OF SMALL ARTIFICIAL RECREATIONAL PONDS IN CENTRAL MASSACHUSETTS,
W69-03086 02H

MULTIPURPOSE PROJECTS
PROGRAM FOR COOPERATIVE STUDY FOR COMPREHENSIVE WATER RESOURCE DEVELOPMENT,
W69-02854 06B

MULTISTORY BUILDINGS
RECENT DEVELOPMENTS IN PLASTIC DESIGN PRACTICE,
W69-02942 08G

MULTIVARIATE ANALYSIS
SOME COMMENTS ON THE USE OF FACTOR ANALYSES,
W69-03050 07C

MUNICIPAL RESERVOIRS
RECREATIONAL USE OF MUNICIPAL RESERVOIRS,
W69-03136 06B

MUNICIPAL WATER
BINO V CITY OF HUBLEY (CONSTITUTIONALITY OF ORDINANCE DENYING RIPARIAN RIGHTS WITHOUT COMPENSATION).
W69-03021 04A

BOARD OF SUPERVISORS OF LOUDOUN CITY V TOWN OF FAIRFAX (APPLICATION TO ERECT DAM FOR MUNICIPAL WATER SUPPLY).
W69-03046 04A

SYSTEMS APPROACH TO WATER RESOURCE MANAGEMENT.
W69-03122 06A

MYAKKA RIVER(FLORIDA)
LOW STREAMFLOW IN THE MYAKKA RIVER BASIN AREA IN FLORIDA,
W69-02808 02E

NATURAL FLOW
GEIS V MOHRER (RIGHT OF NATURAL DRAINAGE).
W69-02877 04A

NATURAL FLOW DOCTRINE
WEIMER V CAUBLE (ACTION TO ENJOIN DIVERSION OF SURFACE WATERS ONTO PLAINTIFF'S LAND IN HARMFUL MANNER).
W69-02902 04A

NAVIGABLE IN FACT
BAKER V STATE (TEST FOR NAVIGABILITY OF WATERS).
W69-02892 06E

NAVIGABLE RIVERS
FAIRCHILD V KRAEMER (ACCESS TO ARTIFICIALLY CREATED BASIN).
W69-03018 04A

NAVIGABLE WATERS
SENCO V LACROSSE DREDGING CORP (DEFINITION OF NAVIGABLE WATERS).
W69-02879 04A

BAKER V STATE (TEST FOR NAVIGABILITY OF WATERS).
W69-02892 06E

STATE V ADAMS (OWNERSHIP OF BEDS).
W69-02899 06E

OLIN GAS TRANSMISSION CORP V HARRISON (OWNERSHIP OF BEDS OF NON-NAVIGABLE WATERS).
W69-02904 06E

CORDOVANA V VIPOND (INJUNCTION TO REMOVE FENCE WHICH DENIED RIPARIAN RIGHTS).
W69-03038 04A

NAVIGATION
NAVIGATION -- BUOYS, BEACONS, FLOODGATES, AND DUMPING MUD OR REFUSE.
W69-02870 06E

PEOPLE V KRAEMER (TRESPASSING ON LANDS SUBMERGED UNDER NAVIGABLE WATERS).
W69-02991 06E

STEAMTUG ALADDIN, INC V CITY OF BOSTON (FEDERAL LIABILITY FOR BRIDGE AS NAVIGATIONAL HAZARD).
W69-03010 06E

NAVIGATION AND FLOOD CONTROL IMPROVEMENTS IN COOPERATION WITH THE FEDERAL GOVERNMENT.
W69-03033 06E

NAVIGATIONAL OBSTRUCTION
STEAMTUG ALADDIN, INC V CITY OF BOSTON (FEDERAL LIABILITY FOR BRIDGE AS NAVIGATIONAL HAZARD).
W69-03010 06E

NETWORK DESIGN
METHODOLOGICAL PREREQUISITES FOR CONDUCTING NETWORK OBSERVATIONS OF THE CHANNEL PROCESS,
W69-02807 07A

NEW JERSEY
STATE V LANZA (EMINENT DOMAIN).
W69-02860 06E

HAMMETT V ROSENSOHN (ACTION TO DETERMINE EFFECT OF RESTRICTIONS IN DEED).
W69-02861 06E

NAVIGATION -- BUOYS, BEACONS, FLOODGATES, AND DUMPING MUD OR REFUSE.
W69-02870 06E

TAPPING, INTERFERING WITH, OR DAMAGING SEWERAGE WORKS - RUNNING WATER INTO MINES.
W69-02871 05G

SANS V RAMSEY GOLF AND COUNTRY CLUB (USE OF LAKE ON GOLF COURSE).
W69-03012 06E

CAMP CLEARWATER V FLOCK (EASEMENT TO USE PRIVATE LAKE).
W69-03016 06E

NEW MEXICO
FLOOD OF AUGUST 1966 AT CARLSBAD, NEW MEXICO,
W69-02820 02E

NEW SOUTH WALES(AUSTRALIA)
WATER RESOURCES RESEARCH ASPECTS OF A REGIONAL STUDY IN THE HUNTER VALLEY, NEW SOUTH WALES,
W69-02819 02E

EW YORK
FLOODS ON CHENANGO RIVER AND CANASAWACTA CREEK AT NORWICH, NEW YORK,
W69-02839 02E

CUGLAR V POWER AUTHORITY (EMINENT DOMAIN BY POWER AUTHORITY TO FORM POWER POOL).
W69-02863 06E

RESERVOIRS.
W69-02874 05B

FILLING LOW, SWAMP, AND WASTE LANDS.
W69-02875 06E

PRIVATE SEWERS.
W69-02876 05G

APPLICATION OF THE TOWN OF WATERFORD (VALIDITY OF STREAM CLASSIFICATION).
W69-02990 05D

PEOPLE V KRAEMER (TRESPASSING ON LANDS SUBMERGED UNDER NAVIGABLE WATERS).
W69-02991 06E

ROSKIN BROS, INC V STATE (LIABILITY OF STATE FOR NEGLIGENT MAINTENANCE OF CULVERT).
W69-02992 04C

CUGLAR V POWER AUTHORITY (EMINENT DOMAIN BY POWER AUTHORITY TO FORM POWER POOL).
W69-02993 04A

RINALDI V STATE (DAMAGE FROM STANDING WATERS).
W69-02994 04C

BECK V CITY OF NEW YORK (OVERFLOWING SEWERS).
W69-03020 04A

POWERS AND DUTIES OF THE DELAWARE RIVER BASIN COMMISSION.
W69-03026 06E

RIVER IMPROVEMENT DISTRICTS.
W69-03027 06E

SEC 452 WATER SUPPLY TO OTHER STATES.
W69-03028 04A

DISCHARGE OF SEWAGE INTO WATERS (PERMITS REQUIRED).
W69-03029 06E

ACTIONS BY MUNICIPALITIES TO PREVENT DISCHARGE OF SEWAGE INTO WATERS.
W69-03031 05B

ORDER TO DISCONTINUE POLLUTION OF WATERS.
W69-03032 06E

NAVIGATION AND FLOOD CONTROL IMPROVEMENTS IN COOPERATION WITH THE FEDERAL GOVERNMENT.
W69-03033 06E

NITRIFICATION
SIGNIFICANCE OF NITRIFICATION IN STREAM ANALYSIS--EFFECTS ON THE OXYGEN BALANCE,
W69-03077 05B

NITROGEN
EFFECTS OF MOISTURE AND NITROGEN FERTILIZER ON GROWTH AND WATER USE BY NATIVE GRASS,
W69-02969 02I

INVESTIGATIONS ON THE IRRIGATION REQUIREMENTS OF HYBRID MAIZE CROP IN ARID REGION OF PUNJAB,
W69-02973 03F

NITROGEN CYCLE
NUTRIENT SOURCES FOR ALGAE AND AQUATIC WEEDS,
W69-03185 05B

FIELD AND LABORATORY EVALUATIONS OF BIOASSAYS FOR NITROGEN AND PHOSPHORUS WITH ALGAE AND AQUATIC WEEDS,
W69-03186 05A

NONMETALS
THE INFORMATION BACKGROUND IN THE FIELD OF BIOLOGICAL DETERIORATION OF NONMETALLIC MATERIALS,
W69-02905 08C

NON-DARCY FLOW
NON-DARCY FLOW CHARACTERISTICS OF WATER AS INFLUENCED BY CLAY CONCENTRATION,
W69-03195 02G

NON-NAVIGABLE WATERS
STRUCK V CITY OF MIAMI (CONDEMNATION OF A RIGHT OF WAY TO A PRIVATELY OWNED LAKE).
W69-02891 06E

OLIN GAS TRANSMISSION CORP V HARRISON (OWNERSHIP OF BEDS OF NON-NAVIGABLE WATERS).
W69-02904 06E

SNEED V WEBER (RIGHT OF UNITED STATES TO REMOVE OBSTRUCTIONS TO NAVIGATION COULD NOT INURE TO ANY MEMBER OF THE PUBLIC).
W69-02995 06E

NON-STRUCTURAL ALTERNATIVES
BROAD HORIZONS IN WATER RESOURCE PLANNING AND INVESTMENT,
W69-02845 06B

ECONOMIC ANALYSIS OF ALTERNATIVE FLOOD CONTROL MEASURES,
W69-03111 04A

NORTH CAROLINA
EMINENT DOMAIN - PONDS, DAMS, RESERVOIRS - PUBLIC UTILITIES.
W69-02857 06E

STATE V BROOKS (PROOF OF ADVERSE POSSESSION TO MARSHLAND).
W69-02873 06E

POLLUTION OF WATER ON LANDS USED FOR DAIRY PURPOSES.
W69-02893 05B

APPROPRIATIONS FOR CONSTRUCTION OF WATER AND SEWER LINES.
W69-02894 06C

INJURIES TO DAMS AND WATER CHANNELS OF MILLS AND FACTORIES.
W69-03001 04A

LEAVING UNUSED WELL OPEN AND EXPOSED.
W69-03002 06E

ERECTING ARTIFICIAL ISLANDS AND LUMPS IN PUBLIC WATERS.
W69-03003 06E

DUTY AS TO BRIDGES OF MILLOWNERS ON, OR PERSONS DITCHING OR ENLARGING DITCHES ACROSS, HIGHWAYS.
W69-03004 06E

NORTH CAROLINA SEASHORE COMMISSION.
W69-03005 06E

SPAUGH V CITY OF WINSTON-SALEM (DAMAGES FOR POLLUTION).
W69-03011 05B

NORTH CENTRAL REGION
OPPORTUNITIES FOR REGIONAL RESEARCH ON WATER RESOURCES PROBLEMS.
W69-02872 06B

NUCLEAR MOISTURE METERS
NEUTRON MOISTURE METER CALIBRATION FOR USE IN SALINE SOILS,
W69-02965 02G

NUCLEAR POWERPLANTS
NUCLEAR REACTORS STATUS AND FUTURE TRENDS,
W69-02940 08A

NUCLEAR REACTORS
NUCLEAR REACTORS STATUS AND FUTURE TRENDS,
W69-02940 08A

NUCLEAR SAFETY
NUCLEAR REACTORS STATUS AND FUTURE TRENDS,
W69-02940 08A

NUCLEAR TECHNOLOGY
NUCLEAR REACTORS STATUS AND FUTURE TRENDS,
W69-02940 08A

NUISANCE
FLORIO V STATE (WATER SKIING NUISANCE).
W69-02903 06E

NUTRIENT REQUIREMENTS
FIELD AND LABORATORY EVALUATIONS OF BIOASSAYS FOR NITROGEN AND PHOSPHORUS WITH ALGAE AND AQUATIC WEEDS,
W69-03186 05A

NUTRIENTS
AN INVESTIGATION OF THE EFFECT OF CONTROLLED RELEASES ON THE PHYSICAL, CHEMICAL AND BACTERIOLOGICAL CHARACTERISTICS OF FORT LOUDOUN RESERVOIR,
W69-03180 05C

UNDERWATER SOILS A REVIEW OF LAKE SEDIMENTS,
W69-03187 02H

OBSTRUCTION TO FLOW
STATE V SIMS (ACTION TO COMPEL PAYMENT OUT OF ALLOCATED FUNDS FOR FLOOD DAMAGE CAUSED BY A STATE AGENCY).
W69-02881 04C

FERGUSON V UNION ELECTRIC COMPANY (SUIT FOR DAMAGES CAUSED BY IMPROPER OPERATION OF A DAM).
W69-02885 04A

ADAMS V ADAMS (DAMAGE FROM OBSTRUCTING DRAINAGE DITCH).
W69-02996 04A

GRASLEY V EPPLEY (SURFACE DRAINAGE).
W69-03025 04A

OCEANOGRAPHY
BENEFIT-COST ANALYSIS AND THE NATIONAL OCEANOGRAPHIC PROGRAM,
W69-03126 06B

OHIO
NORWALK TRUCK LINE CO V VINY (RESERVATION OF RIPARIAN RIGHTS).
W69-02867 06E

NORWALK TRUCK LINE CO V VINY (LITTORAL RIGHTS).
W69-02868 06E

GRASLEY V EPPLEY (SURFACE DRAINAGE).
W69-03025 04A

CITY OF GALLIPOLIS V STATE EX REL WATER POLLUTION CONTROL BD

(DENIAL OF PERMIT TO DISCHARGE SEWAGE INTO RIVER).
W69-03034 05B

STATE V CITY OF DEFIANCE (CONSTITUTIONALITY OF STATUTE REQUIRING CITIES TO FURNISH OUTSIDERS WITH WATER).
W69-03035 04A

ONONDAGA LAKE
PRIMARY PRODUCTIVITY STUDIES IN ONONDAGA LAKE, NEW YORK,
W69-02959 05C

ONONDAGA LAKE(NEW YORK)
ONONDAGA LAKE, NEW YORK, AN UNUSUAL ALGAL ENVIRONMENT,
W69-02961 02H

ON-SITE TESTS
NEUTRON MOISTURE METER CALIBRATION FOR USE IN SALINE SOILS,
W69-02965 02G

OPEN CHANNEL FLOW
THE INITIAL PHASE OF THE RISING HYDROGRAPH OF TURBULENT FREE SURFACE FLOW WITH UNSTEADY LATERAL INFLOW,
W69-02837 02E

UNSTEADY FLOW IN OPEN CHANNELS,
W69-03044 02E

OPEN CHANNELS
INFLUENCE OF SIDE SPILLING FLOW IN A COLLECTING CHANNEL,
W69-02945 08B

OPTIMAL YIELD
OPTIMAL GROUNDWATER MINING,
W69-03114 04B

OPTIMIZATION
REVIEW AND ANALYSIS OF RAINFALL AND RUNOFF DATA FOR SELECTED WATERSHEDS IN MINNESOTA,
W69-03098 02A

OPTIMIZATION AND RANGE OF APPLICATION OF NUCLEAR REACTORS AND FLASH EVAPORATORS FOR SEA WATER DESALINATION,
W69-03147 03A

OPTIMIZATION OF PRESSURE CONDUIT SIZES,
W69-03148 08B

OPTIMIZATION OF TIDAL POWER GENERATION,
W69-03160 06A

DESIGN OF OPTIMAL WATER DISTRIBUTION SYSTEMS,
W69-03165 06B

OPTIMUM DESIGN
RECENT DEVELOPMENTS IN OPTIMAL STRUCTURAL DESIGN,
W69-02932 08A

OPTIMUM DEVELOPMENT PLANS
FIELD LEVEL PLANNING OF WATER RESOURCE SYSTEMS,
W69-02843 06B

ORGANIC SOILS
AQUEOUS TRANSPORT OF DIELDRIN RESIDUES IN SOILS,
W69-02801 05B

OSMOTIC POTENTIAL
GERMINATION IN LOWER OSMOTIC POTENTIAL AS AN INDEX OF DROUGHT RESISTANCE IN CROP PLANTS - A REVIEW,
W69-02984 02I

OSMOTIC PRESSURE
GERMINATION IN LOWER OSMOTIC POTENTIAL AS AN INDEX OF DROUGHT RESISTANCE IN CROP PLANTS - A REVIEW,
W69-02984 02I

OUTDOOR RECREATION
BENEFIT-COST ANALYSIS AND THE NATIONAL OCEANOGRAPHIC PROGRAM,
W69-03126 06B

OUTLET WORKS
CAVITATION TESTS OF A MODEL OF THE RADIAL GATE OF THE BOTTOM OUTLET OF THE KRASNOYARSK HYDROELECTRIC STATION DAM,
W69-02914 08C

OVERFLOW
NAYLOR V EAGLE (DAMAGE FROM BACKWATER OF DAM).
W69-02883 04A

FERGUSON V UNION ELECTRIC COMPANY (SUIT FOR DAMAGES CAUSED BY IMPROPER OPERATION OF A DAM).
W69-02885 04A

BECK V CITY OF NEW YORK (OVERFLOWING SEWERS).
W69-03020 04A

OVERLAND FLOW
THE INITIAL PHASE OF THE RISING HYDROGRAPH OF TURBULENT FREE SURFACE FLOW WITH UNSTEADY LATERAL INFLOW,
W69-02837 02E

THE HYDRAULICS OF OVERLAND FLOW ON HILLSLOPES,
W69-03110 02E

OWNERSHIP OF BEDS
MCDOWELL V TRUSTEES OF THE INTERNAL IMPROVEMENT FUND (OWNERSHIP OF BEDS OF A NAVIGABLE LAKE).
W69-02890 06E

STATE V ADAMS (OWNERSHIP OF BEDS).
W69-02899 06E

OLIN GAS TRANSMISSION CORP V HARRISON (OWNERSHIP OF BEDS OF NON-NAVIGABLE WATERS).
W69-02904 06E

PEOPLE V KRAEMER (TRESPASSING ON LANDS SUBMERGED UNDER NAVIGABLE WATERS).
W69-02991 06E

CAMP CLEARWATER V PLOCK (EASEMENT TO USE PRIVATE LAKE).
W69-03016 06E

OXYGEN
THE PRODUCTIVITY OF A LAKE POLLUTED BY ORGANIC WASTES DERIVED PRIMARILY FROM SEPTIC TANKS,
W69-03182 05C

OXYGEN BALANCE
PREDICTING DISSOLVED OXYGEN CONCENTRATION IN A LAKE COVERED WITH EVAPORATION SUPPRESSANT,
W69-02825 02D

PARETO RELEVANT
EXTERNALITY,
W69-03132 06B

PATH OF POLLUTANTS
ACCURACY OF DISCRETE MODELS USED TO PREDICT ESTUARY POLLUTION,
W69-03107 05B

PENNSYLVANIA
DANIELS V BETHLEHEM MINES CORP (RIPARIAN EASEMENTS).
W69-02858 5G

CRAIG V BOROUGH OF EBENSBURG (DAMS).
W69-02859 04A

BUMBARGER V WALKER (CONTAMINATION OF SPRING BY MINE DRAINAGE).
W69-02901 05G

WATER AND POWER RESOURCES BOARD V GREEN SPRINGS COMPANY (CONSTITUTIONALITY OF DAM PERMIT ACT).
W69-03013 06E

FRYE V PENNSYLVANIA RR (ACTION BY LANDOWNERS FOR DAMAGES FROM FLOODING CAUSED BY CLOGGED DRAINAGE PIPE UNDER DEFENDANTS RAILROAD).
W69-03014 04A

DUNCAN V GHEEN (ENFORCEMENT OF EASEMENT GRANTING RIGHT TO SPRING WATER).
W69-03023 04B

PERCHED WATER
THE PERCHED WATER TABLE IN THE UPPER LIMESTONE AQUIFER OF MALTA,
W69-02833 02F

PERCOLATING WATER
MENNE V CITY OF FOND DU LAC (RIGHT OF WATER REMOVAL TO NON-CONTIGUOUS LANDS).
W69-02855 04B

PERCOLATION
FURROW SIZE, PLACEMENT, AND GRASS CULTURE EFFECTS ON VINEYARD IRRIGATION,
W69-02978 03F

PERIPHYTON
AN EVALUATION OF ARTIFICIAL SUBSTRATES FOR MEASURING PERIPHYTON PRODUCTION,
W69-02955 05C

PERMAFROST
VELOCITY OF COMPRESSIONAL WAVES IN POROUS MEDIA AT PERMAFROST TEMPERATURES,
W69-03090 02C

PERMEABILITY
PERMEABILITY OF ORTHOTROPIC POROUS MEDIUMS,
W69-02812 02F

IN SITU PERMEABILITIES FOR DETERMINING RATES OF CONSOLIDATION,
W69-02934 08D

PERMEABILITY TESTS
IN SITU PERMEABILITIES FOR DETERMINING RATES OF CONSOLIDATION,
W69-02934 08D

PERMEAMETERS
IN SITU PERMEABILITIES FOR DETERMINING RATES OF CONSOLIDATION,
W69-02934 08D

PERMITS
WATER AND POWER RESOURCES BOARD V GREEN SPRINGS COMPANY (CONSTITUTIONALITY OF DAM PERMIT ACT).
W69-03013 06E

DISCHARGE OF SEWAGE INTO WATERS (PERMITS REQUIRED).
W69-03029 06E

CITY OF GALLIPOLIS V STATE EX REL WATER POLLUTION CONTROL (DENIAL OF PERMIT TO DISCHARGE SEWAGE INTO RIVER).
W69-03034 05B

PERSISTENCE

A STUDY OF THE SURVIVAL OF BACTERIAL INDICATORS OF POLLUTION IN NATURAL WATERS,
W69-03181 05B

PETROGRAPHIC INVESTIGATIONS
A SYSTEMS APPROACH TO ANALYSIS OF HARDENED CONCRETE,
W69-02909 08F

PETROGRAPHY
HYDRO-GEOLOGY OF QUATERNARY FORMATION FROM RIVER LUNI AND ITS TRIBUTARIES CATCHMENT.
W69-02983 02F

PHOSPHORUS COMPOUNDS
ADSORPTION OF PHOSPHORUS BY LAKE SEDIMENT,
W69-03075 02H

PHOTOELASTICITY
STRESS AND STRAIN ANALYSIS ON MODELS,
W69-02948 08A

PHREATOPHYTES
PONTACYL BRILLIANT PINK AS A TRACER DYE IN THE MOVEMENT OF WATER IN PHREATORPHYTES,
W69-03047 02I

PHYSIOLOGICAL ECOLOGY
SOME FACTORS IN THE COMPETITION OR ANTAGONISM BETWEEN BACTERIA, ALGAE, AND AQUATIC WEEDS,
W69-03188 05C

PHYTOTOXICITY
SOME FACTORS IN THE COMPETITION OR ANTAGONISM BETWEEN BACTERIA, ALGAE, AND AQUATIC WEEDS,
W69-03188 05C

PIEZOMETERS
IN SITU PERMEABILITIES FOR DETERMINING RATES OF CONSOLIDATION,
W69-02934 08D

DETECTION OF SATURATED INTERFLOW IN SOILS WITH PIEZOMETERS,
W69-03074 07B

PILE BEARING CAPACITIES
LOAD TRANSFER--BEARING CAPACITY FOR SINGLE PILES AND PILE CLUSTERS,
W69-02922 08D

PILE FOUNDATIONS
LOAD TRANSFER--BEARING CAPACITY FOR SINGLE PILES AND PILE CLUSTERS,
W69-02922 08D

PILE GROUPS
LOAD TRANSFER--BEARING CAPACITY FOR SINGLE PILES AND PILE CLUSTERS,
W69-02922 08D

PILE(FOUNDATIONS)
LOAD TRANSFER--BEARING CAPACITY FOR SINGLE PILES AND PILE CLUSTERS,
W69-02922 08D

PIPE LININGS
INCRUSTATION IN WATER PIPELINES,
W69-02928 08G

PIPELINES
PRIVATE SEWERS.
W69-02876 05G

STATE V CITY OF DEFIANCE (CONSTITUTIONALITY OF STATUTE REQUIRING CITIES TO FURNISH OUTSIDERS WITH WATER).
W69-03035 04A

PIPES
INCRUSTATION IN WATER PIPELINES,
W69-02928 08G

PLANKTON
LONG-TERM CHANGES IN WATER CHEMISTRY AND ABUNDANCE OF PLANKTON AT A SINGLE SAMPLING LOCATION IN LAKE ONTARIO,
W69-02958 02H

PLANT GROWTH
DWINDLING LAKES,
W69-02956 02H

PLASTIC DESIGN
RECENT DEVELOPMENTS IN PLASTIC DESIGN PRACTICE,
W69-02942 08G

PLASTICS
PROSPECTS FOR USE OF NONMETALLIC REINFORCEMENT,
W69-02937 08G

POLICY MATTERS
THE ECONOMIST'S ROLE IN WATER PRICING POLICY,
W69-02906 06C

POLLUTION ABATEMENT
ACTIONS BY MUNICIPALITIES TO PREVENT DISCHARGE OF SEWAGE INTO WATERS.
W69-03031 05B

PONDEROSA PINE TREES
THE EFFECT OF APPLIED INTERCEPTION ON TRANSPIRATION RATES OF POTTED PONDEROSA PINE,
W69-03116 02I

PONDS
PRESCOTT V HERRING (BOUNDARY DISPUTE).
W69-02882 04C

POPULATION GROWTH RATES
MARYLAND'S ROLE IN WATER RESOURCES DEVELOPMENT.
W69-03171 06B

POROSITY
DRAINAGE THEORY FOR REMOVAL OF EXCESS WATER FROM IRRIGATED LANDS,
W69-03189 04A

POROUS MEDIA
MISCIBLE DISPLACEMENT IN AN UNSATURATED GLASS BEAD MEDIUM,
W69-02810 02G

PERMEABILITY OF ORTHOTROPIC POROUS MEDIUMS,
W69-02812 02F

APPLICATION OF THE FINITE ELEMENT METHOD TO TRANSIENT FLOW IN POROUS MEDIA,
W69-03064 08B

TRANSPORT IN SOILS THE BALANCE OF MOMENTUM,
W69-03071 02G

VELOCITY-GRADIENT RELATIONSHIPS FOR STEADY-STATE UNSATURATED FLOW OF WATER IN NON-SWELLING ARTIFICIAL SOILS,
W69-03072 02G

VELOCITY OF COMPRESSIONAL WAVES IN POROUS MEDIA AT PERMAFROST TEMPERATURES,
W69-03090 02C

POTABLE WATER
ACTIONS BY MUNICIPALITIES TO PREVENT DISCHARGE OF SEWAGE INTO WATERS.
W69-03031 05B

POTENTIAL EVAPORATION
RELATIONSHIP BETWEEN PRECIPITATION, EVAPORATION, AND RUNOFF IN TROPICAL-EQUATORIAL REGIONS,
W69-03092 02A

POTENTIALLY RELEVANT
EXTERNALITY,
W69-03132 06B

POTHOLES
SOME ASPECTS OF THE HYDROLOGY OF PONDS AND SMALL LAKES,
W69-03091 02H

POWER PLANTS
WATER-POWER COMPANIES.
W69-02900 06E

POWERPLANTS
STRUCTURAL DESIGN--GRAND COULEE THIRD POWERPLANT,
W69-02939 08A

PRECIPITATION(ATMOSPHERIC)
INFLUENCE OF THE FOREST ON PRECIPITATION,
W69-02803 02B

HYDROLOGIC STUDIES OF SMALL WATERSHEDS IN AGRICULTURAL AREAS OF SOUTHERN MICHIGAN,
W69-03045 02A

PRESCRIPTIVE RIGHTS
CAMP CLEARWATER V PLOCK (EASEMENT TO USE PRIVATE LAKE).
W69-03016 06E

PRESSURE CONDUITS
OPTIMIZATION OF PRESSURE CONDUIT SIZES,
W69-03148 08B

PRESTRESSED CONCRETE
PROSPECTS FOR USE OF NONMETALLIC REINFORCEMENT,
W69-02937 08G

PRICING
THE ECONOMIST'S ROLE IN WATER PRICING POLICY,
W69-02906 06C

WATER SHORTAGES AND PRICING,
W69-03135 06C

CONSUMER RESPONSES TO PRICES OF RESIDENTIAL WATER,
W69-03140 06B

PRIMARY PRODUCTION
THE PRODUCTIVITY OF A LAKE POLLUTED BY ORGANIC WASTES DERIVED PRIMARILY FROM SEPTIC TANKS,
W69-03182 05C

PRIMARY PRODUCTIVITY
PRIMARY PRODUCTIVITY STUDIES IN ONONDAGA LAKE, NEW YORK,
W69-02959 05C

COLOR-INFRARED AERIAL PHOTOGRAPHIC INTERPRETATION AND NET PRIMARY PRODUCTIVITY OF A REGULARLY-FLOODED NORTH CAROLINA SALT MARSH,
W69-03177 02I

PRIVATE NUISANCE
WHITEHALL CONSTRUCTION CO V WASHINGTON SUBURBAN SANITARY COMM'N (REQUIREMENTS FOR TRESPASS ACTION).
W69-03007 06E

PRODUCER'S SURPLUS

WHAT IS PRODUCER'S SURPLUS,
W69-03133 06B

PRODUCTION-RESPIRATION RATIO
THE PRODUCTIVITY OF A LAKE POLLUTED BY ORGANIC WASTES DERIVED PRIMARILY FROM SEPTIC TANKS,
W69-03182 05C

PROJECT PLANNING
BROAD HORIZONS IN WATER RESOURCE PLANNING AND INVESTMENT,
W69-02845 06B

URBAN AND BASIN PLANNING,
W69-02851 06B

STATE WATER PLANNING GOALS AND ANALYTICAL APPROACHES,
W69-02963 06B

ROOKERY BAY AREA PROJECT A DEMONSTRATION STUDY IN CONSERVATION AND DEVELOPMENT, NAPLES, FLORIDA.
W69-03169 06B

PROTECTIVE COATINGS
INCRUSTATION IN WATER PIPELINES,
W69-02928 08G

PSYCHROMETERS
PSYCHROMETRIC MEASUREMENT OF SOIL WATER POTENTIAL IN SITU UNDER COTTON PLANTS,
W69-02980 02G

PUBLIC HEALTH
CITY OF MURPHYSBORO V SANITARY WATER BOARD OF ILLINOIS (POLLUTION ABATEMENT).
W69-02869 05B

APPROPRIATIONS FOR CONSTRUCTION OF WATER AND SEWER LINES.
W69-02894 06C

BOARD OF HEALTH V CREW (STATE'S RIGHT TO ORDER WELL CLOSING).
W69-03024 05G

PUBLIC INVESTMENT
THE OPPORTUNITY COSTS OF PUBLIC INVESTMENT COMMENT,
W69-03125 06B

PUBLIC RIGHTS
PEOPLE V KRAEMER (TRESPASSING ON LANDS SUBMERGED UNDER NAVIGABLE WATERS).
W69-02991 06E

PUBLIC UTILITIES
GREENWICH WATER CO V ADAMS (EMINENT DOMAIN).
W69-03015 06E

PULL-OUT TESTS
ANCHORED FOOTINGS FOR TRANSMISSION TOWERS,
W69-02938 08F

PUMPING
EICKSTEDT V SEIFERT (NEGLIGENCE IN DRAINING ARTIFICIAL RESERVOIR).
W69-02856 04A

QUATERNARY PERIOD
HYDRO-GEOLOGY OF QUATERNARY FORMATION FROM RIVER LUNI AND ITS TRIBUTARIES CATCHMENT.
W69-02983 02F

RADIAL GATES
CAVITATION TESTS OF A MODEL OF THE RADIAL GATE OF THE BOTTOM OUTLET OF THE KRASNOYARSK HYDROELECTRIC STATION DAM,
W69-02914 08C

RADIOACTIVE DATING
CARBON 14 AGES AND FLOW RATES OF WATER IN CARRIZO SAND, AT ATASCOSA COUNTY, TEXAS,
W69-03082 02F

RADIOACTIVE GASES
MATHEMATICAL MODEL FOR UNDERGBOUND DISCHARGE OF RADIOACTIVE GASES,
W69-02813 05B

RADIOACTIVE WASTE DISPOSAL
MATHEMATICAL MODEL FOR UNDERGROUND DISCHARGE OF RADIOACTIVE GASES,
W69-02813 05B

EXPERIENCE IN BURIAL OF LIQUID RADIOACTIVE WASTES IN DEEP GEOLOGICAL FORMATIONS,
W69-03061 05E

RADIOACTIVITY
UNITED STATES TRITIUM RAINOUT AND ITS HYDROLOGIC IMPLICATIONS,
W69-03121 02B

RADIOISOTOPES
TRACER MEASUREMENT OF STREAM REAERATION. II. FIELD STUDIES,
W69-02821 02E

RAILROADS
FRYE V PENNSYLVANIA RR (ACTION BY LANDOWNERS FOR DAMAGES FROM FLOODING CAUSED BY CLOGGED DRAINAGE PIPE UNDER DEFENDANTS RAILROAD).
W69-03014 04A

RAINFALL
AN EVALUATION OF PRECIPITATION, VEGETATION AND RELATED FACTORS ON THE SANTA RITA EXPERIMENTAL RANGE,
W69-02989 02E

RAINFALL INTENSITY
EVALUATION OF ZINGG CONSERVATION BENCH TERRACES ON AMARILLO FINE SANDY LOAM SOIL.
W69-02971 02E

RUNOFF AND HILLSLOPE EROSION RESULTING FROM A HIGH-INTENSITY THUNDERSTORM NEAR MACK, WESTERN COLORADO,
W69-03052 02A

RAINFALL INTENSITY AND ELEVATION IN SOUTHWESTERN IDAHO,
W69-03047 02B

RAINFALL-RUNOFF RELATIONSHIPS
DERIVATION OF BASIN HYDROGRAPHS,
W69-02811 02E

LOW-FLOW AND BASIN CHARACTERISTICS OF TWO STREAMS IN NORTHERN VERMONT,
W69-02814 02A

EFFECTS OF CLIMATOLOGIC AND BASIN CHARACTERISTICS ON ANNUAL RUNOFF,
W69-03055 02A

INFILTRATION, OVERLAND FLOW, AND SOIL MOVEMENT ON FROZEN AND SNOW-COVERED PLOTS,
W69-03060 02A

AN EXPERIMENTAL RAINFALL-RUNOFF FACILITY,
W69-03076 02A

MOMENTS OF THE INPUT, OUTPUT, AND IMPULSE RESPONSE FUNCTIONS OF LINEAR SYSTEMS ABOUT ARBITRARY POINTS,
W69-03089 02A

STEPS TOWARD A BETTER UNDERSTANDING OF URBAN RUNOFF PROGRESS,
W69-03097 04C

REVIEW AND ANALYSIS OF RAINFALL AND RUNOFF DATA FOR SELECTED WATERSHEDS IN MINNESOTA,
W69-03098 02A

REGRESSION MODELS FOR PREDICTING ON-SITE RUNOFF FROM SHORT-DURATION CONVECTIVE STORMS,
W69-03103 06A

THE HYDRAULICS OF OVERLAND FLOW ON HILLSLOPES,
W69-03110 02E

RAJASTHAN(INDIA)
HYDRO-GEOLOGY OF QUATERNARY FORMATION FROM RIVER LUNI AND ITS TRIBUTARIES CATCHMENT.
W69-02983 02F

RAWCLIFFE BRIDGE(GREAT BRITAIN)
RAWCLIFFE BRIDGE IN YORKSHIRE,
W69-02926 08G

REAERATION
TRACER MEASUREMENT OF STREAM REAERATION. II. FIELD STUDIES,
W69-02821 02E

REASONABLE USE
BUMBARGER V WALKER (CONTAMINATION OF SPRING BY MINE DRAINAGE).
W69-02901 05G

FLORIO V STATE (WATER SKIING NUISANCE).
W69-02903 06E

CENTRAL MAINE POWER CO V PUBLIC UTIL COMM'N (RIPARIAN LAND PURCHASE TO AVOID LIABILITY FOR DAM OPERATION).
W69-03017 04A

RECESSION CURVES
SLOPE LENGTH OF CLAYPAN SOIL AFFECTS RUNOFF,
W69-03106 02A

RECHARGE
GROWTH AND DECAY OF GROUNDWATER-MOUNDS IN RESPONSE TO UNIFORM PERCOLATION,
W69-03048 02F

RESPONSE OF A FINITE-DIAMETER WELL TO AN INSTANTANEOUS CHARGE OF WATER,
W69-03057 02F

RECLAIMED WATER
RECLAIMED WATER FOR INDUSTRY,
W69-02806 03E

WASTE WATER RENOVATION FOR REUSE KEY TO OPTIMUM USE OF WATER RESOURCES,
W69-02929 05D

RECLAMATION
ALBURY V CENTRAL AND SOUTH FLORIDA FLOOD CONTROL DIST (NO COMPENSATION ALLOWED FOR CONSTRUCTION OF A DRAINAGE CANAL).
W69-02889 04A

MCDOWELL V TRUSTEES OF THE INTERNAL IMPROVEMENT FUND (OWNERSHIP OF BEDS OF A NAVIGABLE LAKE).
W69-02890 06E

RECREATION

HAMMETT V ROSENSOHN (ACTION TO DETERMINE EFFECT OF RESTRICTIONS IN DEED).
W69-02861 06E

SANS V RAMSEY GOLF AND COUNTRY CLUB (USE OF LAKE ON GOLF COURSE).
W69-03012 06E

RECREATIONAL USE OF MUNICIPAL RESERVOIRS,
W69-03136 06B

RED CEDAR RIVER(MICH)
AN EVALUATION OF ARTIFICIAL SUBSTRATES FOR MEASURING PERIPHYTON PRODUCTION,
W69-02955 05C

REGIMEN
SOME ASPECTS OF THE HYDROLOGY OF PONDS AND SMALL LAKES,
W69-03091 02H

REGIONAL ANALYSIS
WATER RESOURCES RESEARCH ASPECTS OF A REGIONAL STUDY IN THE HUNTER VALLEY, NEW SOUTH WALES,
W69-02819 02E

OPPORTUNITIES FOR REGIONAL RESEARCH ON WATER RESOURCES PROBLEMS.
W69-02872 06B

COMPUTER SIMULATION MODELS FOR RIVER-BASIN ANALYSIS AND PLANNING,
W69-03153 06B

THE INTERINDUSTRY WATER CONTENT MATRIX APPLICATIONS ON A MULTIREGIONAL BASIS,
W69-03157 06A

WATER RESOURCE MANAGEMENT IN MT. PROSPECT A SURVEY OF THE ENVIRONMENT, PROBLEMS, AND OPPORTUNITIES,
W69-03168 06B

REGIONAL MANAGEMENT
REGIONAL MANAGEMENT OF WATER QUALITY - A SYSTEMS APPROACH,
W69-03146 05G

REGRESSION ANALYSIS
REGRESSION MODELS FOR PREDICTING ON-SITE RUNOFF FROM SHORT-DURATION CONVECTIVE STORMS,
W69-03103 06A

REGULATION
BAILEY V ARKANSAS GAME AND FISH COMM'N (STATE REGULATION OF GAME FISH SALES).
W69-02886 06E

REINFORCED CONCRETE
THE THEORY OF THE STRIP METHOD FOR DESIGN OF SLABS,
W69-02918 08F

ULTIMATE LOAD TESTS OF SLABS DESIGNED BY THE STRIP METHOD,
W69-02919 08F

MECHANISMS OF SHEAR RESISTANCE OF CONCRETE BEAMS,
W69-02927 08F

PROSPECTS FOR USE OF NONMETALLIC REINFORCEMENT,
W69-02937 08G

REINFORCING
PROSPECTS FOR USE OF NONMETALLIC REINFORCEMENT,
W69-02937 08G

REINFORCING MATERIALS
PROSPECTS FOR USE OF NONMETALLIC REINFORCEMENT,
W69-02937 08G

RELATIVE PRICE CHANGES
PARETO AND THE MARSHALLIAN CONSTANCY ASSUMPTION,
W69-03130 06B

RELATIVE RIGHTS
GEIS V ROHRER (RIGHT OF NATURAL DRAINAGE).
W69-02877 04A

REMOTE SENSING
APPLICABILITY OF REMOTE SENSING AND SYSTEMS ANALYSIS TECHNIQUES TO RIVER BASIN PLANNING,
W69-03145 06A

RENOVATING
WASTE WATER RENOVATION FOR REUSE KEY TO OPTIMUM USE OF WATER RESOURCES,
W69-02929 05D

REPORTS
THE FUNCTION OF FEASIBILITY REPORTS,
W69-02910 06A

REPULSION(LEGAL ASPECTS)
GRASLEY V EPPLEY (SURFACE DRAINAGE).
W69-03025 04A

RESEARCH AND DEVELOPMENT
SOME COMMENTS ON THE USE OF FACTOR ANALYSES,
W69-03050 07C

MEASUREMENT OF HYDRAULIC AND SEDIMENT TRANSPORT VARIABLES IN A SMALL RECIRCULATING FLUME,
W69-03056 02J

ANALYSIS OF WATER AND WATER-RELATED RESEARCH REQUIREMENTS IN THE GREAT LAKES REGION.
W69-03079 07A

WATER RESOURCES A REPORT TO THE COMMITTEE ON NATURAL RESOURCES OF THE NATIONAL ACADEMY OF SCIENCES - NATIONAL RESEARCH COUNCIL,
W69-03172 06B

ARKANSAS WATER RESOURCES SUPPLY, USE, AND RESEARCH NEEDS,
W69-03199 06B

RESEARCH FACILITIES
SUSPENDED LOAD RESEARCH,
W69-03062 02J

RESEARCH & DEVELOPMENT
OPPORTUNITIES FOR REGIONAL RESEARCH ON WATER RESOURCES PROBLEMS.
W69-02872 06B

RESERVOIR CONSTRUCTION
CONCRETE RESERVOIR DESIGN,
W69-02952 08A

RESERVOIR DESIGN
CONCRETE RESERVOIR DESIGN,
W69-02952 08A

RESERVOIR LEAKAGE
EVALUATION OF SEEPAGE FROM CHESTER MORSE LAKE AND MASONRY POOL, KING COUNTY, WASHINGTON,
W69-02827 02H

RESERVOIR MANAGEMENT
RECREATIONAL USE OF MUNICIPAL RESERVOIRS,
W69-03136 06B

RESERVOIR OPERATION
OPTIMIZATION BY DYNAMIC PROGRAMMING OF HYDROELECTRIC PLANT OPERATION REGIME DURING INITIAL FILLING PERIOD OF MULTIANNUAL REGULATION RESERVOIR,
W69-03155 06A

RESERVOIR SILTING
FERGUSON V UNION ELECTRIC COMPANY (SUIT FOR DAMAGES CAUSED BY IMPROPER OPERATION OF A DAM).
W69-02885 04A

RESERVOIRS
EICKSTEDT V SEIFERT (NEGLIGENCE IN DRAINING ARTIFICIAL RESERVOIR).
W69-02856 04A

RESERVOIRS.
W69-02874 05B

CONCRETE RESERVOIR DESIGN,
W69-02952 08A

CUGLAR V POWER AUTHORITY (EMINENT DOMAIN BY POWER AUTHORITY TO FORM POWER POOL).
W69-02993 04A

RESIDUAL STRENGTH
THE STRENGTH ALONG STRUCTURAL DISCONTINUITIES IN STIFF CLAYS,
W69-02950 08D

RESIDUAL VARIATION
PARETO AND THE MARSHALLIAN CONSTANCY ASSUMPTION,
W69-03130 06B

RESISTIVITY
AN ELECTRICAL RESISTIVITY PROFILE FROM MAHUKONA TO KAWAIHAE, HAWAII,
W69-03184 06A

RESOURCES
WATER RESOURCES AND ECONOMIC DEVELOPMENT THE CHALLENGE TO KNOWLEDGE,
W69-02964 06B

RETAINING WALLS
NADLER FOUNDRY AND MACHINE CO, INC V UNITED STATES (LIABILITY FOR CAVE-IN CAUSED BY DREDGING).
W69-03008 06E

RETARDANTS
ANTI-TRANSPIRANTS AS A RESEARCH TOOL FOR THE STUDY OF THE EFFECTS OF WATER STRESS ON PLANT BEHAVIOUR,
W69-02986 03F

RIGHT OF WAY
STRUCK V CITY OF MIAMI (CONDEMNATION OF A RIGHT OF WAY TO A PRIVATELY OWNED LAKE).
W69-02891 06E

RIPARIAN LAND
NORWALK TRUCK LINE CO V VINY (RESERVATION OF RIPARIAN RIGHTS).
W69-02867 06E

NORWALK TRUCK LINE CO V VINY (LITTORAL RIGHTS).
W69-02868 06E

NAYLOR V EAGLE (DAMAGE FROM BACKWATER OF DAM).
W69-02883 04A

RIPARIAN RIGHTS
MCDOWELL V TRUSTEES OF THE INTERNAL IMPROVEMENT FUND (OWNERSHIP OF BEDS OF A NAVIGABLE LAKE).

W69-02890 06E

FLORIO V STATE (WATER SKIING NUISANCE).
W69-02903 06E

TRUSTEES OF INTERNAL IMPROVEMENT FUND V CLAUGHTON (THE RIGHT TO FILL SUBMERGED LANDS GRANTED BY THE TRUSTEES DOES NOT EXTEND BEYOND THE BOUNDARIES ACTUALLY CONVEYED).
W69-02999 04A

CENTRAL MAINE POWER CO V PUBLIC UTIL COMM'N (RIPARIAN LAND PURCHASE TO AVOID LIABILITY FOR DAM OPERATION).
W69-03017 04A

BINO V CITY OF HURLEY (CONSTITUTIONALITY OF ORDINANCE DENYING RIPARIAN RIGHTS WITHOUT COMPENSATION).
W69-03021 04A

SHEPHEARD V BOGGS (LAND EXTENSION BY RIPARIAN LANDOWNER BLOCKING STREAM).
W69-03037 04A

CORDOVANA V VIPOND (INJUNCTION TO REMOVE FENCE WHICH DENIED RIPARIAN RIGHTS).
W69-03038 04A

RIPARIAN WATERS
DANIELS V BETHLEHEM MINES CORP (RIPARIAN EASEMENTS).
W69-02858 5G

RIVER BASIN
WATER QUALITY ANALYSIS OF THE DELAWARE RIVER ESTUARY,
W69-03158 06A

RIVER BASIN COMMISSIONS
RIVER IMPROVEMENT DISTRICTS.
W69-03027 06E

RIVER BASIN DEVELOPMENT
THE MUSKINGUM WATERSHED CONSERVANCY DISTRICT A STUDY OF LOCAL CONTROL,
W69-02852 06E

PROGRAM FOR COOPERATIVE STUDY FOR COMPREHENSIVE WATER RESOURCE DEVELOPMENT,
W69-02854 06B

POWERS AND DUTIES OF THE DELAWARE RIVER BASIN COMMISSION.
W69-03026 06E

APPLICABILITY OF REMOTE SENSING AND SYSTEMS ANALYSIS TECHNIQUES TO RIVER BASIN PLANNING,
W69-03145 06A

COMPUTER SIMULATION MODELS FOR RIVER-BASIN ANALYSIS AND PLANNING,
W69-03153 06B

RIVER BASIN PLANNING
OPTIMIZATION OF THE OPERATION OF A MULTIPURPOSE RESERVOIR BY DYNAMIC PROGRAMMING,
W69-02842 06A

URBAN AND BASIN PLANNING,
W69-02851 06B

RIVER DEPLETION
DEPLETION OF FLOW IN RIGHT-ANGLE STREAM BENDS BY STEADY WELLS,
W69-03094 02A

RIVER FORECASTING
HYDROLOGIC FORECASTS, PREDICTION PERIODS, RELIABILITY AND EXPERIENCE USING THEM IN WATER RESOURCES SYSTEMS,
W69-02802 06A

RIVER MILEAGE
RIVER MILEAGE MEASUREMENT,
W69-03100 07A

RIVER SYSTEMS
OPTIMAL WASTE TREATMENT AND POLLUTION ABATEMENT BENEFITS ON A CLOSED RIVER SYSTEM,
W69-03150 05D

RIVERS
AN EVALUATION OF ARTIFICIAL SUBSTRATES FOR MEASURING PERIPHYTON PRODUCTION,
W69-02955 05C

RIVER MILEAGE MEASUREMENT,
W69-03100 07A

RIVERS AND HARBORS ACT
U S V 1,000 ACRES OF LAND (CONDEMNATION FOR WATERWAY CONNECTION).
W69-02897 06E

NAVIGATION AND FLOOD CONTROL IMPROVEMENTS IN COOPERATION WITH THE FEDERAL GOVERNMENT.
W69-03033 06E

ROAD CONSTRUCTION
RINALDI V STATE (DAMAGE FROM STANDING WATERS).
W69-02994 04C

ROCK EXCAVATION
ROCK BREAKAGE BY CRUSHING, BLASTING, AND DRILLING,
W69-02920 08E

ROCK FOOTINGS
ANCHORED FOOTINGS FOR TRANSMISSION TOWERS,
W69-02938 08F

ROCK MECHANICS
A CONTRIBUTION TO THE DEVELOPMENT OF ROCK MECHANICS,
W69-02947 08E

SHEAR STRENGTH OF ROCK,
W69-02951 08E

ROCK SLOPE STABILITY
SHEAR STRENGTH OF ROCK,
W69-02951 08E

ROCKS
SHEAR STRENGTH OF ROCK,
W69-02951 08E

ROLLERS
EVALUATION OF VIBRATORY ROLLERS ON THREE TYPES OF SOILS,
W69-02915 08D

ROOT DEVELOPMENT
ROOT DEVELOPMENT IN RELATION TO PLANT POPULATION AND FERTILITY LEVELS IN SOYBEAN,
W69-02985 02I

ROUTING
RUNOFF HYDROGRAPHS FOR MATHEMATICAL WATERSHED MODEL,
W69-03070 02E

RUMANIA
CARACTERIZAREA HIDROLOGICA A ANULUI 1966 (HYDROLOGICAL CHARACTERIZATION OF 1966),
W69-02815 02E

RUNOFF
RUNOFF AND HILLSLOPE EROSION RESULTING FROM A HIGH-INTENSITY THUNDERSTORM NEAR MACK, WESTERN COLORADO,
W69-03052 02A

MOMENTS OF THE INPUT, OUTPUT, AND IMPULSE RESPONSE FUNCTIONS OF LINEAR SYSTEMS ABOUT ARBITRARY POINTS,
W69-03089 02A

SLOPE LENGTH OF CLAYPAN SOIL AFFECTS RUNOFF,
W69-03106 02A

RUPTURING
SHEAR STRENGTH OF ROCK,
W69-02951 08E

SAFETY
SAFETY FACTORS AND PROBABILITY IN STRUCTURAL DESIGN,
W69-02941 08A

SAFETY FACTORS
SAFETY FACTORS AND PROBABILITY IN STRUCTURAL DESIGN,
W69-02941 08A

SALINE SOILS
INTERRELATIONSHIP BETWEEN PHYSIOGRAPHY, HYDROLOGY, SEDIMENTATION, AND SALINIZATION OF THE LODDON RIVER PLAINS, AUSTRALIA,
W69-02817 02B

NEUTRON MOISTURE METER CALIBRATION FOR USE IN SALINE SOILS,
W69-02965 02G

SALINE WATER
SOME HYDROLOGICAL OBSERVATIONS IN AUCKLAND AND OTAGO HARBOURS,
W69-02835 02L

ESTIMATED USE OF WATER IN THE UNITED STATES, 1965,
W69-02840 06B

SALINE WATER SYSTEMS
SEASONAL CHANGES OF SLOUGH AND LAKE WATER CHEMISTRY IN SOUTHERN SASKATCHEWAN (CANADA),
W69-02838 02H

SALINE WATER-FRESHWATER INTERFACES
STRATIFICATION OF FRESH AND SALT WATER ON BARRIER ISLANDS AS A RESULT OF DIFFERENCES IN SEDIMENT PERMEABILITY,
W69-03058 02F

SALT MARSHES
COLOR-INFRARED AERIAL PHOTOGRAPHIC INTERPRETATION AND NET PRIMARY PRODUCTIVITY OF A REGULARLY-FLOODED NORTH CAROLINA SALT MARSH,
W69-03177 02I

SAN FRANCISCO BAY
A MODEL OF MIXING AND DISPERSION IN SAN FRANCISCO BAY,
W69-02831 05B

SAN JOAQUIN VALLEY(CALIFORNIA)
HYDROLOGIC DATA 1967 - VOLUME IV SAN JOAQUIN VALLEY.
W69-03068 02E

SAND WAVES
BED FORMS IN THE LOWER RED DEER RIVER, ALBERTA,
W69-02816 02J

SANDS
DENSIFICATION OF GRANULAR SOILS BY VIBRATIONS,
W69-02935 08D

GERMINATION OF PROMISING DESERT GRASS SEEDS UNDER DIFFERENT DEPTHS OF SOWING IN SANDY SOIL,

W69-02972 02G

SANTA RITA EXPERIMENTAL RANGE(ARIZONA)
AN EVALUATION OF PRECIPITATION, VEGETATION AND RELATED FACTORS ON THE SANTA RITA EXPERIMENTAL RANGE,
W69-02989 02B

SATURATED FLOW
DETECTION OF SATURATED INTERFLOW IN SOILS WITH PIEZOMETERS,
W69-03074 07B

SATURATED SOILS
INTERRELATIONSHIP BETWEEN PHYSIOGRAPHY, HYDROLOGY, SEDIMENTATION, AND SALINIZATION OF THE LODDON RIVER PLAINS, AUSTRALIA,
W69-02817 02B

SOIL-WATER MOVEMENT IN VAPOUR AND LIQUID PHASES,
W69-02966 02G

SCENIC EASEMENTS
HAMMETT V ROSENSOHN (ACTION TO DETERMINE EFFECT OF RESTRICTIONS IN DEED).
W69-02861 06E

SEASHORES
NORTH CAROLINA SEASHORE COMMISSION.
W69-03005 06E

SEDIMENT DISTRIBUTION
USE OF THE COTTONWOOD IN AN INVESTIGATION OF THE RECENT HISTORY OF A FLOOD PLAIN,
W69-02836 02J

SEDIMENT TRANSPORT
MEASUREMENT OF HYDRAULIC AND SEDIMENT TRANSPORT VARIABLES IN A SMALL RECIRCULATING FLUME,
W69-03056 02J

SUSPENDED LOAD RESEARCH,
W69-03062 02J

SIMILITUDE THEORY APPLIED TO CORRELATION OF FLUME SEDIMENT TRANSPORT DATA,
W69-03095 02J

SEDIMENT SURVEYS IN CANADA,
W69-03123 02J

SEDIMENT YIELD
SEDIMENTATION IN THE PIRU CREEK WATERSHED SOUTHERN CALIFORNIA,
W69-03084 02J

SEDIMENTATION
UNDERWATER SOILS A REVIEW OF LAKE SEDIMENTS,
W69-03187 02H

SEDIMENTATION RATES
USE OF THE COTTONWOOD IN AN INVESTIGATION OF THE RECENT HISTORY OF A FLOOD PLAIN,
W69-02836 02J

SEDIMENTS
THE CHEMISTRY OF LAKE SEDIMENTS FROM INDIAN TIBET,
W69-02960 02H

ADSORPTION OF PHOSPHORUS BY LAKE SEDIMENT,
W69-03075 02H

SEDIMENT-WATER INTERFACES
UNDERWATER SOILS A REVIEW OF LAKE SEDIMENTS,
W69-03187 02H

SEEDS
GERMINATION OF PROMISING DESERT GRASS SEEDS UNDER DIFFERENT DEPTHS OF SOWING IN SANDY SOIL,
W69-02972 02G

SEEPAGE
U S V 1,000 ACRES OF LAND (CONDEMNATION FOR WATERWAY CONNECTION).
W69-02897 06E

UNSTEADY SEEPAGE FLOW BETWEEN FULLY-PENETRATING TRENCHES,
W69-02913 02G

FIELD INVESTIGATIONS OF SEEPAGE ON EXISTING DAMS,
W69-02921 08D

MOVEMENT OF WATER FROM CANALS TO GROUNDWATER TABLE,
W69-03179 02G

SEISMIC INVESTIGATIONS
POSSIBILITIES AND LIMITATIONS OF GEOPHYSICAL METHODS APPLIED TO CIVIL ENGINEERING,
W69-02916 08E

SEISMIC PROPERTIES
POSSIBILITIES AND LIMITATIONS OF GEOPHYSICAL METHODS APPLIED TO CIVIL ENGINEERING,
W69-02916 08E

SENSITIVITY ANALYSIS
RESULTS FROM A SYSTEMS ANALYSIS APPROACH TO THE OPTIMUM CONTROL OF ESTUARINE WATER QUALITY,
W69-03162 05G

DESIGN SENSITIVITY OF POLLUTION CONTROL RESERVOIRS,
W69-03163 05G

SEPTIC TANKS
THE PRODUCTIVITY OF A LAKE POLLUTED BY ORGANIC WASTES DERIVED PRIMARILY FROM SEPTIC TANKS,
W69-03182 05C

SETTLEMENT
TWO-DIMENSIONAL ANALYSIS OF STRESS AND STRAIN IN SOILS, REPORT 5 PLANE-STRAIN LOADING OF A STRAIN-HARDENING SOIL,
W69-02912 08D

COMPARISON OF FIELD AND LABORATORY MEASUREMENTS OF MODULUS OF DEFORMATION OF A CLAY,
W69-02933 08D

SEWAGE
CITY OF GALLIPOLIS V STATE EX REL WATER POLLUTION CONTROL BD (DENIAL OF PERMIT TO DISCHARGE SEWAGE INTO RIVER).
W69-03034 05B

SEWAGE DISPOSAL
HILLHOUSE V CITY OF AURORA (ACTION FOR DAMAGES BROUGHT BY FARM OWNER FOR POLLUTION OF CREEK BY CITY SEWER SYSTEM).
W69-02898 05B

DISCHARGE OF SEWAGE INTO WATERS (PERMITS REQUIRED).
W69-03029 06E

BENEFIT-COST ANALYSIS AND THE NATIONAL OCEANOGRAPHIC PROGRAM,
W69-03126 06B

SEWERS
PRIVATE SEWERS.
W69-02876 05G

MUNICIPAL CORPORATIONS SEWER SYSTEMS.
W69-02895 05D

BECK V CITY OF NEW YORK (OVERFLOWING SEWERS).
W69-03020 04A

SHALLOW WELLS
BOARD OF HEALTH V CREW (STATE'S RIGHT TO ORDER WELL CLOSING).
W69-03024 05G

SHEAR RESISTANCE
MECHANISMS OF SHEAR RESISTANCE OF CONCRETE BEAMS,
W69-02927 08F

SHEAR STRENGTH
MECHANISMS OF SHEAR RESISTANCE OF CONCRETE BEAMS,
W69-02927 08F

EVALUATION OF DEEP IN-SITU SOIL STABILIZATION BY HIGH-PRESSURE LIME-SLURRY INJECTION,
W69-02930 08D

SHEAR STRENGTH OF ROCK,
W69-02951 08E

SHEAR TESTS
A CONTRIBUTION TO THE DEVELOPMENT OF ROCK MECHANICS,
W69-02947 08E

SIDE CHANNEL SPILLWAYS
INFLUENCE OF SIDE SPILLING FLOW IN A COLLECTING CHANNEL,
W69-02945 08B

SILTING
THE EFFECT OF SILT-LADEN WATER ON INFILTRATION IN ALLUVIAL CHANNELS,
W69-02988 02J

SILTS
HYDRAULIC AND MICROMORPHOLOGICAL PROPERTIES OF STREAM CHANNEL SEDIMENTS,
W69-03108 02J

SIMULATION ANALYSIS
FIELD LEVEL PLANNING OF WATER RESOURCE SYSTEMS,
W69-02843 06B

COMPUTER SIMULATION MODELS FOR RIVER-BASIN ANALYSIS AND PLANNING,
W69-03153 06B

SYSTEMS ANALYSIS AND SIMULATION IN WATER QUALITY MANAGEMENT,
W69-03161 05G

SIMULATION OF REGIONAL ECONOMIC IMPACTS OF WATER RESOURCE DEVELOPMENT,
W69-03176 06B

SLABS
THE THEORY OF THE STRIP METHOD FOR DESIGN OF SLABS,
W69-02918 08F

ULTIMATE LOAD TESTS OF SLABS DESIGNED BY THE STRIP METHOD,
W69-02919 08F

SLIP SURFACE
THE STRENGTH ALONG STRUCTURAL DISCONTINUITIES IN STIFF CLAYS,
W69-02950 08D

SLOPE STABILITY
EQUILIBRIUM LIMITS OF EMBANKMENTS AND EARTH DAMS,
W69-02949 08D

SLOPES

PROCESSES AND EXTENT OF EROSION AND ITS EFFECTS ON LAND USE IN THE CENTRAL LUNI BASIN, WESTERN RAJASTHAN,
W69-02987 02J

INFILTRATION, OVERLAND FLOW, AND SOIL MOVEMENT ON FROZEN AND SNOW-COVERED PLOTS,
W69-03060 02A

SLURRIES
EVALUATION OF DEEP IN-SITU SOIL STABILIZATION BY HIGH-PRESSURE LIME-SLURRY INJECTION,
W69-02930 08D

SMALL WATERSHEDS
LOW-FLOW AND BASIN CHARACTERISTICS OF TWO STREAMS IN NORTHERN VERMONT,
W69-02814 02A

HYDROLOGIC STUDIES OF SMALL WATERSHEDS IN AGRICULTURAL AREAS OF SOUTHERN MICHIGAN,
W69-03045 02A

FLOOD OF JUNE 7, 1967, IN THE WAPSINONOC CREEK BASIN, IOWA,
W69-03085 02E

FLOOD RUNOFF FROM PARTIALLY URBANIZED AREAS, WICHITA, KANSAS,
W69-03118 02E

SNOWMELT
RADIATION AND SNOWMELT ON A CLEARCUT WATERSHED,
W69-03078 02C

SNOWPACKS
INFILTRATION, OVERLAND FLOW, AND SOIL MOVEMENT ON FROZEN AND SNOW-COVERED PLOTS,
W69-03060 02A

SOCIAL IMPACT OF DROUGHT
SOCIAL IMPACT OF METEOROLOGICAL DROUGHT IN ILLINOIS,
W69-03193 02B

SOCIAL NEEDS
WATER RESOURCES AND ECONOMIC DEVELOPMENT THE CHALLENGE TO KNOWLEDGE,
W69-02964 06B

SOCIAL PARTICIPATION
LOCAL PARTICIPATION AND WATERSHED DEVELOPMENT A COMPARATIVE STUDY OF TWO COMMUNITIES,
W69-03139 06B

SOCIAL RATE OF DISCOUNT
THE OPPORTUNITY COSTS OF PUBLIC INVESTMENT COMMENT,
W69-03125 06B

THE SOCIAL RATE OF DISCOUNT AND THE OPTIMAL RATE OF INVESTMENT,
W69-03129 06B

SOCIAL UTILITY FUNCTION
THE OPPORTUNITY COSTS OF PUBLIC INVESTMENT COMMENT,
W69-03125 06B

SOCIAL VALUES
CONSERVATION DECISION-MAKING A RATIONALIZATION,
W69-03127 04C

SOCIAL WELFARE FUNCTION
THE SOCIAL RATE OF DISCOUNT AND THE OPTIMAL RATE OF INVESTMENT,
W69-03129 06B

SODIUM CHLORIDE
NEUTRON MOISTURE METER CALIBRATION FOR USE IN SALINE SOILS,
W69-02965 02G

SOIL CHEMICAL PROPERTIES
ROLE OF SOILS AND SEDIMENT IN WATER POLLUTION CONTROL--PART I, REACTIONS OF NITROGENOUS AND PHOSPHATIC COMPOUNDS WITH SOILS AND GEOLOGIC STRATA,
W69-03080 05E

SOIL COMPACTION
MECHANICAL PROPERTIES OF COMPACTED SOILS,
W69-02925 08D

SOIL COMPATION
DENSIFICATION OF GRANULAR SOILS BY VIBRATIONS,
W69-02935 08D

SOIL CONSERVATION
EVALUATION OF ZINGG CONSERVATION BENCH TERRACES ON AMARILLO FINE SANDY LOAM SOIL.
W69-02971 02E

SOIL DENSITY
DYNAMIC LOADINGS,
W69-02908 08D

DENSIFICATION OF GRANULAR SOILS BY VIBRATIONS,
W69-02935 08D

SOIL DISPOSAL FIELDS
ROLE OF SOILS AND SEDIMENT IN WATER POLLUTION CONTROL--PART I, REACTIONS OF NITROGENOUS AND PHOSPHATIC COMPOUNDS WITH SOILS AND GEOLOGIC STRATA,
W69-03080 05E

SOIL DYNAMICS
DYNAMIC LOADINGS,
W69-02908 08D

DENSIFICATION OF GRANULAR SOILS BY VIBRATIONS,
W69-02935 08D

SOIL EROSION
DETACHMENT OF SOIL PARTICLES IN SIMULATED RAINFALL,
W69-02832 04D

PROCESSES AND EXTENT OF EROSION AND ITS EFFECTS ON LAND USE IN THE CENTRAL LUNI BASIN, WESTERN RAJASTHAN,
W69-02987 02J

SOIL MECHANICS
THE STRENGTH ALONG STRUCTURAL DISCONTINUITIES IN STIFF CLAYS,
W69-02950 08D

SOIL MOISTURE
EFFECTS OF MOISTURE AND NITROGEN FERTILIZER ON GROWTH AND WATER USE BY NATIVE GRASS,
W69-02969 02I

GERMINATION OF PROMISING DESERT GRASS SEEDS UNDER DIFFERENT DEPTHS OF SOWING IN SANDY SOIL,
W69-02972 02G

CHAPARRAL FIRES CHANGE SOIL MOISTURE DEPLETION PATTERNS,
W69-02979 02G

PSYCHROMETRIC MEASUREMENT OF SOIL WATER POTENTIAL IN SITU UNDER COTTON PLANTS,
W69-02980 02G

RELATION OF SOIL PROPERTIES TO THE EVAPORATION OF WATER FROM SOILS,
W69-03175 02D

SOIL PHYSICAL PROPERTIES
ROLE OF SOILS AND SEDIMENT IN WATER POLLUTION CONTROL--PART I, REACTIONS OF NITROGENOUS AND PHOSPHATIC COMPOUNDS WITH SOILS AND GEOLOGIC STRATA,
W69-03080 05E

SOIL PROPERTIES
RELATION OF SOIL PROPERTIES TO THE EVAPORATION OF WATER FROM SOILS,
W69-03175 02D

UNDERWATER SOILS A REVIEW OF LAKE SEDIMENTS,
W69-03187 02H

SOIL STABILITY
NADLER FOUNDRY AND MACHINE CO, INC V UNITED STATES (LIABILITY FOR CAVE-IN CAUSED BY DREDGING).
W69-03008 06E

SOIL STABILIZATION
EVALUATION OF DEEP IN-SITU SOIL STABILIZATION BY HIGH-PRESSURE LIME-SLURRY INJECTION,
W69-02930 08D

SOIL TEMPERATURE
AN ANALYSIS OF TEMPERATURE BEHAVIOR IN IRRIGATED SOIL PROFILES,
W69-03053 02G

SOIL TREATMENT
EVALUATION OF DEEP IN-SITU SOIL STABILIZATION BY HIGH-PRESSURE LIME-SLURRY INJECTION,
W69-02930 08D

SOIL WATER
PRECISION LYSIMETRY FOR DIRECT MEASUREMENT OF EVAPORATIVE FLUX,
W69-02981 02G

SOIL STUDY FOR WATER ECONOMICS,
W69-03042 02G

AN ANALYSIS OF TEMPERATURE BEHAVIOR IN IRRIGATED SOIL PROFILES,
W69-03053 02G

SOIL WATER MOVEMENT
AQUEOUS TRANSPORT OF DIELDRIN RESIDUES IN SOILS,
W69-02801 05B

MISCIBLE DISPLACEMENT IN AN UNSATURATED GLASS BEAD MEDIUM,
W69-02810 02G

SOIL-WATER MOVEMENT IN VAPOUR AND LIQUID PHASES,
W69-02966 02G

SOIL WATER FLUX BELOW A RYEGRASS ROOT ZONE,
W69-02975 02G

MOVEMENT OF WATER TAGGED WITH (2)H, (3)H, AND (18)O THROUGH ACIDIC KAOLINITIC SOIL,
W69-03073 02G

DETECTION OF SATURATED INTERFLOW IN SOILS WITH PIEZOMETERS,
W69-03074 07B

SOIL WATER POTENTIAL
PSYCHROMETRIC MEASUREMENT OF SOIL WATER POTENTIAL IN SITU UNDER COTTON PLANTS,
W69-02980 02G

SOILS
VIRUS MOVEMENT IN GROUNDWATER,

W69-02824 05B

VELOCITY-GRADIENT RELATIONSHIPS FOR STEADY-STATE UNSATURATED FLOW OF WATER IN NON-SWELLING ARTIFICIAL SOILS,
W69-03072 02G

SOUTH CAROLINA
HILTON V DUKE POWER CO (DAM ADDITIONS CAUSED FLOODING OF UPSTREAM LAND).
W69-03006 04A

SOYBEAN
ROOT DEVELOPMENT IN RELATION TO PLANT POPULATION AND FERTILITY LEVELS IN SOYBEAN,
W69-02985 02I

SPACERS
EVALUATION OF SPACERS FOR BUNDLED CONDUCTOR TRANSMISSION LINES,
W69-02943 08C

SPAWNING
WATER QUALITY AS RELATED TO THE SURVIVAL OF SALMON EGGS AND LARVAE,
W69-03190 05C

SPECIFIC YIELD
SPECIFIC YIELD-COMPILATION OF SPECIFIC YIELDS FOR VARIOUS MATERIALS,
W69-02828 02F

SPILLWAYS
INFLUENCE OF SIDE SPILLING FLOW IN A COLLECTING CHANNEL,
W69-02945 08B

SPOIL BANKS
ERECTING ARTIFICIAL ISLANDS AND LUMPS IN PUBLIC WATERS.
W69-03003 06E

SPRING WATERS
DUNCAN V GHEEN (ENFORCEMENT OF EASEMENT GRANTING RIGHT TO SPRING WATER).
W69-03023 04B

SPRINKLER IRRIGATION
SPRINKLER AND SURFACE IRRIGATION OF VEGETABLE AND FIELD CROPS IN AN ARID ENVIRONMENT,
W69-02974 03F

STABILITY ANALYSIS
STRUCTURAL DESIGN--GRAND COULEE THIRD POWERPLANT,
W69-02939 08A

STABLE CHANNELS
DESIGN OF STABLE CHANNELS IN ALLUVIAL MATERIALS,
W69-03066 08B

STAGNANT WATER
CHEMICAL AND ISOTOPIC BALANCES FOR A MEROMICTIC LAKE,
W69-03088 02H

STANDARDS
APPLICATION OF THE TOWN OF WATERFORD (VALIDITY OF STREAM CLASSIFICATION).
W69-02990 05D

RIVER MILEAGE MEASUREMENT,
W69-03100 07A

STANDING WATERS
RINALDI V STATE (DAMAGE FROM STANDING WATERS).
W69-02994 04C

STATE GOVERNMENTS
THE CALIFORNIA WATER PROJECT IS PUBLIC DECISION-MAKING BECOMING MORE EFFICIENT,
W69-02841 06B

STATISTICAL METHODS
AN EVALUATION OF PRECIPITATION, VEGETATION AND RELATED FACTORS ON THE SANTA RITA EXPERIMENTAL RANGE,
W69-02989 02B

RESEARCH ON BED-LOAD,
W69-03043 02J

SOME COMMENTS ON THE USE OF FACTOR ANALYSES,
W69-03050 07C

METHODS OF FLOW FREQUENCY ANALYSIS,
W69-03102 02E

SCHEMES FOR HANDLING INCONSISTENT MATRICES,
W69-03117 07C

WHEN IS IT SAFE TO EXTEND A PREDICTION EQUATION--AN ANSWER BASED UPON FACTOR AND DISCRIMINANT FUNCTION ANALYSIS,
W69-03183 06A

STATISTICAL MODELS
COLOR-INFRARED AERIAL PHOTOGRAPHIC INTERPRETATION AND NET PRIMARY PRODUCTIVITY OF A REGULARLY-FLOODED NORTH CAROLINA SALT MARSH,
W69-03177 02I

STEEL PIPES
INCRUSTATION IN WATER PIPELINES,
W69-02928 08G

STOCHASTIC PROCESSES
RESEARCH ON BED-LOAD,
W69-03043 02J

STOMATA
ANTI-TRANSPIRANTS AS A RESEARCH TOOL FOR THE STUDY OF THE EFFECTS OF WATER STRESS ON PLANT BEHAVIOUR,
W69-02986 03F

STORM RUNOFF
FLOOD RUNOFF FROM PARTIALLY URBANIZED AREAS, WICHITA, KANSAS,
W69-03118 02E

STRAIN HARDENING
TWO-DIMENSIONAL ANALYSIS OF STRESS AND STRAIN IN SOILS, REPORT 5 PLANE-STRAIN LOADING OF A STRAIN-HARDENING SOIL,
W69-02912 08D

STRATIFICATION
AN INVESTIGATION OF THE EFFECT OF CONTROLLED RELEASES ON THE PHYSICAL, CHEMICAL AND BACTERIOLOGICAL CHARACTERISTICS OF FORT LOUDOUN RESERVOIR,
W69-03180 05C

STREAM CLASSIFICATION
APPLICATION OF THE TOWN OF WATERFORD (VALIDITY OF STREAM CLASSIFICATION).
W69-02990 05D

STREAMFLOW
LOW STREAMFLOW IN THE MYAKKA RIVER BASIN AREA IN FLORIDA,
W69-02808 02E

CARACTERIZAREA HIDROLOGICA A ANULUI 1966 (HYDROLOGICAL CHARACTERIZATION OF 1966),
W69-02815 02E

EVALUATION OF SEEPAGE FROM CHESTER MORSE LAKE AND MASONRY POOL, KING COUNTY, WASHINGTON,
W69-02827 02H

URBANIZATION AND ITS EFFECT ON THE TEMPERATURE OF LONG ISLAND STREAMS,
W69-02830 05A

ELECTRIC-ANALOG AND DIGITAL-COMPUTER MODEL ANALYSIS OF STREAM DEPLETION BY WELLS,
W69-02976 02F

HYDROLOGIC STUDIES OF SMALL WATERSHEDS IN AGRICULTURAL AREAS OF SOUTHERN MICHIGAN,
W69-03045 02A

STREAMFLOW FORECASTING
HYDROLOGIC FORECASTS, PREDICTION PERIODS, RELIABILITY AND EXPERIENCE USING THEM IN WATER RESOURCES SYSTEMS,
W69-02802 06A

STREAMS
HILLHOUSE V CITY OF AURORA (ACTION FOR DAMAGES BROUGHT BY FARM OWNER FOR POLLUTION OF CREEK BY CITY SEWER SYSTEM).
W69-02898 05B

AN EVALUATION OF ARTIFICIAL SUBSTRATES FOR MEASURING PERIPHYTON PRODUCTION,
W69-02955 05C

SIGNIFICANCE OF NITRIFICATION IN STREAM ANALYSIS--EFFECTS ON THE OXYGEN BALANCE,
W69-03077 05B

STRESS ANALYSIS
STRESS AND STRAIN ANALYSIS ON MODELS,
W69-02948 08A

STRIP METHOD
THE THEORY OF THE STRIP METHOD FOR DESIGN OF SLABS,
W69-02918 08F

ULTIMATE LOAD TESTS OF SLABS DESIGNED BY THE STRIP METHOD,
W69-02919 08F

STRUCTURAL ANALYSIS
STRUCTURAL DESIGN--GRAND COULEE THIRD POWERPLANT,
W69-02939 08A

STRESS AND STRAIN ANALYSIS ON MODELS,
W69-02948 08A

STRUCTURAL BEHAVIOR
STRESS AND STRAIN ANALYSIS ON MODELS,
W69-02948 08A

STRUCTURAL DESIGN
THE THEORY OF THE STRIP METHOD FOR DESIGN OF SLABS,
W69-02918 08F

ULTIMATE LOAD TESTS OF SLABS DESIGNED BY THE STRIP METHOD,
W69-02919 08F

RECENT DEVELOPMENTS IN OPTIMAL STRUCTURAL DESIGN,
W69-02932 08A

STRUCTURAL DESIGN--GRAND COULEE THIRD POWERPLANT,
W69-02939 08A

SAFETY FACTORS AND PROBABILITY IN STRUCTURAL DESIGN,
W69-02941 08A

RECENT DEVELOPMENTS IN PLASTIC DESIGN PRACTICE,
W69-02942 08G

STRUCTURAL MODELS
STRESS AND STRAIN ANALYSIS ON MODELS,
W69-02948 08A

SUBSTRATES
AN EVALUATION OF ARTIFICIAL SUBSTRATES FOR MEASURING PERIPHYTON PRODUCTION,
W69-02955 05C

SUBSURFACE RUNOFF
DETECTION OF SATURATED INTERFLOW IN SOILS WITH PIEZOMETERS,
W69-03074 07B

SLOPE LENGTH OF CLAYPAN SOIL AFFECTS RUNOFF,
W69-03106 02A

SURFACE DRAINAGE
BURKE V FREY (SURFACE WATER DRAINAGE).
W69-03019 04A

GRASLEY V EPPLEY (SURFACE DRAINAGE).
W69-03025 04A

SURFACE IRRIGATION
SPRINKLER AND SURFACE IRRIGATION OF VEGETABLE AND FIELD CROPS IN AN ARID ENVIRONMENT,
W69-02974 03F

SURFACE RUNOFF
EVALUATION OF ZINGG CONSERVATION BENCH TERRACES ON AMARILLO FINE SANDY LOAM SOIL.
W69-02971 02E

BURKE V FREY (SURFACE WATER DRAINAGE).
W69-03019 04A

RADIATION AND SNOWMELT ON A CLEARCUT WATERSHED,
W69-03078 02C

SURFACE WATER
ESTIMATED USE OF WATER IN THE UNITED STATES, 1965,
W69-02840 06B

ARKANSAS WATER RESOURCES SUPPLY, USE, AND RESEARCH NEEDS,
W69-03199 06B

SURFACE WATERS
THE TEMPORAL AND SPATIAL DISTRIBUTION OF DISSOLVED OXYGEN IN STREAMS,
W69-02809 05A

TRACER MEASUREMENT OF STREAM REAERATION. II. FIELD STUDIES,
W69-02821 02E

EVALUATION OF SEEPAGE FROM CHESTER MORSE LAKE AND MASONRY POOL, KING COUNTY, WASHINGTON,
W69-02827 02H

WATER RESOURCES OF THE MUSTINKA AND BOIS DE SIOUX RIVERS WATERSHED WEST-CENTRAL MINNESOTA,
W69-02829 02F

WEIMER V CAUBLE (ACTION TO ENJOIN DIVERSION OF SURFACE WATERS ONTO PLAINTIFF'S LAND IN HARMFUL MANNER).
W69-02902 04A

WHITEHALL CONSTRUCTION CO V WASHINGTON SUBURBAN SANITARY COMM'N (REQUIREMENTS FOR TRESPASS ACTION).
W69-03007 06E

SURFACE-GROUNDWATER RELATIONSHIPS
DEPLETION OF FLOW IN RIGHT-ANGLE STREAM BENDS BY STEADY WELLS,
W69-03094 02A

SURVEYS
APPLICATION OF THE GRAVITY SURVEY METHOD TO WATERSHED HYDROLOGY,
W69-02982 04D

AN ELECTRICAL RESISTIVITY PROFILE FROM MAHUKONA TO KAWAIHAE, HAWAII,
W69-03184 06A

SUSPENDED LOAD
THE EFFECT OF SILT-LADEN WATER ON INFILTRATION IN ALLUVIAL CHANNELS,
W69-02988 02J

SUSPENDED LOAD RESEARCH,
W69-03062 02J

DEPOSITIONAL BEHAVIOR OF KAOLINITE IN TURBULENT FLOW,
W69-03067 02J

SUSQUEHANNA RIVER BASIN
COMPUTER SIMULATION MODELS FOR RIVER-BASIN ANALYSIS AND PLANNING,
W69-03153 06B

SWAMP LAND ACT
ALBUBY V CENTRAL AND SOUTH FLORIDA FLOOD CONTROL DIST (NO COMPENSATION ALLOWED FOR CONSTRUCTION OF A DRAINAGE CANAL).
W69-02889 04A

SWAMPS
FILLING LOW, SWAMP, AND WASTE LANDS.
W69-02875 06E

CONSTRUCTING 500-KV TRANSMISSION LINES ON A SWAMPY RIVER FLOOD PLAIN,
W69-02936 08F

SWIMMING BEHAVIOR
ACTIVITY PATTERNS OF FISH EXPOSED TO TOXIC MATERIAL,
W69-03194 05C

SYNOPTIC ANALYSIS
EFFECTS OF CLIMATOLOGIC AND BASIN CHARACTERISTICS ON ANNUAL RUNOFF,
W69-03055 02A

SYNTHETIC HYDROLOGY
ANALYTICALLY DERIVED UNIT GRAPH AND RUNOFF,
W69-03069 02A

SYSTEM ANALYSIS
ANALYSIS OF WATER AND WATER-RELATED RESEARCH REQUIREMENTS IN THE GREAT LAKES REGION.
W69-03079 07A

SYSTEMS ANALYSIS
SYSTEMS APPROACH TO WATER QUALITY IN THE GREAT LAKES.
W69-03059 02H

SYSTEMS APPROACH TO WATER RESOURCE MANAGEMENT.
W69-03122 06A

APPLICABILITY OF REMOTE SENSING AND SYSTEMS ANALYSIS TECHNIQUES TO RIVER BASIN PLANNING,
W69-03145 06A

SYSTEMS ANALYSIS AND SIMULATION IN WATER QUALITY MANAGEMENT,
W69-03161 05G

A PROPOSAL FOR A SYSTEMS ENGINEERING STUDY OF WATER POLLUTION ABATEMENT,
W69-03164 05G

SYSTEMS ANALYSIS FOR GROUND WATER BASIN MANAGEMENT,
W69-03200 04B

TAXES
THE OPPORTUNITY COSTS OF PUBLIC INVESTMENT COMMENT,
W69-03125 06B

TECHNOLOGICAL EXTERNALITIES
EXTERNALITY,
W69-03132 06B

TEMPERATURE
URBANIZATION AND ITS EFFECT ON THE TEMPERATURE OF LONG ISLAND STREAMS,
W69-02830 05A

EFFECTS OF A MONOLAYER ON RESERVOIR TEMPERATURE AND EVAPORATION,
W69-03054 03B

TENNESSEE
FLOOD PLAIN INFORMATION, HARPETH RIVER, FRANKLIN, TENNESSEE.
W69-03041 02E

TENSIOMETERS
MOVEMENT OF WATER FROM CANALS TO GROUNDWATER TABLE,
W69-03179 02G

TERRACING
EVALUATION OF ZINGG CONSERVATION BENCH TERRACES ON AMARILLO FINE SANDY LOAM SOIL.
W69-02971 02E

THERMAL POLLUTION
URBANIZATION AND ITS EFFECT ON THE TEMPERATURE OF LONG ISLAND STREAMS,
W69-02830 05A

THERMODYNAMIC BEHAVIOR
GRAPHICAL METHODS FOR STUDIES OF AQUEOUS ALUMINUM HYDROXIDE, FLUORIDE, AND SULFATE COMPLEXES,
W69-02834 01B

THERMODYNAMICS
A CONTRIBUTION TO THE THEORY OF THERMO-ECONOMICS,
W69-03131 06C

THUNDERSTORMS
REGRESSION MODELS FOR PREDICTING ON-SITE RUNOFF FROM SHORT-DURATION CONVECTIVE STORMS,
W69-03103 06A

TIBET
THE CHEMISTRY OF LAKE SEDIMENTS FROM INDIAN TIBET,
W69-02960 02H

TIDAL POWERPLANTS
TUBULAR TURBINES,
W69-02907 08C

OPTIMIZATION OF TIDAL POWER GENERATION,
W69-03160 06A

TIDAL WATERS
SOME HYDROLOGICAL OBSERVATIONS IN AUCKLAND AND OTAGO HARBOURS,
W69-02835 02L

TILL
FLOW OF GROUNDWATER ADJACENT TO SMALL, CLOSED BASINS IN GLACIAL TILL,
W69-03119 02F

TOXICANT
ACTIVITY PATTERNS OF FISH EXPOSED TO TOXIC MATERIAL,
W69-03194 05C

TRACE ELEMENTS
EVALUATION OF THE EFFECT OF TRACE ELEMENTS ON THE ACTIVITY OF MICROORGANISMS,
W69-03196 05C

TRACE AND TRACER ELEMENTS IN GROUND WATER,
W69-03197 02F

TRACERS
TRACER MEASUREMENT OF STREAM REAERATION. II. FIELD STUDIES,
W69-02821 02E

PONTACYL BRILLIANT PINK AS A TRACER DYE IN THE MOVEMENT OF WATER IN PHREATOPHYTES,
W69-03047 02I

MOVEMENT OF WATER TAGGED WITH (2)H, (3)H, AND (18)O THROUGH ACIDIC KAOLINITIC SOIL,
W69-03073 02G

UNITED STATES TRITIUM RAINOUT AND ITS HYDROLOGIC IMPLICATIONS,
W69-03121 02B

TRANSMISSION LINE HARDWARE
EVALUATION OF SPACERS FOR BUNDLED CONDUCTOR TRANSMISSION LINES,
W69-02943 08C

TRANSMISSION LINES
EVALUATION OF SPACERS FOR BUNDLED CONDUCTOR TRANSMISSION LINES,
W69-02943 08C

TRANSMISSION TOWERS
CONSTRUCTING 500-KV TRANSMISSION LINES ON A SWAMPY RIVER FLOOD PLAIN,
W69-02936 08F

ANCHORED FOOTINGS FOR TRANSMISSION TOWERS,
W69-02938 08F

TRANSMISSIVITY
DRAWDOWN IN A WELL OF LARGE DIAMETER,
W69-03049 02F

RESPONSE OF A FINITE-DIAMETER WELL TO AN INSTANTANEOUS CHARGE OF WATER,
W69-03057 02F

TRANSPIRATION
THE EFFECT OF APPLIED INTERCEPTION ON TRANSPIRATION RATES OF POTTED PONDEROSA PINE,
W69-03116 02I

TRANSPIRATION CONTROL
ANTI-TRANSPIRANTS AS A RESEARCH TOOL FOR THE STUDY OF THE EFFECTS OF WATER STRESS ON PLANT BEHAVIOUR,
W69-02986 03F

TRANSPORTATION
SEC 452 WATER SUPPLY TO OTHER STATES.
W69-03028 04A

TREATMENT FACILITIES
MUNICIPAL CORPORATIONS SEWER SYSTEMS.
W69-02895 05D

TRESPASS
WHITEHALL CONSTRUCTION CO V WASHINGTON SUBURBAN SANITARY COMM'N (REQUIREMENTS FOR TRESPASS ACTION).
W69-03007 06E

TRITIUM
UNITED STATES TRITIUM RAINOUT AND ITS HYDROLOGIC IMPLICATIONS,
W69-03121 02B

TRITIUM RAINOUT
UNITED STATES TRITIUM RAINOUT AND ITS HYDROLOGIC IMPLICATIONS,
W69-03121 02B

TROPICAL REGIONS
RELATIONSHIP BETWEEN PRECIPITATION, EVAPORATION, AND RUNOFF IN TROPICAL-EQUATORIAL REGIONS,
W69-03092 02A

TUBE TURBINES
TUBULAR TURBINES,
W69-02907 08C

TUNNELING MACHINES
HORIZONTAL BORING TECHNOLOGY A STATE-OF-THE-ART-STUDY,
W69-02923 08C

TURBULENT FLOW
DEPOSITIONAL BEHAVIOR OF KAOLINITE IN TURBULENT FLOW,
W69-03067 02J

ULTIMATE LOADS
ULTIMATE LOAD TESTS OF SLABS DESIGNED BY THE STRIP METHOD,
W69-02919 08F

UNDERDRAINS
CONCRETE RESERVOIR DESIGN,
W69-02952 08A

UNDERGROUND CABLES
HORIZONTAL BORING TECHNOLOGY A STATE-OF-THE-ART-STUDY,
W69-02923 08C

UNDERGROUND TRANSMISSION LINES
HORIZONTAL BORING TECHNOLOGY A STATE-OF-THE-ART-STUDY,
W69-02923 08C

UNDERSEEPAGE
FIELD INVESTIGATIONS OF SEEPAGE ON EXISTING DAMS,
W69-02921 08D

UNIT HYDROGRAPHS
ANALYTICALLY DERIVED UNIT GRAPH AND RUNOFF,
W69-03069 02A

RUNOFF HYDROGRAPHS FOR MATHEMATICAL WATERSHED MODEL,
W69-03070 02E

A LAPLACE TRANSFORM PROOF OF THE THEOREM OF MOMENTS FOR THE INSTANTANEOUS UNIT HYDROGRAPH,
W69-03120 06A

UNITED STATES
HUTHER V UNITED STATES (DAMAGE CLAIM DUE TO RISING LAKE WATERS).
W69-02865 04A

U S V 1,000 ACRES OF LAND (CONDEMNATION FOR WATERWAY CONNECTION).
W69-02897 06E

NADLER FOUNDRY AND MACHINE CO, INC V UNITED STATES (LIABILITY FOR CAVE-IN CAUSED BY DREDGING).
W69-03008 06E

BEAN V UNITED STATES (BENEFICIAL USE OF WATER GIVES NO VESTED RIGHT).
W69-03009 06E

UNSATURATED FLOW
VELOCITY-GRADIENT RELATIONSHIPS FOR STEADY-STATE UNSATURATED FLOW OF WATER IN NON-SWELLING ARTIFICIAL SOILS,
W69-03072 02G

UNSTEADY FLOW
THE INITIAL PHASE OF THE RISING HYDROGRAPH OF TURBULENT FREE SURFACE FLOW WITH UNSTEADY LATERAL INFLOW,
W69-02837 02E

UNSTEADY SEEPAGE FLOW BETWEEN FULLY-PENETRATING TRENCHES,
W69-02913 02G

UNSTEADY FLOW IN OPEN CHANNELS,
W69-03044 02E

APPLICATION OF THE FINITE ELEMENT METHOD TO TRANSIENT FLOW IN POROUS MEDIA,
W69-03064 08B

URBANIZATION
URBANIZATION AND ITS EFFECT ON THE TEMPERATURE OF LONG ISLAND STREAMS,
W69-02830 05A

URBAN AND BASIN PLANNING,
W69-02851 06B

STEPS TOWARD A BETTER UNDERSTANDING OF URBAN RUNOFF PROGRESS,
W69-03097 04C

FLOOD RUNOFF FROM PARTIALLY URBANIZED AREAS, WICHITA, KANSAS,
W69-03118 02E

WATER RESOURCE MANAGEMENT IN MT. PROSPECT A SURVEY OF THE ENVIRONMENT, PROBLEMS, AND OPPORTUNITIES,
W69-03168 06B

USE COST ALLOCATION
A STUDY IN THE ECONOMICS OF WATER QUALITY MANAGEMENT,
W69-03173 05G

USSR
USE OF MONOMOLECULAR FILMS TO REDUCE EVAPORATION FROM THE SURFACE OF BODIES OF WATER,
W69-02805 03B

METHODOLOGICAL PREREQUISITES FOR CONDUCTING NETWORK OBSERVATIONS OF THE CHANNEL PROCESS,
W69-02807 07A

EXPERIENCE IN BURIAL OF LIQUID RADIOACTIVE WASTES IN DEEP GEOLOGICAL FORMATIONS,
W69-03061 05E

USSR HYDROLOGICAL FORECASTS
HYDROLOGIC FORECASTS, PREDICTION PERIODS, RELIABILITY AND EXPERIENCE USING THEM IN WATER RESOURCES SYSTEMS,
W69-02802 06A

VALLEYS
GROUNDWATER FLOW SYSTEMS IN THE CRYSTALLINE ROCKS OF THE OKANAGAN HIGHLAND, BRITISH COLUMBIA,
W69-02826 02F

VAPOR PRESSURE

A NOTE CONCERNING THE EDDY TRANSFER COEFFICIENTS OF MOMENTUM AND WATER VAPOR UNDER NEAR-ADIABATIC CONDITIONS,
W69-03051 02D

VEGATABLE CROPS
SPRINKLER AND SURFACE IRRIGATION OF VEGETABLE AND FIELD CROPS IN AN ARID ENVIRONMENT,
W69-02974 03F

VEGETATION EFFECTS
INFLUENCE OF THE FOREST ON PRECIPITATION,
W69-02803 02B

VEGETATION REGROWTH
CHAPARRAL FIRES CHANGE SOIL MOISTURE DEPLETION PATTERNS,
W69-02979 02G

VERMONT
LOW-FLOW AND BASIN CHARACTERISTICS OF TWO STREAMS IN NORTHERN VERMONT,
W69-02814 02A

VIBRATORY COMPACTION
EVALUATION OF VIBRATORY ROLLERS ON THREE TYPES OF SOILS,
W69-02915 08D

DENSIFICATION OF GRANULAR SOILS BY VIBRATIONS,
W69-02935 08D

VINEYARD IRRIGATION
FURROW SIZE, PLACEMENT, AND GRASS CULTURE EFFECTS ON VINEYARD IRRIGATION,
W69-02978 03F

VIRGINIA
BOARD OF SUPERVISORS OF LOUDOUN CITY V TOWN OF FAIRFAX (APPLICATION TO ERECT DAM FOR MUNICIPAL WATER SUPPLY).
W69-03036 04A

SHEPHEARD V BOGGS (LAND EXTENSION BY RIPARIAN LANDOWNER BLOCKING STREAM).
W69-03037 04A

CORDOVANA V VIPOND (INJUNCTION TO REMOVE FENCE WHICH DENIED RIPARIAN RIGHTS).
W69-03038 04A

VIRUSES
VIRUS MOVEMENT IN GROUNDWATER,
W69-02824 05B

WAIMANALO(OAHU-HAWAII)
FLOODS IN WAIMANALO AREA, OAHU, HAWAII,
W69-02818 02E

WASHINGTON
GROUND-WATER WITHDRAWAL IN THE ODESSA AREA, ADAMS, GRANT, AND LINCOLN COUNTIES, WASHINGTON.
W69-02823 02F

EVALUATION OF SEEPAGE FROM CHESTER MORSE LAKE AND MASONRY POOL, KING COUNTY, WASHINGTON,
W69-02827 02H

GROUND-WATER OCCURRENCE AND STRATIGRAPHY OF UNCONSOLIDATED DEPOSITS, CENTRAL PIERCE COUNTY, WASHINGTON,
W69-03081 02F

WASTE DISPOSAL
INVESTIGATION OF THE INFLUENCE OF WASTE DISPOSAL PRACTICES ON GROUNDWATER QUALITIES,
W69-03178 05B

WASTE WATER
WASTE WATER RENOVATION FOR REUSE KEY TO OPTIMUM USE OF WATER RESOURCES,
W69-02929 05D

WASTE WATER DISPOSAL
ROLE OF SOILS AND SEDIMENT IN WATER POLLUTION CONTROL--PART I, REACTIONS OF NITROGENOUS AND PHOSPHATIC COMPOUNDS WITH SOILS AND GEOLOGIC STRATA,
W69-03080 05E

THE HYDROLOGIC REGIME DUE TO SPRINKLER IRRIGATION OF TREATED MUNICIPAL EFFLUENT ON SLOPING LAND,
W69-03109 05G

WASTE WATER RECLAMATION
WASTE WATER RENOVATION FOR REUSE KEY TO OPTIMUM USE OF WATER RESOURCES,
W69-02929 05D

WASTE WATER TREATMENT
RECLAIMED WATER FOR INDUSTRY,
W69-02806 03E

WASTE WATER RENOVATION FOR REUSE KEY TO OPTIMUM USE OF WATER RESOURCES,
W69-02929 05D

REGIONAL MANAGEMENT OF WATER QUALITY - A SYSTEMS APPROACH,
W69-03146 05G

OPTIMAL WASTE TREATMENT AND POLLUTION ABATEMENT BENEFITS ON A CLOSED RIVER SYSTEM,
W69-03150 05D

WATER QUALITY ANALYSIS OF THE DELAWARE RIVER ESTUARY,
W69-03158 06A

WATER ALLOCATION
THE CALIFORNIA WATER PROJECT IS PUBLIC DECISION-MAKING BECOMING MORE EFFICIENT,
W69-02841 06B

WATER SHORTAGES AND PRICING,
W69-03135 06C

WATER ANALYSIS
COMPOSITION OF WATER DISCHARGED FROM BITUMINOUS COAL MINES IN NORTHERN WEST VIRGINIA,
W69-02804 05B

WATER CHEMISTRY
GRAPHICAL METHODS FOR STUDIES OF AQUEOUS ALUMINUM HYDROXIDE, FLUORIDE, AND SULFATE COMPLEXES,
W69-02834 01B

SEASONAL CHANGES OF SLOUGH AND LAKE WATER CHEMISTRY IN SOUTHERN SASKATCHEWAN (CANADA),
W69-02838 02H

LONG-TERM CHANGES IN WATER CHEMISTRY AND ABUNDANCE OF PLANKTON AT A SINGLE SAMPLING LOCATION IN LAKE ONTARIO,
W69-02958 02H

THE CHEMISTRY OF LAKE SEDIMENTS FROM INDIAN TIBET,
W69-02960 02H

WATER COLLECTION SYSTEMS
INFLUENCE OF SIDE SPILLING FLOW IN A COLLECTING CHANNEL,
W69-02945 08B

WATER CONTRACTS
BEAN V UNITED STATES (BENEFICIAL USE OF WATER GIVES NO VESTED RIGHT).
W69-03009 06E

WATER CONTROL
PROCESSES AND EXTENT OF EROSION AND ITS EFFECTS ON LAND USE IN THE CENTRAL LUNI BASIN, WESTERN RAJASTHAN,
W69-02987 02J

WATER COSTS
THE ECONOMIST'S ROLE IN WATER PRICING POLICY,
W69-02906 06C

WATER DEMAND
POPULATION GROWTH AND THE DEMAND FOR WATER,
W69-02962 06D

STATE WATER PLANNING GOALS AND ANALYTICAL APPROACHES,
W69-02963 06B

MARYLAND'S ROLE IN WATER RESOURCES DEVELOPMENT.
W69-03171 06B

WATER RESOURCES STUDY, COMPREHENSIVE PLANNING PROGRAM, JEFFERSON COUNTY.
W69-03174 06B

WATER DISTRIBUTION(APPLIED)
DESIGN OF OPTIMAL WATER DISTRIBUTION SYSTEMS,
W69-03165 06B

WATER INJURY
ATLANTIC CRUSHED COKE CO V UNITED STATES (FLOOD DAMAGE).
W69-02864 04A

ROSKIN BROS, INC V STATE (LIABILITY OF STATE FOR NEGLIGENT MAINTENANCE OF CULVERT).
W69-02992 04C

WATER LAW
BAKER V STATE (TEST FOR NAVIGABILITY OF WATERS).
W69-02892 06E

WATER LEVEL FLUCTUATIONS
GROUND-WATER WITHDRAWAL IN THE ODESSA AREA, ADAMS, GRANT, AND LINCOLN COUNTIES, WASHINGTON,
W69-02823 02F

GROWTH AND DECAY OF GROUNDWATER-MOUNDS IN RESPONSE TO UNIFORM PERCOLATION,
W69-03048 02F

HYDROLOGIC EFFECTS OF PUMPING FROM THE FLORIDAN AQUIFER IN NORTHWEST HILLSBOROUGH, NORTHEAST PINELLAS, AND SOUTHWEST PASCO COUNTIES, FLORIDA,
W69-03063 02F

WATER MANAGEMENT
ARKANSAS WATER RESOURCES SUPPLY, USE, AND RESEARCH NEEDS,
W69-03199 06B

WATER MANAGEMENT(APPLIED)
NEW TRENDS IN MANAGEMENT OF WATER RESOURCES PROJECTS,
W69-02944 06B

OPTIMAL GROUNDWATER MINING,
W69-03114 04B

SYSTEMS APPROACH TO WATER RESOURCE MANAGEMENT.
W69-03122 06A

WATER PIPES
INCRUSTATION IN WATER PIPELINES,
W69-02928 08G

WATER POLICY
WATER RESOURCES AND ECONOMIC DEVELOPMENT THE CHALLENGE TO

KNOWLEDGE,
W69-02964 06B

THE WATER-IS-DIFFERENT SYNDROME OR WHAT IS WRONG WITH THE WATER INDUSTRY,
W69-03137 06E

REGIONAL MANAGEMENT OF WATER QUALITY - A SYSTEMS APPROACH,
W69-03146 05G

TER POLLUTION
THE TEMPORAL AND SPATIAL DISTRIBUTION OF DISSOLVED OXYGEN IN STREAMS,
W69-02809 05A

DANIELS V BETHLEHEM MINES CORP (RIPARIAN EASEMENTS).
W69-02858 5G

CITY OF MURPHYSBORO V SANITARY WATER BOARD OF ILLINOIS (POLLUTION ABATEMENT).
W69-02869 05B

POLLUTION OF WATER ON LANDS USED FOR DAIRY PURPOSES.
W69-02893 05B

BUMBARGER V WALKER (CONTAMINATION OF SPRING BY MINE DRAINAGE).
W69-02901 05G

SPAUGH V CITY OF WINSTON-SALEM (DAMAGES FOR POLLUTION).
W69-03011 05B

NEWMAN V CITY OF EL DORADO SPRINGS (ACTION FOR POLLUTION CAUSED BY CITY'S SEWAGE SYSTEM).
W69-03039 05B

WATER POLLUTION RESEARCH 1967.
W69-03065 05G

ACCURACY OF DISCRETE MODELS USED TO PREDICT ESTUARY POLLUTION,
W69-03107 05B

ARKANSAS WATER RESOURCES SUPPLY, USE, AND RESEARCH NEEDS,
W69-03199 06B

TER POLLUTION CONTROL
ORDER TO DISCONTINUE POLLUTION OF WATERS.
W69-03032 06E

WATER POLLUTION RESEARCH 1967.
W69-03065 05G

OPTIMAL WASTE TREATMENT AND POLLUTION ABATEMENT BENEFITS ON A CLOSED RIVER SYSTEM,
W69-03150 05D

A PROPOSAL FOR A SYSTEMS ENGINEERING STUDY OF WATER POLLUTION ABATEMENT,
W69-03164 05G

TER POLLUTION EFFECTS
PRIMARY PRODUCTIVITY STUDIES IN ONONDAGA LAKE, NEW YORK,
W69-02959 05C

WATER POLLUTION RESEARCH 1967.
W69-03065 05G

TER POLLUTION SOURCES
PRIMARY PRODUCTIVITY STUDIES IN ONONDAGA LAKE, NEW YORK,
W69-02959 05C

BOARD OF HEALTH V CREW (STATE'S RIGHT TO ORDER WELL CLOSING).
W69-03024 05G

ORDER TO DISCONTINUE POLLUTION OF WATERS.
W69-03032 06E

WATER POLLUTION RESEARCH 1967.
W69-03065 05G

TER QUALITY
SYSTEMS APPROACH TO WATER QUALITY IN THE GREAT LAKES.
W69-03059 02H

SYSTEMS ANALYSIS AND SIMULATION IN WATER QUALITY MANAGEMENT,
W69-03161 05G

A STUDY IN THE ECONOMICS OF WATER QUALITY MANAGEMENT,
W69-03173 05G

INVESTIGATION OF THE INFLUENCE OF WASTE DISPOSAL PRACTICES ON GROUNDWATER QUALITIES,
W69-03178 05B

TER QUALITY CONTROL
APPLICATION OF THE TOWN OF WATERFORD (VALIDITY OF STREAM CLASSIFICATION).
W69-02990 05D

ACTIONS BY MUNICIPALITIES TO PREVENT DISCHARGE OF SEWAGE INTO WATERS.
W69-03031 05B

WATER QUALITY ANALYSIS OF THE DELAWARE RIVER ESTUARY,
W69-03158 06A

STREAM RESPONSES AND SYSTEM ANALYSIS IN WATER QUALITY MANAGEMENT,
W69-03159 06A

RESULTS FROM A SYSTEMS ANALYSIS APPROACH TO THE OPTIMUM CONTROL OF ESTUARINE WATER QUALITY,
W69-03162 05G

WATER REQUIREMENTS
DETERMINING CONSUMPTIVE USE FOR PLANNING WATER DEVELOPMENTS,
W69-02970 02I

INVESTIGATIONS ON THE IRRIGATION REQUIREMENTS OF HYBRID MAIZE CROP IN ARID REGION OF PUNJAB,
W69-02973 03F

THE LEONTIEF INPUT-OUTPUT SYSTEM AND ITS APPLICATION TO ANALYSIS AND PROJECTION FOR WATER RESOURCES PLANNING,
W69-03156 06A

WATER RESOURCE DEVELOPMENT
A FUNCTIONAL APPROACH TO PROBLEMS OF WATER RESOURCE DEVELOPMENT AND WATER USE,
W69-03134 06A

MARYLAND'S ROLE IN WATER RESOURCES DEVELOPMENT.
W69-03171 06B

WATER RESOURCE MANAGEMENT
BROAD HORIZONS IN WATER RESOURCE PLANNING AND INVESTMENT,
W69-02845 06B

FORMAL MODELS IN THE DESIGN OF WATER RESOURCE SYSTEMS,
W69-02846 06A

SIMILARITIES BETWEEN FLOOD CONTROL PROBLEMS AND OTHER ASPECTS OF WATER MANAGEMENT IN THE UNITED STATES,
W69-02848 06F

WATER RESOURCE PLANNING
FIELD LEVEL PLANNING OF WATER RESOURCE SYSTEMS,
W69-02843 06B

WATER RESOURCES
WATER RESOURCES RESEARCH ASPECTS OF A REGIONAL STUDY IN THE HUNTER VALLEY, NEW SOUTH WALES,
W69-02819 02E

AVAILABILITY OF GROUND WATER IN THE PARTS OF THE ARLINGTON AND WICKLIFFE SW QUADRANGLES IN JACKSON PURCHASE REGION, KENTUCKY,
W69-02822 02A

WATER RESOURCES OF THE MUSTINKA AND BOIS DE SIOUX RIVERS WATERSHED WEST-CENTRAL MINNESOTA,
W69-02829 02F

THE PERCHED WATER TABLE IN THE UPPER LIMESTONE AQUIFER OF MALTA,
W69-02833 02F

THE NATION'S WATER RESOURCES SUMMARY REPORT.
W69-02953 06B

RIVER IMPROVEMENT DISTRICTS.
W69-03027 06E

HYDROLOGIC EFFECTS OF PUMPING FROM THE FLORIDAN AQUIFER IN NORTHWEST HILLSBOROUGH, NORTHEAST PINELLAS, AND SOUTHWEST PASCO COUNTIES, FLORIDA,
W69-03063 02F

GROUND-WATER OCCURRENCE AND STRATIGRAPHY OF UNCONSOLIDATED DEPOSITS, CENTRAL PIERCE COUNTY, WASHINGTON,
W69-03081 02F

GROUNDWATER FAVORABILITY AREAS AND SURFICIAL GEOLOGY OF THE LOWER ANDROSCOGGIN RIVER BASIN, MAINE,
W69-03099 02F

HYDROLOGY AND WATER RESOURCES OF THE HOUSATONIC RIVER BASIN, MASSACHUSETTS,
W69-03101 02A

SYSTEMS APPROACH TO WATER RESOURCE MANAGEMENT.
W69-03122 06A

WATER RESOURCES DEVELOPMENT
OPPORTUNITIES FOR REGIONAL RESEARCH ON WATER RESOURCES PROBLEMS.
W69-02872 06B

ANALYSIS OF WATER AND WATER-RELATED RESEARCH REQUIREMENTS IN THE GREAT LAKES REGION.
W69-03079 07A

THE LEONTIEF INPUT-OUTPUT SYSTEM AND ITS APPLICATION TO ANALYSIS AND PROJECTION FOR WATER RESOURCES PLANNING,
W69-03156 06A

THE INTERINDUSTRY WATER CONTENT MATRIX APPLICATIONS ON A MULTIREGIONAL BASIS,
W69-03157 06A

RESEARCH ON COMPREHENSIVE PLANNING OF WATER-RESOURCE SYSTEMS SYMPOSIUM,
W69-03166 06B

SOME PHYSICAL, TECHNOLOGICAL, AND ECONOMIC CHARACTERISTICS OF WATER AND WATER RESOURCE SYSTEMS IMPLICATIONS FOR ADMINISTRATION,
W69-03167 06B

WATER RESOURCES MANAGEMENT IN MARYLAND.

W69-03170 06B

WATER RESOURCES STUDY, COMPREHENSIVE PLANNING PROGRAM, JEFFERSON COUNTY.
W69-03174 06B

SIMULATION OF REGIONAL ECONOMIC IMPACTS OF WATER RESOURCE DEVELOPMENT,
W69-03176 06B

WATER RESOURCES MANAGEMENT
MODERN MANAGEMENT TECHNIQUES,
W69-02954 06B

WATER RESOURCES SYSTEM
SOME PHYSICAL, TECHNOLOGICAL, AND ECONOMIC CHARACTERISTICS OF WATER AND WATER RESOURCE SYSTEMS IMPLICATIONS FOR ADMINISTRATION,
W69-03167 06B

WATER REUSE
RECLAIMED WATER FOR INDUSTRY,
W69-02806 03E

WASTE WATER RENOVATION FOR REUSE KEY TO OPTIMUM USE OF WATER RESOURCES,
W69-02929 05D

WATER RIGHTS
BEAN V UNITED STATES (BENEFICIAL USE OF WATER GIVES NO VESTED RIGHT).
W69-03009 06E

DUNCAN V GHEEN (ENFORCEMENT OF EASEMENT GRANTING RIGHT TO SPRING WATER).
W69-03023 04B

WATER SKIING
FLORIO V STATE (WATER SKIING NUISANCE).
W69-02903 06E

WATER SUPPLIES
ARKANSAS WATER RESOURCES SUPPLY, USE, AND RESEARCH NEEDS,
W69-03199 06B

WATER SUPPLY
STATE V LANZA (EMINENT DOMAIN).
W69-02860 06E

STATE V CITY OF DEFIANCE (CONSTITUTIONALITY OF STATUTE REQUIRING CITIES TO FURNISH OUTSIDERS WITH WATER).
W69-03035 04A

BOARD OF SUPERVISORS OF LOUDOUN CITY V TOWN OF FAIRFAX (APPLICATION TO ERECT DAM FOR MUNICIPAL WATER SUPPLY).
W69-03036 04A

WATER UTILIZATION
RECLAIMED WATER FOR INDUSTRY,
W69-02806 03E

GROUND-WATER WITHDRAWAL IN THE ODESSA AREA, ADAMS, GRANT, AND LINCOLN COUNTIES, WASHINGTON,
W69-02823 02F

ESTIMATED USE OF WATER IN THE UNITED STATES, 1965,
W69-02840 06B

IVANHOE IRRIGATION DIST V MCCRACKEN.
W69-02896 06E

ARKANSAS WATER RESOURCES SUPPLY, USE, AND RESEARCH NEEDS,
W69-03199 06B

WATER VAPOR
AN ELECTRIC HYGROMETER APPARATUS FOR MEASURING WATER-VAPOUR LOSS FROM PLANTS IN THE FIELD,
W69-02968 02D

WATER WELLS
MENNE V CITY OF FOND DU LAC (RIGHT OF WATER REMOVAL TO NON-CONTIGUOUS LANDS).
W69-02855 04B

RADIUS OF INFLUENCE OF A WELL,
W69-02946 02F

DEPLETION OF FLOW IN RIGHT-ANGLE STREAM BENDS BY STEADY WELLS,
W69-03094 02A

WATER YIELD
RADIUS OF INFLUENCE OF A WELL,
W69-02946 02F

GROUNDWATER FAVORABILITY AREAS AND SURFICIAL GEOLOGY OF THE LOWER ANDROSCOGGIN RIVER BASIN, MAINE,
W69-03099 02F

WATERSHEDS
REVIEW AND ANALYSIS OF RAINFALL AND RUNOFF DATA FOR SELECTED WATERSHEDS IN MINNESOTA,
W69-03098 02A

WATERSHEDS(BASINS)
APPLICATION OF THE GRAVITY SURVEY METHOD TO WATERSHED HYDROLOGY,
W69-02982 04D

EFFECTS OF CLIMATOLOGIC AND BASIN CHARACTERISTICS ON ANNUAL RUNOFF,
W69-03055 02A

SEDIMENTATION IN THE PIRU CREEK WATERSHED SOUTHERN CALIFORNIA,
W69-03084 02J

HYDROLOGY AND WATER RESOURCES OF THE HOUSATONIC RIVER BASIN, MASSACHUSETTS,
W69-03101 02A

WATERSHED(BASINS)
MOMENTS OF THE INPUT, OUTPUT, AND IMPULSE RESPONSE FUNCTIONS OF LINEAR SYSTEMS ABOUT ARBITRARY POINTS,
W69-03089 02A

WEATHER FORECASTING
BENEFIT-COST ANALYSIS AND THE NATIONAL OCEANOGRAPHIC PROGRAM,
W69-03126 06B

WEATHER MODIFICATION
CONTROL LEVELS FOR QUANTITATIVE EVALUATION OF WEATHER MODIFICATION ATTAINMENTS,
W69-03113 02A

WELFARE ECONOMICS
WHAT IS PRODUCER'S SURPLUS,
W69-03133 06B

WELL REGULATIONS
LEAVING UNUSED WELL OPEN AND EXPOSED.
W69-03002 06E

WELLS
RADIUS OF INFLUENCE OF A WELL,
W69-02946 02F

ELECTRIC-ANALOG AND DIGITAL-COMPUTER MODEL ANALYSIS OF STREAM DEPLETION BY WELLS,
W69-02976 02F

LEAVING UNUSED WELL OPEN AND EXPOSED.
W69-03002 06E

WEST VIRGINIA
STATE V SIMS (ACTION TO COMPEL PAYMENT OUT OF ALLOCATED FUNDS FOR FLOOD DAMAGE CAUSED BY A STATE AGENCY).
W69-02881 04C

WIND
A NOTE CONCERNING THE EDDY TRANSFER COEFFICIENTS OF MOMENTUM AND WATER VAPOR UNDER NEAR-ADIABATIC CONDITIONS,
W69-03051 02D

WIND EROSION
PROCESSES AND EXTENT OF EROSION AND ITS EFFECTS ON LAND USE IN THE CENTRAL LUNI BASIN, WESTERN RAJASTHAN,
W69-02987 02J

WISCONSIN
MENNE V CITY OF FOND DU LAC (RIGHT OF WATER REMOVAL TO NON-CONTIGUOUS LANDS).
W69-02855 04B

EICKSTEDT V SEIFERT (NEGLIGENCE IN DRAINING ARTIFICIAL RESERVOIR).
W69-02856 04A

BINO V CITY OF HURLEY (CONSTITUTIONALITY OF ORDINANCE DENYING RIPARIAN RIGHTS WITHOUT COMPENSATION).
W69-03021 04A

CITY OF MADISON V STATE (PUBLIC BUILDINGS ON FILLED LAKE LAND).
W69-03022 04C

WITHDRAWAL
ELECTRIC-ANALOG AND DIGITAL-COMPUTER MODEL ANALYSIS OF STREAM DEPLETION BY WELLS,
W69-02976 02F

WORKABILITY
STRENGTH, DURABILITY, AND SHRINKAGE OF INCOMPLETELY COMPACTED CONCRETE,
W69-02931 08F

YUGOSLAVIA
SUSPENDED LOAD RESEARCH,
W69-03062 02J

AUTHOR INDEX

AMS, JOHN I.
COMPARISON OF FIELD AND LABORATORY MEASUREMENTS OF MODULUS OF DEFORMATION OF A CLAY,
W69-02933 08D

AMS, WILLIAM M.
AN ELECTRICAL RESISTIVITY PROFILE FROM MAHUKONA TO KAWAIHAE, HAWAII,
W69-03184 06A

LRED, E. R.
SOME ASPECTS OF THE HYDROLOGY OF PONDS AND SMALL LAKES,
W69-03091 02H

AD, M. T.
PREDICTING DISSOLVED OXYGEN CONCENTRATION IN A LAKE COVERED WITH EVAPORATION SUPPRESSANT,
W69-02825 02D

IN, MOHAMMAD
SAFETY FACTORS AND PROBABILITY IN STRUCTURAL DESIGN,
W69-02941 08A

DERSON, D. V.
OPTIMAL GROUNDWATER MINING,
W69-03114 04B

DERSON, H. WALTER
STRUCTURAL DESIGN--GRAND COULEE THIRD POWERPLANT,
W69-02939 08A

DERSON, JOHN R.
INVESTIGATION OF THE INFLUENCE OF WASTE DISPOSAL PRACTICES ON GROUNDWATER QUALITIES,
W69-03178 05B

DERSON, MELVIN W.
REGIONAL MANAGEMENT OF WATER QUALITY - A SYSTEMS APPROACH,
W69-03146 05G

G, ALFREDO H. S.
SAFETY FACTORS AND PROBABILITY IN STRUCTURAL DESIGN,
W69-02941 08A

DERN, F. L.
MODERN MANAGEMENT TECHNIQUES,
W69-02954 06B

MBRUST, D. V.
EVALUATION OF ZINGG CONSERVATION BENCH TERRACES ON AMARILLO FINE SANDY LOAM SOIL.
W69-02971 02E

MER, G. S. T.
THE THEORY OF THE STRIP METHOD FOR DESIGN OF SLABS,
W69-02918 08F

ULTIMATE LOAD TESTS OF SLABS DESIGNED BY THE STRIP METHOD,
W69-02919 08F

SCHNER, F. S.
OPTIMIZATION AND RANGE OF APPLICATION OF NUCLEAR REACTORS AND FLASH EVAPORATORS FOR SEA WATER DESALINATION,
W69-03147 03A

AILEY, GEORGE W.
ROLE OF SOILS AND SEDIMENT IN WATER POLLUTION CONTROL--PART I, REACTIONS OF NITROGENOUS AND PHOSPHATIC COMPOUNDS WITH SOILS AND GEOLOGIC STRATA,
W69-03080 05E

AKER, JOHN H.
ADSORPTION OF PESTICIDES ON EARTH MATERIALS,
W69-03192 05G

ALL, ROBERT C.
FERTILIZATION OF NATURAL LAKES IN MICHIGAN,
W69-02957 02H

ALL, R. C.
AN EVALUATION OF ARTIFICIAL SUBSTRATES FOR MEASURING PERIPHYTON PRODUCTION,
W69-02955 05C

ARR, DAVID I. H.
SIMILITUDE THEORY APPLIED TO CORRELATION OF FLUME SEDIMENT TRANSPORT DATA,
W69-03095 02J

ARR, D. I. H.
OPTIMIZATION OF PRESSURE CONDUIT SIZES,
W69-03148 08B

ARTHOLIC, JON F.
EFFECTS OF A MONOLAYER ON RESERVOIR TEMPERATURE AND EVAPORATION,
W69-03054 03B

AUMANN, E. ROBERT
MATHEMATICAL MODELS FOR EXPRESSING THE BIOCHEMICAL OXYGEN DEMAND IN WATER QUALITY STUDIES,
W69-03138 05G

AUMGARDNER, M. F.
APPLICABILITY OF REMOTE SENSING AND SYSTEMS ANALYSIS TECHNIQUES TO RIVER BASIN PLANNING,
W69-03145 06A

BAYER, M. B.
OPTIMAL WASTE TREATMENT AND POLLUTION ABATEMENT BENEFITS ON A CLOSED RIVER SYSTEM,
W69-03150 05D

BEAZLEY, RONALD
CONSERVATION DECISION-MAKING A RATIONALIZATION,
W69-03127 04C

BEEDLE, LYNN S.
RECENT DEVELOPMENTS IN PLASTIC DESIGN PRACTICE,
W69-02942 08G

BEHL, N. K.
INVESTIGATIONS ON THE IRRIGATION REQUIREMENTS OF HYBRID MAIZE CROP IN ARID REGION OF PUNJAB,
W69-02973 03F

BELLPORT, B. P.
NEW TRENDS IN MANAGEMENT OF WATER RESOURCES PROJECTS,
W69-02944 06B

BENOIT, ROBERT E.
EVALUATION OF THE EFFECT OF TRACE ELEMENTS ON THE ACTIVITY OF MICROORGANISMS,
W69-03196 05C

BENSON, MANUEL A.
METHODS OF FLOW FREQUENCY ANALYSIS,
W69-03102 02E

BENZ, L. C.
NEUTRON MOISTURE METER CALIBRATION FOR USE IN SALINE SOILS,
W69-02965 02G

BESSLER, M. B.
EVALUATION OF SPACERS FOR BUNDLED CONDUCTOR TRANSMISSION LINES,
W69-02943 08C

BETSON, ROGER P.
ANALYTICALLY DERIVED UNIT GRAPH AND RUNOFF,
W69-03069 02A

BETSON, R. P.
DETECTION OF SATURATED INTERFLOW IN SOILS WITH PIEZOMETERS,
W69-03074 07B

BEVAN, DONALD E.
WATER QUALITY AS RELATED TO THE SURVIVAL OF SALMON EGGS AND LARVAE,
W69-03190 05C

STUDIES OF JUVENILE SALMON IN THE NOOKSACK RIVER SYSTEM AND BELLINGHAM BAY,
W69-03191 05C

BHAN, SURAJ
GERMINATION IN LOWER OSMOTIC POTENTIAL AS AN INDEX OF DROUGHT RESISTANCE IN CROP PLANTS - A REVIEW,
W69-02984 02I

BIAREZ, J.
EQUILIBRIUM LIMITS OF EMBANKMENTS AND EARTH DAMS,
W69-02949 08D

BIDWELL, L. E.
WATER RESOURCES OF THE MUSTINKA AND BOIS DE SIOUX RIVERS WATERSHED WEST-CENTRAL MINNESOTA,
W69-02829 02F

BLANEY, HARRY F., SR.
DETERMINING CONSUMPTIVE USE FOR PLANNING WATER DEVELOPMENTS,
W69-02970 02I

BLOOMSBURG, G. L.
MOVEMENT OF WATER FROM CANALS TO GROUNDWATER TABLE,
W69-03179 02G

BONEH, A.
MOMENTS OF THE INPUT, OUTPUT, AND IMPULSE RESPONSE FUNCTIONS OF LINEAR SYSTEMS ABOUT ARBITRARY POINTS,
W69-03089 02A

BOOTH, ALFRED W.
SOCIAL IMPACT OF METEOROLOGICAL DROUGHT IN ILLINOIS,
W69-03193 02B

BORELI, MLADEN
RADIUS OF INFLUENCE OF A WELL,
W69-02946 02F

BOWERS, C. EDWARD
REVIEW AND ANALYSIS OF RAINFALL AND RUNOFF DATA FOR SELECTED WATERSHEDS IN MINNESOTA,
W69-03098 02A

BOWER, BLAIR T.
SOME PHYSICAL, TECHNOLOGICAL, AND ECONOMIC CHARACTERISTICS OF WATER AND WATER RESOURCE SYSTEMS IMPLICATIONS FOR ADMINISTRATION,
W69-03167 06B

BRATER, E. F.
STEPS TOWARD A BETTER UNDERSTANDING OF URBAN RUNOFF PROGRESS,

W69-03097 04C

BREDEHOEFT, JOHN D.
RESPONSE OF A FINITE-DIAMETER WELL TO AN INSTANTANEOUS CHARGE OF WATER,
W69-03057 02F

BROCKWAY, C. E.
MOVEMENT OF WATER FROM CANALS TO GROUNDWATER TABLE,
W69-03179 02G

BROECKER, WALLACE
CHEMICAL AND ISOTOPIC BALANCES FOR A MEROMICTIC LAKE,
W69-03088 02H

BROWN, GARDNER, JR.
THE CALIFORNIA WATER PROJECT IS PUBLIC DECISION-MAKING BECOMING MORE EFFICIENT,
W69-02841 06B

BRUCE, WILLIAM E.
HORIZONTAL BORING TECHNOLOGY A STATE-OF-THE-ART-STUDY,
W69-02923 08C

BRUTSAERT, WILFRIED
THE INITIAL PHASE OF THE RISING HYDROGRAPH OF TURBULENT FREE SURFACE FLOW WITH UNSTEADY LATERAL INFLOW,
W69-02837 02E

BUCHANAN, JAMES M.
EXTERNALITY,
W69-03132 06B

BUNTING, DEWEY L.
THE PRODUCTIVITY OF A LAKE POLLUTED BY ORGANIC WASTES DERIVED PRIMARILY FROM SEPTIC TANKS,
W69-03182 05C

BUOL, S. W.
HYDRAULIC AND MICROMORPHOLOGICAL PROPERTIES OF STREAM CHANNEL SEDIMENTS,
W69-03108 02J

BUROV, A. S.
INFLUENCE OF THE FOREST ON PRECIPITATION,
W69-02803 02B

BUTCHER, WILLIAM S.
OPTIMIZATION OF THE OPERATION OF A MULTIPURPOSE RESERVOIR BY DYNAMIC PROGRAMMING,
W69-02842 06A

CADY, P. D.
A SYSTEMS APPROACH TO ANALYSIS OF HARDENED CONCRETE,
W69-02909 08F

CAIRNS, JOHN, JR.
ACTIVITY PATTERNS OF FISH EXPOSED TO TOXIC MATERIAL,
W69-03194 05C

CARY, J. W.
SOIL-WATER MOVEMENT IN VAPOUR AND LIQUID PHASES,
W69-02966 02G

CASE, C. M.
OPTIMAL GROUNDWATER MINING,
W69-03114 04B

CHAKRAVARTY, A. K.
GERMINATION OF PROMISING DESERT GRASS SEEDS UNDER DIFFERENT DEPTHS OF SOWING IN SANDY SOIL,
W69-02972 02G

CHANG, WILLIAM C. F.
FLOODS IN WAIMANALO AREA, OAHU, HAWAII,
W69-02818 02E

CHATTERJI, P. C.
HYDRO-GEOLOGY OF QUATERNARY FORMATION FROM RIVER LUNI AND ITS TRIBUTARIES CATCHMENT.
W69-02983 02F

CHEATHAM, J. B., JR.
ROCK BREAKAGE BY CRUSHING, BLASTING, AND DRILLING,
W69-02920 08E

CHRISTENSEN, P.
FURROW SIZE, PLACEMENT, AND GRASS CULTURE EFFECTS ON VINEYARD IRRIGATION,
W69-02978 03F

CIRIACY-WANTRUP, S. V.
WATER RESOURCES AND ECONOMIC DEVELOPMENT THE CHALLENGE TO KNOWLEDGE,
W69-02964 06B

CLOUGH, DONALD J.
OPTIMAL WASTE TREATMENT AND POLLUTION ABATEMENT BENEFITS ON A CLOSED RIVER SYSTEM,
W69-03150 05D

COHEN, J. B.
TRACER MEASUREMENT OF STREAM REAERATION. II. FIELD STUDIES,
W69-02821 02E

COMER, G. H.
LOW-FLOW AND BASIN CHARACTERISTICS OF TWO STREAMS IN NORTHERN VERMONT,
W69-02814 02A

CONWAY, CLARENCE M.
POPULATION GROWTH AND THE DEMAND FOR WATER,
W69-02962 06D

COOPER, ARTHUR W.
COLOR-INFRARED AERIAL PHOTOGRAPHIC INTERPRETATION AND NET PRIMARY PRODUCTIVITY OF A REGULARLY-FLOODED NORTH CAROLINA SALT MARSH,
W69-03177 02I

COOPER, CHARLES F.
RAINFALL INTENSITY AND ELEVATION IN SOUTHWESTERN IDAHO,
W69-03087 02B

COOPER, HILTON H., JR.
DRAWDOWN IN A WELL OF LARGE DIAMETER,
W69-03049 02F

RESPONSE OF A FINITE-DIAMETER WELL TO AN INSTANTANEOUS CHARGE OF WATER,
W69-03057 02F

CORBETT, ROBERT G.
COMPOSITION OF WATER DISCHARGED FROM BITUMINOUS COAL MINES IN NORTHERN WEST VIRGINIA,
W69-02804 05B

COREY, JOHN C.
MOVEMENT OF WATER TAGGED WITH (2)H, (3)H, AND (18)O THROUGH ACIDIC KAOLINITIC SOIL,
W69-03073 02G

COURCHAINE, ROBERT J.
SIGNIFICANCE OF NITRIFICATION IN STREAM ANALYSIS--EFFECTS O THE OXYGEN BALANCE,
W69-03077 05B

CRAINE, LYLE E.
THE MUSKINGUM WATERSHED CONSERVANCY DISTRICT A STUDY OF LOCAL CONTROL,
W69-02852 06E

CRIDDLE, WAYNE D.
DETERMINING CONSUMPTIVE USE FOR PLANNING WATER DEVELOPMENT
W69-02970 02I

CRUTCHFIELD, JAMES A.
BENEFIT-COST ANALYSIS AND THE NATIONAL OCEANOGRAPHIC PROGRAM,
W69-03126 06B

DASGUPTA, SATADAL
LOCAL PARTICIPATION AND WATERSHED DEVELOPMENT A COMPARATIVE STUDY OF TWO COMMUNITIES,
W69-03139 06B

DAVIS, H. CRAIG
THE INTERINDUSTRY WATER CONTENT MATRIX APPLICATIONS ON A MULTIREGIONAL BASIS,
W69-03157 06A

DAVIS, R. W.
AVAILABILITY OF GROUND WATER IN THE PARTS OF THE ARLINGTO AND WICKLIFFE SW QUADRANGLES IN JACKSON PURCHASE REGION, KENTUCKY,
W69-02822 02A

DAY, H. J.
REGIONAL MANAGEMENT OF WATER QUALITY - A SYSTEMS APPROACH
W69-03146 05G

DENIS, L. P.
FLOOD OF AUGUST 1966 AT CARLSBAD, NEW MEXICO,
W69-02820 02E

DIAMOND, PETER
THE OPPORTUNITY COSTS OF PUBLIC INVESTMENT COMMENT,
W69-03125 06B

DICKINSON, W. T.
AN EXPERIMENTAL RAINFALL-RUNOFF FACILITY,
W69-03076 02A

DISKIN, M. H.
MOMENTS OF THE INPUT, OUTPUT, AND IMPULSE RESPONSE FUNCTI OF LINEAR SYSTEMS ABOUT ARBITRARY POINTS,
W69-03089 02A

A LAPLACE TRANSFORM PROOF OF THE THEOREM OF MOMENTS FOR T INSTANTANEOUS UNIT HYDROGRAPH,
W69-03120 06A

DITORO, DOMINIC M.
WATER QUALITY ANALYSIS OF THE DELAWARE RIVER ESTUARY,
W69-03158 06A

DOMENICO, P. A.
OPTIMAL GROUNDWATER MINING,
W69-03114 04B

DONALDSON, DONALD
PONTACYL BRILLIANT PINK AS A TRACER DYE IN THE MOVEMENT WATER IN PHREATOPHYTES,
W69-03047 02I

DONEEN, L.
FURROW SIZE, PLACEMENT, AND GRASS CULTURE EFFECTS ON VINEYARD IRRIGATION,
W69-02978 03F

DORDEVIC, BRANISLAV

SUSPENDED LOAD RESEARCH,
W69-03062 02J

DORFMAN, ROBERT
FORMAL MODELS IN THE DESIGN OF WATER RESOURCE SYSTEMS,
W69-02846 06A

DORNBUSH, JAMES N.
INVESTIGATION OF THE INFLUENCE OF WASTE DISPOSAL PRACTICES ON GROUNDWATER QUALITIES,
W69-03178 05B

DOUGAL, MERWIN D.
MATHEMATICAL MODELS FOR EXPRESSING THE BIOCHEMICAL OXYGEN DEMAND IN WATER QUALITY STUDIES,
W69-03138 05G

DOUGLAS, JAMES L.
ECONOMIC ANALYSIS OF ALTERNATIVE FLOOD CONTROL MEASURES,
W69-03111 04A

DREWRY, WILLIAM A.
VIRUS MOVEMENT IN GROUNDWATER,
W69-02824 05B

DUFFAUT, P.
POSSIBILITIES AND LIMITATIONS OF GEOPHYSICAL METHODS APPLIED TO CIVIL ENGINEERING,
W69-02916 08E

DUNCAN, C. C.
CHAPARRAL FIRES CHANGE SOIL MOISTURE DEPLETION PATTERNS,
W69-02979 02G

DUNN, ROBERT M., JR.
PROBLEMS OF BIAS IN INPUT PRICING FOR BENEFIT COST ANALYSIS A REPLY,
W69-03128 06B

DUTT, GORDON R.
TRACE AND TRACER ELEMENTS IN GROUND WATER,
W69-03197 02F

D'APPOLONIA, E.
DYNAMIC LOADINGS,
W69-02908 08D

LOAD TRANSFER--BEARING CAPACITY FOR SINGLE PILES AND PILE CLUSTERS,
W69-02922 08D

DENSIFICATION OF GRANULAR SOILS BY VIBRATIONS,
W69-02935 08D

ELIASSEN, ROLF
VIRUS MOVEMENT IN GROUNDWATER,
W69-02824 05B

ELNAGGAR, HAMEED
UNSTEADY SEEPAGE FLOW BETWEEN FULLY-PENETRATING TRENCHES,
W69-02913 02G

ELRICK, D. E.
MISCIBLE DISPLACEMENT IN AN UNSATURATED GLASS BEAD MEDIUM,
W69-02810 02G

EMMETT, WILLIAM W.
THE HYDRAULICS OF OVERLAND FLOW ON HILLSLOPES,
W69-03110 02E

ESCOHBUE, AUSTIN
OPTIMIZATION OF THE OPERATION OF A MULTIPURPOSE RESERVOIR BY DYNAMIC PROGRAMMING,
W69-02842 06A

ETTER, ROBERT J.
DEPOSITIONAL BEHAVIOR OF KAOLINITE IN TURBULENT FLOW,
W69-03067 02J

EVANS, ROBERT
A CONTRIBUTION TO THE THEORY OF THERMO-ECONOMICS,
W69-03131 06C

EVERITT, BEN L.
USE OF THE COTTONWOOD IN AN INVESTIGATION OF THE RECENT HISTORY OF A FLOOD PLAIN,
W69-02836 02J

EYE, J. DAVID
AQUEOUS TRANSPORT OF DIELDRIN RESIDUES IN SOILS,
W69-02801 05B

FALKSON, LOUIS MICHAEL
WATER SHORTAGES AND PRICING,
W69-03135 06C

FARNSWORTH, R. K.
UNITED STATES TRITIUM RAINOUT AND ITS HYDROLOGIC IMPLICATIONS,
W69-03121 02B

FARRELL, DONALD F.
HYDROLOGY AND WATER RESOURCES OF THE HOUSATONIC RIVER BASIN, MASSACHUSETTS,
W69-03101 02A

FEDERER, C. A.
RADIATION AND SNOWMELT ON A CLEARCUT WATERSHED,
W69-03078 02C

FEDOROV, S. F.
INFLUENCE OF THE FOREST ON PRECIPITATION,
W69-02803 02B

FENWICK, R. C.
MECHANISMS OF SHEAR RESISTANCE OF CONCRETE BEAMS,
W69-02927 08F

FIERING, MYRON B.
SCHEMES FOR HANDLING INCONSISTENT MATRICES,
W69-03117 07C

FITCH, WILLIAM N.
DESIGN SENSITIVITY OF POLLUTION CONTROL RESERVOIRS,
W69-03163 05G

FITZGERALD, GEORGE P.
NUTRIENT SOURCES FOR ALGAE AND AQUATIC WEEDS,
W69-03185 05B

FIELD AND LABORATORY EVALUATIONS OF BIOASSAYS FOR NITROGEN AND PHOSPHORUS WITH ALGAE AND AQUATIC WEEDS,
W69-03186 05A

SOME FACTORS IN THE COMPETITION OR ANTAGONISM BETWEEN BACTERIA, ALGAE, AND AQUATIC WEEDS,
W69-03188 05C

FLIPPO, H. N., JR.
LOW STREAMFLOW IN THE MYAKKA RIVER BASIN AREA IN FLORIDA,
W69-02808 02E

GADISH, Y.
DESIGN OF OPTIMAL WATER DISTRIBUTION SYSTEMS,
W69-03165 06B

GALE, J.
ANTI-TRANSPIRANTS AS A RESEARCH TOOL FOR THE STUDY OF THE EFFECTS OF WATER STRESS ON PLANT BEHAVIOUR,
W69-02986 03F

GARDNER, DELWORTH B.
STATE WATER PLANNING GOALS AND ANALYTICAL APPROACHES,
W69-02963 06B

GARRETT, A. A.
GROUND-WATER WITHDRAWAL IN THE ODESSA AREA, ADAMS, GRANT, AND LINCOLN COUNTIES, WASHINGTON,
W69-02823 02F

EVALUATION OF SEEPAGE FROM CHESTER MORSE LAKE AND MASONRY POOL, KING COUNTY, WASHINGTON,
W69-02827 02H

GARRISON, CHARLES L.
THE DYNAMICS OF PUBLIC ROLES IN THE SELECTION OF REVENUE SOURCES IN LOCAL WATER ADMINISTRATION,
W69-02847 06B

GEMMELL, ROBERT S.
SIMULATION OF FLOOD FLOW DIVERSION FROM A LAKE SYSTEM,
W69-03143 04A

GHOSE, B.
PROCESSES AND EXTENT OF EROSION AND ITS EFFECTS ON LAND USE IN THE CENTRAL LUNI BASIN, WESTERN RAJASTHAN,
W69-02987 02J

GLEZIN, M. D.
PRELIMINARY SECTION OF SHAPE IN THE DESIGN OF CELLULAR DAMS,
W69-02917 08A

GLUECKSTERN, P.
OPTIMIZATION AND RANGE OF APPLICATION OF NUCLEAR REACTORS AND FLASH EVAPORATORS FOR SEA WATER DESALINATION,
W69-03147 03A

GOODIN, J. R.
CHAPARRAL FIRES CHANGE SOIL MOISTURE DEPLETION PATTERNS,
W69-02979 02G

GREENFIELD, B. J.
EVALUATION OF DEEP IN-SITU SOIL STABILIZATION BY HIGH-PRESSURE LIME-SLURRY INJECTION,
W69-02930 08D

GREEN, CHRISTINE B.
AN EVALUATION OF PRECIPITATION, VEGETATION AND RELATED FACTORS ON THE SANTA RITA EXPERIMENTAL RANGE,
W69-02989 02B

GREEN, RALPH F.
ANALYTICALLY DERIVED UNIT GRAPH AND RUNOFF,
W69-03069 02A

GRIEVE, B. J.
AN ELECTRIC HYGROMETER APPARATUS FOR MEASURING WATER-VAPOUR LOSS FROM PLANTS IN THE FIELD,
W69-02968 02D

GRIVNIN, YU A.
CAVITATION TESTS OF A MODEL OF THE RADIAL GATE OF THE BOTTOM OUTLET OF THE KRASNOYARSK HYDROELECTRIC STATION DAM,
W69-02914 08C

GROWITZ, DOUGLAS J.
COMPOSITION OF WATER DISCHARGED FROM BITUMINOUS COAL MINES IN NORTHERN WEST VIRGINIA,
W69-02804 05B

GRUJIC, LJUBOMIR
SOIL STUDY FOR WATER ECONOMICS,

W69-03042 02G

GUY, H. P.
MEASUREMENT OF HYDRAULIC AND SEDIMENT TRANSPORT VARIABLES IN A SMALL RECIRCULATING FLUME,
W69-03056 02J

HAAS, H. J.
EFFECTS OF MOISTURE AND NITROGEN FERTILIZER ON GROWTH AND WATER USE BY NATIVE GRASS,
W69-02969 02I

HACKETT, JAMES E.
WATER RESOURCE MANAGEMENT IN MT. PROSPECT A SURVEY OF THE ENVIRONMENT, PROBLEMS, AND OPPORTUNITIES,
W69-03168 06B

HADLEY, RICHARD F.
RUNOFF AND HILLSLOPE EROSION RESULTING FROM A HIGH-INTENSITY THUNDERSTORM NEAR MACK, WESTERN COLORADO,
W69-03052 02A

HAGAN, R. M.
SOIL WATER FLUX BELOW A RYEGRASS ROOT ZONE,
W69-02975 02G

HAJDIN, GEORGIJE
INFLUENCE OF SIDE SPILLING FLOW IN A COLLECTING CHANNEL,
W69-02945 08B

HALL, J. W.
EVALUATION OF VIBRATORY ROLLERS ON THREE TYPES OF SOILS,
W69-02915 08D

HALL, WARREN A.
OPTIMIZATION OF THE OPERATION OF A MULTIPURPOSE RESERVOIR BY DYNAMIC PROGRAMMING,
W69-02842 06A

HAMILTON, HENRY R.
COMPUTER SIMULATION MODELS FOR RIVER-BASIN ANALYSIS AND PLANNING,
W69-03153 06B

HAMILTON, LAWRENCE S.
RECREATIONAL USE OF MUNICIPAL RESERVOIRS,
W69-03136 06B

HANNA, THOMAS H.
COMPARISON OF FIELD AND LABORATORY MEASUREMENTS OF MODULUS OF DEFORMATION OF A CLAY,
W69-02933 08D

HANTUSH, MAHDI S.
GROWTH AND DECAY OF GROUNDWATER-MOUNDS IN RESPONSE TO UNIFORM PERCOLATION,
W69-03048 02F

DEPLETION OF FLOW IN RIGHT-ANGLE STREAM BENDS BY STEADY WELLS,
W69-03094 02A

HARBECK, G. EARL, JR.
A NOTE CONCERNING THE EDDY TRANSFER COEFFICIENTS OF MOMENTUM AND WATER VAPOR UNDER NEAR-ADIABATIC CONDITIONS,
W69-03051 02D

HARRIS, WILLIAM H.
STRATIFICATION OF FRESH AND SALT WATER ON BARRIER ISLANDS AS A RESULT OF DIFFERENCES IN SEDIMENT PERMEABILITY,
W69-03058 02F

HARTER, ROBERT D.
ADSORPTION OF PHOSPHORUS BY LAKE SEDIMENT,
W69-03075 02H

HASLER, ARTHUR D.
DWINDLING LAKES,
W69-02956 02H

HAUPT, HAROLD F.
INFILTRATION, OVERLAND FLOW, AND SOIL MOVEMENT ON FROZEN AND SNOW-COVERED PLOTS,
W69-03060 02A

HAYNIE, R. M.
DESIGN OF STABLE CHANNELS IN ALLUVIAL MATERIALS,
W69-03066 08B

HEATON, B. S.
STRENGTH, DURABILITY, AND SHRINKAGE OF INCOMPLETELY COMPACTED CONCRETE,
W69-02931 08F

HEM, J. D.
GRAPHICAL METHODS FOR STUDIES OF AQUEOUS ALUMINUM HYDROXIDE, FLUORIDE, AND SULFATE COMPLEXES,
W69-02834 01B

HERBERTSON, JOHN G.
SIMILITUDE THEORY APPLIED TO CORRELATION OF FLUME SEDIMENT TRANSPORT DATA,
W69-03095 02J

HIDAKA, F. T.
EVALUATION OF SEEPAGE FROM CHESTER MORSE LAKE AND MASONRY POOL, KING COUNTY, WASHINGTON,
W69-02827 02H

HIGGINS, GERALD
PARETO AND THE MARSHALLIAN CONSTANCY ASSUMPTION,
W69-03130 06B

HILL, DUANE W.
THE DYNAMICS OF PUBLIC ROLES IN THE SELECTION OF REVENUE SOURCES IN LOCAL WATER ADMINISTRATION,
W69-02847 06B

HLADIO, STEPHEN
FLOODS ON CHENANGO RIVER AND CANASAWACTA CREEK AT NORWICH, NEW YORK,
W69-02839 02E

HOEG, KAARE
TWO-DIMENSIONAL ANALYSIS OF STRESS AND STRAIN IN SOILS, REPORT 5 PLANE-STRAIN LOADING OF A STRAIN-HARDENING SOIL,
W69-02912 08D

HOLLAND, M. E.
AN EXPERIMENTAL RAINFALL-RUNOFF FACILITY,
W69-03076 02A

HORTON, J. H.
MOVEMENT OF WATER TAGGED WITH (2)H, (3)H, AND (18)O THROUGH ACIDIC KAOLINITIC SOIL,
W69-03073 02G

HORTON, MAURICE L.
CORRELATING SOIL MOISTURE CONDITIONS AND MICROCLIMATE WITH EVAPORATION LOSSES AND WATER REQUIREMENTS OF PLANTS,
W69-03198 02D

HOSKIN, CHARLES M.
WATER AND SEDIMENT IN THE NORRIS GLACIER OUTWASH AREA, UPPER TAKU INLET, SOUTHEASTERN ALASKA,
W69-03093 02J

HOUGHTON, ANN
POLITICS AND ORGANIZATION IN WATER RESOURCE ADMINISTRATION A COMPARATIVE STUDY OF DECISIONS,
W69-02849 06E

HOUSTON, C.
FURROW SIZE, PLACEMENT, AND GRASS CULTURE EFFECTS ON VINEYARD IRRIGATION,
W69-02978 03F

HOWE, CHARLES W.
BROAD HORIZONS IN WATER RESOURCE PLANNING AND INVESTMENT,
W69-02845 06B

HOYER, RICHARD P.
DEPOSITIONAL BEHAVIOR OF KAOLINITE IN TURBULENT FLOW,
W69-03067 02J

HUFSCHMIDT, MAYNARD F.
FIELD LEVEL PLANNING OF WATER RESOURCE SYSTEMS,
W69-02843 06B

HUFSCHMIDT, MAYNARD M.
RESEARCH ON COMPREHENSIVE PLANNING OF WATER-RESOURCE SYSTEMS SYMPOSIUM,
W69-03166 06B

HUGGINS, L. F.
APPLICABILITY OF REMOTE SENSING AND SYSTEMS ANALYSIS TECHNIQUES TO RIVER BASIN PLANNING,
W69-03145 06A

HUTCHINSON, G. E.
THE CHEMISTRY OF LAKE SEDIMENTS FROM INDIAN TIBET,
W69-02960 02H

INGERSOLL, BRUCE
DWINDLING LAKES,
W69-02956 02H

JACKSON, DANIEL F.
PRIMARY PRODUCTIVITY STUDIES IN ONONDAGA LAKE, NEW YORK,
W69-02959 05C

ONONDAGA LAKE, NEW YORK, AN UNUSUAL ALGAL ENVIRONMENT,
W69-02961 02H

JAGANNATH, BANAD N.
MECHANICAL PROPERTIES OF COMPACTED SOILS,
W69-02925 08D

JAMES, I. C.
FLOOD RUNOFF FROM PARTIALLY URBANIZED AREAS, WICHITA, KANSAS,
W69-03118 02E

JAMES, L. DOUGLAS
THE INCOME REDISTRIBUTION EFFECTS OF RESERVOIR CONSTRUCTION IN APPALACHIA,
W69-03142 06B

JAMISON, V. C.
SLOPE LENGTH OF CLAYPAN SOIL AFFECTS RUNOFF,
W69-03106 02A

JAVANDEL, IRAJ
APPLICATION OF THE FINITE ELEMENT METHOD TO TRANSIENT FLOW IN POROUS MEDIA,
W69-03064 08B

JENKINS, C. T.
ELECTRIC-ANALOG AND DIGITAL-COMPUTER MODEL ANALYSIS OF STREAM DEPLETION BY WELLS,
W69-02976 02F

JENSEN, MAX C.
DRAINAGE THEORY FOR REMOVAL OF EXCESS WATER FROM IRRIGATED LANDS,
W69-03189 04A

JOHNSON, A. I.
SPECIFIC YIELD-COMPILATION OF SPECIFIC YIELDS FOR VARIOUS MATERIALS,
W69-02828 02F

JOHNSON, BERNARD G.
A PROPOSAL FOR A SYSTEMS ENGINEERING STUDY OF WATER POLLUTION ABATEMENT,
W69-03164 05G

JOHNSON, EDWIN L.
A STUDY IN THE ECONOMICS OF WATER QUALITY MANAGEMENT,
W69-03173 05G

JOHNSTON, W. E.
THE ECONOMIST'S ROLE IN WATER PRICING POLICY,
W69-02906 06C

JOVANOVIC, LAZAR
STRESS AND STRAIN ANALYSIS ON MODELS,
W69-02948 08A

JOVANOVIC, SLAVOLJUB
RESEARCH ON BED-LOAD,
W69-03043 02J

JOYCE, R. T.
DETECTION OF SATURATED INTERFLOW IN SOILS WITH PIEZOMETERS,
W69-03074 07B

JOYNER, B. F.
LOW STREAMFLOW IN THE MYAKKA RIVER BASIN AREA IN FLORIDA,
W69-02808 02E

KARADI, GABOR
UNSTEADY SEEPAGE FLOW BETWEEN FULLY-PENETRATING TRENCHES,
W69-02913 02G

KARMELI, DAVID
DESIGN OF OPTIMAL WATER DISTRIBUTION SYSTEMS,
W69-03165 06B

KATES, ROBERT W.
BENEFIT-COST ANALYSIS AND THE NATIONAL OCEANOGRAPHIC PROGRAM,
W69-03126 06B

KAVANAGH, N. J.
MODERN MANAGEMENT TECHNIQUES,
W69-02954 06B

KELLER, FRANK J.
PROGRAM FOR COOPERATIVE STUDY FOR COMPREHENSIVE WATER RESOURCE DEVELOPMENT,
W69-02854 06B

KELSO, MAURICE M.
THE WATER-IS-DIFFERENT SYNDROME OR WHAT IS WRONG WITH THE WATER INDUSTRY,
W69-03137 06E

KENMIR, RUSSEL C.
CONCRETE RESERVOIR DESIGN,
W69-02952 08A

KEVERN, N. R.
AN EVALUATION OF ARTIFICIAL SUBSTRATES FOR MEASURING PERIPHYTON PRODUCTION,
W69-02955 05C

KIMMEL, GRANT E.
GROUND-WATER OCCURRENCE AND STRATIGRAPHY OF UNCONSOLIDATED DEPOSITS, CENTRAL PIERCE COUNTY, WASHINGTON,
W69-03081 02F

KINCAID, D. R.
REGRESSION MODELS FOR PREDICTING ON-SITE RUNOFF FROM SHORT-DURATION CONVECTIVE STORMS,
W69-03103 06A

KING, L. G.
MATHEMATICAL MODEL FOR UNDERGROUND DISCHARGE OF RADIOACTIVE GASES,
W69-02813 05B

KITE, G. W.
SOME USES OF A DIGITAL GRAPH PLOTTER IN HYDROLOGY,
W69-03112 07C

KLUTE, A.
TRANSPORT IN SOILS THE BALANCE OF MOMENTUM,
W69-03071 02G

KNOTT, JAMES M.
SEDIMENTATION IN THE PIRU CREEK WATERSHED SOUTHERN CALIFORNIA,
W69-03084 02J

KNUTILLA, R. L.
HYDROLOGIC STUDIES OF SMALL WATERSHEDS IN AGRICULTURAL AREAS OF SOUTHERN MICHIGAN,
W69-03045 02A

KONDRAT'YEV, N. YE.
METHODOLOGICAL PREREQUISITES FOR CONDUCTING NETWORK OBSERVATIONS OF THE CHANNEL PROCESS,
W69-02807 07A

KOROBOVA, D. N.
OPTIMIZATION BY DYNAMIC PROGRAMMING OF HYDROELECTRIC PLANT OPERATION REGIME DURING INITIAL FILLING PERIOD OF MULTIANNUAL REGULATION RESERVOIR,
W69-03155 06A

KRAHN, R. A.
EVALUATION OF SPACERS FOR BUNDLED CONDUCTOR TRANSMISSION LINES,
W69-02943 08C

KRIZEK, RAYMOND J.
UNSTEADY SEEPAGE FLOW BETWEEN FULLY-PENETRATING TRENCHES,
W69-02913 02G

KRUPP, H. K.
MISCIBLE DISPLACEMENT IN AN UNSATURATED GLASS BEAD MEDIUM,
W69-02810 02G

KRUTILLA, JOHN V.
AN ECONOMIC APPROACH TO COPING WITH FLOOD DAMAGE,
W69-02844 06F

KUJUNDZIC, BRANISLAV
A CONTRIBUTION TO THE DEVELOPMENT OF ROCK MECHANICS,
W69-02947 08E

LANG, A. R. G.
PSYCHROMETRIC MEASUREMENT OF SOIL WATER POTENTIAL IN SITU UNDER COTTON PLANTS,
W69-02980 02G

LARSON, CURTIS L.
RUNOFF HYDROGRAPHS FOR MATHEMATICAL WATERSHED MODEL,
W69-03070 02E

LARSON, FLOYD C.
AN INVESTIGATION OF THE EFFECT OF CONTROLLED RELEASES ON THE PHYSICAL, CHEMICAL AND BACTERIOLOGICAL CHARACTERISTICS OF FORT LOUDOUN RESERVOIR,
W69-03180 05C

LARSON, T. D.
A SYSTEMS APPROACH TO ANALYSIS OF HARDENED CONCRETE,
W69-02909 08F

LARUE, M. E.
SOIL WATER FLUX BELOW A RYEGRASS ROOT ZONE,
W69-02975 02G

LAWSON, D. W.
GROUNDWATER FLOW SYSTEMS IN THE CRYSTALLINE ROCKS OF THE OKANAGAN HIGHLAND, BRITISH COLUMBIA,
W69-02826 02F

LAZARESCU, DUMITRU
CARACTERIZAREA HIDROLOGICA A ANULUI 1966 (HYDROLOGICAL CHARACTERIZATION OF 1966),
W69-02815 02E

LEEDS, J. V.
ACCURACY OF DISCRETE MODELS USED TO PREDICT ESTUARY POLLUTION,
W69-03107 05B

LEE, REUBEN
FLOODS IN WAIMANALO AREA, OAHU, HAWAII,
W69-02818 02E

LEHMAN, W. F.
SPRINKLER AND SURFACE IRRIGATION OF VEGETABLE AND FIELD CROPS IN AN ARID ENVIRONMENT,
W69-02974 03F

LEVCHENKO, G. P.
USE OF MONOMOLECULAR FILMS TO REDUCE EVAPORATION FROM THE SURFACE OF BODIES OF WATER,
W69-02805 03B

LIBBY, FRED J.
APPLICATION OF THE GRAVITY SURVEY METHOD TO WATERSHED HYDROLOGY,
W69-02982 04D

LIEBHAFSKY, H. H.
PARETO AND THE MARSHALLIAN CONSTANCY ASSUMPTION,
W69-03130 06B

LIM, LEE CHONG
RECENT DEVELOPMENTS IN PLASTIC DESIGN PRACTICE,
W69-02942 08G

LITTLE, H. CLAY
A FUNCTIONAL APPROACH TO PROBLEMS OF WATER RESOURCE DEVELOPMENT AND WATER USE,
W69-03134 06A

LI, YUAN HUI
CHEMICAL AND ISOTOPIC BALANCES FOR A MEROMICTIC LAKE,
W69-03088 02H

LOFTING, EVERARD M.
THE LEONTIEF INPUT-OUTPUT SYSTEM AND ITS APPLICATION TO ANALYSIS AND PROJECTION FOR WATER RESOURCES PLANNING,
W69-03156 06A

THE INTERINDUSTRY WATER CONTENT MATRIX APPLICATIONS ON A MULTIREGIONAL BASIS,
W69-03157 06A

LONDE, PIERRE
SHEAR STRENGTH OF ROCK,
W69-02951 08E

LUMB, ALAN M.
DERIVATION OF BASIN HYDROGRAPHS,
W69-02811 02E

LUNDY, H. L., JR.
EVALUATION OF DEEP IN-SITU SOIL STABILIZATION BY HIGH-PRESSURE LIME-SLURRY INJECTION,
W69-02930 08D

LUSBY, GREGG C.
RUNOFF AND HILLSLOPE EROSION RESULTING FROM A HIGH-INTENSITY THUNDERSTORM NEAR MACK, WESTERN COLORADO,
W69-03052 02A

LUTHIN, J. N.
COMPARISON OF THREE COMMERCIAL DRAIN TILES IN A HEAVY CLAY SOIL OF IMPERIAL VALLEY,
W69-02977 08G

LU, LE-WU
RECENT DEVELOPMENTS IN PLASTIC DESIGN PRACTICE,
W69-02942 08G

MACDONALD, R. B.
APPLICABILITY OF REMOTE SENSING AND SYSTEMS ANALYSIS TECHNIQUES TO RIVER BASIN PLANNING,
W69-03145 06A

MACHMEIER, ROGER E.
RUNOFF HYDROGRAPHS FOR MATHEMATICAL WATERSHED MODEL,
W69-03070 02E

MACLAY, R. W.
WATER RESOURCES OF THE MUSTINKA AND BOIS DE SIOUX RIVERS WATERSHED WEST-CENTRAL MINNESOTA,
W69-02829 02F

MACUMBER, P. G.
INTERRELATIONSHIP BETWEEN PHYSIOGRAPHY, HYDROLOGY, SEDIMENTATION, AND SALINIZATION OF THE LODDON RIVER PLAINS, AUSTRALIA,
W69-02817 02B

MANOHAR, MAN SINGH
GERMINATION IN LOWER OSMOTIC POTENTIAL AS AN INDEX OF DROUGHT RESISTANCE IN CROP PLANTS - A REVIEW,
W69-02984 02I

MANSON, P. W.
SOME ASPECTS OF THE HYDROLOGY OF PONDS AND SMALL LAKES,
W69-03091 02H

MARFIN, N. I.
CONSTRUCTING 500-KV TRANSMISSION LINES ON A SWAMPY RIVER FLOOD PLAIN,
W69-02936 08F

MARGLIN, STEPHEN A.
THE SOCIAL RATE OF DISCOUNT AND THE OPTIMAL RATE OF INVESTMENT,
W69-03129 06B

MARINKOVIC, PREDRAG
SOIL STUDY FOR WATER ECONOMICS,
W69-03042 02G

MARIUS, J. B.
DETECTION OF SATURATED INTERFLOW IN SOILS WITH PIEZOMETERS,
W69-03074 07B

MARKOVIC, RADMILO D.
CONTROL LEVELS FOR QUANTITATIVE EVALUATION OF WEATHER MODIFICATION ATTAINMENTS,
W69-03113 02A

MARKS, DAVID H.
RESULTS FROM A SYSTEMS ANALYSIS APPROACH TO THE OPTIMUM CONTROL OF ESTUARINE WATER QUALITY,
W69-03162 05G

MARTIN, S. CLARK
AN EVALUATION OF PRECIPITATION, VEGETATION AND RELATED FACTORS ON THE SANTA RITA EXPERIMENTAL RANGE,
W69-02989 02B

MASSEY, D. T.
OPPORTUNITIES FOR REGIONAL RESEARCH ON WATER RESOURCES PROBLEMS.
W69-02872 06B

MATALAS, N. C.
SOME COMMENTS ON THE USE OF FACTOR ANALYSES,
W69-03050 07C

MATLOCK, WILLIAM GERALD
THE EFFECT OF SILT-LADEN WATER ON INFILTRATION IN ALLUVIAL CHANNELS,
W69-02988 02J

MAXEY, GEORGE B.
HYDROGEOLOGY OF DESERT BASINS,
W69-02924 02F

MCCANN, JAMES A.
A SURVEY AND EVALUATION OF SMALL ARTIFICIAL RECREATIONAL PONDS IN CENTRAL MASSACHUSETTS,
W69-03086 02H

MCCOY, O. D.
SPRINKLER AND SURFACE IRRIGATION OF VEGETABLE AND FIELD CROPS IN AN ARID ENVIRONMENT,
W69-02974 03F

MCGILCHRIST, C. A.
STATISTICAL TESTS FOR COMMON BANKFULL FREQUENCY IN RIVERS,
W69-03096 02E

MCKELL, C. M.
CHAPARRAL FIRES CHANGE SOIL MOISTURE DEPLETION PATTERNS,
W69-02979 02G

MCMAHON, T. A.
WATER RESOURCES RESEARCH ASPECTS OF A REGIONAL STUDY IN THE HUNTER VALLEY, NEW SOUTH WALES,
W69-02819 02E

MEADOWS, JOHN C.
SIMULATION OF REGIONAL ECONOMIC IMPACTS OF WATER RESOURCE DEVELOPMENT,
W69-03176 06B

MEYERS, S.
DESIGN OF OPTIMAL WATER DISTRIBUTION SYSTEMS,
W69-03165 06B

MILLER, RAYMOND J.
NON-DARCY FLOW CHARACTERISTICS OF WATER AS INFLUENCED BY CLAY CONCENTRATION,
W69-03195 02G

MILORADOV, VERA
SUSPENDED LOAD RESEARCH,
W69-03062 02J

MISHAN, E. J.
WHAT IS PRODUCER'S SURPLUS,
W69-03133 06B

MISHRA, M. N.
ROOT DEVELOPMENT IN RELATION TO PLANT POPULATION AND FERTILITY LEVELS IN SOYBEAN,
W69-02985 02I

MOOLANI, M. K.
INVESTIGATIONS ON THE IRRIGATION REQUIREMENTS OF HYBRID MAIZE CROP IN ARID REGION OF PUNJAB,
W69-02973 03F

MOORE, MONROE O.
INCRUSTATION IN WATER PIPELINES,
W69-02928 08G

MORRELL, ROGER J.
HORIZONTAL BORING TECHNOLOGY A STATE-OF-THE-ART-STUDY,
W69-02923 08C

MORTIMER, C. H.
UNDERWATER SOILS A REVIEW OF LAKE SEDIMENTS,
W69-03187 02H

MORTON, FRED I.
EVAPORATION FROM LARGE DEEP LAKES,
W69-03083 02D

MOSHER, PETER N.
DETACHMENT OF SOIL PARTICLES IN SIMULATED RAINFALL,
W69-02832 04D

MUELLER, C.
HYDROLOGIC STUDIES OF SMALL WATERSHEDS IN AGRICULTURAL ARE OF SOUTHERN MICHIGAN,
W69-03045 02A

MUNGER, FRANK
POLITICS AND ORGANIZATION IN WATER RESOURCE ADMINISTRATION A COMPARATIVE STUDY OF DECISIONS,
W69-02849 06E

MURRAY, C. RICHARD
ESTIMATED USE OF WATER IN THE UNITED STATES, 1965,
W69-02840 06B

MUSKATIROVIC, DRAGUTIN
UNSTEADY FLOW IN OPEN CHANNELS,
W69-03044 02E

MUSTONEN, SEPPO E.
EFFECTS OF CLIMATOLOGIC AND BASIN CHARACTERISTICS ON ANNUA RUNOFF,
W69-03055 02A

MUZURAK, ANDREW P.
DETACHMENT OF SOIL PARTICLES IN SIMULATED RAINFALL,
W69-02832 04D

NAYLOR, THOMAS H.
SIMULATION OF REGIONAL ECONOMIC IMPACTS OF WATER RESOURCE DEVELOPMENT,
W69-03176 06B

NAZAROV, A. I.
EXPERIENCE IN BURIAL OF LIQUID RADIOACTIVE WASTES IN DEEP GEOLOGICAL FORMATIONS,
W69-03061 05E

NEILL, C. R.
BED FORMS IN THE LOWER RED DEER RIVER, ALBERTA,

69-02816 02J

BERY, J.
HE PERCHED WATER TABLE IN THE UPPER LIMESTONE AQUIFER OF
ALTA,
69-02833 02F

LSEN, D. R.
EUTRON MOISTURE METER CALIBRATION FOR USE IN SALINE SOILS,
69-02965 02G

OIL WATER FLUX BELOW A RYEGRASS ROOT ZONE,
69-02975 02G

TH, RONALD M.
ONSUMER RESPONSES TO PRICES OF RESIDENTIAL WATER,
69-03140 06B

VITCH, RALPH F.
YDROLOGY AND WATER RESOURCES OF THE HOUSATONIC RIVER BASIN,
ASSACHUSETTS,
69-03101 02A

OVA, O. N.
IELD INVESTIGATIONS OF SEEPAGE ON EXISTING DAMS,
69-02921 08D

BERG, EMIL
ATER RESOURCE MANAGEMENT IN MT. PROSPECT A SURVEY OF THE
NVIRONMENT, PROBLEMS, AND OPPORTUNITIES,
69-03168 06B

ON, T. C.
ELOCITY-GRADIENT RELATIONSHIPS FOR STEADY-STATE UNSATURATED
LOW OF WATER IN NON-SWELLING ARTIFICIAL SOILS,
69-03072 02G

RMAN, ALLEN R.
ON-DARCY FLOW CHARACTERISTICS OF WATER AS INFLUENCED BY
LAY CONCENTRATION,
69-03195 02G

ONNER, DONALD J.
ATER QUALITY ANALYSIS OF THE DELAWARE RIVER ESTUARY,
69-03158 06A

ONNOR, DONALD J.
HE TEMPORAL AND SPATIAL DISTRIBUTION OF DISSOLVED OXYGEN IN
TREAMS,
69-02809 05A

ST, ARTHUR F.
EVIEW AND ANALYSIS OF RAINFALL AND RUNOFF DATA FOR SELECTED
ATERSHEDS IN MINNESOTA,
69-03098 02A

EN, CHARLES A.
ECHANICAL PROPERTIES OF COMPACTED SOILS,
69-02925 08D

DEY, S.
ROCESSES AND EXTENT OF EROSION AND ITS EFFECTS ON LAND USE
N THE CENTRAL LUNI BASIN, WESTERN RAJASTHAN,
69-02987 02J

NE, JAMES
ORIZONTAL BORING TECHNOLOGY A STATE-OF-THE-ART-STUDY,
69-02923 08C

PADOPULOS, ISTAVROS S.
DRAWDOWN IN A WELL OF LARGE DIAMETER,
69-03049 02F

RESPONSE OF A FINITE-DIAMETER WELL TO AN INSTANTANEOUS
CHARGE OF WATER,
69-03057 02F

RTHENIADES, EMMANUEL
DEPOSITIONAL BEHAVIOR OF KAOLINITE IN TURBULENT FLOW,
69-03067 02J

ULAY, THOMAS
ECHANISMS OF SHEAR RESISTANCE OF CONCRETE BEAMS,
69-02927 08F

USZEK, FELIX H.
HYDROLOGY AND WATER RESOURCES OF THE HOUSATONIC RIVER BASIN,
MASSACHUSETTS,
69-03101 02A

ARSON, F. J., JR.
CARBON 14 AGES AND FLOW RATES OF WATER IN CARRIZO SAND, AT
ATASCOSA COUNTY, TEXAS,
69-03082 02F

ART, R. M.
APPLICABILITY OF REMOTE SENSING AND SYSTEMS ANALYSIS
TECHNIQUES TO RIVER BASIN PLANNING,
69-03145 06A

ELE, T. C.
RELATION OF SOIL PROPERTIES TO THE EVAPORATION OF WATER FROM
SOILS,
69-03175 02D

TERS, D. B.
SLOPE LENGTH OF CLAYPAN SOIL AFFECTS RUNOFF,
69-03106 02A

TERS, J. C.
AN EVALUATION OF ARTIFICIAL SUBSTRATES FOR MEASURING
PERIPHYTON PRODUCTION,
69-02955 05C

PETLEY, D. J.
THE STRENGTH ALONG STRUCTURAL DISCONTINUITIES IN STIFF
CLAYS,
69-02950 08D

PEVERLY, JOHN H.
NON-DARCY FLOW CHARACTERISTICS OF WATER AS INFLUENCED BY
CLAY CONCENTRATION,
69-03195 02G

PIMENOV, M. K.
EXPERIENCE IN BURIAL OF LIQUID RADIOACTIVE WASTES IN DEEP
GEOLOGICAL FORMATIONS,
69-03061 05E

PLAMENAC, NIKOLA
SOIL STUDY FOR WATER ECONOMICS,
69-03042 02G

PLETCHER, CHARLES B.
METHODS OF FLOW FREQUENCY ANALYSIS,
69-03102 02E

PLUHOWSKI, EDWARD J.
URBANIZATION AND ITS EFFECT ON THE TEMPERATURE OF LONG
ISLAND STREAMS,
69-02830 05A

POLJAKOFF-MAYBER, A.
ANTI-TRANSPIRANTS AS A RESEARCH TOOL FOR THE STUDY OF THE
EFFECTS OF WATER STRESS ON PLANT BEHAVIOUR,
69-02986 03F

POPOV, I. V.
METHODOLOGICAL PREREQUISITES FOR CONDUCTING NETWORK
OBSERVATIONS OF THE CHANNEL PROCESS,
69-02807 07A

POPOV, YE. G.
HYDROLOGIC FORECASTS, PREDICTION PERIODS, RELIABILITY AND
EXPERIENCE USING THEM IN WATER RESOURCES SYSTEMS,
69-02802 06A

POTTER, W. D.
METHODS OF FLOW FREQUENCY ANALYSIS,
69-03102 02E

POWER, J. F.
EFFECTS OF MOISTURE AND NITROGEN FERTILIZER ON GROWTH AND
WATER USE BY NATIVE GRASS,
69-02969 02I

PRAGER, W.
RECENT DEVELOPMENTS IN OPTIMAL STRUCTURAL DESIGN,
69-02932 08A

PRASAD, RAM
GERMINATION IN LOWER OSMOTIC POTENTIAL AS AN INDEX OF
DROUGHT RESISTANCE IN CROP PLANTS - A REVIEW,
69-02984 02I

PRESCOTT, GLENN C., JR.
GROUNDWATER FAVORABILITY AREAS AND SURFICIAL GEOLOGY OF THE
LOWER ANDROSCOGGIN RIVER BASIN, MAINE,
69-03099 02F

POSHKAREV, V. F.
USE OF MONOMOLECULAR FILMS TO REDUCE EVAPORATION FROM THE
SURFACE OF BODIES OF WATER,
69-02805 03B

QASHU, H. K,
HYDRAULIC AND MICROMORPHOLOGICAL PROPERTIES OF STREAM
CHANNEL SEDIMENTS,
69-03108 02J

RAATS, P. A. C.
TRANSPORT IN SOILS THE BALANCE OF MOMENTUM,
69-03071 02G

RATHBUN, R. E.
MEASUREMENT OF HYDRAULIC AND SEDIMENT TRANSPORT VARIABLES IN
A SMALL RECIRCULATING FLUME,
69-03056 02J

REBUCK, ERNEST C.
THE HYDROLOGIC REGIME DUE TO SPRINKLER IRRIGATION OF TREATED
MUNICIPAL EFFLUENT ON SLOPING LAND,
69-03109 05G

REGINATO, R. J.
PRECISION LYSIMETRY FOR DIRECT MEASUREMENT OF EVAPORATIVE
FLUX,
69-02981 02G

REID, GEORGE W.
STREAM RESPONSES AND SYSTEM ANALYSIS IN WATER QUALITY
MANAGEMENT,
69-03159 06A

REIHER, BARBARA J.
SOME COMMENTS ON THE USE OF FACTOR ANALYSES,
69-03050 07C

RIGGS, LOUIS W.
THE FUNCTION OF FEASIBILITY REPORTS,
69-02910 06A

RITTER, JOHN R.
SEDIMENTATION IN THE PIRU CREEK WATERSHED SOUTHERN CALIFORNIA,
W69-03084 02J

ROBINSON, F. E.
SPRINKLER AND SURFACE IRRIGATION OF VEGETABLE AND FIELD CROPS IN AN ARID ENVIRONMENT,
W69-02974 03F

COMPARISON OF THREE COMMERCIAL DRAIN TILES IN A HEAVY CLAY SOIL OF IMPERIAL VALLEY,
W69-02977 08G

ROBINSON, T. W.
PONTACYL BRILLIANT PINK AS A TRACER DYE IN THE MOVEMENT OF WATER IN PHREATOPHYTES,
W69-03047 02I

ROGERS, JERRY R.
SIMULATION OF FLOOD FLOW DIVERSION FROM A LAKE SYSTEM,
W69-03143 04A

ROSE, G. D.
OPPORTUNITIES FOR REGIONAL RESEARCH ON WATER RESOURCES PROBLEMS.
W69-02872 06B

ROZKOWSKA, A. D.
SEASONAL CHANGES OF SLOUGH AND LAKE WATER CHEMISTRY IN SOUTHERN SASKATCHEWAN (CANADA),
W69-02838 02H

ROZKOWSKI, A.
SEASONAL CHANGES OF SLOUGH AND LAKE WATER CHEMISTRY IN SOUTHERN SASKATCHEWAN (CANADA),
W69-02838 02H

RUNKLES, JACK R.
EFFECTS OF A MONOLAYER ON RESERVOIR TEMPERATURE AND EVAPORATION,
W69-03054 03B

RUTT, F. E.
NUCLEAR REACTORS STATUS AND FUTURE TRENDS,
W69-02940 08A

SALIMAN, RICHARD S.
ANCHORED FOOTINGS FOR TRANSMISSION TOWERS,
W69-02938 08F

SALO, ERNEST O.
WATER QUALITY AS RELATED TO THE SURVIVAL OF SALMON EGGS AND LARVAE,
W69-03190 05C

STUDIES OF JUVENILE SALMON IN THE NOOKSACK RIVER SYSTEM AND BELLINGHAM BAY,
W69-03191 05C

SALTOUN, ANDRE
ROLE OF LOCAL GOVERNMENT IN WATER LAW,
W69-02853 06E

SANDOVAL, F. M.
NEUTRON MOISTURE METER CALIBRATION FOR USE IN SALINE SOILS,
W69-02965 02G

SARGENT, THOMAS J.
SOME EVIDENCE ON THE SMALL SAMPLE PROPERTIES OF DISTRIBUTED LAG ESTIMATORS IN THE PRESENCE OF AUTOCORRELATED DISTURBANCES,
W69-03124 06A

SAXENA, R. K.
HYDRO-GEOLOGY OF QUATERNARY FORMATION FROM RIVER LUNI AND ITS TRIBUTARIES CATCHMENT.
W69-02983 02F

SCHAEFER, ROBERT H.
ANCHORED FOOTINGS FOR TRANSMISSION TOWERS,
W69-02938 08F

SCHENK, C. F.
LONG-TERM CHANGES IN WATER CHEMISTRY AND ABUNDANCE OF PLANKTON AT A SINGLE SAMPLING LOCATION IN LAKE ONTARIO,
W69-02958 02H

SCHMER, FRED A.
PROJECTION OF AGRICULTURAL WATER AND LAND USE FOR LONG RANGE WATER RESOURCES IN TEXAS,
W69-03144 03F

SCHRECONGOST, ROLAND W.
DESIGN SENSITIVITY OF POLLUTION CONTROL RESERVOIRS,
W69-03163 05G

SCHREIBER, H. A.
REGRESSION MODELS FOR PREDICTING ON-SITE RUNOFF FROM SHORT-DURATION CONVECTIVE STORMS,
W69-03103 06A

SCHWARTZ, G. M.
SOME ASPECTS OF THE HYDROLOGY OF PONDS AND SMALL LAKES,
W69-03091 02H

SCHWOB, HARLAN H.
FLOOD OF JUNE 7, 1967, IN THE WAPSINONOC CREEK BASIN, IOWA,
W69-03085 02E

SCOFIELD, LARRY R.
A SURVEY AND EVALUATION OF SMALL ARTIFICIAL RECREATIONAL PONDS IN CENTRAL MASSACHUSETTS,
W69-03086 02H

SCOTT, KEVIN M.
SEDIMENTATION IN THE PIRU CREEK WATERSHED SOUTHERN CALIFORNIA,
W69-03084 02J

SELLECK, ROBERT E.
A MODEL OF MIXING AND DISPERSION IN SAN FRANCISCO BAY,
W69-02831 05B

SETLOW, JANE K.
THE CHEMISTRY OF LAKE SEDIMENTS FROM INDIAN TIBET,
W69-02960 02H

SEWELL, W. R. DERRICK
BENEFIT-COST ANALYSIS AND THE NATIONAL OCEANOGRAPHIC PROGRAM,
W69-03126 06B

SHARMA, M. L.
HYDRO-GEOLOGY OF QUATERNARY FORMATION FROM RIVER LUNI AND ITS TRIBUTARIES CATCHMENT.
W69-02983 02F

SHEAFFER, JOHN R.
WATER RESOURCE MANAGEMENT IN MT. PROSPECT A SURVEY OF THE ENVIRONMENT, PROBLEMS, AND OPPORTUNITIES,
W69-03168 06B

SHEARER, S. D.
TRACER MEASUREMENT OF STREAM REAERATION. II. FIELD STUDIES,
W69-02821 02E

SHEU, C. Y.
RECENT DEVELOPMENTS IN OPTIMAL STRUCTURAL DESIGN,
W69-02932 08A

SHIRER, HAMPTON W.
ACTIVITY PATTERNS OF FISH EXPOSED TO TOXIC MATERIAL,
W69-03194 05C

SILER, W. C.
NUCLEAR REACTORS STATUS AND FUTURE TRENDS,
W69-02940 08A

SIMONS, D. B.
DESIGN OF STABLE CHANNELS IN ALLUVIAL MATERIALS,
W69-03066 08B

SIMS, F. A.
RAWCLIFFE BRIDGE IN YORKSHIRE,
W69-02926 08G

SINGH, A. N.
ROOT DEVELOPMENT IN RELATION TO PLANT POPULATION AND FERTILITY LEVELS IN SOYBEAN,
W69-02985 02I

SINGH, S.
PROCESSES AND EXTENT OF EROSION AND ITS EFFECTS ON LAND USE IN THE CENTRAL LUNI BASIN, WESTERN RAJASTHAN,
W69-02987 02J

SKEMPTON, A. W.
THE STRENGTH ALONG STRUCTURAL DISCONTINUITIES IN STIFF CLAYS,
W69-02950 08D

SLATT, ROGER M.
WATER AND SEDIMENT IN THE NORRIS GLACIER OUTWASH AREA, UPPER TAKU INLET, SOUTHEASTERN ALASKA,
W69-03093 02J

SLINN, D. J.
SOME HYDROLOGICAL OBSERVATIONS IN AUCKLAND AND OTAGO HARBOURS,
W69-02835 02L

SMIKA, D. E.
EFFECTS OF MOISTURE AND NITROGEN FERTILIZER ON GROWTH AND WATER USE BY NATIVE GRASS,
W69-02969 02I

SMIRNOV, E. N.
PROSPECTS FOR USE OF NONMETALLIC REINFORCEMENT,
W69-02937 08G

SMITH, G. L.
AN EXPERIMENTAL RAINFALL-RUNOFF FACILITY,
W69-03076 02A

SMITH, ROBERT L.
DERIVATION OF BASIN HYDROGRAPHS,
W69-02811 02E

SMITH, T. F.
SEDIMENT SURVEYS IN CANADA,
W69-03123 02J

SNYDER, WILLARD M.
SOME ERROR PROPERTIES OF SEGMENTED HYDROLOGIC FUNCTIONS,
W69-03105 07C

SOLOMON, S.
RELATIONSHIP BETWEEN PRECIPITATION, EVAPORATION, AND RUNOFF IN TROPICAL-EQUATORIAL REGIONS,
W69-03092 02A

PPER, WILLIAM E.
WASTE WATER RENOVATION FOR REUSE KEY TO OPTIMUM USE OF WATER RESOURCES,
W69-02929 05D

ANGLER, DANIEL P.
APPLICATION OF THE GRAVITY SURVEY METHOD TO WATERSHED HYDROLOGY,
W69-02982 04D

ARKS, JARED
ARKANSAS WATER RESOURCES SUPPLY, USE, AND RESEARCH NEEDS,
W69-03199 06B

ANHILL, G.
THE CONCEPT OF POTENTIAL EVAPOTRANSPIRATION IN ARID ZONE AGRICULTURE,
W69-02967 02D

ENMARK, ERNEST B.
EFFECTS OF A MONOLAYER ON RESERVOIR TEMPERATURE AND EVAPORATION,
W69-03054 03B

EWART, G. L.
UNITED STATES TRITIUM RAINOUT AND ITS HYDROLOGIC IMPLICATIONS,
W69-03121 02B

EWART, J. W.
HYDROLOGIC EFFECTS OF PUMPING FROM THE FLORIDAN AQUIFER IN NORTHWEST HILLSBOROUGH, NORTHEAST PINELLAS, AND SOUTHWEST PASCO COUNTIES, FLORIDA,
W69-03063 02F

ICHLING, W.
SEDIMENT SURVEYS IN CANADA,
W69-03123 02J

ROMMEN, N. D.
HYDROLOGIC STUDIES OF SMALL WATERSHEDS IN AGRICULTURAL AREAS OF SOUTHERN MICHIGAN,
W69-03045 02A

ROUD, LINDA M.
COLOR-INFRARED AERIAL PHOTOGRAPHIC INTERPRETATION AND NET PRIMARY PRODUCTIVITY OF A REGULARLY-FLOODED NORTH CAROLINA SALT MARSH,
W69-03177 02I

URBLEBINE, WM. CRAIG
EXTERNALITY,
W69-03132 06B

, JOHN P.
WATER QUALITY ANALYSIS OF THE DELAWARE RIVER ESTUARY,
W69-03158 06A

UTHERLAND, ROBERT A.
TUBULAR TURBINES,
W69-02907 08C

ALES, M. C.
OPTIMIZATION OF TIDAL POWER GENERATION,
W69-03160 06A

ARTZENDRUBER, D.
VELOCITY-GRADIENT RELATIONSHIPS FOR STEADY-STATE UNSATURATED FLOW OF WATER IN NON-SWELLING ARTIFICIAL SOILS,
W69-03072 02G

ZABO, BARNA A.
PERMEABILITY OF ORTHOTROPIC POROUS MEDIUMS,
W69-02812 02F

AKAHASHI, TARO
CHEMICAL AND ISOTOPIC BALANCES FOR A MEROMICTIC LAKE,
W69-03088 02H

ANG, W. H.
TWO-DIMENSIONAL ANALYSIS OF STRESS AND STRAIN IN SOILS,
REPORT 5 PLANE-STRAIN LOADING OF A STRAIN-HARDENING SOIL,
W69-02912 08D

AYLOR, S. A.
SOIL-WATER MOVEMENT IN VAPOUR AND LIQUID PHASES,
W69-02966 02G

EBBUTT, T. H. Y.
RECLAIMED WATER FOR INDUSTRY,
W69-02806 03E

HOMANN, ROBERT V.
SYSTEMS ANALYSIS AND SIMULATION IN WATER QUALITY MANAGEMENT,
W69-03161 05G

RESULTS FROM A SYSTEMS ANALYSIS APPROACH TO THE OPTIMUM CONTROL OF ESTUARINE WATER QUALITY,
W69-03162 05G

HOMPSON, B. E.
LONG-TERM CHANGES IN WATER CHEMISTRY AND ABUNDANCE OF PLANKTON AT A SINGLE SAMPLING LOCATION IN LAKE ONTARIO,
W69-02958 02H

HORUD, DAVID B.
THE EFFECT OF APPLIED INTERCEPTION ON TRANSPIRATION RATES OF POTTED PONDEROSA PINE,
W69-03116 02I

TIMUR, A.
VELOCITY OF COMPRESSIONAL WAVES IN POROUS MEDIA AT PERMAFROST TEMPERATURES,
W69-03090 02C

TODD, DAVID K.
SYSTEMS ANALYSIS FOR GROUND WATER BASIN MANAGEMENT,
W69-03200 04B

TSIVOGLOU, E. C.
TRACER MEASUREMENT OF STREAM REAERATION. II. FIELD STUDIES,
W69-02821 02E

VAN BAVEL, C. H. M.
PRECISION LYSIMETRY FOR DIRECT MEASUREMENT OF EVAPORATIVE FLUX,
W69-02981 02G

VAN NIEROP, EMMANUEL T.
RECREATIONAL USE OF MUNICIPAL RESERVOIRS,
W69-03136 06B

VERMA, C. M.
GERMINATION OF PROMISING DESERT GRASS SEEDS UNDER DIFFERENT DEPTHS OF SOWING IN SANDY SOIL,
W69-02972 02G

VOELLER, DON
SOCIAL IMPACT OF METEOROLOGICAL DROUGHT IN ILLINOIS,
W69-03193 02B

VUKMIROVIC, VOJISLAV
RESEARCH ON BED-LOAD,
W69-03043 02J

WALKER, WILLIAM
SIMILARITIES BETWEEN FLOOD CONTROL PROBLEMS AND OTHER ASPECTS OF WATER MANAGEMENT IN THE UNITED STATES,
W69-02848 06F

WALLIS, JAMES R.
WHEN IS IT SAFE TO EXTEND A PREDICTION EQUATION--AN ANSWER BASED UPON FACTOR AND DISCRIMINANT FUNCTION ANALYSIS,
W69-03183 06A

WALTERS, KENNETH L.
GROUND-WATER OCCURRENCE AND STRATIGRAPHY OF UNCONSOLIDATED DEPOSITS, CENTRAL PIERCE COUNTY, WASHINGTON,
W69-03081 02F

WEBER, WILLIAM G., JR.
IN SITU PERMEABILITIES FOR DETERMINING RATES OF CONSOLIDATION,
W69-02934 08D

WELCH, N. H.
EVALUATION OF ZINGG CONSERVATION BENCH TERRACES ON AMARILLO FINE SANDY LOAM SOIL.
W69-02971 02E

WENT, F. W.
AN ELECTRIC HYGROMETER APPARATUS FOR MEASURING WATER-VAPOUR LOSS FROM PLANTS IN THE FIELD,
W69-02968 02D

WERENFELS, L.
FURROW SIZE, PLACEMENT, AND GRASS CULTURE EFFECTS ON VINEYARD IRRIGATION,
W69-02978 03F

WESSEL, CARL J.
THE INFORMATION BACKGROUND IN THE FIELD OF BIOLOGICAL DETERIORATION OF NONMETALLIC MATERIALS,
W69-02905 08C

WHITE, D. E.
CARBON 14 AGES AND FLOW RATES OF WATER IN CARRIZO SAND, AT ATASCOSA COUNTY, TEXAS,
W69-03082 02F

WIERENGA, P. J.
AN ANALYSIS OF TEMPERATURE BEHAVIOR IN IRRIGATED SOIL PROFILES,
W69-03053 02G

WILCOX, J. C.
A SIMPLE EVAPORIMETER FOR USE IN COLD AREAS,
W69-03115 07B

WILKINSON, KENNETH P.
LOCAL PARTICIPATION AND WATERSHED DEVELOPMENT A COMPARATIVE STUDY OF TWO COMMUNITIES,
W69-03139 06B

WILLIAMS, R. E.
FLOW OF GROUNDWATER ADJACENT TO SMALL, CLOSED BASINS IN GLACIAL TILL,
W69-03119 02F

WILLIS, W. O.
NEUTRON MOISTURE METER CALIBRATION FOR USE IN SALINE SOILS,
W69-02965 02G

WILSON, E. M.
OPTIMIZATION OF TIDAL POWER GENERATION,
W69-03160 06A

WINTER, T. C.
WATER RESOURCES OF THE MUSTINKA AND BOIS DE SIOUX RIVERS WATERSHED WEST-CENTRAL MINNESOTA,

W69-02829 02F

WISTRAND, GLEN L.
PROJECTION OF AGRICULTURAL WATER AND LAND USE FOR LONG RANGE WATER RESOURCES IN TEXAS,
W69-03144 03F

WITHERSPOON, P. A.
APPLICATION OF THE FINITE ELEMENT METHOD TO TRANSIENT FLOW IN POROUS MEDIA,
W69-03064 08B

WOLLACK, ANNE
THE CHEMISTRY OF LAKE SEDIMENTS FROM INDIAN TIBET,
W69-02960 02H

WOLMAN, ABEL
WATER RESOURCES A REPORT TO THE COMMITTEE ON NATURAL RESOURCES OF THE NATIONAL ACADEMY OF SCIENCES - NATIONAL RESEARCH COUNCIL,
W69-03172 06B

WOMACK, JAMES D.
A STUDY OF THE SURVIVAL OF BACTERIAL INDICATORS OF POLLUTION IN NATURAL WATERS,
W69-03181 05B

WOODHEAD, S.
RAWCLIFFE BRIDGE IN YORKSHIRE,
W69-02926 08G

WOODYER, K. D.
STATISTICAL TESTS FOR COMMON BANKFULL FREQUENCY IN RIVERS,
W69-03096 02E

WOOD, DONALD F.
URBAN AND BASIN PLANNING,
W69-02851 06B

WOOD, E. H.
THE THEORY OF THE STRIP METHOD FOR DESIGN OF SLABS,
W69-02918 08F

WORKER JR, G. F.
SPRINKLER AND SURFACE IRRIGATION OF VEGETABLE AND FIELD CROPS IN AN ARID ENVIRONMENT,
W69-02974 03F

YIFTAH, S.
OPTIMIZATION AND RANGE OF APPLICATION OF NUCLEAR REACTORS AND FLASH EVAPORATORS FOR SEA WATER DESALINATION,
W69-03147 03A

YOUNG, GEORGE K.
DESIGN SENSITIVITY OF POLLUTION CONTROL RESERVOIRS,
W69-03163 05G

YUDIN, F. P.
EXPERIENCE IN BURIAL OF LIQUID RADIOACTIVE WASTES IN DEEP GEOLOGICAL FORMATIONS,
W69-03061 05E

ZADVORNYI, G. M.
FIELD INVESTIGATIONS OF SEEPAGE ON EXISTING DAMS,
W69-02921 08D

ZANELLA, EUGENE F.
A SURVEY AND EVALUATION OF SMALL ARTIFICIAL RECREATIONAL PONDS IN CENTRAL MASSACHUSETTS,
W69-03086 02H

ZIMMERMAN, R. C.
LOW-FLOW AND BASIN CHARACTERISTICS OF TWO STREAMS IN NORTHERN VERMONT,
W69-02814 02A

ORGANIZATIONAL INDEX

ICULTURAL RESEARCH SERVICE, BIG SPRING, TEX. AND
ICULTURAL RESEARCH SERVICE, CHICHASHA, OKLA.
VALUATION OF ZINGG CONSERVATION BENCH TERRACES ON AMARILLO
INE SANDY LOAM SOIL.
69-02971 02E

ICULTURAL RESEARCH SERVICE, COLUMBIA, MO. AND
ICULTURAL RESEARCH SERVICE, URBANA, ILL.
LOPE LENGTH OF CLAYPAN SOIL AFFECTS RUNOFF,
69-03106 02A

ICULTURAL RESEARCH SERVICE, DANVILLE, VT. SOIL AND WATER
SERVATION RESEARCH DIV.
OW-FLOW AND BASIN CHARACTERISTICS OF TWO STREAMS IN
ORTHERN VERMONT,
69-02814 02A

ICULTURAL RESEARCH SERVICE, TEMPE, ARIZ. WATER
SERVATION LAB.
RECISION LYSIMETRY FOR DIRECT MEASUREMENT OF EVAPORATIVE
LUX,
69-02981 02G

ICULTURAL RESEARCH SERVICE, TUCSON ARIZ. SOUTHWEST
ERSHED RESEARCH CENTER.
EGRESSION MODELS FOR PREDICTING ON-SITE RUNOFF FROM SHORT-
URATION CONVECTIVE STORMS,
69-03103 06A

ICULTURAL RESEARCH SERVICE, TUCSON, ARIZONA. SOUTHWEST
ERSHED RESEARCH CENTER.
PPLICATION OF THE GRAVITY SURVEY METHOD TO WATERSHED
YDROLOGY,
69-02982 04D

ICULTURAL RESEARCH SERVICE, WASHINGTON, D. C.
FFECTS OF MOISTURE AND NITROGEN FERTILIZER ON GROWTH AND
ATER USE BY NATIVE GRASS,
69-02969 02I

ICULTURE COLL., KANPUR (INDIA).
OOT DEVELOPMENT IN RELATION TO PLANT POPULATION AND
ERTILITY LEVELS IN SOYBEAN,
69-02985 02I

SKA UNIV., COLLEGE. INST. OF WATER RESOURCES.
ATER AND SEDIMENT IN THE NORRIS GLACIER OUTWASH AREA, UPPER
AKU INLET, SOUTHEASTERN ALASKA,
69-03093 02J

ZONA UNIV., TUCSON AND NORTH CAROLINA STATE UNIV.,
LEIGH.
YDRAULIC AND MICROMORPHOLOGICAL PROPERTIES OF STREAM
HANNEL SEDIMENTS,
69-03108 02J

ZONA UNIV., TUCSON.
HE WATER-IS-DIFFERENT SYNDROME OR WHAT IS WRONG WITH THE
ATER INDUSTRY,
69-03137 06E

ZONA UNIV., TUCSON. DEPT. OF HYDROLOGY.
RACE AND TRACER ELEMENTS IN GROUND WATER,
69-03197 02F

ZONA UNIV., TUCSON. DEPT. OF WATERSHED MANAGEMENT.
HE EFFECT OF APPLIED INTERCEPTION ON TRANSPIRATION RATES OF
OTTED PONDEROSA PINE,
69-03116 02I

ZONA UNIV., TUCSON. INST. OF ATMOSPHERIC PHYSICS AND
CKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION, FORT
LLINS, COLO.
N EVALUATION OF PRECIPITATION, VEGETATION AND RELATED
FACTORS ON THE SANTA RITA EXPERIMENTAL RANGE,
69-02989 02B

KANSAS UNIV., FAYETTEVILLE AND STANFORD UNIV., CALIF.
VIRUS MOVEMENT IN GROUNDWATER,
69-02824 05B

KANSAS UNIV., FAYETTEVILLE. DEPT. OF ECONOMICS.
ARKANSAS WATER RESOURCES SUPPLY, USE, AND RESEARCH NEEDS,
69-03199 06B

MY ELECTRONICS COMMAND, FORT HUACHUCA, ARIZ. ATMOSPHERIC
IENCES LABORATORY AND TEXAS A AND M UNIV., COLLEGE
ATION.
EFFECTS OF A MONOLAYER ON RESERVOIR TEMPERATURE AND
EVAPORATION,
69-03054 03B

OMIC ENERGY COMMISSION, WASHINGTON, D. C. AND UNITED
GINEERS AND CONSTRUCTORS, INC., PHILADELPHIA, PA.
NUCLEAR REACTORS STATUS AND FUTURE TRENDS,
69-02940 08A

CKLAND UNIV. (NEW ZEALAND) AND MARINE BIOLOGICAL STATION,
RT ERIN, ISLE OF MAN (ENGLAND).
SOME HYDROLOGICAL OBSERVATIONS IN AUCKLAND AND OTAGO
HARBOURS,
69-02835 02L

TTELLE MEMORIAL INST., COLUMBUS, OHIO.
COMPUTER SIMULATION MODELS FOR RIVER-BASIN ANALYSIS AND
PLANNING,
69-03153 06B

BATTELLE-NORTHWEST, RICHLAND, WASH. PACIFIC NORTHWEST LAB.
MATHEMATICAL MODEL FOR UNDERGROUND DISCHARGE OF RADIOACTIVE
GASES,
69-02813 05B

BELGRADE UNIV. (YUGOSLAVIA).
A CONTRIBUTION TO THE DEVELOPMENT OF ROCK MECHANICS,
69-02947 08E

UNSTEADY FLOW IN OPEN CHANNELS,
69-03044 02E

BOARD OF AGRICULTURE, HELSINKI (FINLAND).
EFFECTS OF CLIMATOLOGIC AND BASIN CHARACTERISTICS ON ANNUAL
RUNOFF,
69-03055 02A

BOVAY ENGINEERS, INC., HOUSTON, TEX.
PREDICTING DISSOLVED OXYGEN CONCENTRATION IN A LAKE COVERED
WITH EVAPORATION SUPPRESSANT,
69-02825 02D

BUILDING RESEARCH STATION, WATFORD (ENGLAND) AND WARWICK
UNIV., COVENTRY (ENGLAND).
THE THEORY OF THE STRIP METHOD FOR DESIGN OF SLABS,
69-02918 08F

BUILDING RESEARCH STATION, WATFORD (ENGLAND).
ULTIMATE LOAD TESTS OF SLABS DESIGNED BY THE STRIP METHOD,
69-02919 08F

BUREAU OF MINES, MINNEAPOLIS, MINN.
HORIZONTAL BORING TECHNOLOGY A STATE-OF-THE-ART-STUDY,
69-02923 08C

BUREAU OF RECLAMATION, BOULDER CITY, NEV.
INCRUSTATION IN WATER PIPELINES,
69-02928 08G

BUREAU OF RECLAMATION, DENVER, COLO.
ANCHORED FOOTINGS FOR TRANSMISSION TOWERS,
69-02938 08F

STRUCTURAL DESIGN--GRAND COULEE THIRD POWERPLANT,
69-02939 08A

EVALUATION OF SPACERS FOR BUNDLED CONDUCTOR TRANSMISSION
LINES,
69-02943 08C

NEW TRENDS IN MANAGEMENT OF WATER RESOURCES PROJECTS,
69-02944 06B

CALIFORNIA RESOURCES AGENCY. DEPT. OF WATER RESOURCES.
HYDROLOGIC DATA 1967 - VOLUME IV SAN JOAQUIN VALLEY.
69-03068 02E

CALIFORNIA UNIV., BERKELEY.
A MODEL OF MIXING AND DISPERSION IN SAN FRANCISCO BAY,
69-02831 05B

SPRINKLER AND SURFACE IRRIGATION OF VEGETABLE AND FIELD
CROPS IN AN ARID ENVIRONMENT,
69-02974 03F

APPLICATION OF THE FINITE ELEMENT METHOD TO TRANSIENT FLOW
IN POROUS MEDIA,
69-03064 08B

THE LEONTIEF INPUT-OUTPUT SYSTEM AND ITS APPLICATION TO
ANALYSIS AND PROJECTION FOR WATER RESOURCES PLANNING,
69-03156 06A

THE INTERINDUSTRY WATER CONTENT MATRIX APPLICATIONS ON A
MULTIREGIONAL BASIS,
69-03157 06A

CALIFORNIA UNIV., BERKELEY. DEPT. OF CIVIL ENGINEERING.
SYSTEMS ANALYSIS FOR GROUND WATER BASIN MANAGEMENT,
69-03200 04B

CALIFORNIA UNIV., DAVIS.
THE ECONOMIST'S ROLE IN WATER PRICING POLICY,
69-02906 06C

NEUTRON MOISTURE METER CALIBRATION FOR USE IN SALINE SOILS,
69-02965 02G

SOIL WATER FLUX BELOW A RYEGRASS ROOT ZONE,
69-02975 02G

CALIFORNIA UNIV., DAVIS. DEPARTMENT OF WATER SCIENCE AND
ENGINEERING AND CALIF. UNIV., DAVIS. AGRICULTURAL
EXTENSION SERVICE.
FURROW SIZE, PLACEMENT, AND GRASS CULTURE EFFECTS ON
VINEYARD IRRIGATION,
69-02978 03F

CALIFORNIA UNIV., DAVIS. DEPARTMENT OF WATER SCIENCE AND
ENGINEERING.
AN ANALYSIS OF TEMPERATURE BEHAVIOR IN IRRIGATED SOIL
PROFILES,
69-03053 02G

CALIFORNIA UNIV., DAVIS. DEPT. OF WATER SCIENCE AND
ENGINEERING.

COMPARISON OF THREE COMMERCIAL DRAIN TILES IN A HEAVY CLAY SOIL OF IMPERIAL VALLEY,
W69-02977 08G

CALIFORNIA UNIV., LOS ANGELES AND CLYDE-CRIDDLE-WOODWARD, INC., SALT LAKE CITY, UTAH.
DETERMINING CONSUMPTIVE USE FOR PLANNING WATER DEVELOPMENTS,
W69-02970 02I

CALIFORNIA UNIV., LOS ANGELES.
OPTIMIZATION OF THE OPERATION OF A MULTIPURPOSE RESERVOIR BY DYNAMIC PROGRAMMING,
W69-02842 06A

A CONTRIBUTION TO THE THEORY OF THERMO-ECONOMICS,
W69-03131 06C

CALIFORNIA UNIV., RIVERSIDE. DEPT. OF AGRONOMY.
CHAPARRAL FIRES CHANGE SOIL MOISTURE DEPLETION PATTERNS,
W69-02979 02G

CALIFORNIA UNIV., SAN DIEGO, LA JOLLA.
RECENT DEVELOPMENTS IN OPTIMAL STRUCTURAL DESIGN,
W69-02932 08A

CARNEGIE INST. OF TECH., PITTSBURGH, PA.
SOME EVIDENCE ON THE SMALL SAMPLE PROPERTIES OF DISTRIBUTED LAG ESTIMATORS IN THE PRESENCE OF AUTOCORRELATED DISTURBANCES,
W69-03124 06A

CENTRAL ARID ZONE RESEARCH INSTITUTE, JODHPUR (INDIA).
HYDRO-GEOLOGY OF QUATERNARY FORMATION FROM RIVER LUNI AND ITS TRIBUTARIES CATCHMENT.
W69-02983 02F

CENTRAL ARID ZONE RESEARCH INST., JODHPUR (INDIA).
GERMINATION OF PROMISING DESERT GRASS SEEDS UNDER DIFFERENT DEPTHS OF SOWING IN SANDY SOIL,
W69-02972 02G

PROCESSES AND EXTENT OF EROSION AND ITS EFFECTS ON LAND USE IN THE CENTRAL LUNI BASIN, WESTERN RAJASTHAN,
W69-02987 02J

CHEVRON RESEARCH CO., LA HABRA, CALIF.
VELOCITY OF COMPRESSIONAL WAVES IN POROUS MEDIA AT PERMAFROST TEMPERATURES,
W69-03090 02C

CINCINNATI UNIV., OHIO., ENVIRONMENTAL HEALTH ENGINEERING.
AQUEOUS TRANSPORT OF DIELDRIN RESIDUES IN SOILS,
W69-02801 05B

CLEMSON UNIV., S. C. AGRICULTURAL EXPERIMENT STATION.
RELATION OF SOIL PROPERTIES TO THE EVAPORATION OF WATER FROM SOILS,
W69-03175 02D

COLORADO STATE UNIV., FORT COLLINS.
THE DYNAMICS OF PUBLIC ROLES IN THE SELECTION OF REVENUE SOURCES IN LOCAL WATER ADMINISTRATION,
W69-02847 06B

AN EXPERIMENTAL RAINFALL-RUNOFF FACILITY,
W69-03076 02A

CONTROL LEVELS FOR QUANTITATIVE EVALUATION OF WEATHER MODIFICATION ATTAINMENTS,
W69-03113 02A

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, GRIFFITH (AUSTRALIA). DIV. OF IRRIGATION RESEARCH.
PSYCHROMETRIC MEASUREMENT OF SOIL WATER POTENTIAL IN SITU UNDER COTTON PLANTS,
W69-02980 02G

CONNECTICUT AGRICULTURAL EXPERIMENTAL STATION, NEW HAVEN.
ADSORPTION OF PHOSPHORUS BY LAKE SEDIMENT,
W69-03075 02H

CONNECTICUT UNIV., STORRS. INST. OF WATER RESOURCES.
CONNECTICUT WATER LAW JUDICIAL ALLOCATION OF WATER RESOURCES.
W69-02866 06E

CONSERVATION FOUNDATION, WASHINGTON, D. C.
ROOKERY BAY AREA PROJECT A DEMONSTRATION STUDY IN CONSERVATION AND DEVELOPMENT, NAPLES, FLORIDA.
W69-03169 06B

CORNELL UNIV., ITHACA, N. Y.
THE INITIAL PHASE OF THE RISING HYDROGRAPH OF TURBULENT FREE SURFACE FLOW WITH UNSTEADY LATERAL INFLOW,
W69-02837 02E

WATER SHORTAGES AND PRICING,
W69-03135 06C

CORNELL UNIV., ITHACA, N. Y. AND MICHIGAN STATE UNIV., EAST LANSING.
RECREATIONAL USE OF MUNICIPAL RESERVOIRS,
W69-03136 06B

CORPS OF ENGINEERS, NASHVILLE, TENN.
FLOOD PLAIN INFORMATION, HARPETH RIVER, FRANKLIN, TENNESSEE.
W69-03041 02E

COUNCIL OF STATE GOVERNMENTS AND SOUTHERN LAND ECONOMIC RESEARCH COMMITTEE.
POPULATION GROWTH AND THE DEMAND FOR WATER,
W69-02962 06D

COUNCIL OF STATE GOVERNMENTS AND THE SOUTHERN LAND ECONOMIC RESEARCH COMMITTEE.
WATER RESOURCES AND ECONOMIC DEVELOPMENT THE CHALLENGE TO KNOWLEDGE,
W69-02964 06B

COYNE ET BELLIER, BUREAU D'INGENIEURS CONSEILS, PARIS (FRANCE).
SHEAR STRENGTH OF ROCK,
W69-02951 08E

DEPARTMENT OF AGRICULTURE, BROOKINGS, S. D. AND PURDUE UNIV., LAFAYETTE, IND. DEPT. OF AGRONOMY.
VELOCITY-GRADIENT RELATIONSHIPS FOR STEADY-STATE UNSATURATED FLOW OF WATER IN NON-SWELLING ARTIFICIAL SOILS,
W69-03072 02G

DEPARTMENT OF AGRICULTURE, SUMMERLAND (BRITISH COLUMBIA). RESEARCH STATION.
A SIMPLE EVAPORIMETER FOR USE IN COLD AREAS,
W69-03115 07B

DEPARTMENT OF ENERGY, MINES AND RESOURCES, OTTAWA (CANADA). INLAND WATERS BRANCH.
SOME USES OF A DIGITAL GRAPH PLOTTER IN HYDROLOGY,
W69-03112 07C

DEPARTMENT OF ENERGY, MINES AND RESOURCES, OTTAWA (ONTARIO). INLAND WATERS BRANCH.
GROUNDWATER FLOW SYSTEMS IN THE CRYSTALLINE ROCKS OF THE OKANAGAN HIGHLAND, BRITISH COLUMBIA,
W69-02826 02F

DEPARTMENT OF ENERGY, MINES AND RESOURCES, OTTAWA (ONTARIO). INLAND WATERS BRANCH.
SEDIMENT SURVEYS IN CANADA,
W69-03123 02J

DEPARTMENT OF WATER RESOURCES, OLYMPIA, WASH.
GROUND-WATER OCCURRENCE AND STRATIGRAPHY OF UNCONSOLIDATED DEPOSITS, CENTRAL PIERCE COUNTY, WASHINGTON,
W69-03081 02F

DU PONT DE NEMOURS (E. I.) AND CO., AIKEN, S. C. SAVANNAH RIVER LAB.
MOVEMENT OF WATER TAGGED WITH (2)H, (3)H, AND (18)O THROUG ACIDIC KAOLINITIC SOIL,
W69-03073 02G

DUKE UNIV., DURHAM, N. C. DEPT. OF ECONOMICS.
SIMULATION OF REGIONAL ECONOMIC IMPACTS OF WATER RESOURCE DEVELOPMENT,
W69-03176 06B

D'APPOLONIA (E.) CONSULTING ENGINEERS, INC., PITTSBURGH, PA.
DYNAMIC LOADINGS,
W69-02908 08D

LOAD TRANSFER--BEARING CAPACITY FOR SINGLE PILES AND PILE CLUSTERS,
W69-02922 08D

DENSIFICATION OF GRANULAR SOILS BY VIBRATIONS,
W69-02935 08D

ELECTRICITE DE FRANCE, PARIS.
POSSIBILITIES AND LIMITATIONS OF GEOPHYSICAL METHODS APPL TO CIVIL ENGINEERING,
W69-02916 08E

FEDERAL RESERVE SYSTEM, WASHINGTON, D. C.
PROBLEMS OF BIAS IN INPUT PRICING FOR BENEFIT COST ANALYS A REPLY,
W69-03128 06B

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, PHILADELPHIA, PA.
RESULTS FROM A SYSTEMS ANALYSIS APPROACH TO THE OPTIMUM CONTROL OF ESTUARINE WATER QUALITY,
W69-03162 05G

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, WASHINGTON, D. C.
ROLE OF SOILS AND SEDIMENT IN WATER POLLUTION CONTROL--PA I, REACTIONS OF NITROGENOUS AND PHOSPHATIC COMPOUNDS WITH SOILS AND GEOLOGIC STRATA,
W69-03080 05E

DESIGN SENSITIVITY OF POLLUTION CONTROL RESERVOIRS,
W69-03163 05G

A STUDY IN THE ECONOMICS OF WATER QUALITY MANAGEMENT,
W69-03173 05G

FOREST PRODUCTS LAB., MADISON, WISCONSIN AND ILLINOIS UNIV., CHAMPAIGN.
TRANSPORT IN SOILS THE BALANCE OF MOMENTUM,
W69-03071 02G

FORESTRY SCIENCES LAB., MOSCOW, IDAHO.
INFILTRATION, OVERLAND FLOW, AND SOIL MOVEMENT ON FROZEN SNOW-COVERED PLOTS,
W69-03060 02A

FRESHWATER BIOLOGICAL ASSOCIATION, AMBLESIDE (ENGLAND).
UNDERWATER SOILS A REVIEW OF LAKE SEDIMENTS,
W69-03187 02H

OLOGICAL SURVEY OF AUSTRALIA, MELBOURNE.
INTERRELATIONSHIP BETWEEN PHYSIOGRAPHY, HYDROLOGY, SEDIMENTATION, AND SALINIZATION OF THE LODDON RIVER PLAINS, AUSTRALIA,
W69-02817 02B

OLOGICAL SURVEY, ARLINGTON, VA.
SOME COMMENTS ON THE USE OF FACTOR ANALYSES,
W69-03050 07C

OLOGICAL SURVEY, AUSTIN, TEX. WATER RESOURCES DIV.
CARBON 14 AGES AND FLOW RATES OF WATER IN CARRIZO SAND, AT ATASCOSA COUNTY, TEXAS,
W69-03082 02F

OLOGICAL SURVEY, DENVER, COLO.
ELECTRIC-ANALOG AND DIGITAL-COMPUTER MODEL ANALYSIS OF STREAM DEPLETION BY WELLS,
W69-02976 02F

A NOTE CONCERNING THE EDDY TRANSFER COEFFICIENTS OF MOMENTUM AND WATER VAPOR UNDER NEAR-ADIABATIC CONDITIONS,
W69-03051 02D

RUNOFF AND HILLSLOPE EROSION RESULTING FROM A HIGH-INTENSITY THUNDERSTORM NEAR MACK, WESTERN COLORADO,
W69-03052 02A

OLOGICAL SURVEY, FORT COLLINS, COLO.
MEASUREMENT OF HYDRAULIC AND SEDIMENT TRANSPORT VARIABLES IN A SMALL RECIRCULATING FLUME,
W69-03056 02J

OLOGICAL SURVEY, IOWA CITY, IOWA.
FLOOD OF JUNE 7, 1967, IN THE WAPSINONOC CREEK BASIN, IOWA,
W69-03085 02E

OLOGICAL SURVEY, LANSING, MICH. MICHIGAN STATE UNIV., ST LANSING AND ENVIRONMENTAL SCIENCES SERVICES MINISTRATION, EAST LANSING, MICH.
HYDROLOGIC STUDIES OF SMALL WATERSHEDS IN AGRICULTURAL AREAS OF SOUTHERN MICHIGAN,
W69-03045 02A

OLOGICAL SURVEY, LAWRENCE, KANS. AND WICHITA AND SEDGWICK UNTY FLOOD CONTROL OFFICE, WICHITA, KANS.
FLOOD RUNOFF FROM PARTIALLY URBANIZED AREAS, WICHITA, KANSAS,
W69-03118 02E

OLOGICAL SURVEY, MENLO PARK, CALIF.
PONTACYL BRILLIANT PINK AS A TRACER DYE IN THE MOVEMENT OF WATER IN PHREATOPHYTES,
W69-03047 02I

OLOGICAL SURVEY, RALEIGH, N. C.
STRATIFICATION OF FRESH AND SALT WATER ON BARRIER ISLANDS AS A RESULT OF DIFFERENCES IN SEDIMENT PERMEABILITY,
W69-03058 02F

OLOGICAL SURVEY, TALLAHASSEE, FLA.
LOW STREAMFLOW IN THE MYAKKA RIVER BASIN AREA IN FLORIDA,
W69-02808 02E

HYDROLOGIC EFFECTS OF PUMPING FROM THE FLORIDAN AQUIFER IN NORTHWEST HILLSBOROUGH, NORTHEAST PINELLAS, AND SOUTHWEST PASCO COUNTIES, FLORIDA,
W69-03063 02F

OLOGICAL SURVEY, WASHINGTON, D C. WATER RESOURCES DIV.
RESPONSE OF A FINITE-DIAMETER WELL TO AN INSTANTANEOUS CHARGE OF WATER,
W69-03057 02F

OLOGICAL SURVEY, WASHINGTON, D. C.
FLOODS IN WAIMANALO AREA, OAHU, HAWAII,
W69-02818 02E

FLOOD OF AUGUST 1966 AT CARLSBAD, NEW MEXICO,
W69-02820 02E

AVAILABILITY OF GROUND WATER IN THE PARTS OF THE ARLINGTON AND WICKLIFFE SW QUADRANGLES IN JACKSON PURCHASE REGION, KENTUCKY,
W69-02822 02A

SPECIFIC YIELD-COMPILATION OF SPECIFIC YIELDS FOR VARIOUS MATERIALS,
W69-02828 02F

WATER RESOURCES OF THE MUSTINKA AND BOIS DE SIOUX RIVERS WATERSHED WEST-CENTRAL MINNESOTA,
W69-02829 02F

URBANIZATION AND ITS EFFECT ON THE TEMPERATURE OF LONG ISLAND STREAMS,
W69-02830 05A

FLOODS ON CHENANGO RIVER AND CANASAWACTA CREEK AT NORWICH, NEW YORK,
W69-02839 02E

ESTIMATED USE OF WATER IN THE UNITED STATES, 1965,
W69-02840 06B

GROUNDWATER FAVORABILITY AREAS AND SURFICIAL GEOLOGY OF THE LOWER ANDROSCOGGIN RIVER BASIN, MAINE,
W69-03099 02F

HYDROLOGY AND WATER RESOURCES OF THE HOUSATONIC RIVER BASIN, MASSACHUSETTS,
W69-03101 02A

UNITED STATES TRITIUM RAINOUT AND ITS HYDROLOGIC IMPLICATIONS,
W69-03121 02B

GEOLOGICAL SURVEY, WASHINGTON, D. C. WATER RESOURCES DIV.
EVALUATION OF SEEPAGE FROM CHESTER MORSE LAKE AND MASONRY POOL, KING COUNTY, WASHINGTON,
W69-02827 02H

DRAWDOWN IN A WELL OF LARGE DIAMETER,
W69-03049 02F

SEDIMENTATION IN THE PIRU CREEK WATERSHED SOUTHERN CALIFORNIA,
W69-03084 02J

THE HYDRAULICS OF OVERLAND FLOW ON HILLSLOPES,
W69-03110 02E

GEOLOGICAL SURVEY, WASHINGTON, D.C.
GRAPHICAL METHODS FOR STUDIES OF AQUEOUS ALUMINUM HYDROXIDE, FLUORIDE, AND SULFATE COMPLEXES,
W69-02834 01B

GEORGIA INST. OF TECH., ATLANTA ARCTIC HEALTH RESEARCH CENTER, FAIRBANKS, ALASKA AND SOUTHWESTERN RADIOLOGICAL HEALTH LAB., LAS VEGAS, NEV.
TRACER MEASUREMENT OF STREAM REAERATION. II. FIELD STUDIES,
W69-02821 02E

GEORGIA INST. OF TECH., ATLANTA.
SOME ERROR PROPERTIES OF SEGMENTED HYDROLOGIC FUNCTIONS,
W69-03105 07C

GEORGIA UNIV., ATHENS.
CONSUMER RESPONSES TO PRICES OF RESIDENTIAL WATER,
W69-03140 06B

GREAT LAKES-ST. LAWRENCE STUDY OFFICE, CORNWALL (ONTARIO). DEPT. OF MINES AND TECHNICAL SURVEYS.
EVAPORATION FROM LARGE DEEP LAKES,
W69-03083 02D

GUELPH UNIV., (ONTARIO).
MISCIBLE DISPLACEMENT IN AN UNSATURATED GLASS BEAD MEDIUM,
W69-02810 02G

HARVARD UNIV., CAMBRIDGE, MASS.
SCHEMES FOR HANDLING INCONSISTENT MATRICES,
W69-03117 07C

THE SOCIAL RATE OF DISCOUNT AND THE OPTIMAL RATE OF INVESTMENT,
W69-03129 06B

HARVARD UNIV., CAMBRIDGE, MASS. HARVARD WATER PROGRAM.
FIELD LEVEL PLANNING OF WATER RESOURCE SYSTEMS,
W69-02843 06B

FORMAL MODELS IN THE DESIGN OF WATER RESOURCE SYSTEMS,
W69-02846 06A

HAWAII STATE DEPT. OF LAND AND NATURAL RESOURCES, HONOLULU. DIV. OF WATER AND LAND DEVELOPMENT HAWAII UNIV., HONOLULU. WATER RESOURCES RESEARCH CENTER AND HAWAII INST. OF GEOPHYSICS, HONOLULU.
AN ELECTRICAL RESISTIVITY PROFILE FROM MAHUKONA TO KAWAIHAE, HAWAII,
W69-03184 06A

HEBREW UNIV., JERUSALEM (ISRAEL). DEPT. OF BOTANY.
ANTI-TRANSPIRANTS AS A RESEARCH TOOL FOR THE STUDY OF THE EFFECTS OF WATER STRESS ON PLANT BEHAVIOUR,
W69-02986 03F

IDAHO UNIV., MOSCOW.
FLOW OF GROUNDWATER ADJACENT TO SMALL, CLOSED BASINS IN GLACIAL TILL,
W69-03119 02F

IDAHO UNIV., MOSCOW. DEPT. OF CIVIL ENGINEERING AND IDAHO UNIV., MOSCOW. DEPT. OF AGRICULTURAL ENGINEERING.
MOVEMENT OF WATER FROM CANALS TO GROUNDWATER TABLE,
W69-03179 02G

ILLINOIS UNIV., URBANA.
SAFETY FACTORS AND PROBABILITY IN STRUCTURAL DESIGN,
W69-02941 08A

ILLINOIS UNIV., URBANA. DEPT. OF AGRONOMY.
NON-DARCY FLOW CHARACTERISTICS OF WATER AS INFLUENCED BY CLAY CONCENTRATION,
W69-03195 02G

ILLINOIS UNIV., URBANA. DEPT. OF GEOGRAPHY.
SOCIAL IMPACT OF METEOROLOGICAL DROUGHT IN ILLINOIS,
W69-03193 02B

IMPERIAL COLL. OF SCIENCE AND TECHNOLOGY, LONDON (ENGLAND).
THE STRENGTH ALONG STRUCTURAL DISCONTINUITIES IN STIFF CLAYS,
W69-02950 08D

INSTITUT ZA VODOPRIVREDU JAROSLAV CERNI, BELGRADE (YUGOSLAVIA).
SOIL STUDY FOR WATER ECONOMICS,
W69-03042 02G

SUSPENDED LOAD RESEARCH,
W69-03062 02J

INSTITUT ZA VODOPRIVREDU, JAROSLAV CERNI, BELGRADE (YUGOSLAVIA) AND BELGRADE UNIV. (YUGOSLAVIA).
RESEARCH ON BED-LOAD,
W69-03043 02J

INSTITUTION OF WATER ENGINEERS, LONDON (ENGLAND).
THE PERCHED WATER TABLE IN THE UPPER LIMESTONE AQUIFER OF MALTA,
W69-02833 02F

INSTYTUT GEOLOGICZNY, SOSNOWIEC (POLAND).
SEASONAL CHANGES OF SLOUGH AND LAKE WATER CHEMISTRY IN SOUTHERN SASKATCHEWAN (CANADA),
W69-02838 02H

INTER-AGENCY COMMITTEE ON WATER RESOURCES, WASHINGTON, D. C. SUBCOMMITTEE ON HYDROLOGY.
METHODS OF FLOW FREQUENCY ANALYSIS,
W69-03102 02E

IOWA STATE UNIV., AMES.
MATHEMATICAL MODELS FOR EXPRESSING THE BIOCHEMICAL OXYGEN DEMAND IN WATER QUALITY STUDIES,
W69-03138 05G

IOWA UNIV., IOWA CITY.
LIABILITY RESULTING FROM ARTIFICIAL BODIES OF WATER.
W69-03030 06E

IOWA UNIV., IOWA CITY. AGRICULTURAL LAW CENTER.
OPPORTUNITIES FOR REGIONAL RESEARCH ON WATER RESOURCES PROBLEMS.
W69-02872 06B

JEFFERSON COUNTY REGIONAL PLANNING COMMISSION, STEUBENVILLE, OHIO.
WATER RESOURCES STUDY, COMPREHENSIVE PLANNING PROGRAM, JEFFERSON COUNTY.
W69-03174 06B

JOHNS HOPKINS UNIV., BALTIMORE, MD. DEPT. OF GEOGRAPHY.
USE OF THE COTTONWOOD IN AN INVESTIGATION OF THE RECENT HISTORY OF A FLOOD PLAIN,
W69-02836 02J

JOHNSON (BERNARD) ENGINEERS, INC., HOUSTON, TEX.
A PROPOSAL FOR A SYSTEMS ENGINEERING STUDY OF WATER POLLUTION ABATEMENT,
W69-03164 05G

KANSAS STATE UNIV., MANHATTAN AND COLORADO STATE UNIV., FORT COLLINS.
DESIGN OF STABLE CHANNELS IN ALLUVIAL MATERIALS,
W69-03066 08B

KANSAS STATE UNIV., MANHATTAN.
ACTIVITY PATTERNS OF FISH EXPOSED TO TOXIC MATERIAL,
W69-03194 05C

KANSAS WATER RESOURCES RESEARCH INST., MANHATTAN.
DERIVATION OF BASIN HYDROGRAPHS,
W69-02811 02E

KENTUCKY UNIV., LEXINGTON.
THE INCOME REDISTRIBUTION EFFECTS OF RESERVOIR CONSTRUCTION IN APPALACHIA,
W69-03142 06B

KENTUCKY UNIV., LEXINGTON. DEPT. OF CIVIL ENGINEERING.
ECONOMIC ANALYSIS OF ALTERNATIVE FLOOD CONTROL MEASURES,
W69-03111 04A

LAMONT GEOLOGICAL OBSERVATORY, PALISADES, N. Y.
CHEMICAL AND ISOTOPIC BALANCES FOR A MEROMICTIC LAKE,
W69-03088 02H

LEHIGH UNIV., BETHLEHEM, PA.
RECENT DEVELOPMENTS IN PLASTIC DESIGN PRACTICE,
W69-02942 08G

LONDON SCHOOL OF ECONOMICS AND POLITICAL SCIENCE (ENGLAND).
WHAT IS PRODUCER'S SURPLUS,
W69-03133 06B

LOUISIANA STATE UNIV., BATON ROUGE CARNEGIE-MELLON UNIV., PITTSBURGH, PA. AND HARZA ENGINEERING CO., CHICAGO, ILL.
REGIONAL MANAGEMENT OF WATER QUALITY - A SYSTEMS APPROACH,
W69-03146 05G

MANHATTAN COLL., BRONX, N. Y.
THE TEMPORAL AND SPATIAL DISTRIBUTION OF DISSOLVED OXYGEN IN STREAMS,
W69-02809 05A

SYSTEMS ANALYSIS AND SIMULATION IN WATER QUALITY MANAGEMENT,
W69-03161 05G

MANHATTAN COLL., BRONX, N. Y. AND HYDROSCIENCE, INC., LEONIA, N. J.
WATER QUALITY ANALYSIS OF THE DELAWARE RIVER ESTUARY,
W69-03158 06A

MARYLAND DEPT. OF WATER RESOURCES, ANNAPOLIS.
WATER RESOURCES MANAGEMENT IN MARYLAND.
W69-03170 06B

MARYLAND UNIV., COLLEGE PARK. WATER RESOURCES STUDY COMMITTEE.
MARYLAND'S ROLE IN WATER RESOURCES DEVELOPMENT.
W69-03171 06B

MASSACHUSETTS INST. OF TECH., CAMBRIDGE AND STATE UNIV. OF NEW YORK, BUFFALO.
DEPOSITIONAL BEHAVIOR OF KAOLINITE IN TURBULENT FLOW,
W69-03067 02J

MASSACHUSETTS INST. OF TECH., CAMBRIDGE.
TWO-DIMENSIONAL ANALYSIS OF STRESS AND STRAIN IN SOILS, REPORT 5 PLANE-STRAIN LOADING OF A STRAIN-HARDENING SOIL
W69-02912 08D

THE OPPORTUNITY COSTS OF PUBLIC INVESTMENT COMMENT,
W69-03125 06B

MASSACHUSETTS UNIV., AMHERST.
A SURVEY AND EVALUATION OF SMALL ARTIFICIAL RECREATIONAL PONDS IN CENTRAL MASSACHUSETTS,
W69-03086 02H

ADSORPTION OF PESTICIDES ON EARTH MATERIALS,
W69-03192 05G

MICHIGAN STATE UNIV., EAST LANSING DEPT. OF ZOOLOGY.
FERTILIZATION OF NATURAL LAKES IN MICHIGAN,
W69-02957 02H

MICHIGAN STATE UNIV., EAST LANSING. DEPT. OF FISHERIES AND WILDLIFE.
AN EVALUATION OF ARTIFICIAL SUBSTRATES FOR MEASURING PERIPHYTON PRODUCTION,
W69-02955 05C

MICHIGAN UNIV., ANN ARBOR.
ANALYSIS OF WATER AND WATER-RELATED RESEARCH REQUIREMENT THE GREAT LAKES REGION.
W69-03079 07A

RAINFALL INTENSITY AND ELEVATION IN SOUTHWESTERN IDAHO,
W69-03087 02B

STEPS TOWARD A BETTER UNDERSTANDING OF URBAN RUNOFF PROGRESS,
W69-03097 04C

MICHIGAN WATER RESOURCES COMMISSION, LANSING.
SIGNIFICANCE OF NITRIFICATION IN STREAM ANALYSIS--EFFECT THE OXYGEN BALANCE,
W69-03077 05B

MINNESOTA UNIV., MINNEAPOLIS. ST. ANTHONY FALLS HYDRAULIC LAB.
REVIEW AND ANALYSIS OF RAINFALL AND RUNOFF DATA FOR SEL WATERSHEDS IN MINNESOTA,
W69-03098 02A

MINNESOTA UNIV., ST PAUL. DEPT. OF AGRICULTURAL ENGINEERING.
RUNOFF HYDROGRAPHS FOR MATHEMATICAL WATERSHED MODEL,
W69-03070 02E

MINNESOTA UNIV., ST. PAUL. DEPT. OF AGRICULTURAL ENGINEERING.
SOME ASPECTS OF THE HYDROLOGY OF PONDS AND SMALL LAKES,
W69-03091 02H

MISSISSIPPI STATE UNIV., STATE COLLEGE.
LOCAL PARTICIPATION AND WATERSHED DEVELOPMENT A COMPARATIVE STUDY OF TWO COMMUNITIES,
W69-03139 06B

MONASH UNIV., CLAYTON (AUSTRALIA).
WATER RESOURCES RESEARCH ASPECTS OF A REGIONAL STUDY THE HUNTER VALLEY, NEW SOUTH WALES,
W69-02819 02E

MONTGOMERY (JAMES M.) CONSTRUCTION ENGINEERS, INC., PASADENA, CALIF.
CONCRETE RESERVOIR DESIGN,
W69-02952 08A

MOTT, HAY AND ANDERSON, (GT. BRIT.) AND CANTERBURY UNIV. CHRISTCHURCH, (NEW ZEALAND).
MECHANISMS OF SHEAR RESISTANCE OF CONCRETE BEAMS,
W69-02927 08F

NATIONAL ACADEMY OF SCIENCES-NATIONAL RESEARCH COUNCIL, WASH., D. C., COMMITTEE ON NATURAL RESOURCES.
WATER RESOURCES A REPORT TO THE COMMITTEE ON NATURAL RESOURCES OF THE NATIONAL ACADEMY OF SCIENCES - NATION RESEARCH COUNCIL,
W69-03172 06B

NATIONAL AND UNIV. INST. OF AGRICULTURE, REHOVOTH (ISRAE
THE CONCEPT OF POTENTIAL EVAPOTRANSPIRATION IN ARID ZO AGRICULTURE,
W69-02967 02D

NEBRASKA UNIV., LINCOLN. DEPT. OF AGRONOMY.
DETACHMENT OF SOIL PARTICLES IN SIMULATED RAINFALL,
W69-02832 04D

NEVADA BUREAU OF MINES, RENO. DESERT RESEARCH INST.
OPTIMAL GROUNDWATER MINING,
W69-03114 04B

NEVADA UNIV., RENO.
HYDROGEOLOGY OF DESERT BASINS,
W69-02924 02F

A FUNCTIONAL APPROACH TO PROBLEMS OF WATER RESOURCE DEVELOPMENT AND WATER USE,
W69-03134 06A

NEW MEXICO INST. OF MINING AND TECHNOLOGY, SOCORRO.
GROWTH AND DECAY OF GROUNDWATER-MOUNDS IN RESPONSE TO UNIFORM PERCOLATION,
W69-03048 02F

NEW MEXICO TECH., SOCORRO.
DEPLETION OF FLOW IN RIGHT-ANGLE STREAM BENDS BY STEADY WELLS,
W69-03094 02A

NEW MEXICO UNIV., ALBUQUERQUE. DEPT. OF CIVIL ENGINEERING.
SOME PHYSICAL, TECHNOLOGICAL, AND ECONOMIC CHARACTERISTICS OF WATER AND WATER RESOURCE SYSTEMS IMPLICATIONS FOR ADMINISTRATION,
W69-03167 06B

NEW SOUTH WALES UNIV., KENSINGTON (AUSTRALIA). DEPT. OF STATISTICS AND COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, CANBERRA (AUSTRALIA). DIV. OF LAND RESEARCH.
STATISTICAL TESTS FOR COMMON BANKFULL FREQUENCY IN RIVERS,
W69-03096 02E

NEW YORK STATE DEPARTMENT OF CONSERVATION.
PROGRAM FOR COOPERATIVE STUDY FOR COMPREHENSIVE WATER RESOURCE DEVELOPMENT,
W69-02854 06B

NEWCASTLE UNIV., (AUSTRALIA).
STRENGTH, DURABILITY, AND SHRINKAGE OF INCOMPLETELY COMPACTED CONCRETE,
W69-02931 08F

NORTH CAROLINA STATE UNIV., RALEIGH. DEPT. OF BOTANY.
COLOR-INFRARED AERIAL PHOTOGRAPHIC INTERPRETATION AND NET PRIMARY PRODUCTIVITY OF A REGULARLY-FLOODED NORTH CAROLINA SALT MARSH,
W69-03177 02I

NORTH CAROLINA UNIV., CHAPEL HILL.
RESEARCH ON COMPREHENSIVE PLANNING OF WATER-RESOURCE SYSTEMS SYMPOSIUM,
W69-03166 06B

NORTHEASTERN FOREST EXPERIMENT STATION, DURHAM, N. H.
RADIATION AND SNOWMELT ON A CLEARCUT WATERSHED,
W69-03078 02C

OHIO STATE UNIV., COLUMBUS.
MECHANICAL PROPERTIES OF COMPACTED SOILS,
W69-02925 08D

OKLAHOMA UNIV., NORMAN.
STREAM RESPONSES AND SYSTEM ANALYSIS IN WATER QUALITY MANAGEMENT,
W69-03159 06A

ONTARIO WATER RESOURCES COMMISSION, TORONTO AND MUNICIPALITY OF METROPOLITAN TORONTO (ONTARIO). DEPT. OF WORKS.
LONG-TERM CHANGES IN WATER CHEMISTRY AND ABUNDANCE OF PLANKTON AT A SINGLE SAMPLING LOCATION IN LAKE ONTARIO,
W69-02958 02H

PACIFIC SOUTHWEST FOREST AND RANGE EXPERIMENT STATION, BERKELEY, CALIF.
WHEN IS IT SAFE TO EXTEND A PREDICTION EQUATION--AN ANSWER BASED UPON FACTOR AND DISCRIMINANT FUNCTION ANALYSIS,
W69-03183 06A

PENNSYLVANIA STATE UNIV., UNIVERSITY PARK.
A SYSTEMS APPROACH TO ANALYSIS OF HARDENED CONCRETE,
W69-02909 08F

WASTE WATER RENOVATION FOR REUSE KEY TO OPTIMUM USE OF WATER RESOURCES,
W69-02929 05D

PENNSYLVANIA STATE UNIV., UNIVERSITY PARK. DEPT. OF AGRICULTURAL ENGINEERING.
THE HYDROLOGIC REGIME DUE TO SPRINKLER IRRIGATION OF TREATED MUNICIPAL EFFLUENT ON SLOPING LAND,
W69-03109 05G

PUNJAB AGRICULTURAL UNIV., HISSAR (INDIA). DEPT. OF AGRONOMY.
INVESTIGATIONS ON THE IRRIGATION REQUIREMENTS OF HYBRID MAIZE CROP IN ARID REGION OF PUNJAB,
W69-02973 03F

PURDUE UNIV., LAFAYETTE, IND.
APPLICABILITY OF REMOTE SENSING AND SYSTEMS ANALYSIS TECHNIQUES TO RIVER BASIN PLANNING,
W69-03145 06A

RESEARCH COUNCIL OF ALBERTA, EDMONTON.
BED FORMS IN THE LOWER RED DEER RIVER, ALBERTA,
W69-02816 02J

RESOURCES FOR THE FUTURE, INC., WASHINGTON, D. C.
AN ECONOMIC APPROACH TO COPING WITH FLOOD DAMAGE,
W69-02844 06F

BROAD HORIZONS IN WATER RESOURCE PLANNING AND INVESTMENT,
W69-02845 06B

RICE UNIV., HOUSTON, TEX.
ROCK BREAKAGE BY CRUSHING, BLASTING, AND DRILLING,
W69-02920 08E

ACCURACY OF DISCRETE MODELS USED TO PREDICT ESTUARY POLLUTION,
W69-03107 05B

ROYAL INST. OF PUBLIC ADMINISTRATION, LONDON (ENGLAND). STAFFORDSHIRE POTTERIES WATER BOARD.
MODERN MANAGEMENT TECHNIQUES,
W69-02954 06B

SHAWINIGAN ENGINEERING CO. LTD., MONTREAL (QUEBEC).
RELATIONSHIP BETWEEN PRECIPITATION, EVAPORATION, AND RUNOFF IN TROPICAL-EQUATORIAL REGIONS,
W69-03092 02A

SHEAFFER (JOHN R.) AND ASSOCIATES, WHEATON, ILL.
WATER RESOURCE MANAGEMENT IN MT. PROSPECT A SURVEY OF THE ENVIRONMENT, PROBLEMS, AND OPPORTUNITIES,
W69-03168 06B

SHEFFIELD UNIV., (ENGLAND) AND HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO, TORONTO.
COMPARISON OF FIELD AND LABORATORY MEASUREMENTS OF MODULUS OF DEFORMATION OF A CLAY,
W69-02933 08D

SOUTH DAKOTA STATE UNIV., BROOKINGS.
CORRELATING SOIL MOISTURE CONDITIONS AND MICROCLIMATE WITH EVAPORATION LOSSES AND WATER REQUIREMENTS OF PLANTS,
W69-03198 02D

SOUTH DAKOTA STATE UNIV., BROOKINGS. DEPT. OF CIVIL ENGINEERING.
INVESTIGATION OF THE INFLUENCE OF WASTE DISPOSAL PRACTICES ON GROUNDWATER QUALITIES,
W69-03178 05B

SOUTHERN ILLINOIS UNIV., CARBONDALE.
CONSERVATION DECISION-MAKING A RATIONALIZATION,
W69-03127 04C

SOUTHERN METHODIST UNIV., DALLAS, TEX. AND NORTHWESTERN UNIV., EVANSTON, ILL.
SIMULATION OF FLOOD FLOW DIVERSION FROM A LAKE SYSTEM,
W69-03143 04A

STATE HYDROLOGICAL INST., LENINGRAD (USSR).
INFLUENCE OF THE FOREST ON PRECIPITATION,
W69-02803 02B

STATE UNIV. OF NEW YORK, BUFFALO.
PERMEABILITY OF ORTHOTROPIC POROUS MEDIUMS,
W69-02812 02F

STRATHCLYDE UNIV., GLASGOW (SCOTLAND). DEPT. OF CIVIL ENGINEERING.
SIMILITUDE THEORY APPLIED TO CORRELATION OF PLUME SEDIMENT TRANSPORT DATA,
W69-03095 02J

SWINDELL-DRESSLER CO., PITTSBURGH, PA.
EVALUATION OF DEEP IN-SITU SOIL STABILIZATION BY HIGH-PRESSURE LIME-SLURRY INJECTION,
W69-02930 08D

SYRACUSE UNIV., N. Y.
POLITICS AND ORGANIZATION IN WATER RESOURCE ADMINISTRATION A COMPARATIVE STUDY OF DECISIONS,
W69-02849 06E

SYRACUSE UNIV., N. Y. DEPT OF CIVIL ENGINEERING.
PRIMARY PRODUCTIVITY STUDIES IN ONONDAGA LAKE, NEW YORK,
W69-02959 05C

SYRACUSE UNIV., N. Y. DEPT. OF CIVIL ENGINEERING.
ONONDAGA LAKE, NEW YORK, AN UNUSUAL ALGAL ENVIRONMENT,
W69-02961 02H

TECHNION ISRAEL INST. OF TECH., HAIFA.
A LAPLACE TRANSFORM PROOF OF THE THEOREM OF MOMENTS FOR THE INSTANTANEOUS UNIT HYDROGRAPH,
W69-03120 06A

TECHNION - ISRAEL INST. OF TECH., HAIFA.
DESIGN OF OPTIMAL WATER DISTRIBUTION SYSTEMS,
W69-03165 06B

TECHNION-ISRAEL INST. OF TECH., HAIFA AND WATER PLANNING FOR ISRAEL LTD., TEL-AVIV.
MOMENTS OF THE INPUT, OUTPUT, AND IMPULSE RESPONSE FUNCTIONS OF LINEAR SYSTEMS ABOUT ARBITRARY POINTS,
W69-03089 02A

TECHNION-ISRAEL INST. OF TECH., HAIFA.
OPTIMIZATION AND RANGE OF APPLICATION OF NUCLEAR REACTORS AND FLASH EVAPORATORS FOR SEA WATER DESALINATION,
W69-03147 03A

TENNESSEE UNIV., KNOXVILLE. DEPT. OF CIVIL ENGINEERING.
AN INVESTIGATION OF THE EFFECT OF CONTROLLED RELEASES ON THE PHYSICAL, CHEMICAL AND BACTERIOLOGICAL CHARACTERISTICS OF FORT LOUDOUN RESERVOIR,
W69-03180 05C

A STUDY OF THE SURVIVAL OF BACTERIAL INDICATORS OF POLLUTION IN NATURAL WATERS,
W69-03181 05B

TENNESSEE UNIV., KNOXVILLE. DEPT. OF ZOOLOGY AND

ENTOMOLOGY.
THE PRODUCTIVITY OF A LAKE POLLUTED BY ORGANIC WASTES DERIVED PRIMARILY FROM SEPTIC TANKS,
W69-03182 05C

TENNESSEE VALLEY AUTHORITY, KNOXVILLE.
ANALYTICALLY DERIVED UNIT GRAPH AND RUNOFF,
W69-03069 02A

DETECTION OF SATURATED INTERFLOW IN SOILS WITH PIEZOMETERS,
W69-03074 07B

TEXAS A AND M UNIV., COLLEGE STATION.
PROJECTION OF AGRICULTURAL WATER AND LAND USE FOR LONG RANGE WATER RESOURCES IN TEXAS,
W69-03144 03F

TEXAS UNIV., AUSTIN.
PARETO AND THE MARSHALLIAN CONSTANCY ASSUMPTION,
W69-03130 06B

THOMPSON (JOHN I.) AND CO, WASHINGTON, D. C.
THE INFORMATION BACKGROUND IN THE FIELD OF BIOLOGICAL DETERIORATION OF NONMETALLIC MATERIALS,
W69-02905 08C

TORONTO UNIV., ONTARIO.
OPTIMAL WASTE TREATMENT AND POLLUTION ABATEMENT BENEFITS ON A CLOSED RIVER SYSTEM,
W69-03150 05D

TRW SYSTEMS GROUP, SAN BERNARDINO, CALIF. RESOURCE MANAGEMENT DEPT.
SYSTEMS APPROACH TO WATER RESOURCE MANAGEMENT.
W69-03122 06A

TUDOR ENGINEERING CO., SAN FRANCISCO, CALIF.
THE FUNCTION OF FEASIBILITY REPORTS,
W69-02910 06A

UDAIPUR UNIV. (INDIA) AGRICULTURAL EXPERIMENT STATION.
GERMINATION IN LOWER OSMOTIC POTENTIAL AS AN INDEX OF DROUGHT RESISTANCE IN CROP PLANTS - A REVIEW,
W69-02984 02I

UTAH AGRICULTURAL EXPERIMENT STATION, LOGAN.
STATE WATER PLANNING GOALS AND ANALYTICAL APPROACHES,
W69-02963 06B

UTAH STATE UNIV., LOGAN.
SOIL-WATER MOVEMENT IN VAPOUR AND LIQUID PHASES,
W69-02966 02G

VIRGINIA POLYTECHNIC INST., BLACKSBURG. WATER RESOURCES RESEARCH CENTER.
SIMILARITIES BETWEEN FLOOD CONTROL PROBLEMS AND OTHER ASPECTS OF WATER MANAGEMENT IN THE UNITED STATES,
W69-02848 06F

EVALUATION OF THE EFFECT OF TRACE ELEMENTS ON THE ACTIVITY OF MICROORGANISMS,
W69-03196 05C

VIRGINIA UNIV., CHARLOTTESVILLE.
EXTERNALITY,
W69-03132 06B

WASHINGTON STATE DEPT. OF WATER RESOURCES.
GROUND-WATER WITHDRAWAL IN THE ODESSA AREA, ADAMS, GRANT, AND LINCOLN COUNTIES, WASHINGTON,
W69-02823 02F

WASHINGTON STATE UNIV., PULLMAN.
TUBULAR TURBINES,
W69-02907 08C

WASHINGTON STATE UNIV., PULLMAN. DEPT. OF AGRICULTURAL ENGINEERING.
DRAINAGE THEORY FOR REMOVAL OF EXCESS WATER FROM IRRIGATED LANDS,
W69-03189 04A

WASHINGTON UNIV., SEATTLE CLARK UNIV., WORCESTER, MASS. AND VICTORIA UNIV., TORONTO (ONTARIO).
BENEFIT-COST ANALYSIS AND THE NATIONAL OCEANOGRAPHIC PROGRAM,
W69-03126 06B

WASHINGTON UNIV., SEATTLE.
THE CALIFORNIA WATER PROJECT IS PUBLIC DECISION-MAKING BECOMING MORE EFFICIENT,
W69-02841 06B

WASHINGTON UNIV., SEATTLE. COLL. OF FISHERIES.
WATER QUALITY AS RELATED TO THE SURVIVAL OF SALMON EGGS AND LARVAE,
W69-03190 05C

STUDIES OF JUVENILE SALMON IN THE NOOKSACK RIVER SYSTEM AND BELLINGHAM BAY,
W69-03191 05C

WATER POLLUTION RESEARCH STEERING COMMITTEE, LONDON (ENGLAND).
WATER POLLUTION RESEARCH 1967.
W69-03065 05G

WATER RESOURCES COUNCIL, WASHINGTON, D. C.
THE NATION'S WATER RESOURCES SUMMARY REPORT.
W69-02953 06B

WATER RESOURCES COUNCIL, WASHINGTON, D. C. HYDROLOGY COMMITTEE.
RIVER MILEAGE MEASUREMENT,
W69-03100 07A

WEBER (W. G.) AND ASSOCIATES, INC., SACRAMENTO, CALIF.
IN SITU PERMEABILITIES FOR DETERMINING RATES OF CONSOLIDATION,
W69-02934 08D

WEST RIDING COUNTY COUNCIL, YORKSHIRE (ENGLAND).
RAWCLIFFE BRIDGE IN YORKSHIRE,
W69-02926 08G

WEST VIRGINIA UNIV., MORGANTOWN.
COMPOSITION OF WATER DISCHARGED FROM BITUMINOUS COAL MINES IN NORTHERN WEST VIRGINIA,
W69-02804 05B

WESTERN AUSTRALIA UNIV., NEDLANDS AND BOTANIC GARDENS, ST. LOUIS, MO.
AN ELECTRIC HYGROMETER APPARATUS FOR MEASURING WATER-VAPOUR LOSS FROM PLANTS IN THE FIELD,
W69-02968 02D

WISCONSIN DEPT. OF RESOURCE DEVELOPMENT, MADISON.
URBAN AND BASIN PLANNING,
W69-02851 06B

WISCONSIN UNIV., MADISON. ENGINEERING EXPERIMENT STATION.
NUTRIENT SOURCES FOR ALGAE AND AQUATIC WEEDS,
W69-03185 05B

SOME FACTORS IN THE COMPETITION OR ANTAGONISM BETWEEN BACTERIA, ALGAE, AND AQUATIC WEEDS,
W69-03188 05C

WISCONSIN UNIV., MADISON. ENGINEERING EXPERIMENTAL STATION.
FIELD AND LABORATORY EVALUATIONS OF BIOASSAYS FOR NITROGEN AND PHOSPHORUS WITH ALGAE AND AQUATIC WEEDS,
W69-03186 05A

WISCONSIN UNIV., MADISON. LAB. OF LIMNOLOGY.
DWINDLING LAKES,
W69-02956 02H

WISCONSIN UNIV., MILWAUKEE AND NORTHWESTERN UNIV., EVANSTON, ILL.
UNSTEADY SEEPAGE FLOW BETWEEN FULLY-PENETRATING TRENCHES,
W69-02913 02G

YALE UNIV., NEW HAVEN, CONN. OSBORN ZOOLOGICAL LAB.
THE CHEMISTRY OF LAKE SEDIMENTS FROM INDIAN TIBET,
W69-02960 02H

ACCESSION NUMBER INDEX

B	W69-02801	04A	W69-02878	06B	W69-02954	06E	W69-03030
A	W69-02802	04A	W69-02879	05C	W69-02955	05B	W69-03031
B	W69-02803	04C	W69-02880	02H	W69-02956	06E	W69-03032
B	W69-02804	04C	W69-02881	02H	W69-02957	06E	W69-03033
B	W69-02805	04C	W69-02882	02H	W69-02958	05B	W69-03034
E	W69-02806	04A	W69-02883	05C	W69-02959	04A	W69-03035
A	W69-02807	04A	W69-02884	02H	W69-02960	04A	W69-03036
E	W69-02808	04A	W69-02885	02H	W69-02961	04A	W69-03037
A	W69-02809	06E	W69-02886	06D	W69-02962	04A	W69-03038
G	W69-02810	04A	W69-02887	06B	W69-02963	05B	W69-03039
E	W69-02811	04A	W69-02888	06B	W69-02964	04A	W69-03040
F	W69-02812	04A	W69-02889	02G	W69-02965	02E	W69-03041
B	W69-02813	06E	W69-02890	02G	W69-02966	02G	W69-03042
A	W69-02814	06E	W69-02891	02D	W69-02967	02J	W69-03043
E	W69-02815	06E	W69-02892	02D	W69-02968	02E	W69-03044
J	W69-02816	05B	W69-02893	02I	W69-02969	02A	W69-03045
B	W69-02817	06C	W69-02894	02I	W69-02970	02I	W69-03047
E	W69-02818	05D	W69-02895	02E	W69-02971	02F	W69-03048
E	W69-02819	06E	W69-02896	02G	W69-02972	02F	W69-03049
E	W69-02820	06E	W69-02897	03F	W69-02973	07C	W69-03050
E	W69-02821	05B	W69-02898	03F	W69-02974	02D	W69-03051
A	W69-02822	06E	W69-02899	02G	W69-02975	02A	W69-03052
F	W69-02823	06E	W69-02900	02F	W69-02976	02G	W69-03053
B	W69-02824	05G	W69-02901	08G	W69-02977	03B	W69-03054
D	W69-02825	04A	W69-02902	03F	W69-02978	02A	W69-03055
F	W69-02826	06E	W69-02903	02G	W69-02979	02J	W69-03056
H	W69-02827	06E	W69-02904	02G	W69-02980	02F	W69-03057
F	W69-02828	08C	W69-02905	02G	W69-02981	02F	W69-03058
F	W69-02829	06C	W69-02906	04D	W69-02982	02H	W69-03059
A	W69-02830	08C	W69-02907	02F	W69-02983	02A	W69-03060
B	W69-02831	08D	W69-02908	02I	W69-02984	05E	W69-03061
D	W69-02832	08F	W69-02909	02I	W69-02985	02J	W69-03062
F	W69-02833	06A	W69-02910	03F	W69-02986	02F	W69-03063
B	W69-02834	08A	W69-02911	02J	W69-02987	08B	W69-03064
L	W69-02835	08D	W69-02912	02J	W69-02988	05G	W69-03065
J	W69-02836	02G	W69-02913	02B	W69-02989	08B	W69-03066
E	W69-02837	08C	W69-02914	05D	W69-02990	02J	W69-03067
H	W69-02838	08D	W69-02915	06E	W69-02991	02E	W69-03068
E	W69-02839	08E	W69-02916	04C	W69-02992	02A	W69-03069
B	W69-02840	08A	W69-02917	04A	W69-02993	02E	W69-03070
B	W69-02841	08F	W69-02918	04C	W69-02994	02G	W69-03071
A	W69-02842	08F	W69-02919	06E	W69-02995	02G	W69-03072
B	W69-02843	08E	W69-02920	04A	W69-02996	02G	W69-03073
F	W69-02844	08D	W69-02921	04A	W69-02997	07B	W69-03074
B	W69-02845	08D	W69-02922	06E	W69-02998	02H	W69-03075
A	W69-02846	08C	W69-02923	04A	W69-02999	02A	W69-03076
B	W69-02847	02F	W69-02924	06E	W69-03000	05B	W69-03077
F	W69-02848	08D	W69-02925	04A	W69-03001	02C	W69-03078
E	W69-02849	08G	W69-02926	06E	W69-03002	07A	W69-03079
B	W69-02851	08F	W69-02927	06E	W69-03003	05E	W69-03080
E	W69-02852	08G	W69-02928	06E	W69-03004	02F	W69-03081
E	W69-02853	05D	W69-02929	06E	W69-03005	02F	W69-03082
B	W69-02854	08D	W69-02930	04A	W69-03006	02D	W69-03083
B	W69-02855	08F	W69-02931	06E	W69-03007	02J	W69-03084
A	W69-02856	08A	W69-02932	06E	W69-03008	02E	W69-03085
E	W69-02857	08D	W69-02933	06E	W69-03009	02H	W69-03086
G	W69-02858	08D	W69-02934	06E	W69-03010	02B	W69-03087
A	W69-02859	08D	W69-02935	05B	W69-03011	02H	W69-03088
E	W69-02860	08F	W69-02936	06E	W69-03012	02A	W69-03089
E	W69-02861	08G	W69-02937	06E	W69-03013	02C	W69-03090
A	W69-02862	08F	W69-02938	04A	W69-03014	02H	W69-03091
E	W69-02863	08A	W69-02939	06E	W69-03015	02A	W69-03092
A	W69-02864	08A	W69-02940	06E	W69-03016	02J	W69-03093
A	W69-02865	08A	W69-02941	04A	W69-03017	02A	W69-03094
E	W69-02866	08G	W69-02942	04A	W69-03018	02J	W69-03095
E	W69-02867	08C	W69-02943	04A	W69-03019	02E	W69-03096
E	W69-02868	06B	W69-02944	04A	W69-03020	04C	W69-03097
B	W69-02869	08B	W69-02945	04A	W69-03021	02A	W69-03098
E	W69-02870	02F	W69-02946	04C	W69-03022	02F	W69-03099
G	W69-02871	08E	W69-02947	04B	W69-03023	07A	W69-03100
B	W69-02872	08A	W69-02948	05G	W69-03024	02A	W69-03101
E	W69-02873	08D	W69-02949	04A	W69-03025	02E	W69-03102
B	W69-02874	08D	W69-02950	06E	W69-03026	06A	W69-03103
E	W69-02875	08E	W69-02951	06E	W69-03027	07C	W69-03105
G	W69-02876	08A	W69-02952	04A	W69-03028	02A	W69-03106
A	W69-02877	06B	W69-02953	06E	W69-03029	05B	W69-03107

02J	W69-03108
05G	W69-03109
02E	W69-03110
04A	W69-03111
07C	W69-03112
02A	W69-03113
04B	W69-03114
07B	W69-03115
02I	W69-03116
07C	W69-03117
02E	W69-03118
02F	W69-03119
06A	W69-03120
02B	W69-03121
06A	W69-03122
02J	W69-03123
06A	W69-03124
06B	W69-03125
06B	W69-03126
04C	W69-03127
06B	W69-03128
06B	W69-03129
06B	W69-03130
06C	W69-03131
06B	W69-03132
06B	W69-03133
06A	W69-03134
06C	W69-03135
06B	W69-03136
06E	W69-03137
05G	W69-03138
06B	W69-03139
06B	W69-03140
06B	W69-03142
04A	W69-03143
03F	W69-03144
06A	W69-03145
05G	W69-03146
03A	W69-03147
08B	W69-03148
05D	W69-03150
06B	W69-03153
06A	W69-03155
06A	W69-03156
06A	W69-03157
06A	W69-03158
06A	W69-03159
06A	W69-03160
05G	W69-03161
05G	W69-03162
05G	W69-03163
05G	W69-03164
06B	W69-03165
06B	W69-03166
06B	W69-03167
06B	W69-03168
06B	W69-03169
06B	W69-03170
06B	W69-03171
06B	W69-03172
05G	W69-03173
06B	W69-03174
02D	W69-03175
06B	W69-03176
02I	W69-03177
05B	W69-03178
02G	W69-031
05C	W69-031
05B	W69-031
05C	W69-03
06A	W69-03
06A	W69-03
05B	W69-03
05A	W69-03
02H	W69-03
05C	W69-03
04A	W69-03
05C	W69-03
05C	W69-03
05G	W69-03
02B	W69-03
05C	W69-03
02G	W69-03
05C	W69-03
02F	W69-03
02D	W69-03
06B	W69-03
04B	W69-03

Subject Fields

- NATURE OF WATER
- WATER CYCLE
- WATER SUPPLY AUGMENTATION AND CONSERVATION
- WATER QUANTITY MANAGEMENT AND CONTROL
- WATER QUALITY MANAGEMENT AND PROTECTION
- WATER RESOURCES PLANNING
- RESOURCES DATA
- ENGINEERING WORKS
- MANPOWER, GRANTS, AND FACILITIES
- SCIENTIFIC AND TECHNICAL INFORMATION

INDEXES

- SUBJECT INDEX
- AUTHOR INDEX
- ORGANIZATIONAL INDEX
- ACCESSION NUMBER INDEX

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF COMMERCE

LIBRARY RATE
PRINTED MATTER

U.S. DEPARTMENT OF COMMERCE
CLEARINGHOUSE FOR FEDERAL
SCIENTIFIC AND TECHNICAL INFORMATION
SPRINGFIELD, VA. 22151

OFFICIAL BUSINESS

6.33391

UNIVERSITY OF ILLINOIS
AUG 29 1969
LIBRARY

SELECTED WATER RESOURCES ABSTRACTS

VOLUME 2, NUMBER 9
MAY 1, 1969

WR 69-03201--WR 69-03700

Selected Water Resources Abstracts is published semimonthly for the Water Resources Scientific Information Center (WRSIC) by the Clearinghouse for Federal Scientific and Technical Information (CFSTI) of the Bureau of Standards, U. S. Department of Commerce. It is available to Federal agencies, contractors, or grantees in water resources upon request to: Manager, Water Resources Scientific Information Center, Office of Water Resources Research, U. S. Department of the Interior, Washington, D. C. 20240. Annual subscription is $22.00 (domestic), $27.50 (foreign), single copy price is $3.00. Certain documents abstracted in this journal can be purchased from the Clearinghouse at the prices indicated in the entry. Prepayment is required.

CLEARINGHOUSE
FOR FEDERAL SCIENTIFIC AND TECHNICAL INFORMATION
U.S. Department of Commerce, Springfield, Va., 22151

SELECTED
WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

VOLUME 2, NUMBER 9
MAY 1, 1969

WR 69-03201 -- WR 69-03700

of funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States--now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources. WRSIC is not presently prepared to furnish loan or retention copies of the publications announced.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas. Centers, and their subject coverage, now in operation are:

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

CONTENTS

FOREWORD_____iii

SUBJECT FIELDS AND GROUPS

(Use Edge Index on back cover to Locate Subject Fields and Indexes in the journal.)

01 NATURE OF WATER
Includes the following Groups: Properties; Aqueous Solutions and Suspensions

02 WATER CYCLE
Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION
Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL
Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Non-Water Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION
Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING
Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA
Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS
Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS, AND FACILITIES
Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.

10 SCIENTIFIC AND TECHNICAL INFORMATION
Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

SELECTED WATER RESOURCES ABSTRACTS

. NATURE OF WATER

. Properties

FLECTIVITY OF ELECTROMAGNETIC AVES AT AN AIR-WATER INTERFACE FOR RE AND SEA WATER,
waii Univ., Honolulu.
ry K. Lepley, and William M. Adams.
waii Water Resources Research Center, Tech No 25, Dec 1968. 15 p, 8 fig, 7 ref. OWRR ject B-008-HI.

criptors: *Reflectivity, *Electromagnetic ves, Air-water interface, Sea water, Pure water.

optical properties of electromagnetic waves in- ent on chemically pure water or sea water have n compiled. This information indicates that avior is significantly different for the two water es above and below a frequency of 10 billion cy- per second. For all lower frequencies, sea er behaves like a metal and pure water behaves a semi-conductor. For higher frequencies, both h and pure water behave as dielectrics having lar optical properties. The optics of natural ers of all salinities are well known only at the ble frequencies. The reflectivity contrast ween pure and sea water to visible light, i.e., the er frequencies, is approximately 3%. The ectivity contrast between sea water and pure er at frequencies less than about 10 billion cy- per second is approximately 44%.
-03598

. WATER CYCLE

. General

TENTIAL FLOW AND SOIL STRUCTURE ANGES,
ak Technical Univ., Bratislava (C- oslovakia).
primary bibliographic entry see Field 02F.
abstract, see .
-03203

DIFFUSION OF AIR THROUGH THE E WATER OF SOILS,
chester Univ. (England); and Salford Univ. gland).
arden, and G. R. Sides.
3d Asian Reg Conf, Int Soc of Soil Mech and d Eng, Haifa, Israel, Sept 25-28, 1967, Vol 1, , pp 135-138, 1967. 4 p, 2 fig, 2 tab, 9 ref.

riptors: *Diffusion, *Air, *Solubility, *Soil r movement, *Porous media, Fluid mechanics, orption, Model studies, Clays.
ifiers: Air diffusion, Multiphase flow, Dif- neters.

surements are reported of the diffusion of air gh the pore water of both saturated and com- ed clays. It is shown that the average coeffi- of diffusion D through adsorbed water is less than that through free water. As the ture content of the soil is reduced, the average of D decreases, suggesting that as the clay ce is approached there is a reduction in D and nsequent increase in the viscosity of the ad- ed water. The marked reduction in D below evel for free water will cause a large increase in me required for the air-water mixture in a par- saturated soil to reach equilibrium. (Knapp- S)
-03205

NEMENT OF PARAMETERS FOR CALCU- NG EVAPORATION FROM BOGS ON THE S OF OBSERVATIONS AT BOG STA- NS,
rimary bibliographic entry see Field 02D.
bstract, see .

W69-03211

HYDROLOGIC SUBSTANTIATION AND COMPUTATION OF THE REDUCTION OF FORESTS AND THE EXPANSION OF NATURALLY WATERLOGGED AREAS AFTER UNDERFLOODING IN RIVER SYSTEMS,
K. Ye Ivanov, and Ye. L. Shumakova.
Transl from Trudy Gos Gidrol Inst, No 145, 1967. Soviet Hydrol: Selec Pap, Issue No 4, pp 329-347, 1967. 19 p, 11 fig, 5 tab, 15 ref.

Descriptors: *Reservoirs, *Groundwater, *Water level fluctuations, *Saturated soils, *Forests, Water injury, Flooding, River systems.
Identifiers: USSR, Lower Ob' River Basin.

A method is proposed for computing recession of forests in plains affected by rising water tables caused by reservoir inundation of river systems. A theoretical substantiation of the empirical method is given. The computation is designed for cases in which detailed geohydrologic data for the area are not available and stratigraphic cross sections are scarce. An example of the computations is given for the effect of the planned Lower Ob' Hydroelectric plant on the forest cover of the Ob' basin. (Knapp-USGS)
W69-03214

SOIL MOISTURE.
National Research Council of Canada, Ottawa (Ontario). Subcommittee on Hydrology.
For primary bibliographic entry see Field 02G.
For abstract, see .
W69-03223

AN APPLICATION OF PRINCIPAL COMPONENT ANALYSIS AND FACTOR ANALYSIS IN THE STUDY OF WATER YIELD,
Tennessee Univ., Knoxville. Dept. of Agricultural Engineering.
Guillermo Diaz, J. I. Sewell, and C. H. Shelton.
Water Resources Res, Vol 4, No 2, pp 299-306, April 1968. 8 p, 7 tab, 13 ref.

Descriptors: *Rainfall-runoff relationships, *Statistical methods, *Watersheds (Basins), Water yield, Runoff, Statistics, Ohio, Texas.
Identifiers: Ohio watersheds, Texas watersheds.

Principal component and factor analyses were applied to annual precipitation and runoff data of fourteen watersheds from Coshocton, Ohio, and seven watersheds from Riesel, Texas. The objective was to identify the factors affecting the water yield of these watersheds and to determine the relative importance of the identified factors. From the Ohio watersheds, the rotated factor analysis suggested that watershed area and slope were, in that order, the two most important factors affecting water yield. For the Texas watersheds, three almost equally important watershed factors were identified as the soil type, cultural practices, and land capability. A stepwise regression of runoff-precipitation ratios of the Ohio data on area-slope variables substantiated the effects of area and slope on runoff as determined by the factor analysis. (Steinhilber-USGS)
W69-03233

HYDROGEOLOGY OF DESERT BASINS,
Nevada Bureau of Mines, Reno. Desert Research Inst.
For primary bibliographic entry see Field 02F.
For abstract, see .
W69-03238

STREAMS-THEIR DYNAMICS AND MORPHOLOGY,
Antioch Coll., Yellow Springs, Ohio.
For primary bibliographic entry see Field 02E.
For abstract, see .
W69-03248

CLIMATE AND SOIL MOISTURE EXTRACTION,
Volcani Inst. of Agricultural Research, Bet-Dagan (Israel); and Israel Meteorological Service, Bet-Dagan.
For primary bibliographic entry see Field 02G.
For abstract, see .
W69-03250

AN EXTENSION TO THE THOMAS-FIERING MODEL FOR THE SEQUENTIAL GENERATION OF STREAMFLOW,
Washington Univ., Seattle; and Washington Water Research Center, Pullman.
Archie A. Harms, and Thomas H. Campbell.
Water Resources Res, Vol 3, No 3, pp 653-661, 1967. 9 p, 12 fig, 5 ref.

Descriptors: *Streamflow forecasting, *Synthetic hydrology, *Statistical methods, *River systems, Model studies, Computer models, Digital computers.
Identifiers: *Algorithmic methods, Pacific Northwest rivers.

An extension to an algorithm for the sequential generation of nonhistoric streamflow, previously used by Thomas and Fiering, is suggested. The distinguishing features of this model are preservation of (1) normal distribution of annual flows; (2) log-normal distribution of monthly flows; (3) correlation between annual flows; and (4) correlation between monthly flows. This model has been applied to two representative Pacific Northwest rivers. A graphical examination of the results suggests that this model provides an authentic representation of streamflow.
W69-03307

THE NONLINEAR PREDICTION PROBLEM IN THE STUDY OF THE RUNOFF CYCLE,
California Univ., Davis.
J. Amorocho.
Water Resources Res, Vol 3, No 3, pp 861-880, 1967. 20 p, 12 fig, 32 ref.

Descriptors: *Forecasting, *Rainfall-runoff relationships, *Synthetic hydrology, *Sequential generation, Mathematical models, Simulation analysis.
Identifiers: *Hydrologic systems, Nonlinear systems, Nonlinear synthesis, Uncertainty.

The general theory of nonlinear synthesis and analysis in hydrology is discussed, with particular reference to the problems of predictive uncertainty. These problems are associated with incomplete descriptions of the hydrologic systems, limited model-prototype equivalences, system variability in time, and system nonlinearity. Solutions to the nonlinear analysis problem of hydrologic systems under the assumption of approximate time invariance, based on complex cascade network approximations, power series and polynomial expansions, and variable response function approximations are presented. The relations between present theoretical knowledge and its practical application are summarized.
W69-03308

A REVIEW OF RAINFALL-RUNOFF, PHYSICAL MODELS AS DEVELOPED BY DIMENSIONAL ANALYSIS AND OTHER METHODS,
Agricultural Research Service, Tucson, Ariz. Southwest Watershed Research Center.
D. L. Chery, Jr.
Water Resources Res, Vol 3, No 3, pp 881-889, 1967. 9 p, 1 fig, 12 ref.

Descriptors: *Model studies, *Hydraulic models, *Rainfall-runoff relationships, *Hydraulic similitude, *Dimensional analysis, Demonstration watersheds, Analytical techniques, Design.
Identifiers: Hydrologic systems, Drainage basin characteristics, Simulation.

Model studies of the rainfall-runoff relationship are reviewed. Limited similitude relations for the construction of physical models of the watershed hydrologic system have been developed, using dimensional analysis, by Mamisao and Chery. Tests on both constructed models indicate that the hoped for similarity did not materialize, and that further testing is necessary to develop empirically the needed similarity relations. Grace and Eagleson have, using differential equations, also developed similitude relations for hydrologic system modeling and discussed the limitations of such modeling. Other individuals are also contemplating modeling, but their endeavors are not concerned with similitude relations, because their devices are non-scaled representatives of parts of the natural hydrologic system.
W69-03309

INTERCEPTION BY EASTERN WHITE PINE,
Coweeta Hydrologic Lab., Asheville, N. C.
For primary bibliographic entry see Field 02I.
For abstract, see .
W69-03315

THROUGHFALL AND STEMFLOW IN A PINE-HARDWOOD STAND IN THE OUACHITA MOUNTAINS OF ARKANSAS,
Southern Forest Experiment Station, Harrison, Ark.
For primary bibliographic entry see Field 02I.
For abstract, see .
W69-03339

DISPOSITION OF CONSTANT INTENSITY RAINFALL IN A KARST AREA,
Montpellier Univ. (France). Geologic Lab.
Claude Drogue.
Extrait des Annales de Speleologie, Tome 19, F 4, pp 631-634, 1964. 4 p, 1 fig, 4 ref.

Descriptors: *Precipitation (Atmospheric), *Rainfall disposition, *Rainfall-runoff relationship, Rainfall intensity, Infiltration, Evaporation, Karst, Evapotranspiration, Meteoric water, Groundwater.
Identifiers: France, Karst topography.

Disposition of constant intensity rainfall was investigated on the basis of Linsley's investigation (Trans. A.S.C.E., V. 68, 1942) and the studies of karst areas conducted by the author in Langedoc. By using the generalized formula of hydrologic balance, i.e. P (precipitation atmospheric)= E (evaporation)+ R (runoff)+ I (infiltration), two diagrams giving the disposition of rainfall in the karst areas for dry and wet seasons were presented. The diagrams show that, to some extent, the calcareous basins may be identified by the degree of their karstification. (Gabriel-USGS)
W69-03520

HYDROLOGY OF SURFACE MINING-A CASE STUDY,
Indiana Univ., Bloomington.
Yaron M. Sternberg, and Allen F. Agnew.
Water Resources Rep, Vol 4, No 2, pp 363-368, Apr 1968. 6 p, 3 fig, 9 ref.

Descriptors: *Strip mines, *Strip mine lakes, *Hydrology, *Mathematical models, Infiltration, Water table, Water level fluctuations, Discharge (Water), Groundwater movement, Streamflow.
Identifiers: Surface mining, Surface mining hydrology.

A mathematical model representing a strip-mined area is formulated and analyzed. Solutions are obtained for the changes in groundwater elevation and groundwater flow that would occur in response to a uniform rate of deep percolation over the spoil bank. The solutions developed are for a bounded 1-dimensional aquifer (spoil bank) where the water level in the last cut (ditch) is a function of time described by an error function. Computed curves showing the groundwater elevation for 2 particular sets of aquifer characteristics for various times are presented. The solution for the groundwater flow can be used to forecast maximum and minimum flows from the spoil bank to the last cut. The formulation of the model is based on some preliminary data and may require some modification as more data become available.
W69-03547

THE USE OF PRECIPITATION RECORDS FOR PEAK STREAMFLOW SYNTHESIS,
Geological Survey, Washington, D. C.
Ernest D. Cobb.
Geol Surv Res 1968, Prof Pap 600-D, pp D48-D51, 1968. 4 p, 5 fig, 1 tab, 4 ref.

Descriptors: *Rainfall-runoff relationships, *Flood forecasting, Hydrographs, Streamflow forecasting, Alabama, Precipitation (Atmospheric).
Identifiers: *Peak streamflow synthesis, Recurrence intervals, Flood frequencies, Flood peaks.

A major problem in the extension of peak streamflow records by synthesis from precipitation records is to obtain a representative long-term precipitation record for the particular basin being studied. To help solve this problem a flood-frequency curve at a given site was developed using long-term precipitation records from surrounding areas and a relation with 3 climatic variables. This method was used on 2 Alabama streams and may be applicable to other similar areas. For a selected streamflow site, a set of frequency curves is synthesized from long-term precipitation records of surrounding areas. The flood of a given recurrence interval, T, for the stream site studied is then estimated from a relation between the T-year floods, obtained from the set of synthesized frequency curves, and a rainfall variable. (USGS)
W69-03562

2B. Precipitation

METEOROLOGICAL STUDIES IN THE MARMOT CREEK WATERSHED, ALBERTA, CANADA, IN AUGUST 1965,
Canadian Meteorological Service, Toronto (Ontario); and East Slopes Watershed Research Program, Calgary (Alberta).
For primary bibliographic entry see Field 02D.
For abstract, see .
W69-03330

RELATIONS BETWEEN TOPOGRAPHY AND ANNUAL PRECIPITATION IN WESTERN OREGON AND WASHINGTON,
Weather Bureau, Portland, Oreg. River Forecast Center.
Vail P. Schermerhorn.
Water Resources Res, Vol 3, No 3, pp 707-711, 1967. 5 p, 4 fig, 1 tab, 12 ref.

Descriptors: *Precipitation (Atmospheric), *Rainfall disposition, *Topography, *Distribution patterns, *Mountains, Washington, Oregon.
Identifiers: Topography-precipitation relationships, Cascade Range, Barrier elevation, Index elevation, Index latitude.

Average annual precipitation in western Oregon and Washington varies from less than 20 in. to over 150 in. in obvious general relation to the topographic influences of the Coast and Cascade mountain ranges. If these influences could be isolated and measured, it would result in better definition of the precipitation resource in the mountainous areas of sparse measurements. Testing of the parameters and methods used by investigators in other regions led to the development of simple indexes to terrain elevation and barrier elevation. Together with a latitude index, they explain most of the variation in precipitation among the more than 280 stations. The key to the method is in the empirical definition of the contours of 'effective' barrier elevation. The pattern of residual errors from the graphical correlation shows no need for the usual zone parameter.
W69-03340

FREQUENCY OF WET AND DRY SPELLS FIVE STATIONS IN RAJASTHAN,
Colaba Observatory, Bombay (India).
B. R. D. Gupta.
Indian Journal of Meor and Geophysics, Vol No 3, pp 451-456, 1966. 6 p, 1 fig, 8 tab.

Descriptors: *Dry seasons, *Wet seasons, lands, *Monsoons, Precipitation (Atmosphe *Rainfall disposition, Data collections, *Freq cy, Meteorological data.
Identifiers: *Rajasthan (India).

The main source of rain in arid Rajasthan, Ind the southwest monsoon period from June to tember. Frequencies of wet and dry spells at stations in Rajasthan for the southwest mon period were studied. The study was based on rainfall data of these stations from 1891 to Tables were included which gave a general ave picture of the rainfall of the area during the pe of study. Frequencies of rain spells greater tha days were rare and those less than 5 days common. Frequencies of dry spells less than 5 were common for all 5 stations. Frequencies o spells greater than 15 days were also common of the 5 stations. (Affleck-Ariz)
W69-03490

A FIRST-ORDER MARKOV MODEL FOR SESSING RAINFALL DISCONTINUITY IN TRAL AUSTRALIA,
Commonwealth Scientific and Industrial Res Organization, Canberra (Australia); and Ce Arid Zone Research Inst., Jodhpur (India).
E. A. Fitzpatrick, and A. Krishnan.
Archiv fur Meteorologie, Geophysik and B matologie, Serie B, Vol 15, No 3, pp 242 1967. 18 p, 2 fig, 7 tab, disc.

Descriptors: *Rainfall, *Rainfall dispos *Statistical methods, *Markov processes, M matical studies, Frequency, Equations, seasons, *Data collections, Arid climates, P bility, Model studies, Wet seasons.
Identifiers: First-Order Markov Model, Austra

The applicability of a simple first-order M model within the arid interior of Australia w amined using rainfalls combined over fiv periods. The periods were classed as either dry according to whether a total of at least 0. of rain had occurred. A Markov model and ple random model were constructed for dis tion of runs of wet and dry periods. The ra model gave a poor fit to the observed freque The Markov model could be further impro be a practical statistical tool for assessing th term incidence of runs of wet or dry weather central Australia. (Blecker-Ariz)
W69-03494

THE SPATIAL DISTRIBUTION OF ST RAINFALL,
Water Resource Board, Reading (Eng Research Div.; and Newcastle-upon-Tyne (England).
V. K. Collinge, and D. G. Jamieson.
J Hydrol, Vol 6, No 1, pp 45-57, Jan 1968. fig, 6 ref.

Descriptors: *Spatial distribution, *Rainfall sity, *Storm runoff, Flood forecasting, Rain Orography, Topography.
Identifiers: *Surface-wind direction, Tyne Rain-shadow area.

The various parameters affecting the distribu rainfall over an area were investigated. It is ble that detailed distribution is determined the atmospheric boundary layer. This invest confirms that surface-wind direction, in asso with topography, causes the observed spat tribution patterns in rainfall. As the topogr fixed, then the variation in position of rain-

s on the leeward side of hill barriers is
erned by the surface-wind direction. The areal
nt and nature of these rain-shadow areas is ex-
nely variable and dependent to some degree on
instability, largely a function of surface-wind
d, induced in the atmospheric boundary layer
he orographic barrier. Results show that rain-
data together with surface-wind information
nits a reasonable estimate to be made of the
age areal storm rainfall over the sub-
hments. Utilizing this method of flood warning
em for the river Tyne would involve telemeter-
a minimal amount of information to a control
er, where the resulting estimated rainfall
unts could be used for predicting flood hydro-
hs at selected points within the drainage
em. (Llaverias-USGS)
-03534

RRICANE 'BEULAH', SEPT. 8-21, 1967.
os of Engineers, Galveston, Tex.

os of Eng Rep on Hurricane 'Buelah', Sept 8-
1967, 26 p, Sept 1968. 76 plate, 21 photo, 5
9 ref.

criptors: *Hurricanes, *Texas, Damages,
ds, Flood damage, Tornadoes, Disasters.
tifiers: Hurricane Beulah (1967).

meteorologic and hydrologic phenomena of
icane Beulah, September, 1967, are described
the damages to physical property are evalu-
. The major disaster area declared by the Pre-
nt included 29 counties in south Texas. About
million acres of land were inundated by rain
630,000 acres by storm tides. A total of 115
adoes were reported. The total damage was
nated to be $168,844,000. Rains of 10-30 in.
on the area. Winds of over 130 mph were
rded just before the storm reached Texas.
s of over 10 ft higher than normal were
rded. (Knapp-USGS)
-03543

. Snow, Ice, AND Frost

ERVATIONS OF SNOW ACCUMULATION
MELT IN DEMONSTRATION CUTTINGS
PONDEROSA PINE IN CENTRAL
ZONA,
ky Mountain Forest and Range Experiment
on, Fort Collins, Colo.; and Northern Arigzona
., flagstaff.
ard A. Hansen, and Peter F. Ffolliott.
Department of Agriculture, Forest Service,
arch Note RM-111, pp 1-12, 1968. 1 fig, 1
o, 11 chart, 10 ref.

criptors: *Water yield improvement, *Snow
agement, Snowpacks, Snowmelt, Snow cover,
er conservation, Forest management, Clear-
ng, Cutting management, Arizona.

earcut block on a north aspect and strips with
hs of one and one-and-one-half times tree
ht on a east aspect increased snow accumula-
and increased rates of melt and daily water
A strip three-fourths as wide as tree height on
st aspect increased snow accumulation. None
e strips cut on south and southwest aspects af-
d snowpacks measurably.
-03408

IOSPHERIC HUMIDITY MEASUREMENT
R THE SNOW SURFACE,
ky Mountain Forest and Range Experiment
on, Fort Collins, Colo.
es D. Bergen.
Department of Agriculture, Forest Service,
arch Note RM-116, pp 1-4, 1968. 1 fig, 5
t, 5 ref.

criptors: *Hygrometry, Snow cover, Water
r, Vapor pressure, Evaporation, Humidity.
Identifiers: Snow temperature.

Describes a technique for measuring atmospheric humidity in the first few centimeters over a snow cover. Results are presented for four observation periods. The water vapor density at a nominal reference level of 2 cm. above the snow surface was found to vary from less than 20 percent to 90 percent of the density corresponding to saturation at the snow surface temperature. Little diurnal variation was found for the Bowen ratio. Possible remedies for difficulties encountered in the measurements are described.
W69-03409

THE EFFECTS OF THERMAL POLLUTION ON RIVER ICE CONDITIONS,
Cold Regions Research and Engineering Lab., Hanover, N. H.
For primary bibliographic entry see Field 05C.
For abstract, see .
W69-03546

2D. Evaporation and Transpiration

REFINEMENT OF PARAMETERS FOR CALCULATING EVAPORATION FROM BOGS ON THE BASIS OF OBSERVATIONS AT BOG STATIONS,
L. G. Bavina.
Transl Trudy Gos Gidrol Inst No 145, 1967. Soviet Hydrol: Selec Pap, Issue No 4, pp 348-370, 1967. 23 p, 9 fig, 25 tab, 15 ref.

Descriptors: *Evaporation, *Bogs, Energy budget, Light, Meteorology, Climates, Albedo, Thermodynamic behavior, Thermal capacity, Heat transfer, Air temperature, Radiation, Humidity.
Identifiers: USSR, Radiometers, Evaporimeters.

A method of calculating evaporation from bogs is described and the parameters of the working formula are refined on the basis of observations at bog stations. The characteristics of the radiation balance are analyzed and the balance is computed from observations at actinometric and meteorological stations. New maps of evaporation from highmoor and lowmoor bogs are constructed for the growing season. Evaporimeters are used with energy budget methods to verify the results of empirical methods of evaporation estimation.
W69-03211

METEOROLOGICAL STUDIES IN THE MARMOT CREEK WATERSHED, ALBERTA, CANADA, IN AUGUST 1965,
Canadian Meteorological Service, Toronto (Ontario); and East Slopes Watershed Research Program, Calgary (Alberta).
R. E. Munn, and D. Storr.
Water Resources Res, Vol 3, No 3, pp 713-722, 1967. 10 p, 10 fig, 8 ref.

Descriptors: *Evapotranspiration, *Forests, *Mountains, *Micrometeorology, *Water balance, Winds, Air circulation, Radiation, Rain gages, Temperature.
Identifiers: Canada, Alberta, Rocky Mountains.

The meteorology of a mountainous watershed in the Alberta Rockies was shown to be strongly influenced by upslope-downslope diurnal wind circulations during rainfree periods of observation in August 1965. The evapotranspiration from the forest is inferred from measurements of net radiation above the canopy and from vertical temperature gradients obtained from an 80-ft tower. The forest loss during August rainfree periods is estimated to be between 0.15 and 0.6 gm/sq cm/day with high confidence, or between 0.25 and 0.48 gm/sq cm with somewhat less confidence. A 'best' engineering estimate of evapotranspiration is 0.3 gm/sq cm/day.
W69-03330

EFFECTS OF SPECIES AND ARRANGEMENT OF FORESTS ON EVAPOTRANSPIRATION,
Southeastern Forest Experiment Station, Franklin, N. C.
J. E. Douglass.
Reprint from Int. Symp. on Forest Hydrology, Penn State Univ 1965, 451-461, Pergamon Press, Inc. New York, 1967.

Descriptors: *Evapotranspiration, *Plant physiology, *Deciduous forests, *Coniferous forests, Grasses, Root distribution, Water yield improvement, Watershed management, Microclimatology.
Identifiers: *Rooting depths, Rooting habits.

This paper reviews research concerned with effects of species and their arrangement on evapotranspiration. In general it was observed that grasses use less water than forest species because of the shallower rooting habits of grass, but if evapotranspiration differences occur between forest species, they could not be detected except where rooting depths were unequal. Evapotranspiration varies with stand density and vegetative height, at least in humid regions, and evapotranspiration probably varies with slope and aspect as well.
W69-03386

COMPARISON OF THE DYE METHOD WITH THE THERMOCOUPLE PSYCHROMETER FOR MEASURING LEAF WATER POTENTIALS,
Southeastern Forest Experiment Station, Franklin, N. C.; and Duke Univ., Durham, N. C.
For primary bibliographic entry see Field 02I.
For abstract, see .
W69-03390

MEASUREMENT OF LEAF WATER POTENTIAL BY THE DYE METHOD,
Southeastern Forest Experiment Station, Franklin, N. C.; and Duke Univ., Durham, N. C.
For primary bibliographic entry see Field 02I.
For abstract, see .
W69-03392

EFFECT OF LEAF AGING ON WATER DEFICIT-WATER POTENTIAL RELATIONSHIPS OF DOGWOOD LEAVES GROWING IN TWO ENVIRONMENTS,
Southeastern Forest Experiment Station, Franklin, N. C.; and Duke Univ., Durham, N. C.
For primary bibliographic entry see Field 02I.
For abstract, see .
W69-03393

DESIGN CRITERIA FOR INTERCEPTION STUDIES,
Southeastern Forest Experiment Station, Franklin, N. C.
For primary bibliographic entry see Field 02I.
For abstract, see .
W69-03395

TEST OF A TRANSPIRATION INHIBITOR OF A FORESTED WATERSHED,
Southeastern Forest Experiment Station, Franklin, N. C.; and Connecticut Agricultural Experiment Station, New Haven.
P. E. Waggoner, and J. D. Hewlett.
Water Resources Research 1 (3):391-396, 1965.

Descriptors: *Demonstration watersheds, *Transpiration, *Stomata, *Streamflow, Retardants, Inhibitors, Films, Chemcontrol, Watershed management.
Identifiers: *Experimental watersheds, Suppressants.

The glyceral half-ester of decenylsuccinic acid (GIOSA) closes tree stomata when sprayed directly upon the undersides of leaves. At Coweeta Hydrologic Laboratory a 12% reduction in transpiration might be detected as a significant increase in streamflow. Two sprays of 50 lbs. of GIOSA in

water applied to 30 acres of one watershed from a helicopter produced little deposit on the undersides of leaves and no clear evidence of stomatal closure. Observed increases in streamflow were statistically insignificant.
W69-03396

DETERMINING EVAPO TRANSPIRATION BY THE GRAVIMETRIC METHOD FOR THE WHEAT CROP IN THE IRRIGATION DISTRICT OF RIO YAQUI, SONORA, MEXICO.
International Commission on Irrigation and Drainage.

International Commission on Irrigation and Drainage, Annual Bulletin, pp 69-71, 1967. 3 p, 3 tab.

Descriptors: *Evapotranspiration, *Gravimetric analysis, *Wheat, *Consumptive use, On-site tests, Sampling, Electrical conductance, Wilting point, Field capacity, Rainfall, Density, Irrigation efficiency, Soil moisture, Plant growth, Root systems.
Identifiers: Sonora (Mexico), *Blaney-Criddle method.

The gravimetric method was used to determine evapotranspiration for the wheat crop in the irrigation district of Rio Yaqui, Sonora, Mexico. The gravimetric method consists of determining the moisture variations in each layer making up the soil profile, down to a depth (75cm.) equal to that reached by the root-system of the crop studied. From the average consumptions the coefficients of consumptive use were computed according to the modified Blaney-Criddle method. The modifications was necessary in order to attain a better correlation between the mean temperature values and the corresponding consumptive uses. Coefficients of consumptive use over the plant growth for four crop years were given. (Blecker-Ariz)
W69-03497

ACCURACY OF EVAPOTRANSPIRATION DETERMINATIONS BY THE BOWEN RATIO METHOD,
Agricultural Research Service, Tempe, Ariz. Water Conservation Lab.
Leo J. Fritschen.
Bull International ass Sci Hydrol, Vol 10, No 2, pp 38-48, Jan 1965. 11 p, 6 fig, 2 tab, 2 append.

Descriptors: *Evapotranspiration, *Lysimeters, *Arid climates, Arizona, *Air temperature, *Vapor pressure, Radiation, Evaporation, Flucuation, Solar radiation, Heat, Meteorological data, Measurement, Instrumentation, Diurnal, Wind velocity, Soil temperature.
Identifiers: Bowen ratio method.

Evapotranspiration rates calculated from meteorological data by the Bowen ratio method were tested against rates obtained from weighing lysimeters to determine whether the instrumentation and method would yield reliable results in a hot arid environment. The tests were conducted near Phoenix, Arizona, where evapotranspiration generally exceeds net radiation. The Bowen ratio is the ratio of sensible heat to latent heat. Air-temperature and vapor-pressure differences obtained as 15 minute averages at heights of from 5 to 40 cm above the crop surface were used to calculate evapotranspiration. The method could be used successfully to determine the evaporative flux for short periods which later could be summed for longer periods. (Blecker-Ariz)
W69-03504

2E. Streamflow and Runoff

NUMERICAL MODEL OF THE NONSTATIONARY TEMPERATURE FIELD OF FLOWING BODIES OF WATER,
Sredneaziatskii Nauchno-Issledovatelskii Institut Irrigatsii, Tashkent (USSR).
Yu. M. Denisov, and L. M. Oreshina.
Transl from Izvestiya Akademii Nauk Uzbekskoy SSR, Seriya teknicheskikh nauk, No 6, 1967. Soviet Hydrol: Selec Pap, Issue No 4, pp 405-409, 1967. 5 p, 6 ref.

Descriptors: *Water temperature, *Reservoirs, Mathematical models, Digital computers, Energy budget, Heat transfer, Radiation.
Identifiers: USSR, Reservoir water temperature.

A numerical model of the temperature field of flowing bodies of water is presented. The problem is solved for depth and temperature. It is assumed that heat derived from the inflow and outflow of water is evenly distributed over the volume of the reservoir so that outflow temperature can be taken as the average temperature of the water body. The parameters used are water turbulence, water albedo, incident solar radiation, heat input from precipitation, bottom temperature, air temperature, and atmospheric turbulence. The equations presented can be solved on a digital computer. (Knapp-USGS)
W69-03213

FUNDAMENTALS OF HYDROLOGIC FORECASTING,
Josef Matusewicz.
Translated from Polish book 'Podstawy Prognoz Zjawisk Hydrologicznych'. Rep of Cent Inst for Sci, Tech and Econ Inform, Warsaw, Poland, 169 p, 1968. 46 fig, 17 tab, 50 ref. Available as TT66-57041.

Descriptors: *Streamflow forecasting, *Runoff forecasting, Hydrogeology, Statistical methods, Rainfall-runoff relationships, Routing, Stage-discharge relations, Hydrographs, Stream gages, Infiltration, Ice, Freezing, Thawing.
Identifiers: *Poland, Hydrological forecasting.

The hydrological forecasting methods used in Poland are described in detail in a book concerned primarily with forecasting methodology. The 7 chapters cover fundamentals of forecasts, forecast methods, forecasts of Spring floods, forecasts of Summer and Fall floods (from rainfall), periodic forecasts, forecasts of ice phenomena, and a summary. Data requirements, present data collection methods, and needs for improved data are discussed. Most of the forecasting methods given are empirical in nature and are based largely on stage-discharge relations for past similar general hydrological and meteorological conditions. Research on forecasting methods using general meteorological and hydrological data aided by theoretical models is being done, particularly for long-range forecasts. Runoff management and urbanization effects are under study. Statistical methods are approached with attention to the physics of the phenomena involved, to elucidate the fundamental laws of the meteorological and hydrological processes in streamflow. (Knapp-USGS)
W69-03218

SEQUENTIAL STUDY OF DESERT FLOODING IN THE WHITE MOUNTAINS OF CALIFORNIA AND NEVADA,
Montana Univ., Missoula. Dept. of Geography.
Chester B. Beaty.
Sponsored by US Army Natick Laboratories, Natick, Mass. DA19-129-AMC-987 (N). Earth Sci Lab Tech Rep 68-31-ES, Ser ES-37, Jan 1968. 96 p, 55 fig, 1 tab, 21 ref, 1 append. 1T025001A29.

Descriptors: *Floods, *Alluvial channels, *Storm runoff, *California, *Nevada, Snowmelt, Cloudbursts, Mudflows, Flood damage, Erosion, Alluvium, Washouts, Roads.
Identifiers: *Alluvial fans, White Mountains (Cal-Nev).

A field study of flood conditions in the White Mountains of California and Nevada was carried out during the period September 1966 to August 1967. The investigation was a follow-up to a similar study conducted in 1956-57. The purpose of th current study was to determine what changes, any, flooding had produced in the area during th decade 1957-66 and to observe flooding in actio and record its effects. Flooding during the decad 1957-66 produced significant changes in parts the White Mountains landscape. One minor and major debris flows occurred, and minor snowme flooding was frequent. Flooding observed durin the contract period was of Wintertime, Snowmel and Cloudburst types. Floods were observed December 1966, May-June 1967, and July-Augu 1967. No debris flows developed during any of th episodes of flooding. In the study of 1956-57 it w found that 3 physiographic characteristics i fluence flooding behavior in a desert strea system: (1) trunk canyon profile; (2) amount debris on floor of trunk canyon; (3) width of low canyon and canyon mouth. The most dangero canyons are steep, narrow, and floored with 5 to ft of unconsolidated debris. The area of greate flooding danger on a desert alluvial fan is a radi zone extending from the apex toward the marg and flanking and including the active channel. napp-USGS)
W69-03222

MAGNITUDE AND FREQUENCY OF FLOOD IN THE UNITED STATES,
Geological Survey, Washington, D. C.
H. F. Matthai.
U S Geol Surv Water-Supply Pap 1680, 1968. 4 p, 15 fig, 1 plate, 3 tab, 3 ref.

Descriptors: *Floods, *Flood forecasting, *Da collections, Hydrologic data, Stage-discharge re tions, Streamflow, Missouri River, Stream gages.
Identifiers: Flood frequencies, Flood measu ments, Missouri River basin.

For the Missouri River Basin below Sioux C Iowa, a means is presented for estimating the m nitude of any flood of any selected frequen between 1.1 and 50 years for both gaged a ungaged sites where the floodflow is not materia affected by regulation or diversion. The ranges size of drainage basins for which estimates can made are established by the available base data a are quite different from one part of the study a to another. Within these limits of definition, frequency of a flood of known magnitude can estimated. Curves showing the relation between mean annual flood and a flood of any ot frequency between 1.1 and 50 years were defi for eight homogenous flood-frequency regions. curves of relation between the mean annual flo and contributing drainage area in 21 hydrolo areas were defined. In four of these areas, m basin elevation was also a factor. Additional cur are applicable to all or parts of seven large riv The regional and areal curves were defined records for 501 gaging stations and curves for large rivers were defined by records for 57 gag stations. Flood records at all streamflow stati having 5 or more years of record through the 1 water year are compiled in this report. Also, tab showing the maximum known flood at gaging tions and at miscellaneous sites are included. napp-USGS)
W69-03225

HYDROLOGY OF BROOKHAVEN NATION LABORATORY AND VICINITY, SUFFO COUNTY, NEW YORK,
Geological Survey, Washington, D. C.
M. A. Warren, Wallace de Laguna, and N. J. Lusczynski.
U S Geol Surv Bull 1156-C, 1968. 127 p, 41 fig plate, 14 tab, 38 ref.

Descriptors: *Hydrogeology, *Water resour *Groundwater, *Surface waters, New York, collections, Hydrologic data, Streamflow, Aquif Water levels, Flow nets, Water sources, W yield, Specific capacity, Water utilization.
Identifiers: Long Island (NY), Upton area, Bro haven National Laboratory, Well tests.

e groundwater and surface water hydrology of area near Brookhaven National Laboratory, folk County, New York were studied as part of a es of studies of sites for nuclear energy facili-. The area studied includes the Laboratory and ends across the island in a band about 13 mi e from the Atlantic Ocean to Long Island Sound ween longitudes 72 degrees 45' and 73 degrees . Precipitation averages about 45 in. a year nly distributed throughout the year. The soil the immediately underlying sediments are erally sandy and highly permeable. Except in iods of intense precipitation there is very little ect overland runoff to streams. Permeable istocene deposits, 100-200 ft thick, constitute uppermost aquifer. It receives recharge from cipitation and discharges mainly into streams, ocean, and the sound and to a lesser extent into er aquifers. The lower aquifers, several hundred t in total thickness, transmit water under arte-n pressure from the high central part of the nd toward its edges where it is discharged into eams or into bodies of salt water. Streamflow is ported throughout the year very largely by undwater discharge. Water may move from the d surface to the water table at a rate of about 1 0 ft per day. Under less favorable conditions it y move 1 ft a day or less. (Knapp-USGS)
9-03232

REAMS-THEIR DYNAMICS AND ORPHOLOGY,
tioch Coll., Yellow Springs, Ohio.
rie Morisawa.
th and Planetary Sci Ser Publ, 175 p, 1968. al 61 fig, 24 plate, 14 tab, 132 ref.

scriptors: *Geomorphology, *Running waters, uid mechanics, *Hydrology, Graded, Deposi-n (Sediments), Erosion, Land forming, Channel rphology, Sediment transport, Slopes, River in development.
ntifiers: *Open-channel hydraulics.

extbook for beginning students of quantitative morphology presents the basic principles of d mechanics, open-channel hydraulics, and rology, as well as some recent work in quantita-geomorphology. Detailed explanations are also en of sediment transport, erosion, deposition, pe and channel morphology, graded profile or dy state, channel pattern, and river basin elopment. Photographs are used to illustrate ny natural examples of the topics discussed. No thematical derivations of the equations used are en; explanations are conceptual whenever possi-, and mathematical expressions when needed presented and briefly explained. (Knapp-GS)
9-03248

EXTENSION TO THE THOMAS-FIERING ODEL FOR THE SEQUENTIAL GENERA-ON OF STREAMFLOW,
shington Univ., Seattle; and Washington Water search Center, Pullman.
primary bibliographic entry see Field 02A.
abstract, see .
9-03307

E NONLINEAR PREDICTION PROBLEM IN E STUDY OF THE RUNOFF CYCLE,
ifornia Univ., Davis.
primary bibliographic entry see Field 02A.
abstract, see .
9-03308

ATER RESOURCES DATA FOR KENTUCKY, 57--PART 1: SURFACE WATER RECORDS.
ological Survey, Louisville, Ky.

ol Surv Duplicated rep, 1968. 162 p, 2 fig.

scriptors: *Data collections, *Surface waters, treamflow, *Kentucky, Stream gages, Lakes, servoirs, Stage-discharge relations.
Identifiers: *Surface water records, Water resources data.

The surface-water records for the 1967 water year for gaging stations, partial-record stations, and miscellaneous sites in Kentucky are presented. The data generally comprise a description of the station and a table showing the daily discharge and monthly and yearly discharge of the stream. Records are published for the water year which begins on Oct 1 and ends on Sept 30. The description of the station gives the location, drainage area, records available, type and history of gages, average discharge, extremes of discharge, and general remarks. The location of the gaging station and the drainage area are obtained from the most accurate maps available. Under 'Records available' are given periods for which there are published records for the present station or for stations generally equivalent to the present one. Under 'Gage' are given the type of gage currently in use and the datum of the gage above mean sea level, and a condensed history of the types, locations, and datums of previous gages used during the period of records available. Information pertaining to the accuracy of the records and to conditions which affect the natural flow at the gaging station is given under 'Remarks.' Daily discharges for the water year are listed in a table. The records also include average discharge, extremes, yearly totals, and peak discharges. (Knapp-USGS)
W69-03318

WATER RESOURCES DATA FOR COLORADO, 1967--PART 2. WATER QUALITY RECORDS.
Geological Survey, Denver, Colo.

Geol Surv Duplicated rep, 1968. 101 p, 3 fig, 21 ref.

Descriptors: *Data collections, *Water quality, *Colorado, Sampling, Gaging stations, Hydrologic data, Water temperature, Sediment discharge.
Identifiers: Surface water records, Water resources data.

Data on the chemical and physical characteristics of the surface waters in Colorado for the 1967 water year are compiled. Water quality information is presented for chemical quality, fluvial sediment, and water temperatures. The chemical quality includes concentrations of individual dissolved constituents and certain properties or characteristics such as hardness, sodium-adsorption-ratio, specific conductance, and pH. Fluvial sediment information is given for suspended-sediment discharges and concentrations and for particle size distribution of suspended sediment and bed material. Water temperature data represent once-daily observations except for stations where a continuous temperature recorder furnishes information from which daily minimums and maximums are obtained. Each sample site description includes location, drainage area, records available, and remarks. (Knapp-USGS)
W69-03319

WATER RESOURCES DATA FOR NEW YORK, 1967--PART 1. SURFACE WATER RECORDS.
Geological Survey, Albany, N.Y.

Geol Surv Duplicated rep, 1968. 376 p, 5 fig.

Descriptors: *Data collections, *Surface waters, *Streamflow, *New York, Stream gages, Lakes, Reservoirs, Stage-discharge relations.
Identifiers: *Surface-water records, Water resources data.

The surface-water records for the 1967 water year for gaging stations, partial-record stations, and miscellaneous sites in New York are presented. Daily discharge records are given for 284 stream gaging stations. Daily or monthly data on stage or content are given for 42 lakes and reservoirs. Discharge measurements are listed for 562 sites, 144 of which are low-flow partial-record stations, and the remainder are miscellaneous sites. Annual maximum stages and discharges are given for 58 crest-stage partial-record stations. For 48 sites, the annual maximum stages are given. Each station record contains location, drainage area, records available, gage type, average discharge, extremes, remarks, measured discharges and stages, and summary data. (Knapp-USGS)
W69-03320

WATER RESOURCES DATA FOR MASSACHUSETTS, NEW HAMPSHIRE, RHODE ISLAND, VERMONT, 1967--PART 1. SURFACE WATER RECORDS, PART 2. WATER QUALITY RECORDS.
Geological Survey, Boston, Mass.

Geol Surv Duplicated rep, 1968. Total 305 p, 1 fig, 1 plate, 11 ref.

Descriptors: *Data collections, *Surface waters, *Streamflow, *Massachusetts, *New Hampshire, *Rhode Island, *Vermont, *Water quality, Stream gages, Lakes, Reservoirs, Stage-discharge relations, Water temperature, Sediment discharge.
Identifiers: Surface water records, Water quality records, Water resources data.

The surface-water records for the 1967 water year for gaging stations, partial-record stations, and miscellaneous sites in Massachusetts, New Hampshire, Rhode Island and Vermont are presented. The data generally comprise a description of the station and a table showing the daily discharge and monthly and yearly discharge of the stream. The description of the station gives the location, drainage area, records available, type and history of gages, average discharge, extremes of discharge, and general remarks. The type of gage currently in use and the datum of the gage above mean sea level, and a condensed history of the types, locations, and datums of previous gages used during the period of records available are listed. Information on the accuracy of the records and conditions which affect the natural flow is given under 'Remarks.' Daily discharges, average discharge, extremes, yearly totals, and peak discharges are listed in a table. Chemical quality, fluvial sediment, and water temperatures are also listed. The chemical quality includes concentrations of individual dissolved constituents, hardness, specific conductance, and pH. Fluvial-sediment information is given for suspended-sediment discharges and concentrations. Water-temperature data represent once-daily observations except for stations where a continuous temperature recorder furnishes information from which daily minimums and maximums are obtained. (Knapp-USGS)
W69-03321

MONTHLY SURFACE-WATER INFLOW TO CHESAPEAKE BAY,
Geological Survey, Washington, D. C.
Conrad D. Bue.
Geol Surv open-file rep, Oct 1968. 41 p, 7 fig, 9 tab, 4 ref, 1 append.

Descriptors: *Streamflow, *Estuaries, *Estimating, Virginia, Maryland, Pennsylvania, Diversion, Hydrology, Stage-discharge relations, Stream gages.
Identifiers: Chesapeake Bay inflow.

A convenient and rapid means is presented for estimating monthly or yearly inflow to Chesapeake Bay. The method was developed for the monthly data release 'Estimated stream discharge entering Chesapeake Bay' prepared by the U. S. Geological Survey in cooperation with Maryland, Pennsylvania, and Virginia and placed in open-file report status, U. S. Geological Survey, for public use. In addition to methodology used in estimating inflow, data on drainage basins and streamflow patterns is included. Estimates of inflow are derived from graphical relations between gaging stations on the 3 major streams entering the bay and the total calculated 10-yr discharge. Tables and graphs show the

relation between streamflow and total bay inflow. Diversions from and returns to streamflow entering the bay are calculated. An example of the monthly Chesapeake Bay inflow bulletin is attached. (Knapp-USGS)
W69-03325

FLOODS IN DYER QUADRANGLE, NORTHEASTERN ILLINOIS,
Geological Survey, Washington, D. C.
Howard E. Allen.
Geol Surv Hydrol Invest Atlas HA-301, 1 sheet, 1968. 8 fig, 1 map, 2 tab, 3 ref.

Descriptors: *Floods, *Illinois, Stage-discharge relations, Discharge (Water), Profiles, Flood plains, Hydrologic data.
Identifiers: *Dyer (Illinois), Flood frequencies, Flooded area, Flood profiles.

Hydrological data are presented for use in evaluation of the extent, depth, and frequency of flooding in the flood plains in the Dyer quadrangle, northeastern Illinois. A 7 1/2 min topographic map shows the areas inundated by floods. Figures show annual floods above 626.4 ft, frequency-discharge relations, frequency-stage relations, and flood profiles. (Knapp-USGS)
W69-03327

FLOODS IN MCHENRY QUADRANGLE, NORTHEASTERN ILLINOIS,
Geological Survey, Washington, D. C.
Roman T. Mycyk, and Gerald L. Walter.
Geol Surv Hydrol Invest Atlas HA-255, 1 sheet, 1968. 9 fig, 1 map, 3 tab, 3 ref.

Descriptors: *Floods, *Illinois, Stage-discharge relations, Discharge (Water), Profiles, Hydrologic data.
Identifiers: *McHenry (Illinois), Flood frequencies, Flooded area, Flood profiles.

Hydrological data are presented for use in evaluation of the extent, depth, and frequency of flooding in the flood plains in the McHenry quadrangle, northeastern Illinois. A 7 1/2 min topographic map shows the areas inundated by floods. Figures show annual floods above 736 ft, frequency-discharge relations, frequency-stage relations, and flood profiles. (Knapp-USGS)
W69-03328

LINEAR ANALYSIS OF HYDROGRAPHS,
Geological Survey, Champaign, Ill.
For primary bibliographic entry see Field 07C.
For abstract, see .
W69-03331

UNSTEADY, ONE-DIMENSIONAL FLOW OVER A PLANE-THE RISING HYDROGRAPH,
Cornell Univ., Ithaca, N. Y. Dept. of Water Resources Engineering.
D. A. Woolhiser, and J. A. Liggett.
Water Resources Res, Vol 3, No 3, pp 753-771, 1967. 19 p, 9 fig, 1 tab, 23 ref.

Descriptors: *Hydrographs, *Mathematical models, *Unsteady flow, *Overland flow, *Synthetic hydrology, Chezy equation, Rainfall-runoff relationships, Mannings equation, Digital computers.
Identifiers: Kinematic wave theory, Boundary conditions, Method of characteristics.

The equations describing overland flow, in 3 nondimensional forms, are solved for the rising hydrograph by finite-difference integration of the characteristic equations utilizing a characteristic net. A dry channel was used as an initial condition; the upstream and downstream boundary conditions were zero inflow and critical depth (or no condition for supercritical flow), respectively. A series solution is derived for flow in Zone A, the domain of determinacy of the initial conditions along t= 0. When compared with previous numerical, analytic, and experimental results, the results show that in general there is no unique dimensionless rising hydrograph for overland flow, but that for most hydrologically significant causes the kinematic wave solution gives very accurate results. A single dimensionless parameter was found to be a suitable criterion for choice between the complete equations or the kinematic wave approximation.
W69-03332

A COMMENT ON HORTON'S LAW OF STREAM NUMBERS,
IBM Watson Research Center, Yorktown Heights, N. Y.
Samuel J. Smart.
Water Resources Res, Vol 3, No 3, pp 773-776, 1967. 4 p, 2 fig, 1 tab, 8 ref.

Descriptors: *Drainage patterns (Geologic), *Tributaries, *Probability, *Statistical models, Mathematical studies, Monte Carlo method, Geomorphology.
Identifiers: Hortons laws, Stream numbers, Branching ratios, Drainage basin characteristics.

Horton's law of Stream Numbers is shown to be internally inconsistent in the following sense: If there exists a large channel network of order S, with stream numbers that satisfy Horton's Law exactly, then the mean stream numbers for lower order networks contained in the large one will show definite deviations from Horton's Law. These mean stream numbers can be expressed by a recursive formula, which involves the probabilities that a stream of order i terminates in a stream of order j greater than i. Reasonable assumptions about the nature of the probability suggest that Horton curves for the small order basins should be concave upwards, a result which is in general agreement with observation.
W69-03338

SOME STATISTICAL TOOLS IN HYDROLOGY,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 07B.
For abstract, see .
W69-03344

MEASUREMENT OF PEAK DISCHARGE AT CULVERTS BY INDIRECT METHODS,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 07B.
For abstract, see .
W69-03345

GENERAL PROCEDURE FOR GAGING STREAMS,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 07B.
For abstract, see .
W69-03346

MICROSESTON DYNAMICS IN A SIMPLE SIERRA NEVADA LAKE-STREAM SYSTEM,
Bureau of Sport Fisheries and Wildlife, Bishop, Calif., and California Univ., Davis. Dept. of Zoology.
J. A. Maciolek, and M. G. Tunzi.
Ecology, Vol 49, No 1, Winter 1968. 16 p, 12 fig, 1 tab, 33 ref.

Descriptors: *Streams, *Seston, *Organic matter, California, Detritus, Diatoms, Aquatic drift, Eutrophication, Invertebrates, Lakes, Oligotrophy, Phytoplankton, Primary productivity, Sedimentation, Streamflow, Trophic level, Periphyton, Trout, Chrysophyta, Chlorophyta.
Identifiers: *Sierra Nevada (Calif), *Lake-stream system, *Microseston, Trophodynamics, Laurel Creek (Calif), Laurel Lake (Calif), Mono County (Calif), Sierra Nevada Aquatic Research Lab, Bishop (Calif), Simuliidae, Stephanodiscus, Asterionella, Stream gradient, Allochthonous sources, Autochthonous sources, Wilderness area Diatoma, Synedra, Gomphonema, Spirogyra Hydrurus, Nostoc.

Microseston (particulate size, 0.45-350 microns) i considered important in Sierra Nevada, Calif stream trophodynamics. Eight stations along 6. kilometers of precipitously descending lake-strea system (Laurel Creek drainage) were sample Microsestonic biomass was determined by wet o idation and its dynamics related to system's ecol gy. Headwaters and seepage sources contain under 2 gcal/liter (= 0.5 mg dry weight/liter) principally organic detritus. More than 12 gcal/lit appeared in stream as effluent phytoplankton fro lake near headwaters, whose influence persisted f 2-3 miles. Cellular microseston's progressiv decrease below lake accompanied increase detritus. Increasing percentages of empty diato (Stephanodiscus) frustules indicated that uptak by non-selectively filter-feeding simulid larva which could remove 60% of suspended algae alon 0.4 kilometers of stream, accounted for most suc losses. Detritus gain resulted from allochthono vegetation abetted by autochthonous decompos tion, including digestion by invertebrates. Sedime tary and physicochemical losses were secondary trophic removal of seston. Cell destruction by tu bulent flow (indicated by persistent inta Asterionella frustules) was proportionate to strea gradient but clearly evident only in gradients pr longedly exceeding 5%. Because loss-causing fa tors operate selectively on cells, detritus can be e pected as chief microseston component in strea isolated from lake outflows. (Eichhorn-Wisc)
W69-03359

FACTORS AFFECTING THE RESPONSE O SMALL WATERSHEDS TO PRECIPITATIO IN HUMID AREAS,
Southeastern Forest Experiment Station, Frankli N. C.
J. D. Hewlett, and A. R. Hibbert.
Reprint from Proc. Int. Symp. Forest. Hydro Penn State Univ 1965, 275-290, Pergamon Pres Inc. New York, 1967.

Descriptors: *Stream hydrographs, *Streamflo forecasting, *Flow characteristics, *Baseflo *Overland flow, Small watersheds, Precipitatio (Atmospheric), Subsurface flow, Hydrograph ana ysis, Hydrology.
Identifiers: *Hydrologic analysis.

Customary separation of stream hydrographs in overland flow, interflow and baseflow has litt meaning when applied to most small watersheds. revised description of runoff processes in forest headwaters relates quick rises in streamflow variable source areas and subsurface translato flow, or the rapid displacement of stored water new rain. Because this makes the classification hydrograph components difficult, if not impossibl a numerical rating system, the response factor w developed from precipitation and streamflo records for use in classifying the hydrolog response of small watersheds in humid areas. simple uniform hydrograph separation method w necessary to make inter-watershed and inter-r gional comparison of response meaningful.
W69-03388

EFFECT OF SEDIMENT LOAD ON THE RA ING CURVES OF 0.6-FOOT HS FLUMES,
Agricultural Research Service, Beltsville, Md. S and Water Conservation Div.; and Minnes Agricultural Experiment Station, St. Paul.
L. F. Hermsmeier, and R. A. Young.
U S Department of Agriculture, Agricultu Research Service ARS 41-142, pp 1-10, June 196 10 p, 1 dwg, 4 tab, 6 chart.

Descriptors: *Flow measurement, *Sediment loa Flumes, Flow rates, Channels, Sediment discharg Water measurement, Hydrology, Viscosity, Dens stratification, Suspended load.

bration tests of a standard 0.6-foot HS flume
e made using both clear water and sediment-
n water. Corrections to a standard calibration
e determined for 1-, 2-, 4-, 6-, 8-, and 12- per-
sediment in the measured water and flow rates
0.003 to 0.10 c.f.s. Soil was used as the sedi-
t in the first series of tests and sand was used
a second series. The sediment-laden water
ed measurement errors up to 30 percent when
ndard calibration curve was used with a 0.6-
HS flume. Difference in stage height caused by
ment in the measured water were largely
ed by changes in the slope and the elevation of
loor of the flume and approach channel. Errors
use of changes in viscosity and density of the
sured water caused by suspended sediment
negligible.
-03403

ISION S-6-SOIL AND WATER MANAGE-
NT AND CONSERVATION--LEVEL PAN
TEM FOR SPREADING AND STORING
TERSHED RUNOFF,
tral Great Plains Field Station, Akron, Colo.
e H. Mickelson.
Sci Soc Amer Proc, Vol 30, No 3, pp 388-392,
-June 1966. 5 p, 4 fig, 2 tab.

criptors: Rainfall, *Water spreading, *Surface
ff, Colorado, Watersheds (Basins), *Water
ge, *Dry farming, Runoff, Water management
plied), Moisture availability, Water conserva-
Soil moisture, Feasibility studies, Crop
luction, Semiarid climates.
tifiers: Pan system.

Akron, Colorado, a level pan system was
gned and contructed in broad natural water-
to intercept runoff from contributing
rsheds for storage and crop use. The objectives
to evaluate feasibility of utilizing watershed
ff on dryland level areas for annual crop
luction, response of different crops to intermit-
flooding and some water management
blems involved in the spreading system.
ounts and depth of moisture in level pans
iving runoff during 7 to 9 months of storage
almost equivalent to that on fallow after 19-21
ths. Moisture storage in level pans was twice as
ctive as that for unleveled and leveled check
s of continuous cropping. Level pans increased
moisture supplies 3.5-7.0 inches annually,
t of which originated from runoff. Although ru-
was sometimes heavily laden with sediments,
osition had not been serious. Level pans could
onstructed in arid climates in order to increase
r use efficiency with respect to water spread-
nd storing watershed runoff. (Blecker-Ariz)
-03499

RTHWOOD GAGING INSTALLATION, BAL-
IORE-INSTRUMENTATION AND DATA,
erican Society of Civil Engineers Program Of-
Cambridge, Mass.
Tucker.
CE Tech Mem No 1, Urban Water Resources
Program, Aug 1, 1968. 16 p, 11 fig, 2 tab, 3 ap-
d. OWRR: 14-01-0001-1585 and USGS-14-08-
1-11257.

criptors: *Rainfall-runoff relationships, *Data
ections, *Storm runoff, *Urbanization,
ersheds (Basins), Stream gages, Flumes, Rain
es, Land use, Discharge (Water), Runoff,
rographs, Hyetographs, Evaporation, Rainfall.
tifiers: *Urban hydrology, Parshall flumes, Bal-
re (Md).

ailed data of the hydrology of Northwood, a
ll urban drainage area in Baltimore, Maryland,
presented. Northwood is one of the few
ered catchments in the U. S. that is gaged with
es. The 47.4 acre drainage area is about 4 mi
h of downtown Baltimore in a residential sub-
an area. It contains a 17.4 acre shopping center
30 acres of residential development. Buildings
e residential area are very uniformly grouped houses with 3-4 houses per group. The average imperviousness of the drainage area is 68%. Ground slopes average 3%. A weighing bucket rain gage and a Parshall flume were installed in 1959, and the rain gage was replaced with a tipping bucket gage in 1963. Both in the rain gage and stream gage have recorders. Runoff is estimated to be within 5% of actual flow 95% of the time for flume depths over 4 in. Reduced rainfall and runoff data for 14 storms, hourly precipitation, and daily pan evaporation data are tabulated. Hyetographs and hydrographs illustrate the rapid response of the drainage area. (Knapp-USGS)
W69-03507

OAKDALE GAGING INSTALLATION, CHICAGO-INSTRUMENTATION AND DATA,
American Society of Civil Engineers Program Office, Cambridge, Mass.
L. S. Tucker.
ASCE Tech Mem No 2, Urban Water Resources Res Program, Aug 15, 1968. 14 p, 8 fig, 2 tab, 2 append. OWRR: 14-01-0001-1585, USGS: 14-08-0001-11257.

Descriptors: *Data collections, *Storm runoff, *Rainfall, *Rainfall-runoff relationships, *Urbanization, Watersheds (Basins), Stream gages, Flumes, Rain gages, Land use, Drainage, Discharge (Water), Runoff, Hydrographs, Hyetographs, Sewers.
Identifiers: *Urban hydrology, Parabolic flumes, Chicago (Ill), Oakdale (Chicago).

An instrumented 12.9 acre urban drainage area in Chicago, Illinois is described. Rainfall and runoff data for storms for which data are reliable are tabulated and presented. The area is 2 1/2 blocks by 1 block wide and consists entirely of detached family dwellings. The drainage system is a 30-in. combined sewer draining into a 10.5 ft square concrete trunk sewer. Runoff is measured by a parabolic flume in an underground vault. A tipping bucket rain gage is located about 1 block north of the drainage area. The rain and flume gages are connected to recorders by telephone lines. Rainfall and runoff records from storms are shown in tables, hyetographs, and hydrographs. Copies of some of the original recorder charts are included. (Knapp-USGS)
W69-03508

RESPONSE CHARACTERISTICS OF URBAN WATER RESOURCE DATA SYSTEMS,
Florida Univ., Gainesville. Dept. of Environmental Engineering.
For primary bibliographic entry see Field 07A.
For abstract, see .
W69-03509

THE NATURE OF CHANGES IN URBAN WATERSHEDS AND THEIR IMPORTANCE IN THE DECADES AHEAD,
American Society of Civil Engineers Program Office, Cambridge, Mass.
For primary bibliographic entry see Field 04C.
For abstract, see .
W69-03511

SLOPE-DISCHARGE RELATIONS FOR EIGHT RIVERS IN THE UNITED STATES,
Geological Survey, Washington, D. C.
Charles W. Carlston.
Geol Surv Res 1968, Prof Pap 600-D, pp D45-D47, 1968. 3 p, 4 fig, 1 ref.

Descriptors: *Discharge (Water), *Streamflow, *Hydrographs, Graded, Delaware River, Missouri River.
Identifiers: Slope-discharge relationships, Arkansas River, Susquehanna River, Red River, Alabama River.

Graphs showing slope versus mean annual discharge have been prepared for 8 rivers in the United States, and eye-fitted lines were constructed for those rivers showing acceptable statistical correlation of slope with discharge. Two alluvial-bed graded rivers, the Red River of Louisiana and Arkansas and the Arkansas River, showed a very close correlation of slope varying with discharge. A third river, the Missouri, showed a slope-discharge relation of slope unrelated to discharge for more than 1,800 mi upstream from its mouth. Two other rivers, the Tennessee-Holston and the Delaware, showed a good correlation of slope with discharge. The remaining 3 rivers- the Ohio, the Susquehanna, and the Alabama and its headwaters-showed no correlation of slope plotted against discharge. (USGS)
W69-03521

AN ANALYSIS OF THE MEANDERING TENDENCY OF SERPENTINE CAVE, N.S.W.,
Sydney Univ. (Australia). Dept. of Geography.
For primary bibliographic entry see Field 02F.
For abstract, see .
W69-03532

CALIBRATION AND MAINTENANCE OF VERTICAL-AXIS TYPE CURRENT METERS,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 07B.
For abstract, see .
W69-03536

URBAN HYDROLOGY OF THE HOUSTON, TEXAS METROPOLITAN AREA-COMPILATION OF BASIC DATA-1966,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 04C.
For abstract, see .
W69-03538

FLOOD PLAIN INFORMATION, WILLAMETTE RIVER AND TRIBUTARIES IN MARION AND POLK COUNTIES, OREGON,
Corps of Engineers, Portland, Oreg.

Corps of Eng Flood Plain Rep, 2 Vol, May-June 1968. Total 88 p text, 12 fig, 95 plate, 22 tab.

Descriptors: *Floods, *Flood damage, *Flood plains, Flood control, Non-structural alternatives, Oregon, Maximum probable flood.
Identifiers: Marion County (Oregon), Polk County (Oregon), Willamette River (Oregon), Santiam River (Oregon), Luckiamute River (Oregon), Standard project flood.

Flooding of the Willamette River and its tributaries in Marion and Polk Counties, Oregon, is described in a report of flood plain problems based on records of rainfall, runoff, and historical and current flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulation, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-03539

CURRENT TRENDS IN THE USE OF RADIOACTIVE TRACERS IN HYDROLOGIC INVESTIGATIONS,
International Atomic Energy Agency, Vienna (Austria).
For primary bibliographic entry see Field 07B.
For abstract, see .
W69-03544

DECEMBER 1964, A 400-YEAR FLOOD IN NORTHERN CALIFORNIA,
Geological Survey, Menlo Park, Calif.
Edward J. Helley, and Valmore C. LaMarche, Jr.

Geol Surv Res 1968, Prof Pap 600-D, pp D34-D37, 1968. 4 p, 3 fig, 5 ref.

Descriptors: *Floods, *California, *Historic flood, Flood damage, Alluvium, Radioactive dating, Dendrochronology.
Identifiers: Blue Creek (Cal), Klamath River (Cal), 400-year flood, Flood frequencies, Tree-ring counts.

Twice in the past 13 yr, recordbreaking floods have occurred over large areas of northern California. The true long-term recurrence intervals of these destructive floods is difficult to estimate by conventional flood-frequency analysis because prediction of a given flood discharge is based on historical records of flood peaks. Geomorphic and botanical evidence of a major prehistoric flood has been investigated on Blue Creek, a tributary to the Klamath River in northern California. Radiocarbon analysis, supplemented by tree-ring counts, established a date about 400 yr ago of a flood event that had approximately the same order of magnitude as the devastating floods of December 1964. (USGS)
W69-03560

THE USE OF PRECIPITATION RECORDS FOR PEAK STREAMFLOW SYNTHESIS,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02A.
For abstract, see .
W69-03562

FLOOD HEIGHT-FREQUENCY RELATIONS FOR THE PLAINS AREA IN MISSOURI,
Geological Survey, Rolla, Mo.
E. Eugene Gann.
Geol Surv Res 1968, Prof Pap 600-D, pp D52-D53, 1968. 2 p, 2 fig, 3 ref.

Descriptors: *Stage-discharge relationships, *Flood forecasting, Streamflow forecasting, Missouri, Floods, Flood plains, Drainage areas.
Identifiers: *Flood high-frequency-drainage area-relations, Recurrence intervals, Peak stages, Flood frequencies.

Regional relations are defined for estimating the heights of floods having recurrence intervals ranging from 1.2 to 50 years at natural flow sites in the plains area of Missouri. Drainage-area size is the only independent variable required. Average standard errors of the relations range from 21% for the 50- and 25-year floods to 35% for the 1.2-year flood. A method is presented for utilizing the relations at ungaged sites. (USGS)
W69-03563

STREAMFLOW ROUTING (WITH APPLICATIONS TO NORTH CAROLINA RIVERS),
North Carolina State Univ., Raleigh. Dept. of Civil Engineering; and North Carolina Univ., Chapel Hill.
Michael Amien, and Ching Seng Fang.
N C Univ Water Resources Res Inst Rep No 17, Jan 1969. 72 p, 20 fig, 3 tab, 19 ref. 14-01-0001-1401, OWRR Proj A-001-NC.

Descriptors: *Routing, *Flood routing, *Unsteady flow, *Numerical analysis, *Digital computers, *Computer programs, Mathematical studies, Backwater, Floods, Open channel flow, Streamflow forecasting, Hydraulics, North Carolina, Runoff.
Identifiers: Mass conservation equations, Momentum conservation equations, Iteration methods, Neuse River (N.C.), Implicit methods.

The unsteady flow of water was studied, particularly in relation to the planning, design, and management of water resources when computations must be made on flood flows, reservoir regulation, surges in canals, and tidal flow. The equations of conservation of mass and momentum are powerful analytical tools for the investigation of unsteady flows. Although approximate solutions of these equations are often used, the digital computer makes it feasible to obtain complete solutions of the equations by numerical methods. In this study, the explicit, characteristic, and implicit methods were investigated in detail and were applied to artificial and natural channels. The natural channel selected for this purpose was a reach of the Neuse River, North Carolina. Even though the three methods provided almost identical solutions, their speed, reliability, simplicity, and convenience are different. The implicit method, as developed from this study, proved to be fast, accurate, and convenient, and highly suitable for problems involving flow in natural river channels of complex geometry. The advantages of the implicit method make it feasible to use this sophisticated tool for the solution of unsteady flow problems in a routine manner. (Knapp-USGS)
W69-03564

AN EMPIRICAL FORMULA FOR DETERMINING THE AMOUNT OF DYE NEEDED FOR TIME-OF-TRAVEL MEASUREMENTS,
Geological Survey, Cheyenne, Wyo.
For primary bibliographic entry see Field 07C.
For abstract, see .
W69-03565

FLOOD HYDROLOGY OF SMALL WATERSHEDS--EVALUATION OF TIME PARAMETERS AND DETERMINATION OF PEAK DISCHARGE,
Hawaii Univ., Honolulu.
I-pai Wu.
Contrib No 13, Dec 1968. ASAE Paper No 68-711, 33 p, 14 fig, 2 tab, 19 ref. OWRR Project B-006-HI.

Descriptors: *Peak discharge, *Flood hydrograph, *Linearity test, *Hawaiian small watershed, Hawaii.

Hawaiian small watersheds are small and steep. Both of the two hydrograph time parameters, time to peak and recession constant, are short. The shape of the flood hydrograph is a steep triangle and most likely produced by a short duration, high intensity rainfall. Peak discharge equations which are derived by three different approaches, triangular hydrograph, instantaneous unit hydrograph, and overland flow analysis, can all be shown as a simple equation, Qp= CAR. A linearity test between peak discharge and runoff has been made for the small watersheds and a good linear relationship was found between peak discharge and for runoff less than 6 inches.
W69-03569

2F. Groundwater

POTENTIAL FLOW AND SOIL STRUCTURE CHANGES,
Slovak Technical Univ., Bratislava (Czechoslovakia).
P. Peter, and J. Hulla.
Proc 3d Asian Reg Conf, Int Soc of Soil Mech and Found Eng, Haifa, Israel, Sept 25-28, 1967, Vol 1, Div 4, pp 168-170, 1967. 3 p, 4 fig, 1 tab.

Descriptors: *Soil water movement, *Water level fluctuations, *Soil structure, *Potential flow, Flow characteristics, Permeability, Model studies, Fine-textured soils, Sands, Gravels, Leaching, Transmissivity, Structures, Dam failure.
Identifiers: *Soil structure change, *Piping.

Changes in soil structure due to water level fluctuation are described. Field and laboratory studies showed that rapid changes in the groundwater level and of the horizontal flow pattern caused the fines to wash out of the gravel sands which changed both their structure and permeability values. A difference of up to 250-fold occurred in permeability between disintegrated and sand-enriched soils. Use of the potential flow equation shows that high pressures are transmitted through the disintegrated soil to distances of several hundred meters and can cause a piping and leaching effect, endanger hydraulic structures such as dams. (Lang-USGS)
W69-03203

SEEPAGE FROM A CANAL INTO SOIL WI SHALLOW WATER DEPTH,
Kyoto Univ. (Japan).
K. Akai, and T. Uno.
Proc 3d Asian Reg Conf, Int Soc of Soil Mech Found Eng, Haifa, Israel, Sept 25-28, 1967, Ve Div 4, pp 131-134, 1967. 4 p, 12 fig, 2 ref.

Descriptors: *Seepage, *Canals, Mathemat models, Hydraulic models, Recharge, Water l fluctuations, Groundwater movement, Lakes, moisture.
Identifiers: *Seepage models.

Seepage from canals underlain by high water ta was studied with 2 mathematical models of systems, and verified by sand model tests method for estimating the free surface position rate of recharge was derived. The rate of rise o free water surface in the direction opposite the gional groundwater flow direction is nearly pro tional to the rate of recharge, and a 'curtain' or of no net upstream recharge occurs under canal. (Knapp-USGS)
W69-03204

ANALYSIS OF SOME PUMPING T RESULTS,
Nottingham Univ. (England). Dept. of Civil gineering.
E. W. Brand.
Proc 3d Asian Reg Conf, Int Soc of Soil Mech Found Eng, Haifa, Israel, Sept 25-28, 1967, V Div 4, pp 139-144, 1967. 6 p, 12 fig, 2 tab, 9 re

Descriptors: *Groundwater movement, *D down, *Theis equation, *Thiems equation, Pu ing, Testing, Test procedures, Dupuit-Forchhe theory.
Identifiers: *Well testing, Pumping tests, Cor depression, Chow method, Cooper and J method, Boulton method.

Four pumping tests carried out in Antwerp analyzed by a number of methods with a vie quantitative assessment of the formation cons of the unconfined sand aquifer. The wells pumped at a nearly constant rate for the fi hours and water levels were read at short inter Water levels were then read at longer intervals apparent equilibrium was reached. Equilib discharge and water level were recorded afte days in 4 of the wells. Data were analyzed by Thiem equilibrium method and the Theis, Co and Jacob, Chow, and Boulton non-equilib methods. Some explanation is given of the principles of the analyses, and the methods compared in respect of their applicability and of use. The numerical results computed from tests indicate that permeabilities of the right can be predicted by most of the techniques that more exact agreement cannot in gener achieved. The simpler techniques appear, a present time, to have definite practical advan over those resulting from more sophistic mathematical treatment of the problem. (K USGS)
W69-03206

ON THE MECHANISM OF SUSPENDED CA LARY WATER AND PERCHED GROU WATER,
Akademiya Nauk Armyanskoi SSR, Erevan stitut Geologicheskikh Nauk.
G. Ter-Stepanian.
Proc 3d Asian Reg Conf, Int Soc of Soil Mech Found Eng, Haifa, Israel, Sept 25-28, 1967, V Div 4, pp 179-181, 1967. 3 p, 2 fig.

Descriptors: *Capillary water, *Perched water saturated flow, Soil water movement, Lands Capillary action, Groundwater.

ers: Perched groundwater, Capillary
:.

roperties of capillary systems and the
ium of capillary fluids with the surrounding
media are used to explain the behavior of
ded capillary water and temporary perched
orizons. The significance of the curvature of
enisci, and the gravitational potential of
etric levels in these systems, are stressed.
on this theory, the features of formation and
on of suspended capillary water in different
f soils are explained. It is shown that the
ary perched groundwater horizons may not
equilibrium with the stationary horizons
A possible type of migration of suspended
y water is illustrated by capillary siphoning,
e possibility of landslides due to it is in-
. (Knapp-USGS)
3208

ACTERISTICS OF SUBSURFACE
RS HAVING A TENDENCY TO
PITATE IN THE FILTER ZONES OF
S,
lekseyev.
from Doklady Vodgeo No 13, pp 133-143,
oviet Hydrol: Selec Pap, Issue No 4, pp 410-
67. 6 p, 3 fig, 4 tab, 4 ref.

ptors: *Well filters, *Chemical precipitation,
chemistry, Coagulation, Corrosion,
en ion concentration, Iron, Manganese,
n, Silica, Clays, Groundwater.
ers: Well screen clogging, USSR.

nod is given for predicting the clogging of
creens by chemical reactions caused by
ance of chemical equilibrium due to the
ce of wells. The common clogging materials
cium carbonate, silica, particles, and oxides
drates of Fe and Mn. To predict the stability
ers when they are disturbed by wells, it is
onvenient to use pH, ionic concentrations
rtial pressure of carbon dioxide in nomo-
and equations which yield a saturation index
al pH - stable pH. Iron near wells may stay
solution or form colloidal suspensions de-
g on iron concentration and pH; above a pH
t 6-8 in oxidizing conditions, particularly in
sence of iron bacteria, clogging is probably
y natural waters. Examples are given of 2
of different saturation indexes. (Knapp-
3210

ECTIVE SALT DIFFUSION IN A RADIAL
RFACE STREAM IN RELATION TO
PROTECTION OF SUBSURFACE
RS FROM CONTAMINATED
ARGES,
mary bibliographic entry see Field 05B.
tract, see .
3212

OLOGIC SUBSTANTIATION AND COM-
TION OF THE REDUCTION OF FORESTS
THE EXPANSION OF NATURALLY
RLOGGED AREAS AFTER UN-
LOODING IN RIVER SYSTEMS,
mary bibliographic entry see Field 02A.
tract, see .
3214

TIGATION OF WATER ABSORPTION
E SOIL ON THE BASIS OF THE DIMEN-
L THEORY,
mary bibliographic entry see Field 02G.
tract, see .
3215

FATE OF DDT AND NITRATE IN GROUND WATER,
Robert S. Kerr Water Research Center, Ada, Okla.; and Southwestern Great Plains Research Center, Bushland, Tex.
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-03219

FLOW OF GROUNDWATER IN RELATIVELY THICK LEAKY AQUIFERS,
New Mexico Inst. of Mining and Technology, Socorro.
Mahdi S. Hantush.
Water Resources Res, Vol 3, No 2, pp 583-590, 1967. 8 p, 2 fig, 12 ref.

Descriptors: *Groundwater movement, *Aquifers, *Leakage, Artesian wells, Water wells, Aquifer characteristics.
Identifiers: Hydrologic systems, Leaky aquifers, Aquifer leakage factor.

Solutions to many problems of flow in leaky aquifers are based on a differential equation that includes a leakage term in addition to the usual terms of the equation of groundwater motion. In other words, the effect of leakage on the flow is incorporated in the differential equation rather than expressed as a boundary condition, as it actually occurs in the physical system. Such an approximation is justified when the main aquifer is relatively thin, provided, of course, that the conductivity of the semipervious layer relative to those of the main aquifers of the leaky system is small. Although the latter condition is almost always prevalent in nature, real aquifers are not always relatively thin. In thick aquifers, the use of the available solutions may yield poor results, especially when a quantitative criterion for the relative thickness of the aquifers is not available. Solutions are developed by using the usual differential equation of groundwater motion and the pertinent initial and boundary conditions, expressing the effect of leakage on the flow as a boundary condition. Moreover, a quantitative criterion is established for the applicability of the solutions that are already available from the approximate theory now in use. The already available solutions appear to be applicable wherever thickness to leakage factor is less than about 0.10. (Knapp-USGS)
W69-03220

GROUND-WATER RESOURCES OF ISLAND COUNTY, WASHINGTON,
Geological Survey, Washington, D. C.
Henry W. Anderson, Jr.
Wash State Dep Nat Resources Water-Supply Bull No 25, Part 2, 1968. 317 p, 18 fig, 4 plate, 12 tab, 12 ref, 1 append.

Descriptors: *Water resources, *Groundwater, *Washington, Aquifers, Hydrologic data, Data collections, Water yield, Water quality, Water levels, Water level fluctuations, Observation wells, Hydrogeology.
Identifiers: *Island County (Wash).

The groundwater resources of Island County, Washington, are the only significant water supply of a population of over 22,000. Average annual precipitation ranges from 20 to 40 in. and is the only recharge to groundwater. The aquifers are Pleistocene deposits from 3 glacial and 3 interglacial periods. Most of the water is produced from depths within 20 ft of sea level. A few draw water from deeper zones, down to 400 feet below sea level. Most of the wells are shallow; 18% are 200-300 ft deep and only 3% are more than 300 ft deep. Average yields range from 20 gpm in shallow wells to 80 gpm in deeper wells. Dissolved solid content of well water ranges from less than 300 mg/d to over 1000, and hardness from 50 to over 800. Total withdrawal is estimated to be about 1 billion gal per yr. About 60% is used for domestic and public supplies, 25% for irrigation, and 15% for stock and industrial purposes. Water levels fluctuate less than 2 ft in 50% of observation wells, but there is some seawater encroachment in a few heavily pumped locations. (Knapp-USGS)
W69-03224

DEUTERIUM CONTENT IN NATURAL WATERS,
Institut Prikladnoi Geofiziki, Leningrad. Trudy (USSR).
For primary bibliographic entry see Field 02K.
For abstract, see .
W69-03229

SHORTCUTS AND SPECIAL PROBLEMS IN AQUIFER TESTS,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 07B.
For abstract, see .
W69-03231

HYDROLOGY OF BROOKHAVEN NATIONAL LABORATORY AND VICINITY, SUFFOLK COUNTY, NEW YORK,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02E.
For abstract, see .
W69-03232

USE OF THE ELECTRICAL RESISTIVITY METHOD FOR INVESTIGATING GEOLOGIC AND HYDROLOGIC CONDITIONS IN SANTA CLARA COUNTY, CALIFORNIA,
For primary bibliographic entry see Field 07B.
For abstract, see .
W69-03235

GEOPHYSICAL SURVEYS IN THE VICINITY OF SANITARY LANDFILLS IN NORTHEASTERN ILLINOIS,
Illinois State Geological Survey, Urbana.
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-03236

NUMERICAL SOLUTIONS FOR DISPERSION IN POROUS MEDIUMS,
Massachusetts Inst. of Tech., Cambridge. Hydrodynamics Lab.
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-03237

HYDROGEOLOGY OF DESERT BASINS,
Nevada Bureau of Mines, Reno. Desert Research Inst.
George B. Maxey.
Ground Water, J Tech Div Nat Water Well Ass, Vol 6, No 5, pp 10-22, Sept-Oct 1968. 13 p, 15 fig, 29 ref.

Descriptors: *Hydrogeology, *Deserts, *Groundwater basins, Nevada, Water law, Planning, Model studies, Water chemistry, Water management (Applied).
Identifiers: Desert Research Institute.

The groundwater flow patterns of desert basins, which usually involve recharge in mountains and discharge in lowlands, are reviewed and illustrated by some detailed studies in the Great Basin of Nevada. In the Great Basin two general categories of groundwater flow systems are recognized: (1) local flow systems where drainage areas are usually small, flow paths are relatively short, interbasin flow is uncommon, springs have large fluctuations in discharge, water temperature is low, and concentration of Na, K, Cl, and SO4 is low, and (2) regional flow systems, where drainage areas are large, flow paths long, interbasin flow common, springs have large discharge, and the water is characteristically of higher temperature and contains higher concentrations of K, Na, Cl, and SO4. Although

detailed delineation of most flow systems in Nevada has not been accomplished, integration of hydrologic, geologic, and chemical methods allow approximate portrayal of many systems, both local and regional. Adequate methods upon which to base planning for optimum development of water resources in desert basins are now available. A conceptual model of optimal groundwater reservoir development illustrates how to determine optimum use of storage and perennial yield provided the use to which the water is to be put and the time of withdrawal are known. (Knapp-USGS)
W69-03238

EXPLANATION OF PARADOXES IN DUPUIT-FORCHHEIMER SEEPAGE THEORY,
Iowa State Univ., Ames. Water Resources Research Inst.
Don Kirkham.
Water Resources Res, Vol 3, No 2, pp 609-622, 1967. 14 p, 10 fig, 29 ref.

Descriptors: *Groundwater movement, *Dupuit-Forchheimer theory, *Mathematical studies, Seepage, Porous media, Hydraulics, Water table, Sediment yield, Flow nets.
Identifiers: Seepage flow, Nonorthogonal flow nets, Streamlines.

Cutting into a porous medium of a large number of vertical, parallel, infinitely permeable, equally spaced, infinitesimally thin slots produces a fictitious soil that follows exactly and without paradoxes Dupuit's assumptions and hence Dupuit-Forchheimer (D.F.) drainage theory in two dimensions. A soil having these infinitesimally thin slots is designated a D. F. soil. For this fictitious soil, a formula for the proper depth and spacing of ditches and drain tiles is derived. The formula is the same one found in conventional D. F. literature. The formula, valid for both tiles and ditches and known to hold approximately for actual soils, is exact for a D. F. soil. Dupuit's 2-dimensional 'parabolic seepage problem' and others may now be considered as exactly solvable for D. F. soils. For 3-dimensional axially symmetric seepage flow, as into wells, the fictitious slots of a D. F. soil become concentric coaxial rings. D. F. streamlines are not horizontal; they converge in a special way. (Knapp-USGS)
W69-03242

THEORETICAL ANALYSIS OF REGIONAL GROUNDWATER FLOW. 2. EFFECT OF WATER-TABLE CONFIGURATION AND SUBSURFACE PERMEABILITY VARIATION,
Department of Mines and Technical Surveys, Calgary (Alberta). Water Research Branch; and California Univ., Berkeley. Dept. of Civil Engineering.
R. Allan Freeze, and P. A. Witherspoon.
Water Resources Res, Vol 3, No 2, pp 623-634, 1967. 12 p, 6 fig, 8 ref.

Descriptors: *Groundwater movement, *Steady flow, *Regional analysis, *Mathematical models, *Digital computers, Water table, Discharge (Water), Anisotropy, Topography, Stratigraphy.
Identifiers: Drainage basin characteristics.

Details of steady-state flow in regional groundwater basins can be investigated using digital computer solutions of appropriately designed mathematical models. The factors that must be considered are: (1) ratio of depth to lateral extent of the basin; (2) water-table configuration; and (3) stratigraphy and resulting subsurface variations in permeability. The results of this study provide a theoretical basis for the following properties of regional flow systems: (1) groundwater discharge will tend to be concentrated in major valleys; (2) recharge areas are invariably larger than discharge areas; (3) in hummocky terrain, numerous subbasins are superposed on the regional system; (4) buried aquifers tend to concentrate flow toward the principal discharge area, having a limiting effect on subbasins, and need not outcrop to produce artesian flow conditions; (5) stratigraphic discontinuities can lead to distributions of recharge and discharge areas that are difficult to anticipate and that are largely independent of the water-table configuration. (Knapp-USGS)
W69-03243

ROLE OF STABLE HYDROGEN ISOTOPES IN THE STUDY OF GEOLOGICAL PROCESSES,
Vsesoyuznyi Nauchno-Issledovatelskii Institut Yadernoi Geofiziki i Geokhimii, Moscow (USSR).
V. N. Soyfer, V. S. Brezgunov, and L. S. Vlasova.
Transl from Geokhimiya, No 5, 1967 (Russian). Geochem Int, Vol 4, No 3, pp 490-497, 1967. 8 p, 4 fig, 4 tab, 19ref.

Descriptors: *Deuterium, *Stable isotopes, *Hydrologic cycle, Water analysis, Aquifers, Evaporation, Surface waters, Groundwater, Meteoric water, Geochemistry, Hydrogen, Hydrogeology.
Identifiers: USSR, Isotope fractionation, Photoneutron analysis, Mass spectrometric analysis.

Data are presented on the distribution of deuterium in natural waters in the USSR. Determinations were made by photoneutron and mass spectrometric analysis of over 500 water samples. The highest deuterium concentrations are characteristic of ocean water, and the lowest, of glacier ice and meteoric waters (particularly snow). The concentration of deuterium in groundwaters is intermediate between the concentrations in ocean and meteoric waters. Deuterium content in river and open basin waters varies with the hydrologic region, but within the same limits as in other waters. These data form a base for investigating the dynamics and origin of underground water. Conclusions are presented on the decisive influence of evaporation and condensation processes in the world-wide hydrologic cycle on the deuterium distribution in natural waters, including underground waters. (Steinhilber-USGS)
W69-03244

FEASIBILITY CRITERIA FOR SUBSURFACE WASTE DISPOSAL IN ILLINOIS,
Illinois State Geological Survey, Urbana.
For primary bibliographic entry see Field 05E.
For abstract, see .
W69-03251

ON THE MEANING OF THE DUPUIT AND PAVLOVSKII APPROXIMATIONS IN AQUIFER FLOW,
Technion-Israel Inst. of Tech., Haifa.
S. Irmay.
Water Resources Res, Vol 3, No 2, pp 599-608, 1967. 10 p, 4 fig, 17 ref.

Descriptors: *Groundwater movement, *Dupuit-Forchheimer theory, *Mathematical studies, Laplaces equations, *Hydraulics.
Identifiers: Hydraulic flow.

Pavlovskii's method is applied to Dupuit's approximate solution of steady hydraulic flow of unconfined 2-dimensional plane or curved aquifers in uniform or nonuniform soils, on a horizontal or inclined impervious base. Graphs correlate the geometrical parameters. The error on the potential is about 1/4%. The effect of end slopes, especially of the seepage face, may account for some 30% of the total discharge. In 1-dimensional flow the discharge is correct even in nonuniform and curving aquifers on a horizontal base and seemingly also on an inclined base. Girinskii's potential in nonuniform soils in Dupuit's approximation is replaced in the exact theory by two other potentials. (Knanp-USGS)
W69-03252

APPLICATIONS OF FACTOR ANALYSIS IN STUDY OF CHEMISTRY OF GROUNDWATER QUALITY, MOJAVE RIVER VALLE CALIFORNIA,
Geological Survey, Menlo Park, Calif.
D. R. Dawdy, and J. H. Feth.
Water Resources Res, Vol 3, No 2, pp 505-5
1967. 6 p, 1 fig, 3 tab, 9 ref.

Descriptors: *Water chemistry, *Geochemist *Groundwater, *Statistical methods, Californ Aqueous solutions, Equilibrium, Correlation ana sis.
Identifiers: Factor analysis, Mojave River (Calif nia).

Factor analysis is applied t results of chemi analyses of 103 water samples from wells in Upper and Middle Mojave River valley, S Bernardino County, California. Chemical analy showed that there are 3 principal chemical types water, calcium bicarbonate, sodium sulfate, a sodium chloride, as well as many mixtures of three. Data were studied by factor analysis to le the relative importance of each principal ion determining the variations among the samples, a to examine the possibility of chemical equilibri between aqueous and solid phases in the aquife Most of the covariance in the system may be counted for by variances of calcium, magnesiu sodium, sulfate, and chloride. There is alm identical loading on the constituents sodium a chloride. The variance in chemical composition the hydrochemical system is governed largely sources of sodium chloride. None of the co ponents is controlled by equilibrium between i in the water and minerals in the aquifers. Conc trations of nitrate and fluoride vary independen of other constituents. Geographic distribution statistical loadings of the principal constituents individual wells does not reveal sources of the c stituents, which must be deduced from geolo and hydrologic evidence. Factor analysis, howe furnished the critical information on chemical r tionships basic to the deduction. (Knapp-USGS)
W69-03253

USE OF THERMAL MODEL TO INVESTIGA THE THEORY OF TRANSIENT FLOW TO PARTIALLY PENETRATING WELL,
California Univ., Berkeley. Dept. of Civil Engine ing.
I. Javandel, and P. A. Witherspoon.
Water Resources Res, Vol 3, No 2, pp 591-5
1967. 7 p, 5 fig, 20 ref.

Descriptors: *Groundwater movement, *Unste flow, *Discharge (Water), *Model studies, *H flow, Penetration.
Identifiers: Partially penetrating wells, Ther models.

A thermal model constructed from a slab of s was used to investigate the theory of transient f to a partially penetrating well in a confined aqu of infinite radial extent where there is no leaka Families of type curves have been prepared f the theoretical solution for tenth, quarter, and penetration. Experimental results from the ther model using the same penetrations are generall very good agreement with the appropriate theo cal solution. This demonstrates the usefulnes the thermal model in studying transient problems. It is concluded that this experime work has provided independent proof of the va ty of the theoretical solution for the effects of tial penetration. (Knapp-USGS)
W69-03254

DICKEY V HONEYCUTT (MINE DAMAGE WELLS).

106 So 2d 665-670 (Ct App Ala 1958).

Descriptors: *Alabama, *Wells, *Mining, * colating water, Judicial decisions, Deep wells, derground, Land subsidence, Water law, W rights.

iff sued for damage to a water well resulting defendant's mining operations. Two tunnels e mine came within a short distance of the iff's property line. According to applicable if the defendant drained percolating water using his land in a careful and ordinary er, and a surface owner's water supply is af-d, no liability for his damage exists. However, drained the water without a reasonable need so, or if he negligently or willfully wasted per-ng water through drainage in such a manner e should have anticipated damage to a water y would occur, then he is liable to injured sur-owners if his action was a proximate cause of damages. The court found that the plaintiff's vas damaged as the proximate result of the de-nt's negligence. (Scott-Fla)
03282

LYZING SUBSURFACE FLOW SYSTEMS H ELECTRIC ANALOGS,
ultural Research Service, Phoenix, Ariz. r Conservation Lab.
an Bouwer.
r Resources Res, Vol 3, No 3, pp 897-907, 11 p, 8 fig, 17 ref.

riptors: *Analog models, *Computer models, log computers, *Groundwater movement, ous media, Digital computers.
ifiers: Hydrologic systems, Boundary ems.

nalysis of subsurface movement of water by ic analog methods is discussed and examples alog systems are given. Direct analogs simu-he transmission and storage properties of the s relevant parameters in the water movement ss. Principles and techniques for constructing perating analogs include calculation of re-ce and capacitance values for network gs, simulation of fixed, free, and infinite boun-s, inclusion of unsaturated flow, solution of -steady flow problems, analysis of diffusion-low systems, simulation of horizontal and ver-flow systems, instrumentation, and data con-n. Direct electric analogs are relatively sim-o build and use, and they enable solution of systems not amenable to mathematical analy-here is, however, a limit as to the complexity w systems that direct analogs can handle, and nt is reached where digital computers are appropriate.
03310

QUIFER TEST USED TO INVESTIGATE A LITY OF WATER ANOMALY,
ogical Survey, Huron, S. Dak. Water urces Div.
ld G. Jorgensen.
nd Water, Vol 6, No 6, pp 18-20, Nov-Dec 3 p, 4 fig, 1 tab, 5 ref.

riptors: *Water quality, *Groundwater, fers, Artesian wells, South Dakota, Leakage.
ifiers: Aquifer tests, Avon (South Dakota).

quifer test and analyses of water samples ed that the anomalous quality of water in a cipal well in Avon, South Dakota was caused akage from a nearby abandoned well tapping ner aquifer. The test used the city well and 1 rvation well. Analysis of test data indicated a missibility of 450 gpd per ft before the cone of ence reached the recharge boundary and 1700 per ft after reaching it. A graphical method ed an image well in about the same area as a old capped city well. The abandoned well was ed in the Dakota aquifer, which has a higher ntiometric surface than the Codell aquifer, in h the city well is finished. Leakage of the cas-f the old well is furthur indicated by chemical ty of the water, which has about the composi-and temperature of a mixture of Codell and ota water. (Knapp-USGS)
-03335

INVESTIGATION OF THE TECHNICAL FEASIBILITY OF STORING FRESH WATER IN SALINE AQUIFERS,
Louisiana State Univ., Baton Rouge. Water Resources Research Inst.
Omar J. Esmail, and Oscar K. Kimbler.
Water Resources Res, Vol 3, No 3, pp 683-695, 1967. 13 p, 5 fig, 4 tab, 14 ref.

Descriptors: *Underground storage, *Aquifers, *Saline water intrusion, *Injection wells, *Model studies, Computer models, Hydraulic models, Porous media, Groundwater movement, Mixing, Diffusion.
Identifiers: Gravitational segregation.

Preliminary studies indicate that the underground storage of fresh water in saline aquifers may be feasible from a technical viewpoint. Such a process would involve injection of fresh water, storage until needed, and subsequent production from the same well. This work, based upon theoretical considerations and model studies, leads to a computer technique by means of which the recovery of stored fresh water may be estimated. Calculations involving five hypothetical aquifers indicate recoveries ranging from 25 to 85%, depending upon aquifer and fluid properties. Loss of fresh water as a result of both dispersion (mixing) and gravitational segregation was considered. Results obtained in porous flow models indicate that gravitational segregation is significantly retarded by the development of a mixed zone. Such a zone is developed naturally during injection and production as a result of fluid movement and to a lesser degree during the storage portion of the cycle as a result of diffusion.
W69-03336

GROUND-WATER SURVEY, ODESSA-LIND AREA, WASHINGTON,
Geological Survey, Tacoma, Wash.
J. E. Luzier, J. W. Bingham, and R. J. Burt.
Wash Dep Water Resources Water-Supply Bull No 36, 1968. 31 p, 14 fig.

Descriptors: *Groundwater, *Water utilization, *Irrigation, *Water level fluctuations, *Washington, Water wells, Water levels.
Identifiers: Odessa (Washington), Lind (Washington).

A comprehensive study of the groundwater of the Odessa-Lind area, Washington, was made by the Washington State Department of Water Resources in cooperation with the U. S. Geological Survey. The results are presented in nontechnical terms. Since about 1963, there has been a continuing increase in the use of groundwater in the Odessa-Lind area, largely for the irrigation of wheat. Although irrigated acreage comprises only a small percentage of this region of predominantly dryland farming, localized areas of water-level decline and well interference were detected as early as 1964 in a preliminary study by A. A. Garrett (Washington Department of Water Resources Water-Supply Bull. No. 31). Pumpage nearly quadrupled from 1963 to 1967, although the number of wells only doubled. This reflected a trend toward use of more powerful pumps for replacement or for installation on new wells. It became obvious that a continued increase in groundwater pumpage would accelerate the lowering of water levels and enlarge the area affected--perhaps reaching a point in a few years where the cost of pumping water from the increased depth would exceed the additional income from increased crop yield. In addition, the shallower zones of groundwater now tapped by many domestic wells would largely be drained. (Knapp-USGS)
W69-03352

GROUND WATER IN ONTARIO SOUTHWESTERN AREA, 1960-1963.
Ontario Water Resources Commission, Toronto.

Ontario Water Resources Comm Ground Water Bull No 6, 1968. 485 p, 4 fig, 7 tab, 4 append.

Descriptors: *Data collections, *Groundwater, Water wells, Hydrologic data, Aquifers, Water levels, Water level fluctuations, Observation wells.
Identifiers: *Ontario, Periodic observations, Pumping-test data, Drillers logs.

Records of wells, water level measurements, observation well hydrographs, and a discussion of the hydrology and water resources of southwestern Ontario are compiled. Each well record contains location, owner, driller, completion date, casing diameter, pumping test discharge, pumping level, static level, kind of water, use, and drillers log. Observation well records include well number, observer, location, type, depth, aquifer, recording method, period of record, measuring point, and water levels. Licensed water well drillers are listed. (Knapp-USGS)
W69-03354

GROUNDWATER RESOURCES OF CHOWAN COUNTY, NORTH CAROLINA,
Geological Survey, Washington, D. C.
O. Bruce Lloyd, Jr.
Geol Surv Hydrol Invest Atlas HA-292, 1 sheet, 1968. 5 map, 2 graph.

Descriptors: *Water resources, *Groundwater, *North Carolina, Aquifers, Water yield, Water quality, Saline water intrusion, Water wells, Municipal water, Specific capacity, Water-level fluctuations.
Identifiers: *Chowan County (North Carolina), Edenton (North Carolina), Well logs.

The results of a study of the groundwater resources of Chowan County, North Carolina are compiled in a 1-sheet Hydrological Atlas. Maps show aquifer characteristics, areas of groundwater recharge and discharge, groundwater chloride content, and piezometric contours of the aquifers. A cross section shows geologic formation and aquifer correlation. Graphs show annual pumpage from municipal wells and water levels in an observation well. Average specific capacities of wells are tabulated. Sediments ranging in age from Cretaceous to post-Miocene are about 2000 ft thick in the area and include 5 major aquifers composed of permeable sand, shell, and limestone beds, separated by silt and clay aquitards. Aquifer E is 320 ft deep, 100 ft thick, and it yields only 1-5 gpm to wells. Aquifer D is 220 ft deep, 50 ft thick, and wells in it have specific capacities of about 5 gpm per ft of drawdown. Aquifer C is about 150 ft deep, 40 ft thick, and wells in it have specific capacities of about 10 gpm per ft. Aquifer B is about 30 ft deep, 50 ft thick and yields a little hard water to wells. Aquifer A is surficial, about 25 ft thick, and yields a little water to wells. A large cone of depression in aquifer C is caused by pumping in Edenton's well field, and its expansion is expected to increase saline water intrusion into the aquifer. (Knapp-USGS)
W69-03355

ELECTRIC ANALOG OF THREE-DIMENSIONAL FLOW TO WELLS AND ITS APPLICATION TO UNCONFINED AQUIFERS,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 07C.
For abstract, see .
W69-03356

ROCK MECHANICS IN THE DISPOSAL OF RADIOACTIVE WASTES BY HYDRAULIC FRACTURING,
Oak Ridge National Lab., Oak Ridge, Tenn. Health Physics Div.
For primary bibliographic entry see Field 08E.
For abstract, see .
W69-03522

CLASSIFICATION OF WATER-BEARING STRATA BASED ON CONDITIONS OF FLOW OF WATER INTO WELLS,
Alfred Kepinski.

Felsmechanik und Ingenieurgeol, J Int Soc Rock Mech, Vol 6, No 3, pp 133-138, 1968. 6 p, 2 tab, 6 ref.

Descriptors: *Water wells, *Aquifers, *Specific capacity, Discharge (Water), Aquifer characteristics, Drawdown, Groundwater.
Identifiers: Well capacity index, Pumping tests.

Sand and gravel aquifers are classified by a well capacity index defined as the discharge in liters per second per meter of drawdown per sq meter of well screen area. Aquifers are divided by this criterion into 7 classes. Results of testing and classifying 92 drilled wells are tabulated. (Knapp-USGS)
W69-03523

AN APPRAISAL OF THE GROUND-WATER RESOURCES OF THE UPPER SUSQUEHANNA RIVER BASIN IN PENNSYLVANIA,
Geological Survey, Washington, D. C.
Paul R. Seaber.
Prepared in cooperation with Atomic Energy Comm. Geol Surv Interim Groundwater Rep, August 1968. 75 p, 6 fig, 5 tab, 14 ref.

Descriptors: *Groundwater, *Pennsylvania, *Hydrologic data, Aquifers, Water yield, Water utilization, Water quality, Water sources, Hydrologic properties.
Identifiers: *Susquehanna River Basin.

The availability, quantity, quality, variability, and cost of development of the groundwater resources in the upper Susquehanna River basin in Pennsylvania are described and appraised by geological formations and by areas of the State. Water moves from the ground into most of the streams of the area with a consequently large effect on surface water quantity and quality. In most of the area, development of groundwater supplies is far below the potential maximum development. Tables show estimated specific capacities and yields, well designs, and costs of hypothetical wells in the geologic units of the area. Water chemical analyses from wells in all the geologic units are also tabulated. (Knapp-USGS)
W69-03528

GROUND-WATER RESOURCES OF THE SEVIER RIVER BASIN BETWEEN YUBA DAM AND LEAMINGTON CANYON, UTAH,
Geological Survey, Washington, D. C.
L. J. Bjorklund, and G. B. Robinson, Jr.
Geol Surv Water-Supply Pap 1848, 79 p, 1968. 11 fig, 2 plate, 7 tab, 33 ref.

Descriptors: *River basins, Surface-Groundwater relationships, *Utah, Groundwater recharge, Groundwater movement, Water quality.
Identifiers: *Yuba Dam, *Leamington Canyon, Sevier River Basin (Utah).

In order to determine the source, occurrence, availability, chemical quality, movement, recharge, discharge and use of groundwater, and the relation of groundwater to surface water within the segment of the basin between Yuba Dam and Leamington Canyon, a study of the groundwater hydrology of the Sevier River basin in Utah was made. The groundwater in Scipio Valley changes its level abruptly near midvalley caused by drainage from a shallow groundwater reservoir in the southern part of the valley. Most recharge to groundwater reservoirs occurs along the mountain fronts where streams emerge from canyons onto permeable alluvial fans. Groundwater in Little Valley is mostly in valley fill under water-table conditions at depths more than 100 ft below the land surface. Groundwater movement downstream from beneath Sevier Bridge Reservoir above Yuba Dam is not related to the discharge from Molten and Blue Springs. (Llaverias-USGS)
W69-03529

HYDROGEOLOGIC DATA FOR BACA AND SOUTHERN PROWERS COUNTIES, COLORADO,
Geological Survey, Denver, Colo.
David B. Richards, Lloyd A. Hershey, and Richard K. Glanzman.
Colo Ground Water Basic-Data Release No 19, 1968. 123 p, 1 fig, 1 plate, 6 tab.

Descriptors: *Data collections, *Groundwater, *Colorado, *Water wells, *Water quality, Aquifers, Water levels, Water level fluctuations, Observation wells.
Identifiers: Baca county (Colo.), Prowers County (Colo.), Periodic observations.

Basic hydrologic data collected in Baca and southern Prowers Counties, Colorado, are tabulated. A map shows locations of inventoried wells. A cross section shows geologic units and their hydrologic character. Each well record shows location, owner, well depth, casing diameter, year completed, type of pump and power, altitude, depth to water, data measured, yield, and geologic source of water. Tabulated chemical analyses include well location, depth, geologic source of water, date of collection, temperature, SiO2, Fe, Ca, Mg, Na, K,HCO3, SO4, Cl, F, NO3, B, TDS, SAR, hardness, Specific conductance, and pH. Periodic water-level measurements are tabulated. Driller's logs are compiled. (Knapp-USGS)
W69-03530

AN ANALYSIS OF THE MEANDERING TENDENCY OF SERPENTINE CAVE, N.S.W.,
Sydney Univ. (Australia). Dept. of Geography.
E. D. Ongley.
J Hydrol, Vol 6, No 1, pp 15-32, Jan 1968. 18 p, 8 fig, 2 tab, 8 ref.

Descriptors: *Meanders, *Wavelengths, *Statistical methods, Bearings, Channel morphology, Hydrology.
Identifiers: *Serpentine Cave, *New South Wales, *Cavern geometry, Planimetric curves, Passage bearings.

In a preliminary study of the meandering tendency of Serpentine Cave, N.S.W., a method of wavelength determination independent of symmetry is presented. The asymmetrical winding form of Serpentine Cave in New South Wales has raised the question whether or not cavern geometry has parameters similar to those of surface meanders. Statistical treatment of passage bearings provides reasonable evidence that bearings relate to hydrology and not to structural control. Planimetric curves of hydraulic significance are designated 'passage oscillations' rather than 'meanders'. Sinuosity and ratios of wavelength to channel width and of channel length to channel width are defined for Serpentine Cave. (Llaverias-USGS)
W69-03532

PRINCIPLES OF CHEMICAL COMPOSITION OF GROUNDWATERS (BASIC FACTORS), (IN RUSSIAN),
Hydro-Chemical Inst., Novocherkassk (USSR).
For primary bibliographic entry see Field 02K.
For abstract, see .
W69-03533

METHODS OF MEASURING WATER LEVELS IN DEEP WELLS,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 07B.
For abstract, see .
W69-03535

GROUND WATER RECHARGE, DEVELOPMENT AND MANAGEMENT,
California Univ., Berkeley; and California State Dept. of Water Resources, Sacramento.
For primary bibliographic entry see Field 04B.
For abstract, see .
W69-03540

CURRENT TRENDS IN THE USE O RADIOACTIVE TRACERS IN HYDROLOG INVESTIGATIONS,
International Atomic Energy Agency, Vien (Austria).
For primary bibliographic entry see Field 07B.
For abstract, see .
W69-03544

OCCURENCE OF GROUND WATER IN TH JUDITH RIVER FORMATION, NORTH-CE TRAL MONTANA,
Geological Survey, Washington, D. C.
W. R. Osterkamp.
Geol Surv Hydrol Invest Atlas HA-308, 1 she 1968. Text, 2 map, 2 tab, 7 ref.

Descriptors: *Water resources, *Groundwat *Aquifers, *Artesian wells, *Montana, Data coll tions, Hydrologic data, Water quality, Water leve Water utilization.
Identifiers: Judith River formation (Montan Well inventory.

A 1-sheet hydrologic atlas describes the occ rence of groundwater in the Cretaceous Jud River formation, north-central Montana. geohydrologic map shows geology, geologic str ture contours, locations of listed wells, pot tiometric surface contours, and areas of flow wells. Chemical analyses of 4 representative w are listed. A list of 114 wells inventoried for study includes location, owner, altitude, well dep static water level, shut-in pressure of flowing we altitude of potentiometric surface, altitude of top of the Judith River formation, water tempe ture, specific conductivity, and use. Geologic cr sections show stratigraphic and potentiome relations. A geologic column shows Cretace Montana Group stratigraphy, lithology, topogra and geologic setting, and hydrology. The Jud River formation is confined above and below shales. It yields 1 gpm per 10 ft of drawfow wells; probably the highest yield to be expected 6-inch well is less than 200 gpm. Few wells f over 10 gpm. Sodium, sulfate, bicarbonate, total dissolved solids concentrations are high. napp-USGS)
W69-03545

HYDROLOGY OF SURFACE MINING-A CA STUDY,
Indiana Univ., Bloomington.
For primary bibliographic entry see Field 02A.
For abstract, see .
W69-03547

DISPERSION AT THE INTERFACE OF MIS BLE LIQUIDS IN A SOIL,
Syracuse Univ., N. Y.
Wen-Hsiung Li, and Gour-Tsyh Yeh.
Water Resources Res, Vol 4, No 2, pp 369-
Apr 1968. 9 p, 7 fig, 10 ref.

Descriptors: *Saline water-freshwater interfa *Dispersion, *Diffusion, *Groundwater m ment, Porous media.
Identifiers: Fick's law, Miscible liquids.

When 2 miscible liquids flow through a po medium (e.g., fresh water and salt water i aquifer), the dispersion at the interface is descr by Fick's law with a velocity-dependent coeffic The horizontal flow of 2 liquids is used to der strate that the influence of gravity and the effec the differences in density and viscosity are us negligible. Solutions are presented for the dis sion at the interface of liquids in 2-dimens flow.
W69-03548

THERMAL PROSPECTING FOR GRO WATER,
Illinois State Geological Survey, Urbana.
Keros Cartwright.
Water Resources Res, Vol 4, No 2, pp 395-
Apr 1968. 7 p, 5 fig, 10 ref.

iptors: *Groundwater, *Thermal properties, oration, Geophysics, Geothermal studies, low, Aquifers.
fiers: *Thermal prospecting.

etical consideration of the thermal properties consolidated deposits suggests that a shallow r might form a heat sink that influences and ies the temperature effects of heat originating land surface and within the crust. The uncon- ted water-yielding deposits apparently are the same temperature as the material sur- ing them. If the shallow aquifer is nonu- ly distributed, it should produce a tempera- nomaly in the surface soil. The size of the ly resulting from a shallow aquifer would de- on the thermal properties and thickness of the urden and on temperature differences en the surface and the aquifer. Thermal ecting offers promise as a rapid, inexpensive, irly reliable means of locating shallow linear solidated aquifers in glacial alluvial deposits.
03549

RIVATION OF DUPUIT SOLUTION OF DY FLOW TOWARD WELLS BY CHED ASYMPTOTIC EXPANSIONS,
ion - Israel Inst. of Tech., Haifa.
gan.
Resources Res, Vol 4, No 2, pp 403-412, 968. 10 p, 3 fig, 12 ref.

iptors: *Groundwater movement, *Steady *Mathematical models, Dupuit-Forchheimer , Porous media, Wells.
fiers: Asymptotic expansions.

proximate solution of the steady and shallow urface flow toward a well in a layer of infinite is obtained by expanding the velocity poten- a small parameter power series. This expan- shown to be valid only in the vicinity of the nd is, therefore, called the inner expansion. ter expansion, which solves the flow problem ge distance from the well, is derived by using ethod of matched asymptotic expansions. The t approximation coincides with the zero term of the potential outer expansion. The tion of a second order outer term makes le the discussion of the validity of the Dupuit ximation, which tends asymptotically toward act solution. In the outer zone, the stream- are parabolic and are not orthogonal to the otentials. The method is illustrated by 2 nu- al examples.
03550

INVESTIGATION OF WATER FLOW OUGH POROUS MEDIUMS BY MEANS OF OTRACERS,
alian Atomic Energy Commission Research lishment, Lucas Heights; and Bureau of al Resources, Geology, and Geophysics, Can- (Australia).
Ellis, L. Kevi, and W. A. Wiebenga.
Resources Res, Vol 4, No 2, pp 413-416, 968. 4 p, 2 fig, 1 tab, 6 ref.

iptors: *Groundwater movement, *Disper- *Tracers, Hydraulic models, Porosity, Porous , Sands, Dupuit-Forchheimer theory.
fiers: Bromine radioisotopes.

adioisotope bromine 82 was used to measure ow of water through a packed sand column. It hown that the commonly accepted Dupuit- heimer assumption did not apply under these tions. Some information was also obtained on l dispersion using iron gauzes and copper 64 on.
03551

PERMEABILITY OF A POROUS MEDIUM ERMINED FROM CERTAIN PROBABILI- AWS FOR PORE SIZE DISTRIBUTION,
ell Univ., Ithaca, N. Y. School of Civil En- ring.
ed Brutsaert.

Water Resources Res, Vol 4, No 2, pp 425-434, Apr 1968. 10 p, 3 fig, 20 ref.

Descriptors: *Permeability, *Porous media, *Mathematical models, Soil moisture movement, Hydraulic models, Porosity, Dupuit-Forchheimer theory.
Identifiers: Series-parallel porosity model, Soil moisture-suction relationship, Porosity-permeability relationships.

An equation derived for the permeability of a porous medium based on the general principles of the series-parallel model contains a double integral which is solved for several continuous probability laws describing the distribution of the sizes of the interstices of the porous medium. The agreement between calculated results and available experimental data is satisfactory.
W69-03553

SEEPAGE FROM CHANNELS THROUGH LAYERED POROUS MEDIUMS,
Utah State Univ., Logan.
For primary bibliographic entry see Field 02G.
For abstract, see .
W69-03554

SODIUM AS A CLUE TO DIRECTION OF GROUNDWATER MOVEMENT, NEVADA TEST SITE,
Geological Survey, Washington, D. C., and Geological Survey, Denver, Colo.
Stuart L. Schoff, and John E. Moore.
Geol Surv Res 1968, Prof Pap 600-D, pp D30-33, 1968. 4 p, 2 fig, 5 ref.

Descriptors: *Groundwater movement, *Water quality, *Tracers, Groundwater basins, Sodium, Nevada.
Identifiers: Natural tracers, Interbasin groundwater flow, Nevada Test Site.

Groundwater movement at the Nevada Test Site was traced by study of the sodium content of waters in the area. The source of the sodium at the Nevada Test Site is in Tertiary volcanic rocks. Sodium dissolved in water generally stays in solution. It is the predominant cation in groundwater in volcanic aquifers in the Nevada Test Site, but is nearly lacking in alluvial and carbonate-rock aquifers in southern Indian Spring valley south of the Nevada Test Site. The low content of sodium in the water of Indian Spring valley shows that the water has not migrated into the valley from the Nevada Test Site. (USGS)
W69-03559

FLOOD-FLOW CHARACTERISTICS OF A RECTIFIED CHANNEL, JACKSON, MISSISSIPPI,
Geological Survey, Jackson, Miss.
K. V. Wilson.
Geol Surv Res 1968, Prof Pap 600-D, pp D57-D59, 1968. 3 p, 2 fig, 1 ref.

Descriptors: *Streamflow, *Channel improvement, *Floodwater, *Mannings Equation, *Discharge coefficients, Roughness (Hydraulic), Velocity, Hydraulic radius, Stream gages, Vegetation effects.
Identifiers: Jackson (Miss.), Flood profiles.

Extreme changes in velocity, stage, and Manning's roughness coefficient n were observed during the first year after construction of an earthen canal for Hanging Moss Creek at Jackson, Miss. The channel, constructed during the summer of 1963, had a 30-ft-wide bottom, 2:1 side slopes, and 12-ft depth. On March 2, 1964, velocities of 7.8 ft per second were observed at a 5 1/2-ft depth in the clean channel and Manning's n was computed to be 0.025. By October 1964, velocities of 3.2 ft per second existed at a 5 1/2-ft depth and Manning's n was computed to be 0.05 in channel which was then lined with fairly thick vegetation consisting of small willows, weeds, and grasses. The observations indicate that the values of Manning's n commonly used in channel rectification are low, and that the carrying capacity of earthen channels may be reduced 100% as a result of only 1 year's growth of vegetation. (USGS)
W69-03566

TEMPERATURE VARIATIONS OF DEEP FLOWING WELLS IN SOUTH DAKOTA,
Geological Survey, Rapid City, S. Dak.; and Geological Survey, Huron, S. Dak.
D. G. Adolphson, and E. F. LeRoux.
Geol Surv Res 1968, Prof Pap 600-D, pp D60-D62, 1968. 3 p, 4 fig, 1 tab, 4 ref.

Descriptors: *Artesian wells, *Water temperature, *South Dakota, Depth, Discharge (Water), Geothermal studies, Aquifers.
Identifiers: Geothermal gradient, Dakota sandstone.

Measurements from about 200 deep artesian wells in South Dakota indicate that temperature differences in water flowing from wells of similar construction are related to the depth of wells and volume of discharge. Geothermal gradients at wells in the Dakota Sandstone east of the Missouri River range from 0.7 deg C per 100 ft in the southeast and 1.1 deg C per 100 ft in the northeast to 1.6 deg C per 100 ft along the Missouri River. Immediately west of the river, geothermal gradients average 1.5 deg C per 100 ft. In a 'hot water belt' farther west, average geothermal gradients of 2.2 deg C per 100 ft may be due to deep high-temperature recharge to the Dakota Sandstone. Relatively low geothermal gradients in pre-Cretaceous rocks in the Black Hills may be due, in part, to rapid downward movement of recharging water in very porous formations. (USGS)
W69-03567

THERMAL SPRINGS NEAR MIDWAY, UTAH,
Geological Survey, Salt Lake City, Utah.
C. H. Baker, Jr.
Geol Surv Res 1968, Prof Pap 600-D, pp D63-D70, 1968. 8 p, 7 fig, 1 tab, 6 ref.

Descriptors: *Thermal springs, *Water quality, *Thermal water, *Utah, Calcium, Carbonates, Discharge (Water), Recharge.
Identifiers: Calcareous tufa, Geothermal gradient, Midway (Utah).

A group of thermal springs near Midway, Utah, is surrounded by a deposit of calcareous tufa that covers an area of about 4.5 sq mi and locally is at least 70 ft thick. The springs include both flowing thermal springs and hot pots, which are small pools of warm water occupying shallow craters in the tops of conical or hemispherical mounds of tufa. Extinct hot pots (dry craters) and solid mounds of tufa as much as 10 ft high are also common. The water from the flowing springs and hot pots is not highly mineralized (the total dissolved solids rarely exceeds 2,000 mg/1), but it is saturated with respect to calcium carbonate. The spring water is of meteoric origin; it enters the carbonate bedrock in the nearby Wasatch Range and moves rapidly through fractures and solution openings. The geothermal gradient in the vicinity of Midway is abnormally high, but the reasons for the high heat flux are not known. (USGS)
W69-03568

2G. Water in Soils

THE DIFFUSION OF AIR THROUGH THE PORE WATER OF SOILS,
Manchester Univ. (England); and Salford Univ. (England).
For primary bibliographic entry see Field 02A.
For abstract, see .
W69-03205

INFILTRATION AND SUBSIDENCE PROCESSES IN LOESS SOILS,
Azerbaijan Polytechnic Inst., Baku (USSR).

A. A. Mustafaev.
Proc 3d Asian Reg Conf, Int Soc of Soil Mech and Found Eng, Haifa, Israel, Sept 25-28, 1967, Vol 1, Div 4, pp 155-158, 1967. 4 p, 5 fig, 2 tab, 9 ref.

Descriptors: *Seepage, *Open channels, *Loess, Infiltration, Subsidence, Mathematical models, On-site tests, Soil moisture.
Identifiers: *USSR, Azerbaijan.

Field experiments were made of infiltration and associated subsidence problems in typical loess soils in Azerbaijan. The relations between water depth, trench geometry, soil characteristics, time, and subsidence are given graphically and in derived equations. (Knapp-USGS)
W69-03207

ON THE MECHANISM OF SUSPENDED CAPILLARY WATER AND PERCHED GROUNDWATER,
Akademiya Nauk Armyanskoi SSR, Erevan. Institut Geologicheskikh Nauk.
For primary bibliographic entry see Field 02F.
For abstract, see .
W69-03208

STEADY UNSATURATED VERTICAL FLOW THROUGH MULTILAYERED SOIL,
Water Planning for Israel Ltd., Haifa.
I. Partom.
Proc 3d Asian Reg Conf, Int Soc of Soil Mech and Found Eng, Haifa, Israel, Sept 25-28, 1967, Vol 1, Div 4, pp 165-167, 1967. 3 p, 11 fig, 5 ref.

Descriptors: *Soil water movement, *Unsaturated flow, *Soil profiles, *Anisotropy, *Digital computers, Numerical analysis, Computer programs.
Identifiers: Vertical flow, Multilayered soil, Runge-Kutta-Gill numerical integration.

Steady unsaturated vertical flow through multilayered soil was solved numerically with the aid of a digital computer. An initial-value formulation is used, and the scheme is based on the RKG integration method in conjunction with the bisection routine. Examples with 2 to 5 layers were worked out. The results are presented graphically. (Knapp-USGS)
W69-03209

INVESTIGATION OF WATER ABSORPTION BY THE SOIL ON THE BASIS OF THE DIMENSIONAL THEORY,
V. Ya. Kulik.
Transl from Trudy Gos Gidrol Inst, No 146, 1967. Soviet Hydrol: Selec Pap, Issue No 4, pp 370-393, 1967. 24 p, 2 fig, 27 ref.

Descriptors: *Infiltration, *Porous media, *Dimensional analysis, *Wetting, Permeability, Soil texture, Soil types.
Identifiers: Wetting curve.

The dynamics of water infiltration into homogeneous soils is analyzed with allowance for the shape of the wetting front, which was frequently observed to be wedge-shaped. It is shown that strict use of dimensional analysis makes it possible to obtain relationships that describe the process and agree well with experiment. The physical significance of capillary columns is examined and it is demonstrated that the mathematical apparatus of this theory is not at variance with the phenomenon of a wedge-shaped wetting front. The shapes of wetting fronts of porous media with various physical properties are analyzed. (Knapp-USGS)
W69-03215

SOIL MOISTURE.
National Research Council of Canada, Ottawa (Ontario). Subcommittee on Hydrology.

Proc Hydrol Symp No 6, Nat Res Counc Can, Nov 1967. Total 336 p, 58 fig, 17 tab, 413 ref, 1 append.

Descriptors: *Soil moisture, *Soil water movement, *Surface-groundwater relationships, *Unsaturated flow, Evapotranspiration, Groundwater movement, Infiltration, Percolation, Permeability, Recharge, Instrumentation, Analog models, Digital computers, Thermodynamics, Freezing, Thawing.
Identifiers: *Symposia, University of Saskatchewan.

A symposium on soil moisture, particularly on movement of soil water, was held at the University of Saskatchewan, November 1967. The 11 papers presented treat soil moisture as part of the hydrologic cycle, relating it to atmospheric water, surface water, and groundwater. The subjects of the papers are moisture in the hydrologic cycle, thermodynamics of soil moisture, movement of moisture and chemical substances, evaluation of flow parameters, similitude for partially saturated flow systems, electrical analog and digital computer estimation of unsaturated flow, effect of soil moisture on infiltration, soil moisture and evapotranspiration, continuity of groundwater flow and unsaturated flow, freezing and thawing, and instrumentation. (Knapp-USGS)
W69-03223

CLIMATE AND SOIL MOISTURE EXTRACTION,
Volcani Inst. of Agricultural Research, Bet-Dagan (Israel); and Israel Meteorological Service, Bet-Dagan.
Obadiah P. Cohen.
Coop Invest by US Weather Bur (ESSA) and Volcani Inst of Agr Res and Israel Meteorol Serv. Environ Sci Serv Admin Rep, 1967. 216 p, 14 fig, 2 tab, 8 ref 4 append. CWB 10836.

Descriptors: *Data collections, *Soil moisture, *Meteorological data, *Microclimatology, Soil-water-plant relationships, Soil temperature, Evapotranspiration, Solar radiation, Air temperature, Wind velocity, Humidity.
Identifiers: *Israel.

A study relating soil moisture to climatological conditions was made at the Gilat Experiment Station of the Volcani Institute of Agricultural Research, Israel, between Oct 20, 1965 and July 31, 1967, to collect a long-term comprehensive record to be made available to scientists who need such records. Punched card decks of the data compiled in the report are available by written request to Director, National Weather Records Center, Federal Building, Asheville, North Carolina, USA. The data compiled are soil moisture, radiation, wind, soil temperature, air temperature, humidity, and general meteorological station data. A detailed description of each deck of punched cards is given. The data collection methods are discussed thoroughly. Evapotranspiration calculations were improved by plot treatment to prevent deep drainage. (Knapp-USGS)
W69-03250

DETERMINATION OF THE HYDRAULIC CONDUCTIVITY OF UNSATURATED SOILS FROM AN ANALYSIS OF TRANSIENT FLOW DATA,
Grenoble Univ., (France). Laboratoires de Mecanique des Fluides.
Georges Vachaud.
Water Resources Res, Vol 3, No 3, pp 697-705, 1967. 9 p, 9 fig, 2 tab, 14 ref.

Descriptors: *Hydraulic conductivity, *Unsteady flow, *Infiltration, *Soil water movement, *Unsaturated flow, *Darcys law, Infiltrometers, Capillary conductivity, Permeability, Model studies.
Identifiers: *Unsaturated soils, Transient flow.

A method is suggested for checking the validity of the generalized Darcy's law for water infiltration into soil and for computing values of the hydraulic conductivity at various water contents in unsaturated flow. Water profiles obtained by gamma-ray absorption during infiltration into soil columns and the wetting part of the soil-water content relation were analyzed. Both horizontal infiltration and capillary rise experiments were performed. For a given water content, capillary conductivity was constant and the generalized Darcy's law was valid for use to describe transient flow in unsaturated soils. (Knapp-USGS)
W69-03337

VOLUMETRIC CALIBRATION OF NEUTRON MOISTURE PROBES,
Southeastern Forest Experiment Station, Franklin, N. C.
J. E. Douglass.
Reprint from Soil Sci. Soc. of Amer. Proc. (5):541-544, 1966.

Descriptors: *Nuclear moisture meter, *Soil water movement, *Infiltration, *Forest soils, Instrumentation, Moisture meters, Soil moisture meters, Soil moisture.
Identifiers: *Neutron meters.

A volumetric method of estimating the slope (coefficient) of a neutron moisture probe calibration curve is discussed. Coefficients obtained for three probes by this method did not differ significantly between soil series or between horizons within a series. Simply dividing the count rate in water by 100 gave a value virtually identical to the b coefficient determined volumetrically for the probes and soils. Agreement was excellent between measured outflow and outflow predicted from neutron measurements made with a volumetrically calibrated moisture probe.
W69-03394

EVALUATION OF SOIL AMENDMENTS IN IMPERIAL VALLEY,
F. E. Robinson, D. W. Cudney, and J. P. Jones.
Calif Agr, Vol 22, No 12, pp 10-11, Dec 1968. 2 tab.

Descriptors: *Soil amendments, *Agricultural chemicals, California, Arid lands, *Irrigation water, On site tests, *Flow measurement, *Infiltration.
Identifiers: *Imperial Valley (Calif), Soil intake rates.

Tests were conducted at the Imperial Valley Field Station to determine whether addition of soil amendments would increase soil intake rates. These tests were conducted with three compounds commonly used by growers in the area as soil amendments: calcium polysulfide, ammonium polysulfide, and sulfuric acid. Of the various chemicals tested, only ammonium polysulfide produced a significant increase in soil intake rates. Failure of calcium polysulfide to produce a similar increase proved that this effect was not associated with the polysulfide compound. The increase in soil intake rates associated with the aqueous application of ammonium polysulfide was evidently caused by a unique property of this compound which is not understood. (Affleck-Ariz)
W69-03481

EFFECT OF ORGANIC MATTER CONTENT OF THE SOIL ON INFILTRATION,
Agricultural Research Service, Lafayette, Ind.
W. H. Wischmeier, and J. V. Mannering.
J Soil Water Conserv, Vol 20, No 4, pp 150-July-Aug 1965. 3 p, 1 fig, 1 tab.

Descriptors: *Organic matter, *Infiltration, *Soil production, Simulated rainfall, *Runoff, Croplands, Contour farming, Aggregates, *Soil properties.
Identifiers: Plots.

The soil and its organic matter content are discussed with respect to infiltration as it is related to plant residues, contour farming and the effect which soils properties have on infiltration. The favorable effect of increasing quantitites of organic residues in soil was shown by the increases in

following changes in crop productivity and e management. For 82 plot-years of continu- rn crops with residue removed, runoff from days after seeding averaged 83% of the cor- ding runoff from fallow. Plots with high corn and correspondingly large quantities of e material had substantially less runoff than with lower yields. Where relatively small ties of residue were incorporated, contour g reduced runoff 13-23%. When simulated rms were applied to a wide range of soil the organic matter content of the soil was the red variable most closely correlated with ru- The organic matter content of arid soils is related to infiltration and runoff. (Blecker-

03484

LING THE SOIL SOLUTION FOR ITY APPRAISAL,
ltural Research Service, Riverside, Calif. y Lab.
Reeve, and E. J. Doering.
ience, Vol 99, No 5, pp 339-344, May-1965. ig, 2 tab.

ptors: *Sampling, *Soil analysis, Chemical is, Salinity, *Water analysis, *Saline soils, hemistry, *Instrumentation, Leaching, Elec- conductance, Analytical techniques, Depth. iers: Soil depth, Soil solution.

aper describes procedures and equipment ave been found useful in sampling soil solu- the suction method both in the field and in tory soil columns. In the field, the procedure en used to follow changes in composition of il solution with soil depth and time during ation of sodic soils and to assess salinity of the root zone of crops under irrigation. In boratory, it has been used to determine es in soil solution composition in soil columns leaching and cropping. Reliable and con- values for soil solution composition were ob- by the suction method in the soil suction of 0-500 millibars. Since most water move- in soil occurs in this suction range, the d may be used in many areas dealing with soil . (Blecker-Ariz)
03488

URING MOISTURE NEAR SOIL SUR- ...MINOR DIFFERENCES DUE TO RON SOURCE TYPE,
Southwest Forest and Range Experiment , Berkeley, Calif.; and California State Dept. ter Resources, Sacramento; and California Dept. of Water Resources, Bakersfield.
t Ziemer, Irving Goldberg, and Norman A. illivray.
orest Service Research Note PSW 158, 1967. ig, 4 tab.

ptors: *Arid climates, *Nuclear moisture , *Soil surfaces, *Moisture content, ure meters, Measurement, Instrumentation, noisture.
iers: Vertical resolution.

ness of the neutron meter is limited if it is ary to measure moisture near the soil sur- Moisture measurements were made in three paraffin, water and saturated sand--with eutron moisture meters. The neutron source 26-radium-beryllium, 227-actinium-berylli- 39-plutonium-beryllium or 241-americium- um. The surface of the medium was detected irly consistent depth with each source in a ular medium. Variability in surface detection different source may be due to differences in n sources, in the length source or both. The n soil moisture meter is usefu' in measuring il moisture depletion in arid soils. (Blecker-

03498

ACCURACY OF SOIL MOISTURE READINGS WITH UNSEALED ACCESS TUBES,
Forest Service, Fort Collins, Colo.
Arnett C. Mace, Jr.
U S Forest Service Research Note RM-61, May, 1966. 2 p, 1 tab.

Descriptors: Soil moisture, *Nuclear moisture meters, Moisture meters, *Moisture content, Soil water movement, *Water table, Tubes, *Zone of saturation, Soil moisture meters, Water wells, Measurement, Condensation.
Identifiers: Access tubes.

Objectives of the study were to determine whether accurate soil moisture measurements could be made if access tubes were not sealed on the bottom and also whether these tubes could be utilized as a water table well where desired. Measurements taken above the zone of saturation were accurate since presence of condensation inside the unsealed access tube had a negligible influence on measurements. In studies with water tables near the surface, it would be desirable to use sealed tubes because entry of water could prevent accurate following of moisutre-depletion rates by neutron readings and might cause short-circuiting and corrosion of the probe. The soil moisture of arid soils can be measured with the techniques used in the study. (Blecker-Ariz)
W69-03500

THE EFFECTS OF ENTRAPPED AIR AND BAROMETRIC FLUCTUATIONS ON THE DRAINAGE OF PUROUS MEDIUMS,
Saskatchewan Univ., Saskatoon; and California Univ., Davis.
D. I. Norum, and J. N. Luthin.
Water Resources Res, Vol 4, No 2, pp 417-424, Apr 1968. 8 p, 4 fig, 12 ref.

Descriptors: *Drainage, *Soil water movement, *Air entrainment, Unsaturated flow, Diffusion, Porous media.
Identifiers: Entrapped air.

A theory was developed for transient drainage of porous mediums taking into consideration the air that is entrapped within the flow region. The theory is based on the soil moisture diffusion equation with modifications made to include the effect of the entrapped air and the effect of changes in pressure due to barometric fluctuations. The theory was tested on a 1-dimensional flow sand model, and the results were compared with results obtained from a numerical solution of the developed equation. The theory and experiments show that barometric fluctuations have little effect on a draining column containing entrapped air when the column is open to the atmosphere at both ends. However, when the column is closed at the bottom, an increase in atmospheric pressure lowers the position of the water table, whereas a decrease in atmospheric pressure raises the water table. Both the experiments and the developed theory show a much greater change in the position of the water table with atmospheric pressure than a previous steady-state theory.
W69-03552

THE PERMEABILITY OF A POROUS MEDIUM DETERMINED FROM CERTAIN PROBABILITY LAWS FOR PORE SIZE DISTRIBUTION,
Cornell Univ., Ithaca, N. Y. School of Civil Engineering.
For primary bibliographic entry see Field 02F.
For abstract, see .
W69-03553

SEEPAGE FROM CHANNELS THROUGH LAYERED POROUS MEDIUMS,
Utah State Univ., Logan.
Roland W. Jeppson.
Water Resources Res, Vol 4, No 2, pp 435-445, Apr 1968. 11 p, 7 fig, 5 ref.

Descriptors: *Seepage, *Channels, *Porous media, *Anisotropy, Mathematical models, Groundwater movement, Soil water movement, Surface-groundwater relationships, Approximation method, Digital computers.
Identifiers: Finite difference methods, Layered porous mediums.

Solutions to steady-state free surface problems of seepage from channels through porous mediums consisting of layers of different permeabilities are obtained by using the methods of finite differences. In the formulation of the problem, the magnitudes of the coordinates x and y are considered the dependent variables, and the potential function and the stream function are considered the independent variables. The method permits the shape of the interface that separates the two layers with different permeabilities to be specified. In the event that each layer is anisotropic, but with different ratios of horizontal to vertical permeabilities, the interface between the two layers is restricted to being horizontal. Example solutions are given for arbitrarily specified interfaces for both the case of seepage from a trapezoidal channel through homogeneous isotropic mediums in each layer (but of different permeabilities) and the case of anisotropic mediums in which the ratio of horizontal to vertical permeabilities is different for each layer.
W69-03554

MOVEMENT OF MOISTURE IN THE UNSATURATED ZONE IN A DUNE AREA, SOUTHWESTERN KANSAS,
Geological Survey, Garden City, Kans.
Robert C. Prill.
Geol Surv Res 1968, Prof Pap 600-D, pp D1-D9, 1968. 9 p, 5 fig, 2 tab, 4 ref.

Descriptors: *Infiltration, *Recharge, *Unsaturated flow, *Dunes, Kansas, Percolation, Evapotranspiration, Evaporation, Grasses.
Identifiers: Arkansas River.

Moisture-content logs for the predominant vegetative conditions in the sanddune area of southwestern Kansas depict the manner of moisture buildup and depletion, and illustrate conditions necessary for deep percolation. Even though the period of study included a year when precipitation was nearly the highest on record, built-up moisture under a sagebrush-grass community penetrated to a depth of only 14 ft, whereas the zone of evapotranspiration extended to at least 17 ft. Under a grass community where the zone of evapotranspiration extended to about 11 ft, a small amount of moisture (2 in.) moved as deep percolation. Under a barren area, where most of the loss by evaporation occurred in the upper 1 ft, large quantities of moisture moved as deep percolation. (USGS)
W69-03556

2H. Lakes

COMPUTATION OF SEICHE VELOCITIES IN BODIES OF WATER WITH A COMPLEX BOTTOM RELIEF,
N. D. Shtefan.
Transl from Meteorol i Gidrol, No 7, 1967, pp 78-82. Soviet Hydrol: Selec Pap, Issue No 4, pp 394-397, 1967. 4 p, 3 fig, 2 ref.

Descriptors: *Seiches, *Lakes, *Water circulation, Waves (Water), Mathematical studies, Model studies, Velocity, Lake stages.
Identifiers: Lake Baikal, Lake bottom relief.

An approximate method for computing seiche velocities in bodies of water with complex plan and bottom relief is given. The position of the node, the shape of the body, and the free surface profile must be known to compute average half-period and maximum surface velocities at any point on the water body's axis. Seiches of Lake Baikal were simulated in a model scaled 1:100,000 with a vertical distor-

tion of 20:1. Agreement with field observations was within 10s15%. (Knapp-USGS)
W69-03217

LAKE GIBSON LAND CO V LESTER (IRRIGATION BY PUMPING LOWERING LAKE LEVEL).

102 So 2d 833-836 (2d DCA Fla 1958).

Descriptors: *Florida, *Reasonable use, *Water rights, Judicial decisions, Public rights, Relative rights, Riparian rights, Irrigation, Irrigation effects, Lakes, *Pumping, Usufructuary right.

Plaintiff, owner of lakeshore property, sought an injunction to prevent defendant from pumping water out of the lake for irrigation purposes during any period when the water of the lake was below its normal level. Evidence showed that the pumping lowered the level of the lake less than one inch. While the court recognized that the plaintiff had been injured by the lowered level of the lake, it could find no evidence that the defendant's irrigation pumping was responsible for the damage. While an injunction would have been granted if the defendant had made unreasonable use of the lake waters, the court held that this requirement had not been met, and the injunction was denied. (Scott-Fla)
W69-03285

VERTICAL CURRENT STRUCTURE IN THE GREAT LAKES: II. CURRENT METER STUDIES OFF SHEBOYGAN, WISCONSIN, AUGUST 1967,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
Vincent E. Noble.
Spec Rep No 37, Great Lakes Res Div, pp 12-25, 1968. 14 p, 7 fig, 2 ref. Grant WP-01067 (FWPCA).

Descriptors: *Currents (Water), *Circulation, *Lake Michigan, Winds, Density currents, Current meters, Buoys, Lake morphology.
Identifiers: Lake circulation dynamics, Geostrophic circulation, Ekman transport.

Current meter measurements in Lake Michigan off Sheboygan give results that conflict seriously with computations from drogue data, wind velocity data, and dynamic water surface height data, and are notably divergent for meter stations only 1/2 mile apart. The results of computation of currents from these data are shown by charts. The complex relation between current vectors and the wind field may be explained by Ekman transport and acceleration of geostrophic eddies. No explanation is given for other discrepancies. (Knapp-USGS)
W69-03334

INTRODUCTION TO PALEOLIMNOLOGY,
Texas Technological Coll., Lubbock. Dept. of Geosciences.
For primary bibliographic entry see Field 02J.
For abstract, see .
W69-03342

VERTICAL CURRENT STRUCTURE IN THE GREAT LAKES: 1. CHARACTERIZATION OF THE CIRCULATION DYNAMICS OF LAKE MICHIGAN,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
Vincent E. Noble.
Spec Rep No 37, Great Lakes Res Div, pp 4-11, 1968. 8 p, 5 fig, 4 ref. Grant WP-01067 (FWPCA).

Descriptors: *Currents (Water), *Circulation, *Lake Michigan, Density currents, Winds, Temperature, Air-water interfaces, Isotherms, Radiation, Lake basins.
Identifiers: Lake circulation dynamics, Geostrophic circulation.

Surface temperature patterns of Lake Michigan obtained by synoptic observations from aircraft and interpreted with the aid of dynamic water surface height computations imply that geostrophic circulation forces are dominant over wind circulation forces. The interaction between forces in the lake's circulation is complex and presently unknown. The persistence of small details in the surface temperature structure of the lake for periods of 3 weeks supports the idea of dominance of geostrophic forces. Isotherms of surface temperatures of the lake are shown on a map. (Knapp-USGS)
W69-03347

VERTICAL CURRENT STRUCTURE IN THE GREAT LAKES: III. DETERMINATION OF EDDY VISCOSITY AND EDDY DIFFUSIVITY IN LAKE MICHIGAN,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
Joseph C. Huang.
Spec Rep No 37, Great Lakes Res Div, pp 26-45, 1968. 20 p, 6 fig, 6 tab, 22 ref. Grant WP-01067 (FWPCA).

Descriptors: *Currents (Water), *Circulation, *Lake Michigan, Winds, Eddies, Turbulence, Tracers, Dye releases.
Identifiers: Eddy viscosity, Eddy diffusivity, Vertical eddy diffusivity.

To evaluate the magnitude of the eddy diffusivity and eddy viscosity associated with the thermal current structure of the late spring/early summer circulation in the Lake Michigan model, current meters, drogues, wind gages, and dye diffusion tests were used to collect data. In modelling a geofluid problem, the eddy viscosity and the eddy diffusivity are of critical importance in order to predict the natural current or wave phenomena with a similarity to laminar flow. In Lake Michigan, though the mean current velocity is small in general, the flow field is turbulent in nature. In solving or explaining the flow pattern of the mean lake current, it is possible to use the governing equations of laminar flow with eddy viscosity and eddy diffusivity in place of the molecular viscosity and the molecular diffusivity. The data presented are quite consistent and in good agreement with the data reported by other investigators. The vertical eddy viscosity in Lake Michigan is in the range of 1 to 100 with a mean of 10 sq cm/sec. The horizontal viscosity is in the range of 100 to 10,000 with a mean value of 1,000 sq cm/sec. The eddy diffusivity may reach the same magnitude as the viscosity but it is in general smaller. A typical mean value for vertical eddy diffusivity is 5 sq cm/sec and for the horizontal eddy diffusivity, 100 sq cm/sec. (Knapp-USGS)
W69-03348

VERTICAL CURRENT STRUCTURE IN THE GREAT LAKES: IV. NUMERICAL EVALUATION OF STERN'S CALCULATION MODEL,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
James H. Saylor.
Spec Rep No 37, Great Lakes Res Div, pp 46-58, 1968. 12 p, 2 fig, 4 tab, 4 ref. Grant WP-01067 (FWPCA).

Descriptors: *Currents (Water), *Circulation, *Lake Michigan, *Mathematical models, Winds, Eddies, Turbulence, Vortices.
Identifiers: Ekman drift, Geostrophic vortex.

mathematical model for the interaction of a uniform wind stress and a geostrophic vortex is evaluated in terms of wind stresses and vortex dimensions that are expected to occur in Lake Michigan. The results predict a broad range of internal wave periods that are within the limits of measured values. The model provides mechanisms for some field observations of rotary currents, internal waves, and transfer of wind energy into water circulation in a way that might explain some apparently anomalous drogue and current meter data in the Lake Michigan study. (Knapp-USGS)
W69-03349

VERTICAL CURRENT STRUCTURE IN T GREAT LAKES: V. THERMAL CURR STRUCTURE IN LAKE MICHIGAN, SOCIATED WITH THE SPRING WARM SEASON--A THEORETICAL STUDY,
Michigan Univ., Ann Arbor. Great Lakes Rese Div.
Joseph C. Huang.
Spec Rep No 37, Great Lakes Res Div, pp 59 1968. 36 p, 11 fig, 2 tab, 11 ref. Grant WP-0 (FWPCA).

Descriptors: *Currents (Water), *Circula *Temperature, *Lake Michigan, *Mathem models, Winds, Eddies, Thermal prope Coriolis force.
Identifiers: Geostrophic circulation, The gradients.

A mathematical model treats Lake Michigan long, symmetrical, trapezoidal body with 2 positely imposed horizontal temperature grad toward the center from both sides, rotating its vertical axis, with a free surface, without stresses. The main flow field is assumed to geostrophic thermal gradient equilibrium. solution of the temperature distribution o model shows about the same pattern as the especially in the interior region. Circulatio terns in the lake and model agree well in ge and the model shows that geostrophic circulat dominant over wind circulation, which ex some currents observed to be counter to direction. The lake's current and temper structures are shown on maps and charts. (K USGS)
W69-03350

MICROSESTON DYNAMICS IN A SI SIERRA NEVADA LAKE-STREAM SYSTE
Bureau of Sport Fisheries and Wildlife, B Calif., and California Univ., Davis. Dept. of gy.
For primary bibliographic entry see Field 02E
For abstract, see .
W69-03359

PALEOECOLOGICAL STUDIES OF PO LAKE AND ITS ENVIRONS,
Indiana Univ., Bloomington.
For primary bibliographic entry see Field 02J
For abstract, see .
W69-03361

PHOSPHORUS RELEASE FROM BOG MUDS,
Wisconsin Univ., Madison. Dept. of Soil Sc and Wisconsin Univ., Madison. Dept. of Zoo
For primary bibliographic entry see Field 02J
For abstract, see .
W69-03363

RECENT SEDIMENTS OF THREE WISC LAKES,
Shell Oil Co., Houston, Tex.
For primary bibliographic entry see Field 02
For abstract, see .
W69-03367

ACETYLENE REDUCTION BY NITR FIXING BLUE-GREEN ALGAE,
Wisconsin Univ., Madison. Dept. of Bioche and Wisconsin Univ., Madison. Water Ch Lab.
For primary bibliographic entry see Field 02
For abstract, see .
W69-03368

IN SITU STUDIES ON (NITROGEN) FIX USING THE ACETYLENE REDU TECHNIQUE,
Wisconsin Univ., Madison. Dept. of Bioch and Wisconsin Univ., Madison. Water Ch Lab.

nary bibliographic entry see Field 02K.
ract, see .
372

ater in Plants

CEPTION BY EASTERN WHITE PINE,
Hydrologic Lab., Asheville, N. C.
dvey.
Resources Res, Vol 3, No 3, pp 723-729,
fig, 5 tab, 16 ref.

tors: *Interception, *White pine trees,
balance, *Evapotranspiration, Deciduous
ainfall-runoff relationships, North Carolina,
hian Mountain Region, Stemflow,
fall.
rs: Thornthwaite method.

ements of gross rainfall, throughfall, stem-
d litter interception in three eastern white
nds, age 10, 35, and 60 yr, in the Southern
hians of western North Carolina, were
derive regression equations for estimating
fall, stemflow, and the sum of throughfall
nflow from measurements of gross rainfall.
ns for total interception loss were derived
braically combining losses from the canopy
er. These equations were used to predict
sonal interception loss from measurements
seasonal rainfall and number of storms.
terception loss in white pine increased with
e, and total loss from all pine stands studied
d losses calculated for mature hardwoods.
he dormant season, calculated monthly in-
on loss from mature hardwoods and white
ceeded potential evapotranspiration calcu-
the Thornthwaite method.
315

GHFALL AND STEMFLOW IN A PINE-
WOOD STAND IN THE OUACHITA
TAINS OF ARKANSAS,
n Forest Experiment Station, Harrison,

. Lawson.
Resources Res, Vol 3, No 3, pp 731-735,
p, 3 fig, 3 tab, 6 ref.

tors: *Interception, *Throughfall, *Stem-
Mixed forests, *Rainfall-runoff relation-
Arkansas, Forests, Hydrologic data,
ous forests, Deciduous forests.
rs: Ouachita Mountains (Arkansas).

e-hardwood stand in the Ouachita Moun-
Arkansas, throughfall was strongly corre-
th gross rainfall and long-term mean tem-
e on the calendar day of the storm, whereas
w was closely related to gross rainfall,
diameter (or basal area at breast height),
ght, and minimum temperature on storm
tal interception averaged 15.1% of average
gross rainfall and stemflow 2.4%. Thus,
annual interception loss was 12.7%. Nearly
total stemflow was from hardwoods, which
marily understory trees.
339

NFLUENCE OF RAINFALL INTERCEP-
N STREAMFLOW,
stern Forest Experiment Station, Franklin,

wank.
n Univ. Counc. on Hydrol., Hydrol. in
Resources Manage. Conf. Proc. 102-112,

tors: *Interception, *Water yield improve-
Forestry, Evapotranspiration, *Streamflow,
nfall, Stemflow, Watershed management,
ous forests, Coniferous forests, Hydrologic

ers: *Experimental watersheds.

Data are presented which provide evidence that interception loss is a major hydrologic process which is involved in reducing the quantity and altering the timing of streamflow from watersheds in the Southern Appalachians when cover types are changed from mature mixed hardwoods to eastern white pine. The role of interception loss differences between loblolly pine and mature hardwoods in the Piedmont of South Carolina is discussed.
W69-03384

COMPARISON OF THE DYE METHOD WITH THE THERMOCOUPLE PSYCHROMETER FOR MEASURING LEAF WATER POTENTIALS,
Southeastern Forest Experiment Station, Franklin, N. C.; and Duke Univ., Durham, N. C.
E. B. Knipling, and P. J. Kramer.
Reprint from Plant Physiol. 42 (10):1315-1320, 1967.

Descriptors: *Moisture stress, *Plant physiology, *Osmotic pressure, Hygrometry, Humidity, Microclimatology, Leaves, Turgidity, Vascular tissues, Transpiration, Moisture deficit, Trees.
Identifiers: *Water potential, Forest trees.

The dye method for measuring water potential was examined and compared with the thermocouple psychrometer method in order to evaluate its usefulness for measuring leaf water potentials of forest trees and common laboratory plants.
W69-03390

INTERCEPTION BY EASTERN WHITE PINE,
Southeastern Forest Experiment Station, Franklin, N. C.
J. D. Helvey.
Reprint from Water Resources Research 3 (3):723-729, 1967.

Descriptors: *Evapotranspiration, *Interception, *Stemflow, *Throughfall, Precipitation (Atmospheric), Raindrops, Evaperation, Watershed management, White pine trees.

Measurements of gross rainfall, throughfall, stemflow and litter interception in three eastern white pine stands, age 10, 35, and 60 years in the Southern Appalachians of Western North Carolina were used to derive regression equations for estimating throughfall, stemflow, and the sum of throughfall and stemflow from measurements of gross rainfall. Equations for total interception loss were derived algebraically combining losses from the canopy and litter. These equations were used to predict total seasonal interception loss (I) from measurements of total seasonal rainfall (sigma P) and number of storms (N). Equations for the 10-, 35-, and 60-year old stands are I+ 0.05 (N)+ 0.08 (sigma P), I= 0.05 (N)+ 0.12 (sigma P), and I= 0.06 (N)+ 0.18 (sigma P), respectively. Total interception loss in white pine increased with stand age, and total loss from all pine stands studied exceeded losses calculated for mature hardwoods. During dormant season calculated monthly interception loss from mature hardwoods and white pine exceeded potential evapotranspiration calculated by the Thornthwaite method.
W69-03391

MEASUREMENT OF LEAF WATER POTENTIAL BY THE DYE METHOD,
Southeastern Forest Experiment Station, Franklin, N. C.; and Duke Univ., Durham, N. C.
E. B. Knipling.
Reprint from Ecology 48 (6):1038-1041, 1967.

Descriptors: *Moisture stress, *Plant physiology, *Osmotic pressure, Moisture uptake, Leaves, Turgidity, Vascular tissues, Transpiration, Moisture deficit.
Identifiers: *Water potential, Water movement.

The dye method for measuring leaf water potential is simple, inexpensive and suitable for both laboratory and field work. Leaves are immersed in a graded series of solutions, and the solution which neither gains nor loses water is assumed to have a water potential equal to that of the leaf.
W69-03392

EFFECT OF LEAF AGING ON WATER DEFICIT-WATER POTENTIAL RELATIONSHIPS OF DOGWOOD LEAVES GROWING IN TWO ENVIRONMENTS,
Southeastern Forest Experiment Station, Franklin, N. C.; and Duke Univ., Durham, N. C.
E. B. Knipling.
Reprint from Physiol. Plant., 20:65-72, 1967.

Descriptors: *Plant physiology, *Moisture stress, Moisture deficit, Vascular tissues, Transpiration, Leaves, Turgidity, Moisture uptake, Osmotic pressure.
Identifiers: *Dogwood, *Water potential, *Water deficit, Water movement.

Water deficit-water potential relationships were determined at approximately monthly intervals from May to August on leaves collected from dogwood trees growing in two environments. The relationships were not the same for leaves of different ages or for leaves of the same age, but growing in different environments. With aging of the leaves, the relationships shifted to progressively lower water potentials for a given water deficit. Increased leaf dry weight, decreased cell wall elasticity, and decreased osmotic potentials accompanied leaf aging. These changes and the shifts in the relationships were greatest for leaves growing under high light intensity and dry environmental conditions. The lack of constancy in the relationships reduces the usefulness of water deficit or relative turgidity as an estimator of water potential. For the purposes of some workers, however, the relationships may be sufficiently constant for mature leaves of a given species growing in a relatively constant environment.
W69-03393

DESIGN CRITERIA FOR INTERCEPTION STUDIES,
Southeastern Forest Experiment Station, Franklin, N. C.
J. D. Helvey, and J. H. Patric.
I.A.S.H. Symp. Design of Hydrol. Networks 67:131-137, 1965.

Descriptors: *Interception, *Stemflow, *Throughfall, Precipitation (Atmospheric), Raindrops, Evaporation, Watershed management.

This report, gleaned from over fifty studies, defines variability of interception parameters and provides sampling designs for obtaining estimates to selected levels of probability for each parameter mean. A new method for estimating stemflow greatly reduces variability inherent in the traditional single-tree method. These sampling and analytical methods will insure that results of different studies are comparable.
W69-03395

SOIL MOISTURE DEPLETION PATTERNS AROUND SCATTERED TREES,
Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.
Robert R. Ziemer.
U S Department of Agriculture, Forest Service, Research Note PSW-166, pp 1-13, 1968. 13p, 13 map. 4 tab, 1 chart, 1 ref.

Descriptors: *Soil-plant-water relationships, *Water utilization, Pine trees, Forest soils, Soil moisture, Retention, Moisture content, Soil profiles, Summer, California.
Identifiers: *Sugar pine trees, *Sierra Nevada Mountains.

Soil moisture was measured around an isolated mature sugar pine tree (Pinus lambertiana Dougl.) in

the mixed conifer forest type of the north central Sierra Nevada, California, from November 1965 to October 1966. From a sequence of measurements, horizontal and vertical soil moisture profiles were developed. Estimated soil moisture depletion from the 61-foot radius plot for the 1966 summer depletion season was 22.57 inches.
W69-03407

THE HEAT RESISTANCE OF PLANTS, ITS DETERMINATION AND VARIABILITY,
Technische Hochschule, Darmstadt (West Germany). Botanisches Institut.
O. L. Lange.
Arid Zone Research 25. Unesco, Paris, 1965. pp 399-405. 7 p, 5 fig, 52 ref, disc.

Descriptors: Physiological ecology, *Heat resistance, Arid climates, *Heat, *Thermal stress, Heating, Ecology, *Plant physiology, Cytological sudies, Variability, Metabolism, *Environmental effects, Resistivity.
Identifiers: Heat injury.

In the arid zones of the world, the heat resistance of plants has a special ecological significance. Its determination is necessary to understand relationships existing between plants and their surroundings and to investigate the possibility of their existence in different localities. The fundamental considerations to be taken into account when measuring heat resistance are given. Since heat damage to a plant depends directly upon the time of heating, the period of heating must be accurately defined. For determination of heat injury, besides measurement of metabolic activities like respiration or photosynthesis, there exists a number of cytological criteria which should be used with care. Within a certain limit, characteristic for each species, heat tolerance can show variations within the same organism, depending upon exogenous or endogenous factors. The heat resistance of plants must be known in order to determine their ability to survive in hot arid climates. (Blecker-Ariz)
W69-03485

EFFECT OF EXTERNAL SALT CONCENTRATIONS ON WATER RELATIONS IN PLANTS: II. EFFECT OF THE OSMOTIC DIFFERENTIAL BETWEEN EXTERNAL MEDIUM AND XYLEM ON WATER RELATIONS IN THE ENTIRE PLANT,
California Univ., Riverside. Citrus Research Center and Agricultural Research Station.
J. J. Oertli.
Soil Sci, Vol 102, No 4, pp 258-263, October 1966. 6 p, 1 fig.

Descriptors: *Osmotic pressure, *Circulation (Plants), Turgidity, *Translocation, *Xylem, Transpiration, Soil-water-plant relationships, Root systems, *Salinity, Plant physiology, Moisture uptake, Humidity, Leaves, Absorption, Cytological studies, Stomata, Crop response.
Identifiers: Water potential.

The purpose of the paper is to consider passage of water from solution or soil through the plant into the free atmosphere. This movement of water must be considered in order to predict what will happen to the osmostic adjustment of root xylem sap under saline soil conditions. Changes of water potential in root medium, due to salinity, are small in relation to the entire potential drop and should not have an effect on the transpiration rate unless there are secondary changes within the plant. Measurements of transpiration rates or of osmotic pressures of expressed leaf sap have little bearing on whether turgidity is maintained or not. At high external humidity (low transpiration), the model predicts a qualitatively correct dependence of root pressure on external concentrations. (Blecker-Ariz)
W69-03487

GERMINATION STUDIES ON ARID ZONE TREE SEEDS,
Central Arid Zone Rsearch Institute, Jodhpur (India).
R. N. Kaul and Man Singh Manohar.
Indian Forester, Vol 92, No 3, pp 499-503, August 1966. 5 p, 3 fig.

Descriptors: *Germination, *Seeds, *Viability, *Arid climates, Field capacity, Moisture availability, *Moisture stress, Wilting point, Drought resistance, Mature growth stage.
Identifiers: *Seed coats, Water potential, Seed dormancy.

Dormancy of most Acacia species is commonly associated with presence of a hard seed coat. Knowledge of extent of seed dormancy and germinability under different degrees of moisture stress is essential for raising plantings of Acacia senegal in arid zones characterized by recurrent droughts. Trials were carried out to investigate extent of seed dormancy, its causes and possible remedies, and extent of germinability of seeds of different maturities under different moiture stresses. Seeds without seed coats gave 94% germination, compared to seed with intact coats which showed only 4% germination. With the decrease in water potential there was a corresponding decrease in cumulative germination % of seeds at successive days after sowing. Germination began a day earlier in fully mature seeds, as compared to the least mature seeds. Seed germination was considerably reduced with decline in availability of moisture from field capacity to near wilting point. (Blecker-Ariz)
W69-03489

DROUGHT-ASSOCIATED MORTALITY OF RANGE GRASSES IN SOUTH TEXAS,
Welder Wildlife Foundation, Sinton, Tex.; and Texas Technological Coll., Lubbock.
Albert D. Chamrad, and Thadis W. Box.
Ecology, Vol 46, No 6, pp 780-785, Autumn 1965. 6 p, 2 fig, 3 tab, 25 ref.

Descriptors: *Drought resistance, Moisture deficit, Droughts, *Moisture stress, *Mortality, *Environmental effects, *Range grasses, Drought tolerance, Texas, Semiarid climates, On site-investigations, Fine-textured soils.
Identifiers: Clones.

The objective of the study was to compare and evaluate mortality of native grasses in relation to soils, species, and size of grass clones. The native grasses were seacoast bluestem, silver bluestem, filly panicum, Pan American balsamscale, buffalograss and brownseed paspalum. The area of study was in South Texas which had had a severe drought which began in the fall of 1961 and lasted through the spring of 1963. The soil types were clay, fine sand and fine sandy loam. The lowest mortality for seacoast bluestem occurred on the clay and the highest occurred on the fine sandy loam. Differences in percentage mortality between soils and between species on given soil types were highly significant. In some instances a significant positive correlation existed between size of grass clones and the percentage of mortality. As the diameter of clones increased, percentage mortality increased. (Blecker-Ariz)
W69-03495

PERIODIC MOWINGS SUPPRESS TAMARISK GROWTH, INCREASE FORAGE FOR BROWSING,
Forest Service, Fort Collins, Colo.
C. J. Campbell.
U S Forest Service Research Note RM-76, 1966. 4 p, 3 fig.

Descriptors: *Tamarisk, Weed control, *Riparian plants, Forages, *Evapotranspiration, *Cutting management, Water conservation, Arizona, *Browse utilization, Carbohydrates, Crop production, Mortality.
Identifiers: Defoliation.

In central Arizona the effects of partia
complete defoliation of tamarisk (Tamarix p
dra Pall.) were determined at various weekly
vals throughout the growing season and p
water savings which resulted from such trea
were studied. Plants were clipped at 2-, 4-, 8
24-week intervals during the growing season
mortality increased with the frequency of cl
Mowings in May, July and September are nec
to keep foliage succulent and within rea
browsing cattle. Evapotranspiration decrea
proximately 50% following mowing treat
Tamarisk can be suppressed on flood plai
reservoir deltas in arid climates by periodic
ing. (Blecker-Ariz)
W69-03496

**THE WATER OUTPUT OF THE DI
VEGETATION IN THE DIFFE
MICROHABITATS OF WADI HOFF,**
Cairo Univ. (Egypt). Dept. of Botany.
A. A. Abd El Rahman, and K. H. Batanouny
J of Ecology, Vol 53, No 1, pp 139-145,
1965. 7 p, 2 fig, 21 ref.

Descriptors: *Arid climates, *Desert
*Habitats, Density, Environmental effects
moisure, *Transpiration, Wet seasons, *M
vironment, Moisture availability, Weigh
seasons, Climatology.
Identifiers: *Wadi, Florestics, Fresh
(Plants).

The total water output of desert vegetati
estimated in the different microhabitats o
Hoff, one of the wadis of the Egyptian
desert. The areas under study were the plat
shaded area and the first and second terrace
wadi bed. The total water output depended
ferent factors: the fresh weight of plants, th
sity, the climatic factors, the floristic com
and the availability of soil moisture. In
season, the total water output was nearly
the plateau and the shaded microhabitat a
the total fresh weight of plants in the plat
only one third of that in the shade. This wa
attributed to the effect of shade in decrea
transpiration rates. In the dry season the wa
put showed a slight increase in most micro
due to the rise in the transpiration rate o
(Blecker-Ariz)
W69-03501

**EFFECT OF HIGH TEMPERATURE
MOISTURE DEPLETION, IMBIBITIO
GERMINATION OF SEEDS OF MIMO
MATA WILLD,**
Jodhpur Univ. (India). Dept. of Botany.
U. N. Chatterji, and Achala (nee` Chatterje
Mukherjee.
Ann of Arid Zone, Vol 7, No 1, pp 93-99
1968. 7 p, 3 tab.

Descriptors: *Temperature, *Seeds, *Germ
Moisture stress, *Moisture deficit, Moist
take, *Thermal stress, Heat, Drying, Root
Absorption, Crop response, Plant physiolog
ryonic growth stage.
Identifiers: Imbibition.

Seeds of Mimosa hamata were subjected
peratures of 70, 90, and 100 deg C for 24
and 144 hours to study what effect exposi
to high temperature would have on gerr
The seeds which had a higher depletion of
germinated poorly in comparison to tho
which lost a lesser amount of moisture. T
ment of 70 deg C for 144 hours gave the
percentage of germination. There was a di
relation between the rate of imbibition
degree and duration of the temperature o
bility of the embryo, and might be a
process related to the colloidal particles
the cells composing the seed. Radicle gro
found to be stunted by exposure to high
tures. There was no significant differenc
behavior of large and small seeds with r
their capacities for imbibition and germina

f their exposure to dry heat treatment. (Af-
riz)
3503

**OF SLOPE DEGRADATION AS DETER-
FROM BOTANICAL EVIDENCE,
MOUNTAINS, CALIFORNIA,**
ical Survey, Washington, D. C.
e C. LaMarche, Jr.
ırv Prof Pap 352-I, pp 341-377, 1968. 37 p,
plate, 8 tab, 39 ref.

ptors: *Bank erosion, *Dendrochronology,
cone pine trees, Weathering, Topography,
Age, Exposure.
ers: *Slope degradation, *Exposed tree
oot age.

ed are the development and application of
s for obtaining long-term rates of slope
tion in areas where the exposed roots of old
ear record of the prior levels of a progres-
owered land surface. Methods of calculating
legradation were developed by studying
relation to age of ancient bristlecone pines
mite areas in the semi-arid White Moun-
Exposed tree roots are direct evidence of
tion, and local degradational rates are esti-
from tree or root age and depth or root ex-
The best estimates of long-term rates of
egradation are those based on study of sam-
ontaining a relatively large number of
ens from small topographically homogene-
eas. Transport rates of products of rock
ring on slopes and in stream channels are
ded to be great enough to account for the
ed degradational rates. (Llaverias-USGS)
3527

**GGESTED METHOD FOR ESTIMATING
OTRANSPIRATION BY NATIVE
ATOPHYTES,**
ical Survey, Menlo Park, Calif.
antz.
ırv Res 1968, Prof Pap 600-D, pp D10-D12,
p, 2 fig, 1 tab, 7 ref.

ptors: *Evapotranspiration, *Phreatophytes,
nmental effects, Plants, Water levels, Water

ers: Blaney-Criddle method, Blaney-Criddle
ient selection charts.

h and table have been developed for select-
ues of the coefficient K to be used in the
-Criddle formula for estimating evapotrans-
n by native phreatophytes. Values of K are
lent on the species of phreatophyte, the den-
growth, and the depth to water table.
)
3557

Erosion and Sedimentation

**RIMENTAL INVESTIGATION AND COM-
TION OF THE VOLUME OF MATERIAL
ED FROM DEEP RAVINES IN
CASTING THE SILTING OF RESER-
ON MOUNTAIN RIVERS,**
aziatskii Nauchno-Issledovatelskii Institut
ii, Tashkent (USSR).
Mal'tsev.
from Izvestiya Akademii nauk Uzbek-
, seriya technicheskikn nauk, No 6, 1967.
Hydrol: Selec Pap, Issue No 4, pp 402-404,
p, 4 fig, 2 tab.

ptors: *Sediment transport, *Sediment
rge, *Ravines, *Reservoir silting, *Bed load,
ded load, Dams.
iers: USSR, Fergana Valley.

ed loads of mountain ravines tributary to the
ed reservoir in the Fergana Valley, USSR,
were measured to estimate reservoir sedimentation. Rainfall and discharge were measured in 1960. Bed load was measured by construction of a rockfill filter dam 1.5 m high and 0.5 m wide constructed to trap material larger than about 5 cm. The volume of trapped coarse material was measured after each flow in the ravine. Current velocities were measured by floats. The relationship between daily rainfall and streamflow is shown graphically. Stream turbidity is tabulated. In the period of observation, a total of 16.24 cu m was deposited, and it was calculated that 120 cu m of suspended load was carried. (Knapp-USGS)
W69-03216

EFFECTS OF CONSTRUCTION ON FLUVIAL SEDIMENT, URBAN AND SUBURBAN AREAS OF MARYLAND,
Johns Hopkins Univ., Baltimore, Md.
M. Gordon Wolman, and Asher P. Schick.
Water Resources Res, Vol 3, No 2, pp 451-464, 1967. 14 p, 3 fig, 5 tab, 29 ref.

Descriptors: *Sediment yield, *Construction, *Urbanization, Maryland, District of Columbia, Virginia, Sediment load, Hydraulics.
Identifiers: Fluvial sediment.

The effects of construction and urbanization on sediment loads of streams in the Washington and Baltimore urban and suburban areas were studied. The rapidly developing areas are on the Coastal Plain and Piedmont. Slopes have deep soil and gradients are mostly 1-10% but some are over 20%. Annual precipitation is 42 in., evenly distributed areally, and with high summer intensities. Average sediment yield is 200-500 ton/ sq mi/ yr. Past intensive farming caused yields of 2-5 times present amounts, but farming has declined markedly. Construction areas yield up to 140,000 tons/sq mi/ yr with sediment concentrations of 3,000 to over 150,000 ppm while natural and farm area yields are not over 2,000 ppm. Sediment storage occurs on construction sites and in valley bottomlands. The increased sediment loads in streams cause channel bar deposition, bank erosion, flow obstruction, flooding, changing channel morphology, blanketing of bottom flora and fauna, alteration of flora and fauna by environmental change, and fish species alteration. Building permits show that 50% of sites were open 8 months, 60% for 9, and 25% over 1 yr. Activity is almost constant through the year. Average site size is 14,400 sq ft. A minimum of 7.2 sq mi are open at any one time. Housing accounts for 5.7 sq mi and highways for 1.5 sq mi. Sediment yield is 700-1800 tons per 1000 increase in population. (Knapp-USGS)
W69-03227

SEDIMENTATION IN A MEANDERING ESTUARY,
Lehigh Univ., Bethelem, Pa. Marine Science Center; Georgia Univ., Sapelo Island, Ga., Marine Inst.; and Georgia Univ., Athens. Dept. of Geology.
Lynton S. Land, and John H. Hoyt.
Grant NSF G-16426. Study supported by National Science Foundation Grant. Sedimentology, No 6, pp 191-207, 1966. 17 p, 9 fig, 33 ref.

Descriptors: *Sedimentation, *Estuaries, Aggradation, Bank erosion, Meanders, Sand waves, Sand bars, Beaches, Georgia.
Identifiers: Sapelo Island (Georgia).

Sand is being deposited in a meandering estuary separating Sapelo and Blackbeard Islands, Georgia, in the channel of the estuary and on two point bars associated with meanders. Sand eroded by the meandering channel from slightly lithified Pleistocene and unconsolidated Holocene strandline deposits is redeposited by the ebb tidal currents. The estuary-channel deposits are course grained and their grain-size decreases down ebb current from the source outcrops. The point bars are elongated in the direction of the ebb current, and grain-size increases from their crests downward as they grade into the channel deposits. Festoon crossbedding and ripple marks on the point bars record the ebb direction, while elongated plant fragments are preferentially oriented normal to the bar elongation (current). Horizontally stratified muds and muddy sands are being deposited behind the bars, and contain a rich fauna (primarily annelids, arthropods, and molluscs). However, the fauna is represented in the deposits more by burrows and disturbed stratification than by preserved organisms. The sands of the bars and channel are biologically less productive but the bioclastic content of the sediment is high. (Knapp-USGS)
W69-03228

RECENT DELTAIC DEPOSITS OF THE MISSISSIPPI RIVER: THEIR DEVELOPMENT AND CHRONOLOGY,
Esso Production Research Co., Houston, Tex.
David E. Frazier.
Trans Gulf Coast Ass Geol Soc, Vol 17, pp 287-315. Oct 1967. 19 p, 13 fig, 35 ref.

Descriptors: *Deltas, *Mississippi River, *Sedimentation, Provenance, Stream erosion, Deposition (Sediments), Radioactive dating.
Identifiers: *Chronology, Delta Complex.

Sixteen separate delta lobes have been formed by the Mississippi River in the past 6,000 years; 14 form the Teche, St. Bernard, and Lafourche delta complexes and the remaining 2 form the present birdfoot delta, which is an extension of the earlier formed initial lobe of the Plaquemines-Modern complex. Each delta complex is genetically related to a major Mississippi River course. Individual delta lobes within each complex are the result of the successive distributary networks of a major river course. Delta lobes were defined by detailed facies analyses of sediment cores from hundreds of shallow borings combined with lithologic and faunal data from several hundred additional borings. Each lobe consists of a basal fine-grained prodelta facies, an overlying sandy delta-front facies, and uppermost fine-grained delta-plain facies, including peat accumulations and nonorganic flood-plain and natural-levee deposits. Radiocarbon dates together with the facies relationships, indicate that the development of each delta complex was not a continual process, but the river shifting from one major course to another caused the temporary cessation of development in one delta complex as progradation occurred in another. Similar deltaic sequences extend basinward as massive subsurface clastic wedges which constitute a major portion of the peripheral basin fill. (Knapp-USGS)
W69-03230

ERODIBILITY INDICES FOR WILDLAND SOILS OF OAHU, HAWAII, AS RELATED TO SOIL FORMING FACTORS,
Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.
Teruo Yamamoto, and Henry W. Anderson.
Water Resources Res, Vol 3, No 3, pp 785-798, 1967. 14 p, 2 fig, 11 tab, 38 ref.

Descriptors: *Erosion, *Soils, *Hawaii, Geology, Topography, Vegetation, Regression analysis, Soil aggregates, Soil formation, Soil properties, Soil conservation.
Identifiers: Multivariate analysis, Soil erodibility, Oahu, Suspension percent.

Soil samples collected along 31 transects in the watersheds of the Koolau and Waianae ranges were analyzed in the laboratory for the size distribution of water-stable aggregates and the suspension percent, a measure of easily dispersed silt and clay in the soil. Indices of soil erodibility were related by principal component analyses with varimax rotation to these 7 soil-forming factors: parent material, rainfall, elevation, vegetation type, slope, aspects, and zone. Parent rock material was the most important factor in explaining variation of water-stable aggregates of soils in Hawaii. Nevertheless, differences in water-stable aggregates were also as-

sociated with differences in vegetation type and other soilrforming factors. Most of the soils studied were rated as slightly to moderately erodible under full vegetative cover. The loose condition plus the dispersive and slaking characteristics of volcanic ash soils suggest that they may be twice as erodible as soils of basaltic flow or of colluvial origin. Among the soil characteristics that serve as indices of erodibility, the suspension percent was found to be independent of other measures; hence, it may be expected to serve well as a part of an erodibility ratio, such as suspension-mean weight diameter or a surface-aggregation ratio. Conversion of the native koa-ohia scrubby forests by planting paperbark or silk-oak trees promises to result in development of less erodible soils as well as more useful forest products.
W69-03316

AN ANALYSIS OF RELATIONSHIPS BETWEEN FLOW CONDITIONS AND STATISTICAL MEASURES OF BED CONFIGURATIONS IN STRAIGHT AND CURVED ALLUVIAL CHANNELS,
Iowa Univ., Iowa City. Water Resources Research Inst.
David Squarer.
Ph D dissertation, June 1968. 173 p, 31 fig, 5 tab, 62 ref. OWRR Project A-015-Ia.

Descriptors: *Sediment transport, *Statistical methods, Markov processes, Correlation analysis, Time series analysis, Digital computers, Froude number, Channel morphology.
Identifiers: Spectral analysis, Autocorrelation, Spectral density, Probability density.

A statistical investigation was made of sediment transport in sinuous channels and the results were compared with data from straight-flume experimental studies. Geometry of bed forms was studied by analyzing records of streambed profiles for autocorrelation, spectral density, and probability density functions of bed elevation as a function of channel length or of elapsed time. Sediment transport rate in a curved channel is about 15 times as much as in a straight flume with the same flow conditions. The difference increases with increasing Froude number. The mean water surface slopes in the straight and curved channels are comparable Bed friction can be determined either in terms of flow or bed geometry. A statistical method is presented to obtain bed wave lengths and heights in terms of moments of spectral density functions. Characteristic bed form dimensions can be obtained from both stationary and nonstationary sample records. Small ripples move faster than large ones and ripple celerity increases with flow velocity. Theoretical second order linear Markov models as well as other simple exponential, sine, cosine, and spectral density functions do not fit the observed phenomena. (Knapp-USGS)
W69-03317

SEDIMENT TRANSPORT OF STREAMS IN THE WASHITA RIVER BASIN IN CADDO AND GRADY COUNTIES, OKLAHOMA,
Agricultural Research Service, Chickasha, Okla. Soil and Water Conservation Research Div.
P. B. Allen, and N. H. Welch.
Water Resources Res, Vol 3, No 3, pp 777-784, 1967. 8 p, 8 fig, 3 tab, 5 ref.

Descriptors: *Sediment yield, *Sediment transport, *Channel morphology, *Provenance, Geology, Oklahoma, Erosion, Watersheds (Basins).
Identifiers: Sediment yield-lithologic relationships, Drainage basin characteristics, Washita River, Einstein method, Colby method, Brooks method.

Sediment yields for 9 experimental watersheds, whose drainage areas vary from 26.0 to 3290 sq mi, were related to the geology in the watersheds. Yields from watersheds with mixed sandstone, siltstone, and shale geology were higher than for watersheds where the geology was predominantly sandstone. The highest yield rate was 29.7 in. per 1000 yr for a mixed geology watershed, the lowest yield rate being 1.32 for a sandstone watershed. Stream channel shape was found to be related to the material in transport. Streams with large sand loads have wide, shallow channels, whereas streams with a predominantly silt load have narrow, deep channels. The correlation between the temperature of the flow and sediment concentration was+ 0.93. Several total load predictions made with the Colby and modified Einstein procedures were compared with those made with the Brooks total suspended load equation when field-determined sediment z values and velocity k values were used. Computations by the modified Einstein and Colby method compared favorably with those made by the Brooks method.
W69-03326

A COMMENT ON HORTON'S LAW OF STREAM NUMBERS,
IBM Watson Research Center, Yorktown Heights, N. Y.
For primary bibliographic entry see Field 02E.
For abstract, see .
W69-03338

INTRODUCTION TO PALEOLIMNOLOGY,
Texas Technological Coll., Lubbock. Dept. of Geosciences.
C. C. Reeves, Jr.
No. 11 in series on Developments in Sedimentology. New York, Amer Elsevier Pub Co, Inc, 1968. 238 p, 22 tab, 125 illus, ref, index.

Descriptors: *Paleolimnology, *Lake basins, *Lakes, *Sedimentology, Chemical precipitation, Detritus, Deposition (Sediments), Erosion, Pleistocene epoch, Structures.
Identifiers: *Lacustrine environment, *Textbook, Detrital sediments.

Summarizes the multiple methods used in paleolimnology, based on studies by the author of fluvial lake basins in the southwestern United States and in Mexico. Part 1 describes the lake basins, their formation and quantitative aspects and their shape and development. Part 2 tells of the lacustrine environment, dividing the lacustrine sediments into chemical precipitates and clastic materials; and lacustrine structures are described as depositional and erosional features. Part 3 discusses the Paleolake Basin and deals with Pleistocene chronology, the distribution, cause, and recognition of the basins. Paleoclimatic and sampling methods are given and future paleolimnological applications presented. (Lang-USGS)
W69-03342

CYCLIC SEDIMENTATION,
Edinburgh Univ. (Scotland). Grant Inst. of Geology.
P. M. D. Duff, A. Hallam, and E. K. Walton.
No. 10 in series on Developments in Sedimentology. New York, N.Y., Amer Elsevier Pub Co, Inc, 1967. 290 p, 35 tab, 91 illus, ref, index.

Descriptors: *Sedimentation, *Cycles, Sediment distribution, Sediments, Environmental effects, Marine geology, Microorganisms, Clays, Sands, Aggradation, Deltas, Erosion, Running waters.
Identifiers: *Cyclic sedimentation, Source book, Fluvial and lacustrine regimes.

A comprehensive and critical treatment is presented of cyclic sedimentation. Although the subject of sedimentology cycles has been argued about since the early 1800's and resulted in voluminous literature, no complete survey of all the aspects of cyclic sedimentation has previously been done. The book discussed and illustrates cycles in fluvial, lacustrine, and transitional regimes in North America and Europe. Details on epicontinental marine environments and sedimentary cycles and faunal changes are presented with conclusions. Many references are given. (Lang-USGS)
W69-03353

PALEOECOLOGICAL STUDIES OF POTAT LAKE AND ITS ENVIRONS,
Indiana Univ., Bloomington.
Melbourne C. Whiteside
Ecology, Vol 46, pp 807-816, Autumn 1965. 10 5 fig, 1 tab, 22 ref.

Descriptors: *Pollen, *Eutrophication, *Paleo nology, Lakes, Sedimentation, Chemical analy Cores, *Erosion, Watersheds (Basins), Ecolog Arizona.
Identifiers: Paleoecological studies, Lake sedim cores, Pollen analysis, Chemistry of cores, Histo cal lake ecology, Watershed erosion, Lake succe sion, Recent sediments, Potato Lake (Ariz).

A 286-cm core was taken from the center of Pot Lake, Coconino Co, Ariz. Pollen, chemical, physical analyses were made on the sediment. F len evidence implying a period of cool moist con tions was represented by the sediments below 1 cm. The correlations of the lower level of ments with this period are confirmed by a r carbon date of 14,400 plus or minus 300 years depth of 1.42-1.72 cm. The warming trend of p glacial time is evidenced by the increase in p which replaced spruce-fir as the predominent boreal pollen in the sediments accumulated abo the 120-cm level. Loss on ignition (considered represent lost of total organic material) of the s ment increases above the 120 cm level correspo ing to the onset of eutrophication in Potato Lak drastic reduction in percentage of organic mate occurs at the uppermost portion of the core. T recent increase of inorganic material at this lev attributed to increased erosion of the basin fol ing the activities of man in the drainage basin, logging and grazing.
W69-03361

PHOSPHATE EQUILIBRIUM BETWE REDUCED SEDIMENTS AND WATER,
Copenhagen Univ., (Denmark). Dept. of P Physiology.
For primary bibliographic entry see Field 02K.
For abstract, see .
W69-03365

RECENT SEDIMENTS OF THREE WISCON LAKES,
Shell Oil Co., Houston, Tex.
Raymond C. Murray.
Bull Geol Soc Amer, Vol 67, pp 883-910, 1956. 28 p, 10 fig, 2 plate, 3 tab, 28 ref.

Descriptors: *Lakes, *Wisconsin, *Sedime Cores, Diadenesis, Carbonates, Organic ma Marl, Sludge, Sedimentation, Eutrophication.
Identifiers: Recent sediments, Lake Men (Wis), Lake Wingra (Wis), Trout Lake (W Clastics, Paleoecology.

Sedimentation in Lake Mendota, Wis, has cha abruptly in the recent past. Cores record this sharp interface separating buff marl from overl 1-14 inches of black sludge. The marl and s differed in being high-carbonate, low-clastic low-carbonate, high-clastic, respectively, but organic content was essentially the same. A ascribes change to increased deposition of c materials as a consequence of farm and dom practice. Contemporaneously, increased biolo productivity and consequent hypolimnetic ox minima have occurred, possibly resulting domestic drainage. Blackness of sludge results anaerobic deposition of ferrous sulfide, not organic content. Dark green sediments of Lake, Wis, were highly organic. Complete se of sediments, when available, showed increase ganic content with advancing time. Most r sediments showed slight decrease in organic tent, which author ascribes to recent incre clastic deposition. Recent bottom deposits of Wingra, Wis, consist of gray marl which be shell marl in shallow water. Author foun evidence supporting theory that impo diagenetic changes are taking place in the ments studied. Exclusive of compaction and

ost-depositional changes appeared to be
ed to upper few inches of most recent
(Eichhorn-Wisc)
3367

LIZING ERODING STREAMBANKS IN
ORIFT AREAS OF THE LAKE STATES.
Central Forest Experiment Station, St. Paul,

A. Hansen.
epartment of Agriculture, Forest Service,
h Paper NC-21, pp 1-12, 1968. 12 p, 3 fig,
3 photo, 1 chart, 17 ref.

tors: *Sands, *Bank erosion, *Bank sta-
n, Bank protection, Riprap, Stream ero-
egetation establishment, Slope stabilization,
bilization, Erosion control, Sedimentation
ediment load, Aquatic environment, Cost-
analysis, Great Lakes.
ers: *Lake States.

rotection planning balances the immediate
t of stabilization against a probable future
The immediate cost of stabilization can be
ed fairly accurately and can be improved
ith the experience gained from treating the
banks. Future benefits, such as protection
te values or reduction in reservoir or lake
ntation rates, can be estimated and ex-
in economic terms. However, the possible
benefit from attempting to increase fish
ion through bank stabilization is obscure.
uently, present justification of such an ob-
will have to be stated in qualitative terms
reduced sediment load or possibly im-
fish habitat. There is a wide variety of sta-
n techniques that can be used for bank pro-
Rock rip-rap is probably the best material
or stabilizing the lower bank, since there is
at can deteriorate with time. However, rock
cient size and quantity is often difficult to
n the Lake States. In such cases, alternative
s employing wire, wood, or live vegetation
used. The upper bank will revegetate natu-
owever, sloping and application of seed, fer-
and mulch will accelerate the revegetation
. Maintenance should be a planned part of a
abilization program because of the possibili-
me structural failure in the future and the
new points of erosion from normal stream
ring.
3405

CEDURE FOR COMPUTATION OF THE
RIVER SAND DISCHARGE AND
LED DISTRIBUTION, BED TO SUR-

f Engineers, Vicksburg, Miss.
offaleti.
ep No 5, Comm Channel Stabilization, U S
Corps Eng, Nov 1968. 29 p, 15 fig, 2 tab, 11
ppend.

tors: *Sedimentation, *Sediment transport,
matical models, *Digital computers, *Com-
programs, Sands, Silts, Rivers, Streams,
, Model studies, Hydraulic models.
ers: Sand discharge computation.

nematical procedure and digital computer
n are presented for solving sedimentation
ns in the design of multipurpose, flood-con-
vigation, channel rectification, and miscel-
hydraulic structure projects. Only a few
ata are required to describe quantitatively
d fraction and the total sediment discharge.
nt discharge profiles from bed to surface
calculated. The method was tested in all
nd sizes of rivers under a full range of flow
ons and in flume models. A flow chart, pro-
sting, and sample computation are included.
-USGS)
3541

DIFFUSION AND SETTLING OF SEDIMENTS AT RIVER MOUTHS: A COMPUTER SIMULATION MODEL,
Stanford Univ., Calif. Dept. of Geology; and Stanford Univ., Calif. Dept. of Civil Engineering.
G. F. Bonham-Carter, and Alex J. Sutherland.
Trans Gulf Coast Ass of Geol Soc, Vol 17, pp 326-338, 1967. 13 p, 14 fig, 5 ref. NR 388 081, N00014-66-C0017-A04.

Descriptors: *Sedimentation, *Deltas, *Computer models, Digital computers, Computer programs, Dispersion, Settling velocity.
Identifiers: Fortran programs.

A FORTRAN IV computer program for simulating the diffusion and settling of suspended sediment at river mouths is presented. The rate of sediment accumulation at any point in front of the channel mouth is governed by water and sediment discharge, sediment grain size distribution, sediment density, the porosity of the resulting sediment, width and depth of the river channel, and the geometry of the basin. A plane jet model is used for determining the velocity field and the rates of sediment diffusion. By adjusting the input parameters, a variety of 'delta' deposits may be created. The shape and foreset slope of the delta fan is found to be closely controlled by grain size and discharge. By allowing the model to respond dynamically to the accumulation of sediment at the channel mouth, a distributary mouth bar and submerged levees can be formed. Delta simulation experiments are monitored by printing maps showing the rates of sedimentation for each grain size at every cell in a digital accounting grid, and by facies maps using alphabetic symbols. Maps and stratigraphic cross sections are drawn with a digital plotter.
W69-03542

2K. Chemical Processes

DEUTERIUM CONTENT IN NATURAL WATERS,
Institut Prikladnoi Geofiziki, Leningrad. Trudy (USSR).
V. A. Molochnova, M. M. Sokolov, and A. V. Gorev.
Transl from Geokhimiya, No 5, 1967 (Russian). Geochem Int, Vol 4, No 3, pp 484-489, 1967. 6 p, 5 fig, 11 ref.

Descriptors: *Deuterium, *Crystalline rocks, Stable isotopes, Water quality, Water analysis, Geochemistry, Groundwater, Aquifers.
Identifiers: *USSR, Hydrology crystalline terranes, Photoneutron method, Ukraine, Kazakhstan.

Deuterium content in groundwaters from Precambrean crystalline rocks of the Ukrainian shield and from Upper Paleozoic volcanic and sedimentary rocks of Central Kazakhstan, USSR, was determined by the photoneutron method. The deuterium content of 74 groundwater samples from the Ukranien shield ranges from 0.0118 to 0.0233 mol.%, although most samples have a concentration of 0.0143 to 0.0148. Deuterium concentration appears to increase with depth. Higher deuterium concentrations occur in waters with high organic content; whereas the lower deuterium concentrations occur in waters with high radioactive content. Most of the 56 samples from the Central Kazakhstan region have deuterium concentrations of 0.0148 plus or minus 0.0003 mol.%. Higher concentrations are restricted to waters with high salinity; lower concentrations are found in waters with relatively low salinity. These data indicate that in igneous terranes the deuterium concentrations of shallow groundwaters are similar to the deuterium content of the large rivers, which is 0.0148 to 0.0149 plus or minus 0.0003 mol.%. Higher concentrations are found in groundwaters with high organic content and high salinity; lower concentrations are associated with groundwaters with high radioactive elements and low salinity. (Steinhilber-USGS)
W69-03229

ROLE OF STABLE HYDROGEN ISOTOPES IN THE STUDY OF GEOLOGICAL PROCESSES,
Vsesoyuznyi Nauchno-Issledovatelskii Institut Yadernoi Geofiziki i Geokhimii, Moscow (USSR).
For primary bibliographic entry see Field 02F.
For abstract, see .
W69-03244

ISOTOPIC COMPOSITION OF LEAD IN NATURAL WATERS,
Institut Prikladnoi Geofiziki, Leningrad. Trudy (USSR).
P. F. Andreyev, N. M. Bugrov, and V. S. Glebovskaya.
Transl from Geokhimiya, No. 6, 1967 (Russian). Geochem Int, Vol 4, No 3, pp 551-556, 1967. 6 p, 5 tab, 11 ref.

Descriptors: *Lead radioisotopes, *Radioisotopes, Water analysis, Surface waters, Groundwater, Aquifers, Geochemistry, Methodology.
Identifiers: USSR, Isotopic fractionation, Spectrometric, Analysis, Ukraine, Kazakhstan.

Data are presented on the isotopic composition of lead in surface and groundwaters in several regions in USSR. Included is a description of the technique used in the field to concentrate the lead in the water samples. Isotopic determinations were made spectrometrically and spectroscopically. Isotopic composition of lead in waters of large basins (Sea of Azov and Lake Balkhash) is similar. Lead isotope composition varies in the rivers and is considerably different from that in the large lakes. The isotopic composition of lead varies considerably in groundwaters from several aquifers in Kazakhstan and the Ukraine. In Kazakhstan, the isotopic composition of lead in the groundwaters is similar to that of the rocks in which these waters circulate. (Steinhilber-USGS)
W69-03245

APPLICATIONS OF FACTOR ANALYSIS IN STUDY OF CHEMISTRY OF GROUNDWATER QUALITY, MOJAVE RIVER VALLEY, CALIFORNIA,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 02F.
For abstract, see .
W69-03253

INTRODUCTION TO PALEOLIMNOLOGY,
Texas Technological Coll., Lubbock. Dept. of Geosciences.
For primary bibliographic entry see Field 02J.
For abstract, see .
W69-03342

PHOSPHORUS RELEASE FROM BOG LAKE MUDS,
Wisconsin Univ., Madison. Dept. of Soil Science; and Wisconsin Univ., Madison. Dept. of Zoology.
E. L. Zicker, K. C. Berger, and A. D. Hasler.
Limnol Oceanogr, Vol 1, No 4, pp 296-303, Oct 1956. 8 p, 5 tab, 27 ref.

Descriptors: *Phosphorus, *Mud-water interface, *Cycling nutrients, Lime, Mud, Solubility, Adsorption, Leaching, Nutrients, Wisconsin, Michigan, Lakes, Acid, Bottom sediments, Cores, Limnology.
Identifiers: *Bog lakes, Phosphorus release, Lime treatment, Bog lake muds, Mud surface, Soluble phosphorus, Phosphorus suppression, Radioactive phosphorus, Nutrient-mud systems, Acidification of muds, Mechanical agitation.

Authors describe laboratory investigations concerning mud-water phosphorus relationship of some Northern Wisconsin and Upper Michigan bog lake muds as influenced by lime, acid, and mechanical agitation. Calcium carbonate added to water phase of mud-water systems reduced soluble phosphorus from 8.0 to 0.8 parts per billion. Lime formed thin crust at mud-water interface, while original pH of bottom material prevailed at 1/4 in. below mud surface. Agitating mud cores by stirring

resulted in complete lime penetration throughout a 3-in. core. Experimental apparatus for obtaining a 12 deg C temperature differential for stratifying water is described. Radioactive ordinary superphosphate fertilizer was placed at various depths below mud surface. Percentage as well as amount of phosphorus released to water was very small with virtually no phosphorus released below 1/4 in. under mud surface. Mud agitation resulted in approximately twice the concentrations of soluble phosphorus in the water phase of agitated systems compared to undisturbed systems. Most effective means of releasing fertilizer phosphorus 1/4 in. below mud surface was acidification of previously limed mud-water systems. Mechanism of phosphorus suppression by adding calcium compounds to mud-water systems, authors suggest, is adsorption of phosphate ions onto surface of calcium particles. (Eichhorn-Wisc)
W69-03363

PHOSPHATE EQUILIBRIUM BETWEEN REDUCED SEDIMENTS AND WATER,
Copenhagen Univ., (Denmark). Dept. of Plant Physiology.
Sigurd Olsen.
Verh Int Ver Limnol, Vol XV, pp 333-341, Feb 1964. 9 p, 7 fig, 2 ref.

Descriptors: *Sediments, *Eutrophication, *Phosphates, *Sediment-water interfaces, *Cycling nutrients, Phosphorus, Oxidation, Mud, Sorption, Adsorption, Equilibrium, Sediment discharge, Lakes, Radioisotopes, Oxidation-reduction potential.
Identifiers: Phosphorus exchange, Lake Fureso (Denmark), Stagnation.

The effect of increasing amounts of phosphate, labeled with P-32, on the adsorption to and the exchange by the sediment has been investigated; time and temperature have been constants. Phosphate adsorption and exchange for a reduced and oxidized coarse sediment and finely grained sediment from Lake Fureso are indicated. The descriptions for the exchanged and adsorbed phosphates for the sediment in reduced state follow the same equation as for the oxidized sediment but with constants of different values. In the reduced state this sediment will exchange and absorb less phosphate than in the oxidized state for the same sediment. In transferring these results for this sediment to normal lake conditions, one may expect not to find any phosphate adsorption to a sediment of this type during stagnation periods but only phosphate exchange and phosphate release. Descriptions of the apparatus used to conduct experiments are included. (Eichhorn-Wisc)
W69-03365

ACETYLENE REDUCTION BY NITROGEN-FIXING BLUE-GREEN ALGAE,
Wisconsin Univ., Madison. Dept. of Biochemistry; and Wisconsin Univ., Madison. Water Chemistry Lab.
W. D. P. Stewart, G. P. Fitzgerald, and R. H. Burris.
Arch Mikrobiol, Vol 62, pp 336-348, 1968. 13 p, 2 fig, 7 tab, 27 ref.

Descriptors: *Cyanophyta, *Nitrogen fixation, *Phytoplankton, Algae, Analytical techniques, Aquatic algae, Aquatic microbiology, Bioassay, Chlorophyta, Cycling nutrients, Environmental effects, essential nutrients, Light, Light penetration, Limnology, Nitrogen compounds, Nutrient requirements, Ammonium compounds, Physiological ecology.

Known nitrogen-fixing species of blue-green algae are capable of reducing acetylene to ethylene, but acetylene is not reduced by Anacystis nidulans, which does not fix nitrogen. Cycad root nodules which contain blue-green algae as endophytes reduce acetylene. Acetylene reduction is inhibited by carbon monoxide. Nitrate- or ammonium-nitrogen has no immediate effect on algae-reducing acetylene, but algae grown on nitrate-nitrogen gradually lose their capacity to reduce acetylene. Nitrate-nitrogen also inhibits heterocyst formation in these algae, and there is a fairly direct correlation between the abundance of heterocysts in a particular sample and its capacity to reduce acetylene. Aphanizomenon flos-aquae reduces acetylene and fixes nitrogen in unialgal culture, and there is strong presumptive evidence that these reductions are carried out by the alga rather than by associated bacteria. The molar ratios of ethylene: ammonia produced vary within the range 1.4-1.8. (Eichhorn-Wisc)
W69-03368

IN SITU STUDIES ON (NITROGEN) FIXATION USING THE ACETYLENE REDUCTION TECHNIQUE,
Wisconsin Univ., Madison. Dept. of Biochemistry; and Wisconsin Univ., Madison. Water Chemistry Lab.
W. D. P. Stewart, G. P. Fitzgerald, and R. H. Burris.
Proc Nat Acad Sci, Vol 58, No 5, pp 2071-2078, Nov 1967. 8 p, 8 fig, 6 tab, 19 ref.

Descriptors: *Cyanophyta, *Nitrogen fixation, *Phytoplankton, Algae, Analytical techniques, Aquatic algae, Aquatic microbiology, Bioassay, Chlorophyta, Diatoms, Cycling nutrients, Environmental effects, Essential nutrients, Light, Light penetration, Limnology, Nitrogen compounds, Nutrient requirements, Ammonium compounds, Physiological ecology.

The reduction of acetylene can be employed as an index of nitrogen-fixation in situ in aquatic environments, in soils, and by nodulated plants. Ethylene produced from acetylene could be measured gas-chromatographically after 5 seconds to 30 minutes of exposure of nitrogen-fixing agents to acetylene. In lakes and soils, reduction was correlated directly with the abundance of heterocystous blue-green algae. Ten replicate 1 ml samples of a bloom of Gloeotrichia echinulata from Lake Mendota, Wis, had ethylene production between 1.32 and 2.08 millimicromoles of ethylene per milligram of protein per minute. Details of daily variations in in situ acetylene reduction, the effect of light on reduction, and depth of sample collected in Lake Mendota are presented. As few as 2 gloeotrichia or 4 aphanizomenon flos-aqua colonies would give measureable rates of acetylene reduction within 30 minutes. Acetylene reduction by alnus, comptonia and soybean was characteristic of the root nodules only. (Eichhorn-Wisc)
W69-03372

NITROGEN CONTENT OF PRECIPITATION IN A COASTAL OREGON FOREST OPENING,
Pacific Northwest Forest and Range Experiment Station, Corvallis, Oreg.
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-03400

NUTRIENT CYCLING BY THROUGHFALL AND STEMFLOW PRECIPITATION IN THREE COASTAL OREGON FOREST TYPES,
Pacific Northwest Forest and Range Experiment Station, Corvallis, Oreg.
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-03402

PRINCIPLES OF CHEMICAL COMPOSITION OF GROUNDWATERS (BASIC FACTORS), (IN RUSSIAN),
Hydro-Chemical Inst., Novocherkassk (USSR).
Ye V. Posokhov.
Leningrad, USSR, Hydrometeorological House, 1966. 256 p, 13 fig, 9 tab, 455 ref.

Descriptors: *Groundwater, *Mineral water, *Water types, *Water chemistry, Hydrogeology, Aquatic microbiology, Chemical analysis, Geochemistry, Water temperature, Geologic control, Groundwater movement, Groundwater recharge, Gravitational water, Topography, Climate, Precipitation (Atmospheric).
Identifiers: Groundwater chemical composition.

This monograph reviews in detail the numerous (455) publications in the USSR and abroad and the author's many investigations about the hydrochemical aspects of groundwater. Because knowledge of the factors influencing occurrence of minerals in water are needed in the search for suitable supplies for drinking, industrial and agricultural uses, an analysis was made of the factors responsible for mineralization and chemical composition of groundwaters. The book consists of the following chapters: (1) historical summary of the development of the concept of processes and factors responsible for the chemical composition of groundwaters; (2) chemical classification of groundwaters and related factors; (3) physico-geographical factors; (4) geological factors; (5) hydrogeological factors; (6) physico-chemical factors; (7) physical factors; and (8) biological factors. (Gabriel-USGS)
W69-03533

THE OCCURRENCE OF TRITIUM IN PRECIPITATION AND ITS SIGNIFICANCE IN HYDROLOGICAL INVESTIGATIONS,
International Atomic Energy Agency, Vienna (Austria).
B. R. Payne, and L. L. Thatcher.
For 8-volume Proceedings, see this issue, Field 06B, W69-03305. Int Conf on Water for Peace, Wash, D. C., Vol 4, pp 320-331, 1967. 12 p, 4 fig, 1 tab, 12 ref.

Descriptors: *Chemistry of precipitation, *Water chemistry, *Tritium, Fallout, Nuclear explosions, Tracers, Monitoring, Networks, Data collections.
Identifiers: *Hydrogen isotopes, *Oxygen isotopes, Tritium distribution.

The international project for measuring the concentration of hydrogen and oxygen isotopes in precipitation which was launched by IAEA and WMO in 1960, provides information on the occurrence of these isotopes at over 100 stations throughout the world. The tritium data provide the base for interpretation of the tritium content of natural waters in studying hydrological problems. Environmental tritium is derived from two sources. The first is due to production by cosmic rays and the second is the production by the detonation of thermonuclear devices, which since 1954 has dwarfed cosmic ray production of tritium. The data obtained from this world network have established certain regularities in the pattern of tritium distribution in area and time which may be used to reconstruct by correlation the history of tritium concentrations in precipitation at a given site, provided that the site is climatologically related to network stations and is not subject to significant climatic disturbances of local origin. The general pattern of distribution of tritium in both the northern and the southern hemisphere is discussed together with examples of the tritium history of key stations which have the longest record. The results of this project are discussed in relation to their use in hydrological studies in different parts of the world.
W69-03555

EVALUATION OF ORGANIC COLOR AND IRON IN NATURAL SURFACE WATERS,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 03E.
For abstract, see .
W69-03558

2L. Estuaries

COMPUTATION OF SEICHE VELOCITIES IN BODIES OF WATER WITH A COMPLEX BOTTOM RELIEF,
For primary bibliographic entry see Field 02H.
For abstract, see .

3217

IENTATION IN A MEANDERING ESTUA-

Univ., Bethelem, Pa. Marine Science
Georgia Univ., Sapelo Island, Ga., Marine
nd Georgia Univ., Athens. Dept. of Geology.
mary bibliographic entry see Field 02J.
tract, see .
3228

OLOGIC DATA COLLECTION IN TIDAL
RIES,
Water Pollution Control Administration,
nati, Ohio.
G. Gunnerson.
Resources Res, Vol 3, No 2, pp 491-504,
4 p, 12 fig, 4 tab, 8 ref.

tors: *Estuaries, *Sampling, *Water pollu-
Path of pollutants, *Prediction, Frequency
, Regression analysis, Time series analysis,
gic data, Mathematical studies, Statistical
s.
ers: Spectral analysis, Potamac River,
Bay, Sacramento River.

dictive models, the optimum sampling inter-
record length depend upon the frequencies
h significant variance is found. Estimates of
density, coherence, and phase relation-
stage, velocity, and salinity provide a basis
aluating hydrologic data collection and
on near the mouth of the Sacramento River.
was found that a 2-hr sampling interval pro-
ne essential data for engineering purposes.
erval is consistent with those found for the
c River estuary and for Raritan Bay. (K-
SGS)
3239

ISTRIBUTION OF EXCESS TEMPERA-
FROM A HEATED DISCHARGE IN AN
RY,
opkins Univ., Baltimore, Md. Chesapeake
.
arter.
one for AEC and Maryland Univ, Natural
t. Chesapeake Bay Inst Tech Rep No 44,
8. 39 p, 18 fig, 4 ref. AT (30-1) 3109.

tors: *Water temperature, *Estuaries,
al powerplants, Heated water, Mixing,
Movement, Tracers, Dye releases.
ers: Patuxent River (Maryland).

tracer and temperature distribution study
in the Patuxent estuary, Maryland, to
ne the effect of powerplant heat discharges
r temperatures. Temperatures were taken
tions upstream and 5 sections downstream
e discharge canal. At each section 3 time-
ature relations were compiled and shown
ally. The theoretical temperature distribu-
time and space is discussed, and the mea-
sults compare reasonably well with predic-
he tracer study was unsuccessful because of
lorine residuals in the condenser discharge
Knapp-USGS)
3341

VATER INTRUSION INTO A FRESH
R FOREBAY DUE TO WAVE ACTION,
tural Research Service, Fresno, Calif. Soil
ter Conservation Research Div.
n L. Dyer, and Jerold J. Behnke.
l, Vol 6, No 1, pp 95-101, Jan 1968. 7 p, 3
f.

tors: *Saline water intrusion, *Fresh water,
(Water), *Forebays, Water quality, Flow,
ow, Sea water.
ers: *Fresh-water forebay, *Salinas River
(California).

The adverse effect of sea water on water quality of the Salinas River Lagoon near Castroville, California, was investigated. Bench levels indicated that the forebay is above mean sea level; however, additional investigations showed that wave action maintains a water level beneath the beach, which is above mean sea level and forebay. Tides, wave action, and density differences between fresh and salt water should be considered in the interpretation of hydraulic relationships between coastal lagoons and the sea. Wave action produces a net landward gradient resulting in underflow from the sea into the forebay. The quantity of sea water added to the lagoon was calculated from salt balance and from gradient-transmissibility relationships. The amount of sea water underflow calculated by these two independent methods was 24.5 and 25.1 acre-ft respectively. (Llaverias-USGS)
W69-03531

THE POTOMAC ESTUARY - STATISTICS AND PROJECTIONS,
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-03603

'STATEMENT', IN CLEAN WATER FOR THE NATION'S ESTUARIES,
Federal Water Pollution Control Administration, Atlanta, Ga.
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-03605

A BIOLOGIST'S VIEWPOINT OF MAN-MADE CHANGES IN ESTUARIES,
For primary bibliographic entry see Field 06G.
For abstract, see .
W69-03607

'DISTRIBUTION OF POLLUTIONAL LOADINGS IN SUISUN BAY',
Stanford Univ., Calif.
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-03609

'ESTUARINE OXYGEN RESOURCES–PHOTOSYNTHESIS AND REAERATION',
Stanford Univ., Stanford, California.
For primary bibliographic entry see Field 05G.
For abstract, see .
W69-03610

COMPREHENSIVE PLANNING IN RELATION TO THE RISE AND MANAGEMENT OF ESTUARIES,
For primary bibliographic entry see Field 06B.
For abstract, see .
W69-03624

CHESAPEAKE BAY STUDY TASK GROUP ON FLOOD CONTROL, NAVIGATION, EROSION, FISHERIES–MINUTES OF THE FIRST MEETING.
For primary bibliographic entry see Field 06B.
For abstract, see .
W69-03626

'MIXING OF COLUMBIA RIVER AND OCEAN WATERS, SUMMER',
Stanford Univ., Calif.
For primary bibliographic entry see Field 05C.
For abstract, see .
W69-03632

TIDAL MARSH - CONFLICTS AND INTERACTIONS,
Franklin C. Daiber.
Estuarine Bulletin, Vol 3, No 1, March, 1968, pp 4-16.

Descriptors: *Competing uses, *Salt marshes, *Delaware, *Ecology, Efficiencies, Marshes, Wetlands, Balance of nature, Biochemistry, Coastal marshes, Hydrography, Hydrologic aspests, Geographical regions, Regions, Northeast U. S., Fisheries, Invertebrates, Animals, Detritus, Plankton, Aquatic life, Zoo-plankton, Aquatic animals, Vegetation, Atlantic coastal plain, Coastal plains, Water utilization.

Salt marshes play an important role in the biotic economy of coastal waters. Because of conflicting uses their productivity has been reduced. Graduate students of the University of Delaware conducted an ecological study of Canary Creek marsh to attempt to answer some of the local problems in Delaware. Topics studied were: hydrographic features, biochemical activity, plant production, quantities of detritus, zooplankton, estimation of the numbers of some of the non-planktonic invertebrates, and evaluation of the fisheries. The ecological cycle in the marsh was described.
W69-03641

THE DELTA PROJECT.
Report, Information Department of Ministry of Transport and Public Works, The Hague, Netherlands, March, 1967.

Descriptors: *Shore protection, *Saline water intrusion, *Foreign countries, *Agricultural engineering, Coastal engineering, Dam construction, Erosion, Engineering, Construction, Geographical regions, Regions.

The Delta Project has two objectives: (1) to considerably shorten and strengthen the total length of coast and dykes washed by the sea; (2) to combat the salination of the Dutch reaches of the rivers and adjoining channels and so increase agricultural production. Land reclamation is not the purpose of the project; very little, if any, will be gained. Working methods and new techniques are discussed.
W69-03646

'STATEMENT',
Federal Water Pollution Control Administration, Atlanta, Ga.
Miller A. Dial.
In CLEAN WATER FOR THE NATION'S ESTUARIES, Proceedings of the Georgia Public Meeting, Jekyll Island, Georgia, February 29, 1968, pp 37-38.

Descriptors: *Georgia, *Sedimentation, *Soil conservation, *Runoff, *Soil erosion, Rivers, Cultivated lands, Sediment control, Erosion, Conservation, Silting, Structures, Landfills, Control, Legislation, Regulation, Water pollution control, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Geographical regions, Regions, Southeast U. S., Urbanization, Dikes, Earthworks, Embankments, Engineering structures, Hydraulic structures.

There are several causes of pollution which fall under the jurisdiction of the Georgia State Soil Conservation Act. Among these are: erosion of agricultural lands (contributing to silting of estuarine areas), siltation of river waters by highway rights-of-way and urban developments, and nutrient enrichment in estuaries, presumably from agricultural runoff. Under the protection of this act these kinds of pollution have been somewhat curtailed. Other practices such as landfill and diking are also controlled by this Act.
W69-03647

ENVIRONMENTAL FACTORS IN COASTAL AND ESTUARINE WATERS: BIBLIOGRAPHIC SERIES - VOLUME II. COAST OF WASHINGTON,
George R. Ditsworth.
Report, Federal Water Pollution Control Administration, Northwest Region, Pacific Northwest Water Laboratory, Corvallis, Oregon, August, 1968.

Descriptors: *Bibliographies, *Estuarine environment, *Washington, Aquatic environment, Environment, Geographical regions, Regions, Pacific coast region, Pacific northwest U. S., Water pollution, Aquatic life.

Indexed herein are references to literature pertaining to the marine waters of the State of Washington. References to these papers, most of which have been published since 1955, are indexed under one or more of the following headings: Marine Biology, Fisheries, Geology, Chemical and Physical Oceanography, Water Pollution, and Bibliographies, Literature Surveys, and Compilations.
W69-03651

ESTUARIES: IRREPLACEABLE ENVIRONMENTS.
For primary bibliographic entry see Field 06B.
For abstract, see .
W69-03662

FEDERAL COURT DECISION JEOPARDIZES CURRENT EFFORTS TO SAFEGUARD NATION'S ESTUARIES.
Conservation Foundation Letter, April 22, 1968, pp 1-6.

Descriptors: *Dredging, *Judicial decisions, Legal aspects, Land reclamation, Navigation.

The article discusses the possible implications and repercussions of a Supreme Court decision denying the right to the Corps of Engineers of considering effects on natural resources when a dredging and filling permit is to be processed. The Corps of Engineers can deny permits only for reasons of impeding navigation.
W69-03663

THE HUDSON RIVER ESTUARY, A PRELIMINARY INVESTIGATION OF FLOW AND WATER-QUALITY CHARACTERISTICS,
G. L. Giese, and J. W. Barr.
New York Conservation Department, Water Resources Commission, Bulletin No 61, 1967.

Descriptors: *Water quality, *Flow, *Hudson river, *New York, Hydrologic aspects, Tidal waters, Bodies of water, Rivers, Running waters, Streams, Surface waters, Appalachian Mountain region, Geographical regions, Great Lakes region, Northeast U. S., Regions.

This report outlines the present level of knowledge of flow and water quality characteristics in the Hudson river estuary.
W69-03668

'STATEMENT',
Federal Water Pollution Control Administration, Atlanta, Ga.
David H. G. Gould.
In CLEAN WATER FOR THE NATION'S ESTUARIES, Proceedings of the Georgia Public Meeting, Jekyll Island, Georgia, February 29, 1968, pp 62-69.

Descriptors: *Economic impact, *Commercial fishing, *Recreation, *Georgia, *Commercial shellfish, Sport fishing, Animals, Aquatic animals, Aquatic life, Invertebrates, Shellfish, Mollusks, Marine animals, Benthos, Benthic fauna, Oysters, Clams, Fishing, Industries, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Geographical regions, Regions, Southeast U. S., Water sports, Shrimp, Crustaceans.

Georgia has 2344 miles of tidal shoreline with a larger estuarine area than any other state. The production of food for man and animal is twice that of the best farmland and 20 times that of the open sea. The estuaries support Georgia's commercial fisheries. Here are some statistics: (1) Average wholesale value of landings and manufactured product - $25 million. (2) Number of manufacturing plants - 57. (3) Number of employees of manufacturing plants - 2000. (4) Amount of commercial landings of fish and shellfish in 1965 - 20 million pounds. (5) Dockside value of commercial landings of fish and shellfish - $4,100,000. (6) The catch by species is: (a) Shrimp - 8,589,000 pounds. (b) Blue crabs - 10,215,000 pounds. (c) Oyster meals - 248,000 pounds. (d) Roe shad - 350,000 pounds. (e) Miscellaneous edible fish - 300,000 pounds. Recreation is also a significant factor in the economy of the Georgia coastal area. In 1960 approximately 167,000 persons participated in sport fishing, spending an average of $80 each.
W69-03671

'NUMERICAL SOLUTION OF THE UNSTEADY, ESTUARY DISPERSION EQUATION',
Stanford Univ., Calif.
Donald R. F. Harleman, Chok-hung Lee, and Lawrence C. Hall.
In PROCEEDINGS OF THE NATIONAL SYMPOSIUM ON ESTUARINE POLLUTION, August 23-25, 1967, pp 586-611.

Descriptors: *Mathematical models, *Tidal effects, *Fresh water, *Dispersion, Mathematical studies, Model studies, Water types, Flow profiles.

The purpose of this paper is to develop a mathematical model which accurately describes the advective (horizontal) motion (including the tidal and fresh water flow) and the longitudinal dispersion term for a variable estuary of arbitrary geometry. This extends previous studies which have assumed that the advective term is due solely to the fresh water discharge and which have ignored advection due to the tidal motion in an estuary. The model developed requires numerical solution procedures.
W69-03675

'ASPECTS OF THE ESTUARINE ECOSYSTEM',
National Security Industrial Association, Washington, D. C.
For primary bibliographic entry see Field 06G.
For abstract, see .
W69-03677

'FINITE-DIFFERENCE MODELLING OF RIVER AND ESTUARY POLLUTION',
Stanford Univ., Calif.
For primary bibliographic entry see Field 05A.
For abstract, see .
W69-03690

'STATEMENT',
Federal Water Pollution Control Administration, Atlanta, Ga.
C. E. Kindsvater.
In CLEAN WATER FOR THE NATION'S ESTUARIES, Proceedings of the Georgia Public Meeting, Jekyll Island, Georgia, February 29, 1968, pp 39-42.

Descriptors: *Resource development, *Estuarine environment, *Ecology, Water resources development, Resources development, Water pollution control, Control, Water pollution effects, Water pollution sources, Hydrologic aspects, Geologic investigations, Biocontrol, Control, Chemcontrol, Social needs.

Since there is much to be learned about the unique problems of an estuarine resources management program, a large part of such a program must consist of research. Estuarine development may be divided into the following research areas: (1) hydrologic, hydraulic, and geologic factors involved in the development of the physical characteristics; (2) biologic and chemical factors, which influence the physical as well as their ecological characteristics; (3) specific man-made pollutional factors and effects; and (4) socioeconomic and institutional factors resulting from man's occupance of estuarine regions and his utilization of their resources.
W69-03696

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

DESALINATION AND ITS ROLE IN WA SUPPLY.
British Information Service, London (England

London, England, Headley Brothers Ltd Pu 1967. 103p, 7 fig, 3 append.

Descriptors: *Desalination, *Thermal power *Nuclear powerplants, Water sources, supply, Water utilization, Research and de ment.
Identifiers: United Kingdom Atomic E Authority.

The use of desalination for water supply in Britain and elsewhere by British technology veyed. The topics covered in detail are avail of water, traditional methods of water supp irrigation, British achievements in water supp irrigation, desalination and other new so desalination methods, British achieveme desalination and desalination research development. Particular attention is given to the waste heat of electric power generati desalination, thus solving a water supply water pollution problem with the same proce napp-USGS)
W69-03351

THE LAKE TAHOE WATER RECLAM PLANT,
For primary bibliographic entry see Field 05
For abstract, see .
W69-03640

ENGINEERING AND ECONOMIC FEAS TY STUDY FOR A COMBINATION NUC POWER-DESALTING PLANT.

Report, Bechtel Corporation, San Fra California, January, 1966.

Descriptors: *Desalination, *Economic fea *Nuclear powerplants, *Electric power tion, *California, *Water costs, Fore Demineralization, Costs, Geographical Pacific coast regions, Regions, Sep techniques, Water purification, Water tre Feasibility, Electric powerplants, Engi structures, Industrial plants, Powerplants tures, Electric power, Southwest U. S.

This report presents results of a study to de the feasibility of a dual purpose electri generation and desalting plant for the Metro Water District of Southern California. Th concludes that 150 million gallons per desalted water can be produced by 1971 cost (undelivered) of 21.9 cents/thousand A critical analysis of this report has been Milliman. Reference to the Milliman pub also appears in this report bibliography.
W69-03658

3B. Water Yield Improvemen

GROUND-WATER RESOURCES OF COUNTY, WASHINGTON,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 0
For abstract, see .
W69-03224

RNATIONAL CONFERENCE ON WATER
EACE 1967.
imary bibliographic entry see Field 06B.
stract, see .
)3305

CONTINENTAL USE OF ARCTIC-FLOW-
IVERS,
ngton State Univ., Pullman; Washington
Research Center, Pullman; and Washington
Seattle.
imary bibliographic entry see Field 04A.
stract, see .
)3313

INFLUENCE OF RAINFALL INTERCEP-
ON STREAMFLOW,
astern Forest Experiment Station, Franklin,

imary bibliographic entry see Field 02I.
stract, see .
)3384

CTS OF SPECIES AND ARRANGEMENT
RESTS ON EVAPOTRANSPIRATION,
astern Forest Experiment Station, Franklin,

imary bibliographic entry see Field 02D.
stract, see .
)3386

ST TREATMENT EFFECTS ON WATER
,
astern Forest Experiment Station, Franklin,

Hibbert.
t from Proc. Int. Symp. Forest Hydrol., Penn
Univ 1965, 527-543, Pergamon Press, Inc.
ork, 1967.

ptors: *Evapotranspiration, *Vegetation ef-
*Water yield improvement, Water yield,
rshed management, Forest management, Re-
tion, Hydrologic aspects.
iers: *Forest treatments, *Experimental
heds, Logging (Forest).

s are reported for thirty-nine studies of the
f altering forest cover on water yield. Taken
ively, these studies reveal that forest reduc-
creases water yield, and that reforestation
ses water yield. Results of individual treat-
vary widely and for the most part are unpre-
e. First-year response to complete forest
ion varies from 34 mm to more than 450 mm
eased streamflow. A practical upper limit of
ncrease appears to be about 4.5 mm per year
h percent reduction in forest cover, but most
ents produce less than half this amount.
is strong evidence that in well-watered re-
at least, streamflow response is proportional
uction in forest cover. As the forest regrows
ng treatment, increases in streamflow
; the rate of decline varies between
ents, but appears to be related to the rate of
recovery. Seasonal distribution of stream-
sponse to treatment is variable; response in
flow may be almost immediate or con-
ly delayed, depending on climate, soils,
aphy, and other factors.
)3387

ORS AFFECTING THE RESPONSE OF
L WATERSHEDS TO PRECIPITATION
MID AREAS,
astern Forest Experiment Station, Franklin,

imary bibliographic entry see Field 02E.
stract, see .
)3388

RCEPTION BY EASTERN WHITE PINE,
astern Forest Experiment Station, Franklin,

For primary bibliographic entry see Field 02I.
For abstract, see .
W69-03391

TEST OF A TRANSPIRATION INHIBITOR OF A FORESTED WATERSHED,
Southeastern Forest Experiment Station, Franklin, N. C.; and Connecticut Agricultural Experiment Station, New Haven.
For primary bibliographic entry see Field 02D.
For abstract, see .
W69-03396

3C. Use of Water of Impaired Quality

A STATISTICAL STUDY OF SOME INDICES OF SALINE WATER IRRIGATED SOILS OF RAJASTHAN,
Udaipur Univ. (India). Agricultural Experiment Station.
K. V. Paliwal, and G. L. Maliwal.
Ann of Arid Zone, Vol 7, No 1, pp 127-131, March 1968. 5 p, 2 tab.

Descriptors: *Statistics, *Saline water, *Irrigation effects, Arid lands, Irrigated land, *Salts, Sodium, Electrical conductance, Hydrogen ion concentration, Alkaline soils, Gypsum, Cation exchange, Adsorption, *Soil chemical properties, Sampling, Conductivity.
Identifiers: Rajasthan (India).

Surface soil samples irrigated with saline water in Rajasthan, India, were examined to determine the interrelationship between pH, exchangeable sodium percentage, sodium adsorption ratio, gypsum requirement, electrical conductivity, and total salt concentration of the saturation extract. The results obtained were discussed in light of results reported by other workers. Electrical conductivity was found to be highly correlated with total soluble salts from the saturation extract. Correlation between the other factors, although statistically significant, was of low order. A knowledge of salt concentration of the upper surface soils irrigated with saline water is exceedingly important in adopting cultural practices, selecting suitable crop species, and in taking reclamation measures in arid lands. (Affleck-Ariz)
W69-03482

EFFECT OF SODIUM SALTS ON THE GROWTH AND MINERAL COMPOSITION OF BAJRA (PENNISETUM TYPHOIDES),
Udaipur Univ. (India). Agricultural Experiment Station.
Ram Deo, B. L. Baser, and D. V. S. Ruhal.
Ann of Arid Zone, Vol 7, No 1, pp 100-104, March 1968. 5 p, 1 tab.

Descriptors: *Sodium, Saline salts, *Salts, Salt tolerance, Nutrients, Alkaline soils, Crop response, Ions, Uptake, *Plant growth, Chlorides, Carbonates, Toxicity.
Identifiers: Rajasthan (India), Dry matter, *Bajra.

Bajra is the most important crop of Rajasthan, India, and is grown in regions of the state where soils are saline and alkaline. A pot experiment was conducted to determine the effect of sodium salts on dry matter production and uptake of nutrients (N, P, Ca, Mn, and Fe) by Bajra. The toxic effect of carbonate ions was always greater than the chloride and bicarbonate ions. Sulphate ions decreased growth to a lesser extent. Total uptake of nitrogen, phosphorus, and calcium decreased with increased concentrations of chloride, bicarbonate, and carbonate ions. Calcium content of the plant decreased as concentration of chloride, bicarbonate and carbonate ions increased, and was affected to the greatest extent by the chloride ions. At the higher concentrations of bicarbonate ions both iron and manganese decreased. (Affleck-Ariz)
W69-03483

3E. Conservation in Industry

EVALUATION OF ORGANIC COLOR AND IRON IN NATURAL SURFACE WATERS,
Geological Survey, Menlo Park, Calif.
William L. Lamar.
Geol Surv Res 1968, Prof Pap 600-D, pp D24-D29, 1968. 6 p, 3 fig, 2 tab, 12 ref.

Descriptors: *Surface waters, *Color, Organic acids, Iron, Colloids, Hydrogen ion concentration, Chelation.
Identifiers: Unsaturated organic compounds, Colloidal sols, Metallo-organic interactions.

Examination of organic color in natural surface waters revealed similarities in the complex color macromolecules extracted with n-butanol from stream waters in areas having pronounced differences in climatic conditions. The organic matter in the colored waters consists primarily of complex polymeric hydroxy carboxylic acids. Aromatic unsaturation also was observed. The infrared spectra of the predominant part of the organic matter were independent of the color intensity, pH, and mineral content of the water as well as the geographical location. Variable quantities of iron unrelated to the concentration and source of the organic matter are held in apparent solution by the complex organic acids. Preliminary results suggest that iron, probably as ferric hydroxide or oxide, forms colloidal sols with the organic matter. The sols vary considerably in particle size, and a relationship between particle size, pH, and iron concentration is indicated. (USGS)
W69-03558

THE ROLE OF INDUSTRIAL PROCESS CHANGES IN AFFECTING WATER REQUIREMENTS,
Washington, State Univ., Pullman. Bureau of Economic and Business Research.
For primary bibliographic entry see Field 06D.
For abstract, see .
W69-03599

3F. Conservation in Agriculture

WATER USE IN TENNESSEE, PART A-AGRICULTURAL WATER USE,
Tennessee Dept. of Conservation, Nashville. Div. of Water Resources.
For primary bibliographic entry see Field 06D.
For abstract, see .
W69-03323

WATER UTILIZATION IN GREENHOUSES: ALTERNATIVES FOR AGRICULTURE IN ARID REGIONS,
Colorado State Univ., Fort Collins, Dept. of Horticulture.
Joe E. Hanan.
Proc Annual Amer Water Resources Conf, pp 160-169, 1967. 10 p, 3 tab, 2 fig, 41 ref.

Descriptors: *Water utilization, *Arid lands, *Greenhouses, *Agriculture, Field crops, Crop production, Acreage, Evapotranspiration, Irrigation efficiency.
Identifiers: Gross return.

Water utilization in greenhouses was discussed in an attempt to compare its advantages with field crop agriculture. Water utilization in greenhouses was high due to a variety of factors; however, production was greatly increased. An attempt to compare gross return and return per acre-foot showed where gross return acre super 1 exceeded $1000 acre super 1, highly intensive crop production was in good position to compete for the water. (Affleck-Ariz)
W69-03486

ECONOMIC VALUE OF IRRIGATION WATER,
For primary bibliographic entry see Field 06B.
For abstract, see .
W69-03582

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on THE Surface

MAGNITUDE AND FREQUENCY OF FLOODS IN THE UNITED STATES,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02E.
For abstract, see .
W69-03225

DEPARTMENT OF NATURAL RESOURCES.
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-03255

POWERS OF THE DEPARTMENT OF PUBLIC WORKS AS TO PR PORT OF BOSTON HARBOR.

Mass Ann Laws, ch 91, secs 3, 4 (1967).

Descriptors: *Massachusetts, *Legislation, *Administrative agencies, *Harbors, Public lands, Shores, Tidal waters, Navigation, Piers, Railroads, State jurisdiction, Excavation, Transportation, Dredging, Industries, Ships, Beds, Water rights.
Identifiers: Boston.

The Department of Public Works of the Commonwealth of Massachusetts has all the rights, powers, and duties (transferred to the directors of the port of Boston under previous statutes) in respect to lands, rights in lands, flats, shores, waters, and rights belonging to the commonwealth in tide waters and land under water in Boston harbor. It may excavate and dredge in Boston harbor wherever public convenience and necessity require. The department shall have charge of all commonwealth lands fronting the harbor and the construction of piers and other public works in the harbor. The department shall undertake such work for the improvement, development, maintenance, and protection of Boston harbor as it deems reasonable and proper. This includes modifications to railroads existing at the port. (Watson-Fla)
W69-03259

DEVELOPMENT OF WATERFRONT FACILITIES - IMPROVEMENT AND PRESERVATION OF RIVERS, HARBORS, ETC.
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-03261

STRUCTURES THE DEPARTMENT OF PUBLIC WORKS MAY LICENSE TO BE ERECTED IN RIVERS AND STREAMS.
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-03262

PUBLIC ACCESS TO GREAT PONDS.

Mass Ann Laws ch 91, sec 18A (1967).

Descriptors: *Massachusetts, *Easements, *Great ponds, *Right of way, Legislation, Administrative agencies, Public lands, Public rights, Access routes, Recreation, Cities, Water supply, Municipal water, Industrial plants.

Upon petition of ten citizens of the Commonwealth of Massachusetts that in their opinion public necessity requires a right of way to any great pond within the commonwealth, the Department of Public Works and the attorney general, or a representative designated by him, sitting jointly, shall hold a public hearing and receive all evidence presented. The joint board may make such additional investigation as it deems desirable, and if it appears to the board that a right of way already exists, it shall present a petition to the land court for registration of the easement. If it appears that no right of way exists, it shall submit a report, together with recommendations, to the general court on or before January 1 of the following year. This section does not apply to any body of water used as sources of water supply by the commonwealth or any town, district, or water company. Neither shall it affect or diminish any existing right to the use of the water of any pond for mercantile or manufacturing purposes. (Watson-Fla)
W69-03265

STRUCTURES IN GREAT PONDS RESTRICTED - LOWERING WATERS REGULATED - SUPERVISION OF ERECTIONS - COMPENSATION FOR TIDE WATER DISPLACED.
Mass Ann Laws ch 91, secs 19-21 (1967).

Descriptors: *Massachusetts, *Legislation, *Great ponds, *Structures, Permits, Dams, Public lands, Administrative agencies, Construction, Pile driving, Landfills, Encroachment, High water mark, Excavation, Tidal waters, Compensation, Industrial plants, Agriculture, Irrigation, Water supply, Insect control.

Generally in Massachusetts, by statute, no structure may be built or extended, piles driven, land filled, or any other obstruction or encroachment made, in, over or upon the waters of any great pond below the natural high water mark. Any of the above encroachments may be made only after attaining a license from the Department of Public Works. A person authorized or licensed to make an encroachment of the waters of a great pond may lower the water level of that pond only after receiving the permission of the Department of Natural Resources. Furthermore, a person who has a license or authority to erect a structure, drive piles, or fill land in the waters controlled by the Department of Public Works may not proceed to do so until he has submitted his plans to the department and received its approval. The amount of tide water displaced by any structure below the high water mark, or any filling of flats, shall be ascertained by the department, which shall require the persons who cause such displacement to make compensation therefor by excavating, under its direction, between the high and low water mark in some part of the same harbor, a basin for a quantity of water equal to that displaced. In lieu of excavation, a payment to the commonwealth of an amount assessed by the department may be made. (Watson-Fla)
W69-03266

ADDITIONAL COMPENSATION WHEN TITLE TO LAND IS IN THE COMMONWEALTH - UNAUTHORIZED ERECTIONS IN TIDE WATER TO BE PUBLIC NUISANCES.
Mass Ann Laws ch 91, secs 22-28 (1967).

Descriptors: *Massachusetts, *Compensation, *Permits, *Encroachment, Legislation, Tidal waters, Public lands, Administrative agencies, Docks, Landfill, Construction, Excavation, Great ponds, Bridges, Highways, Banks, Rivers, High water mark, Harbors, Abatement, Structures, Pile driving, Cities, Connecticut, Financing, Hunting.

If authority or a license is granted by the general court or by the Department of Public Works of the Commonwealth of Massachusetts to a person to build a wharf or other structure upon, or to fill or otherwise occupy, land in tide water, or to build or extend any structure or drive piles, fill land or make any obstruction, encroachment, or excavation over or upon the waters of any great pond, he sh before the work is begun, pay to the commo wealth such compensation for the rights granted any land, the title to which is in the commonwea The amount of compensation shall be determi by the governor and council. All money receiv from licenses and permits, displaced water, a rights in the commonwealth land received un this chapter goes into the general fund as ordi revenue. Any unauthorized erection or one conforming to the license in waters controlle the department are deemed to be public nuisanc This chapter shall not legalize any structure, fi or other occupation or encroachment, w without authority, upon the waters of any g pond prior to May 9, 1888 or in the Conn R below the high water mark prior to April 13, 1 The powers and duties of the department rela to Province lands are also outlined. (Watson-Fla
W69-03267

COUNTIES, CITIES, AND TOWNS MAY PROPRIATE MONEY FOR IMPROVEMENT WATERWAYS.
Mass Ann Laws ch 91, secs 29-29A (1967).

Descriptors: *Massachusetts, *Administra agencies, *Construction, *Cities, Legislation, T waters, Water law, Structures, Banks, Riv Financing, Harbors, Streams, Intertidal ar Shores, Beaches, Damages, Easements.

A county or town of the Commonwealth of M may appropriate money for the improvemen tidal and non-tidal rivers and streams, harbors, waters, foreshores, and shores along a public be within its jurisdiction, or for the constructio structures for the protection of private prop along shores within its boundaries. Money so propriated is paid to the state treasurer and pended by the Department of Public Works such purposes within the limits of the count town. The county or town assumes liability fo damages to property by reason of any takin land, or of any right, interest, or easement in land, within the county or town by the departm for the project. (Watson-Fla)
W69-03268

PROHIBITION OF REMOVAL OF GRA ETC, FROM BEACHES REMOVAL OF NA RAL BARRIERS FROM EROSION BY THE PENALIZED.
Mass Ann Laws ch 91, secs 30, 30A (1967).

Descriptors: *Massachusetts, *Tidal wa *Shores, *Beaches, Legislation, Administra agencies, Water law, Banks, Rivers, Har Navigable waters, Gravel, Sands, Sand Islands, Trees, Shrubs, Grasses, Vegeta Oceans, Erosion, Cities.

The Department of Public Works of the Com wealth of Massachusetts is empowered to pro by written notice, the digging or removal of st gravel, sand, or other material or the destructi any trees, shrubs, grass, or other vegetation o beach, shore, bluff, headland, island, or bar bordering on tide waters if it appears tha removal or destruction is injurious to any harb other navigable tide waters. The removal of st gravel, sand, or other material from any na barrier which protects the adjacent upland ag erosion by the sea is prohibited. (Watson-Fla)
W69-03269

LEAKE V RICHARDSON (TITLE TO PO BY ADVERSE POSSESSION AND PRESC TION).
199 Va 967, 103 SE 2d 227-240 (1958).

Descriptors: *Virginia, *Ownership of *Prescriptive rights, Boundary disputes, Ju decisions, Beds, Riparian land, Riparian w Ponds, Lakes, Fishing, Riparian rights, Lake Legal aspects.

iers: *Adverse possession.

ff filed suit to quiet title, and alleged that she
er predecessors in title acquired title to a
ond by adverse possession, and that she also
ed exclusive fishing rights in the pond by
ption. The court stated that where owner-
a fresh water pond or stream surrounded by
f different persons, whose titles as riparian
include the land under the water to such
r stream, is claimed by adverse possession,
s of ownership must indicate a change of
on, showing a notorious claim of title, ac-
nied by the essential elements of adverse
ion. The acts relied on must show actual,
exclusive and continuous possession for the
ry period, and must be of such notoriety that
ual owner either has knowledge or may be
ed to know of the adverse claim. These
cts are necessary to obtain exclusive fishing
by prescription. The court found that the
sserted by the plaintiff were not necessarily
g more than the assertion of a right held in
n; there was no change in the condition of
d that affected the rights of the defendants,
s there actual possession of the waters of the
The court held that the plaintiff's claims of
rough adverse possession and exclusive fish-
hts through prescription were unfounded.
Fla)
3279

V STODDARD (DIRECTING RUNOFF TO AGE DITCH).

/ 2d 374-379 (Ct App Mo 1958).

tors: *Missouri, *Drainage, *Ditches,
s, Drainage districts, Judicial decisions,
e rights, Watercourses (Legal), Land recla-
, Laterals, Drains, Roads, Runoff, Surface

f and defendant owned adjoining farms,
which were part of the same drainage and
ation district. A main drainage ditch ran
heir eastern property line, and alongside the
n a public road. Under the drainage district
reclamation dirt from the ditch was placed
road, thereby raising its level and making it
evee. Other runways and ditches led surface
lations to the main ditch. Defendant later
levee on his own property that directed sur-
noff into the main ditch. The defendant's
nded within a few feet of the road-levee.
f sued for damages, claiming that defen-
private levee accumulated and unnaturally
water from defendant's farm into, through
er the road and onto his farm. The court
hat the roadway ditch into which defendant
d water was already a drainage district
ourse. Under the applicable statute, any per-
s permitted to construct lateral ditches,
r levees for the purpose of draining water
y of the watercourses constructed by a
e district. The court further held that the
f directors of the district acted within the
f their powers when they cleaned out the
tch and placed the dirt on the public road-
cott-Fla)
3280

OF MIAMI SPRINGS V LAWRENCE AGES FROM FLOODING).

2d 143-147 (Fla 1958).

tors: *Florida, Judicial decisions, *Over-
Impoundments, Impounded waters,
ges, Roads, *Obstruction to flow, Natural
ctrine, Diversion, Legal aspects.

f sued the defendant municipal corporation
nages allegedly resulting from the overflow
pounding of surface waters on plaintiffs'
aused by a raising of the elevation of the
djoining plaintiffs' property by the defen-
he court stated that liability could be im-
for damage caused by overflow resulting from an artificial construction or obstruction, and a new action could be maintained for each successive overflow or flooding. The court found that the flooding constituted a 'continued wrong' against the plaintiff, and awarded temporary damages for past injuries. Since each flooding constituted a new cause of action, plaintiffs' suit was not barred by the statute of limitations. (Scott-Fla)
W69-03284

BURAS ICE FACTORY, INC V DEPARTMENT OF HIGHWAYS (EASEMENTS TO CANALS).
235 La 158, 103 So 2d 74-84 (1957).

Descriptors: *Louisiana, *Easements, *Canals, Judicial decisions, Right-of-way, Roads, Navigation, Eminent domain, Legal aspects.

Defendant, the state highway department, constructed a dirt embankment across a canal for supporting a paved road. This was done under a grant from the owner of the canal. The construction effectively prevented navigation to and from the head of the canal, where plaintiff owned and operated an ice business. Plaintiff brought suit for damages, asserting that the ice plant was rendered a total loss and the value of the lot was greatly depreciated. A prior owner of the canal had also owned the ice plant, and some time ago had sold the plant to the plaintiff's predecessor in title. An easement was granted at that time from the ice plant to the canal, said easement crossing other land owned by the vendor. The court held, however, that the servitude of passage through the canal by the plaintiff is of the discontinuous type, which can be granted only by title, needing for its exercise the act of man. The court held that the easement granted only a way of ingress and egress with respect to the ice factory and the canal's upper bank; it did not grant right to use the canal itself. The court also held that the facts did not establish that a public way had been created through dedication to a public use, even though in some instances public ways may be created in such a manner. (Scott-Fla)
W69-03286

LEHIGH VALLEY RR V THE RUSSELL NO 1 (LIABILITY FOR DAMAGE CAUSED BY SUBMERGED PILINGS).
163 F Supp 459-463 (EDNY 1958).

Descriptors: *New York, Judicial decisions, United States, Ships, Damages, Canals, Piles, *Hazards, *Navigation, Bulkheads, Cities, *Admiralty, Legal aspects.
Identifiers: Towage, *Navigation obstruction.

The owner of the L V 476 brought this action for damages sustained by reason of the negligence of the Tug Russell No 1 while being towed by her. The City of New York has been impleaded with the claim being that the accident occurred because of the negligence of the city in failing to maintain the bulkhead and cribbing on its property in such condition as would prevent obstructions in and of the adjoining navigable waters. The court found that there was negligence in the operation of the tugboat in that the tugboat was operated outside the channel and close to the submerged pilings of an old city dock. The court also found the city negligent in failing to maintain its property so as not to be a hazard to navigation because submerged pilings were not removed. The city was held liable to the tugboat owner for the sum it was required to pay to the vessel owner for damages to the vessel and loss or damage to its cargo. (Scott-Fla)
W69-03287

DRAINAGE OF HIGHWAY.

N C Gen Stat sec 136-21--136-24 (1964).

Descriptors: *North Carolina, *Highways, *Drainage, *Cost allocation, Legislation, Excavation, Canals, Surplus water, Right-of-way, Benefits.

Whenever it becomes necessary to drain any highway by excavating canals to carry the surplus water, and by such excavation, lands other than said highway will be benefited, procedures are established for apportioning the cost of excavation of such canal between the highway authorities and the benefited landowners. (Childs-Fla)
W69-03288

HAYES V BOWMAN (RIPARIAN RIGHTS ON NAVIGABLE WATERS).
91 So 2d 795-803 (Fla 1957).

Descriptors: *Florida, *Ownership of beds, *Riparian rights, *Riparian land, Judicial decisions, Tidal waters, Navigation, Fishing, Swimming, Dredging, Bulkheads, Landfills, Channel, Riparian waters.
Identifiers: *Unobstructed view.

This was a suit for a declaratory judgement involving alleged riparian rights of the parties in tidal waters of Boca Ciega Bay. Appellants contended that as upland owners of land bounded by navigable waters they enjoy certain common-law riparian rights to an unobstructed view of the Bay, as well as a right of ingress and egress to and from their land over the waters of the Bay to and from the channel. Except for statutory variations, the state holds title to lands under navigable tidal waters and the foreshore. As at common law, this title is held in trust for the people for the purposes of navigation, fishing, bathing and similar uses. Such title is not held primarily for the purpose of sale. However, the State may dispose of submerged lands under tidal waters to the extent that the public right will not be infringed. Moreover, any person acquiring any such lands from the State must not interfere with the recognized common-law riparian rights of riparian owners, eg, unobstructed view, ingress and egress over the foreshore to and from the water. These riparian rights must be preserved over an area 'as near as practicable' in the direction of the channel so as to equitably distribute the submerged lands. Riparian rights do not extend over an area measured by lines at right angles to the channel, and the area cannot be defined with mathematical exactitude. The court affirmed the chancellor's ruling adverse to the appellants, noting, however, that if the appellees' proposed fill had blocked the view to the channel, the appellants might have had substantial grounds for complaint. (Childs-Fla)
W69-03290

PAYNE V HAZARD COCA COLA BOTTLING WORKS (ACTION TO ENJOIN OBSTRUCTION TO NATURAL FLOW OF WATER).

294 S W 2d 522-525 (Ct App Ky 1956).

Descriptors: *Kentucky, Judicial decisions, *Obstruction to flow, *Seepage, Cities, Flood damage, *Sewers, Storm drains, Storm runoff, Legal aspects, Subsurface runoff.

This was an action to enjoin defendant from obstructing the natural flow of water between plaintiff's building and a lot belonging to the defendant. Defendant had blocked a storm sewer constructed by the city which emptied onto his vacant lot. This prevented the water from flowing over the lot to the river. The court held that to support the injunctive relief sought, proof that the actions of the defendant caused the seepage into plaintiff's building was sufficient. (Childs-Fla)
W69-03291

NIMMONS V CITY OF LA GRANGE (ACTION BY LAND OWNER FOR FLOODING CAUSED BY CITY'S ROAD CONSTRUCTION).
94 Ga App 511, 95 SE 2d 314-318 (1956).

Descriptors: *Georgia, *Flood damage, *Road construction, *Obstruction to flow, Judicial decisions, Cities, Paving, Surface waters, Stagnant pool, Legal aspects, Surface drainage.

Plaintiff brought this action for damages against the city of La Grange which paved and curbed the street in front of plaintiff's property. It was alleged that these actions caused an obstruction to the natural drainage from the property resulted in the retention of excessive amount of water on the property. Plaintiff seeks recovery for the damage caused by the formation of a stagnant pool of water. The Court of Appeals held that a cause of action was stated for damages resulting from the continuous maintenance of a nuisance. The correct measure of damages was held to be an amount such as would reasonably compensate the realty owner for the hurt, inconvenience, and damage to the use and enjoyment of property. (Child-Fla)
W69-03293

MESSINGER V TOWNSHIP OF WASHINGTON (DRAINAGE LICENSE).
185 Pa Super 554, 137 A 2d 890-895 (1958).

Descriptors: Judicial decision, *Pennsylvania, Legal aspects, *Permits, Easements, *Surface drainage, Cities, Drainage effects, Ditches, Drains, Diversion, *Alteration of flow, Pipes.

Plaintiffs sought to enjoin town from diverting water onto their land. Plaintiffs' predecessor in title gave oral permission to defendant to construct drainage facilities on his land which would cause water to flow onto certain portions of the land. When plaintiffs purchased the property they were unaware of the drain pipe until after partial completion of their house. The discharge from the drain interfered with passage to and from the house. The court held that the license granted to defendant need not be in writing and is binding even though gratuitous. The license became irrevocable after the defendants expended money in reliance on it. (Molica-Fla)
W69-03295

EXISTING RIGHTS AND REMEDIES PRESERVED; LIMITATIONS.
N Y Conserv Law sec 441 (McKinney 1967).

Descriptors: *New York, *Legislation, *Water resources, Administration, Legal aspects, *Riparian rights, Projects, Project planning, Public rights.

Part V does not change, alter, impair, or enlarge, any riparian or other rights or remedies available to any person, state agency, or public corporation with reference to water resources and use of such waters before passage of the article. It does not alter in any way the jurisdiction of any entity as it existed before passage of the Act. Part V does not require that a regional plan involving water resources be approved before a regional project may be carried out. (Molica-Fla)
W69-03297

WATER SUPPLY (STORAGE AND RELEASE OF WATERS).
N Y Conserv Law sec 801 (McKinney 1967) art 4 secs 4.1, 4.2.

Descriptors: *Delaware River Basin Commission, Legislation, *Interstate compacts, State governments, Water policy, *Water supply, Surface water, Ground water, Regulated flow, Public health, Quality control, Diversion, Legal aspects.

The Commission has authority to develop and implement plans and projects for the use of waters of the basin and for that purpose it may provide for and maintain dams and other facilities. For specified purposes, the Commission may operate and control facilities for the storage and regulation of flow of surface and ground waters of the basin. (Molica-Fla)
W69-03301

FLOOD PROTECTION.
N Y Conserv Law sec 801 Art 6 sec 6.1, 6.2, 6.3 (McKinney 1967).

Descriptors: *Delaware River Basin Commission, Administrative agencies, *Interstate compacts, State governments, Water policy, *Flood protection, Legal aspects, Public health, *Flood control, Flood plains, Flood plain zoning, Flood routing.

The Commission has authority to construct and maintain facilities for flood damage reduction. The Commission may delineate the areas of the basin subject to flood, and after a public hearing, it may establish standards for flood plain use relative to the risk of flood within the areas. The Commission may acquire land or any interest therein for the purpose of restricting the use of such property to minimize flood hazard. (Molica-Fla)
W69-03302

INTERNATIONAL CONFERENCE ON WATER FOR PEACE 1967.
For primary bibliographic entry see Field 06B.
For abstract, see .
W69-03305

THE CONTINENTAL USE OF ARCTIC-FLOWING RIVERS,
Washington State Univ., Pullman; Washington Water Research Center, Pullman; and Washington Univ., Seattle.
E. R. Tinney.
Proc Seminar on Arctic Drainage Basin, Pullman, Washington, Apr 1 to May 20, 1968, 176 p, 1968. 9 chapters, 9 fig, 5 map.

Descriptors: *Planning, *Water resources development, *United States, *Inter-basin transfers, Legislation, Legal aspects, Political aspects, Water allocation (Policy).
Identifiers: *North America, *Canada, International water transfers, International water resources development.

The water resources of the arctic drainage basins of North America and the political encouragements and hindrances to their general continental redistribution in both the U. S. and Canada are surveyed in a symposium. Individual papers cover the political and social relationships between the U. S. and Canada, continental water engineering, Alaska's water resources, Canada's water resources, Canadian water resource management, a brief review of the first (U. S.) National Assessment of Water Resources, future U. S. water resource development, economics of massive inter-basin water transfers, and planning for massive water resource development. (Knapp-USGS)
W69-03313

HYDROLOGY AND RESERVOIR CONTROL ON THE WISCONSIN RIVER BASIN,
Robert F. Carlson, Donald G. Watts, Gerald J. Stadler, and A. J. MacCormick.
Univ of Wisconsin, Madison, Water Resources Center, 1968.

Descriptors: *Hydrology, *River basins, *Wisconsin, *Reservoir operation, Simulation analysis, Mathematical models, Data collections, Bibliographies.
Identifiers: *Wisconsin River.

Studies deal with quantities of natural flow, hydrology, and their control by reservoir operation. The main concerns are with water quantity, but, as a sign of the times, not with quantity for its own sake but as a means of achieving a measure of control over water quality. Authors state that studies detailed by them are part of a more comprehensive program being carried on through the Water Resources Center, University of Wisconsin, Madison. The overall program is intended to determine what advantages are to be gained by a regional approach to water quality management and to assess the means by which regional management may be implemented. The report consists of five parts, described as follows: Part I, a selected bibliography on hydrological control by reservoir operation; Part II, an extended analysis, treated by digital simulation, of a water storage reservoir syst (Wisconsin River basin), Part III, a brief set notes, 'On Reservoir Networks,' describing a s ple mathematical model; Part IV, 'Linear Rand Models of Annual Streamflow Series,' a detai treatment of non-seasonal time series; and Part documenting and describing disposition of c collections used in the studies. Bibliography c tains 66 entries. (See also W69-03376--W 03380). (Eichhorn-Wisc)
W69-03375

SELECTED BIBLIOGRAPHY ON HYDROLO CAL CONTROL BY RESERVOIR OPERATIC
Robert F. Carlson, Donald G. Watts, Gerald J. Stadler, and A. J. MacCormick.
Hydrology and Reservoir Control on the Wisco River Basin, Pt I, 1968. 6 p.

Descriptors: *Bibliographies, *Hydrology, *Re voir operation, *River basins, Documenta Wisconsin, River forecasting, Rivers.
Identifiers: *Wisconsin River.

This bibliography of 66 entries bears on the sul of hydrology and its control by reservoir opera Included also are references primarily relate the Wisconsin River Basin. Citations are no haustive, but the list contains material cons during preparation of the parent report. (See 03375). (Eichhorn-Wisc)
W69-03376

ANALYSIS OF A WATER STORAGE RE VOIR SYSTEM,
Gerald J. Stadler.
Hydrology and Reservoir Control on the Wisc River Basin, Pt II, 1968. 132 p, 25 fig, 7 tab, 2

Descriptors: *Hydrology, *Mathematical m *Reservoir operation, *River basins, *Simu analysis, Computer models, Computer prog Continuity equations, Hydraulics, Reser River forecasting, Rivers, Statistical met Streamflow, Systems analysis, Water q Wisconsin.
Identifiers: *Wisconsin River, Linear regres Eau Pleine Reservoir Group (Wis), Ra Reservoir Group (Wis), Rice Reservoir (Wis), Spirit Reservoir Group (Wis).

A digital computer model for analysis o Wisconsin River reservoir system is develop the model, a set of continuity equations defi reservoir system. Solution of the set of equ provides information relative to reservoir c changes in storage of the reservoirs, and s flows at various locations in the basin. Mo counts for flexible reservoir conformation reservoir operating procedures. A sta method estimates the flows from ungaged Experimental solutions with historical data v the model in the sense that actually me reservoir contents were reproduced with fai racy. Author designed his model to si Wisconsin River system in studies of water control, but, with appropriate adjustments plies to other similar reservoir systems. Re cludes appendices covering notation, defi glossary of symbols used in computer progra printouts of Wisconsin River basin program linear regression program. (See W69-((Eichhorn-Wisc)
W69-03377

ON RESERVOIR NETWORKS,
Robert F. Carlson.
Hydrology and Reservoir Control on the W River Basin, Pt III, 1968. 10 p, 2 fig, 1 ref.

Descriptors: *Mathematical models, *N *Simulation analysis, *Reservoir operatio tinuity equations, Hydrology, River fore Systems analysis.
Identifiers: Graph theory, Matrix theory, T

simple mathematical model is described which y be used as an aid in the solution of problems aling with reservoir networks. The main feature the model is that it permits the description of her complicated arbitrary networks as simple trices. Author used the numerical solution of the crete continuity equations for reservoir net- rks to illustrate application of the model. The re- t includes three cases as examples: (1) recon- uction of releases - given the amount of water red in a reservoir (S (t)) and local inflow into reservoir (i (t)), both as a function of time, the ount of water released from a reservoir (r (t)) as nction of time is found; (2) reconstruction of ows - given a history of r (t) and S (t), i (t) is nd; and (3) computation of storage - given i (t),) and S (t), water storage in the reservoir at next sequent interval of time is found. (See W69- 75). (Eichhorn-Wisc)
9-03378

EAR RANDOM MODELS OF ANNUAL REAMFLOW SERIES,
ert F. Carlson, A. J. MacCormick, and Donald Watts.
drology and Reservoir Control on the Wisconsin er Basin, Pt IV, 1968. 55 p, 12 fig, 2 tab, 16 ref.

criptors: *Mathematical models, *Simulation lysis, *Systems analysis, Hydrology, Parametric rology, Rivers, River forecasting, Stochastic cesses, Streamflow, Streamflow forecasting, e series.
ntifiers: *Linear random models, Autocovari- e functions, Missouri River, Neva River, Niger er, Non-stationary processes, St. Lawrence er, Transfer functions.

ear random models of time series are eloped. Parametric models fitted to four annual amflow series (St. Lawrence, Missouri, Neva Niger Rivers) illustrate the theory and the hod of application of the models. An itetive cedure of identification, estimation, and diag- ic checking permitted the estimation of model ameters from the data series. The method cribed leads to models with few parameters and straightforward applications to forecasting. W69-03375). (Eichhorn-Wisc)
9-03379

EAMFLOW AND PRECIPITATION DATA EX,
ald J. Stadler.
rology and Reservoir Control on the Wisconsin r Basin, Pt V, 1968. 6 p, 1 tab.

criptors: *Wisconsin, *Data collections, eamflow, *Rainfall, River basins, Data essing, Gaging stations.
tifiers: *Wisconsin River, US Geological Sur- US Weather Bureau, Univ. of Wisconsin.

amflow records through year 1960 for 83 sta- s located on streams tributary to the Wisconsin r, have been deposited with the Department of Engineering, The University of Wisconsin, in form of computer cards and magnetic tape. e is in the standard format of the US Geological ey. Each computer card lists: (1) number of ng station, (2) year of record, and (3) monthly amflow record for the year. Gaging station bers and locations are tabulated in the report. y rainfall records (January 1964 - June 1966) transferred to magnetic tape from surplus cards furnished by the US Weather Bureau. tape has also been deposited. A catalog of the is available. (See W69-03375). (Eichhorn-)
9-03380

IVERSION OF GULLIES TO VEGETATION- ED WATERWAYS ON MOUNTAIN PES,
ky Mountain Forest and Range Experiment on, Fort Collins, Colo.
hard H. Heede.

U S Department of Agriculture, Forest Service, Research Paper RM-40, pp 11, 1968. 11 p, 1 fig, 4 photo, 3 tab, 7 ref.

Descriptors: *Gully's erosion, *Grassed waterways, *Rocky Mountains, Erosion control, Soil conservation, Gullies, Vegetation establishment, Slope stabilization, Colorado, Surface runoff, Water conveyance.

Four gullies were successfully converted to waterways on slopes of the Rocky Mountains in Colorado. Three years after treatment, they had lost only 9 percent as much soil as comparable untreated gullies. Careful engineering survey and design, close construction supervision, and good response to revegetation measures were responsible for the success. Since limits of applicability could not be established, the method is proposed for application on sites comparable to those of the sudy area.
W69-03406

JERUZAL V HERRICK (STATUTORY AUTHORITY OF DRAIN COMMISSIONER).
350 Mich 527, 87 NW 2d 122-126 (1957).

Descriptors: *Michigan, *Drainage system, *Sewers, *Legislation, Judicial decisions, Storm drains, Surface runoff, Surface waters, Jurisdiction, Administrative agencies, Public health, Remedies, Projects, Legal aspects, State governments, Local governments.
Identifiers: Mandamus.

A statute authorized the county drain commissioner to construct drains, and listed in its definition of 'drain' the term, 'any sewer.' The commissioner proceeded with the planning and financing for a sanitary sewer for an area within the county. The commissioner stopped the proceedings until the legal question of whether he had authority to construct this sewer could be determined. The problem concerned the definition of 'drain' under the statute, and specifically, whether it included the system designed solely as a sanitary sewer, completely closed to surface or storm water drainage. Interested property owners filed application for a writ of mandamus to direct the commission to install the sewer. The court issued the writ, ruling that there was nothing in the language of the statute to preclude the commissioner from installing this particular sewer system. (Wheeler-Fla)
W69-03426

HUDSON V VILLAGE OF HOMER (RIGHT TO REMOVE DAM).

351 Mich 73, 87 N W 2d 72-78 (1957).

Descriptors: *Michigan, *Drainage programs, *Prescriptive rights, *Mill dams, Judicial decisions, Drainage, Backwater, Water law, Riparian land, Riparian rights, Public rights, Drainage districts, Administrative agencies, Recreation, Dams, Ponding, Ponds, Legal aspects, Local governments, Fishing.

Owners of a dam proposed to convey the dam to a county drainage board. The dam, constructed about one hundred years prior to this action, created a pond which extended into a village. The pond followed the natural bed of a stream, and current through the pond was perceptible. The drainage board wished to remove the dam, and with it the pond, in order to improve the drainage of district lands. The village contended that the pond had been generally used for public and riparian boating, bathing, fishing, and hunting, and that such use had continued without interruption for such an extended period of years as to result, by estoppel and prescription, in the acquisition of public and riparian rights against the dam owner. The board filed a bill for declaratory relief to ascertain whether these contentions were sound before proceeding with the project. The lower court ruled that the board had the right to remove the dam. The appellate court affirmed, and pointed out that those people using a mill pond for recreational and riparian purposes are continuously charged with notice that the pond is artificial and that its level may be lowered or returned to its natural state, by the owners, at any time. (Wheeler-Fla)
W69-03427

DEMOSKI V STATE (CLAIMS AGAINST STATE ATTRIBUTED TO FLOOD PROTECTION PLAN).
168 NYS 2d 242-250 (Ct Cl 1957).

Descriptors: *New York, *Legislation, *Federal government, *Bank erosion, Judicial decisions, Legal aspects, Channel improvement, Erosion control, Flood protection, River basin development, Appropriation, Easements, State governments, Retaining walls, Banks, Damage.
Identifiers: Negligence, The Flood Control Act of 1936.

Plaintiff claims damages against the state due to its negligence in allowing defective flood protection project to damage plaintiff's retaining wall and erode his river bank. Plaintiff had built and maintained a retaining wall which had protected its adjoining land from high water erosion prior to 1956. Pursuant to the Flood Control Act of 1936 (U S Code, tit 33, ch 15) and state legislation (L 1936, ch 862, as amended McK Unconsol - Laws, sec 1301 ct seq) the State gained temporary possesion of claimants' lands in order to remove shrubs and debris from the river shoreline. Contractors of the State removed all shrubs and uprooted trees to complete the flood protection project. Subsequently in 1956 highwaters eroded claimants' bank, destroyed his retaining wall and damaged his property improvements. The court held that the State had a non-delegable duty to see that any work done on claimants' land pursuant to flood protection plan would not in the natural course of events cause injury to such land. Since provisions against erosion were not taken, claimant was awarded damages based upon the lesser of restoration costs or dimunution of property.
W69-03430

CONSTRUCTION AND DEVELOPMENT OF EXCESS DRAINAGE FACILITIES - CONTRACTS.

N Y Gen Mun sec 119c-d (McKinney 1965).

Descriptors: *New York, Legislation, *Cities, Drainage, *Drainage districts, Disposal, Construction, *Excess water, Sub-surface waters, Surface waters, Storm runoff, Contract, Legal aspects, Conveyance structures, Rates, Local governments.
Identifiers: Counties.

A municipality or county, on behalf of its drainage district, may, in addition to its other powers with respect to construction and development of drainage facilities, provide for the construction and development of capacity in excess of its own needs in order to convey and dispose of storm waters and other surface and sub-surface water collected by another public corporation and may contract indebtedness for such purpose. Section 119-d allows a municipality authorized to construct drainage facilities in excess of its own needs to enter into contracts for such purpose as long as they do not exceed 40 years. The contracts can contain provisions for the establishment and revision of charges for conveyance of disposal of the water collected and for adjudication of disputes. (Shevin-Fla)
W69-03431

REGULATION OF OPEN WELLS, CESSPOOLS, BASINS OR SUMPS.

N Y Gen Mun sec 99 328-329 (McKinney 1965).

Descriptors: *New York, Legislation, *Cities, Wells, Well screening, *Well regulation, Cesspools, Sumps, Basins, *Construction, Regulation, Legal

aspects, Cities, Local government, Administrative agencies.
Identifiers: Open wells, Fencing.

Section 99, regulation of open wells, cesspools, basins, or sumps, provides that the governing board of a municipality may regulate, by local law, ordinance or resolution, the construction and maintenance of open wells, cesspools, basins, or sumps. They may require that the installations be adequately covered or surrounded by protective fencing. The local authorities shall establish the penalties for violation of the ordinances. However, this statute does not deprive the state water power and control commission of any jurisdiction they now or hereafter have pursuant to the conservation law. (Shevin-Fla)
W69-03432

GRIFFITH V HURT (JOINDER OF PARTIES IN SUIT FOR DAMAGES CAUSED BY OBSTRUCTION TO FLOW).

291 S W 2d 271-273 (Tenn 1956).

Descriptors: *Tennessee, Judicial decisions, Damages, *Flooding, *Obstruction to flow, Natural flow, Streams, Diversion, Legal aspects.
Identifiers: Nuisance.

This was a suit by the owners of separate farms for an injunction against maintenance of a nuisance in interfering with the flow of waters and for resulting damages. The court held that two or more persons may unite in a bill to enjoin a nuisance, although their lands are separate and distinct, where the lands are affected in substantially the same way, but there may not be such joinder for separate and individual resulting damages. (Childs-Fla)
W69-03434

LEEK V BRASFIELD (WRONGFUL FAILURE TO PERMIT DAM REPAIRS).

290 S W 2d 632-636 (Ark 1956).

Descriptors: *Arkansas, Judicial decisions, Dams, Legal aspects, Canals, Drainage systems, Drainage water, Drainage programs, *Rain water, *Dam failure, Dams, Administrative agencies, *Flood damage, Rain, Floods.
Identifiers: Wrongful conduct, Upper landowner, Lower landowner.

Plaintiff's land was situated below defendant's farm on a drainage canal constructed by the drainage district. The district, many years before this action, had constructed a dam which diverted creek water into the canal. In 1953, some unknown person cut the dam, thus exposing the plaintiff's land to flood danger. Plaintiff asked the drain commissioners to repair the dam, who then authorized employment of a contractor to make the repairs. Defendant prevented the contractor from beginning the work by threatening to tie up his equipment in court. A month later, heavy rains caused flooding to plaintiff's land. Plaintiff sued the upper landowner for damages, and the trial court allowed recovery. The appellate court affirmed, ruling that the issue of the upper landowner's liability was a question for the jury. Defendant argued that the contractor's attempt to repair was illegal, but the court ruled that the district was authorized by law to repair its drainage system. The court held that the wrongful act of preventing repair was just as injurious as the wrongful act of cutting. A dissenting opinion was based upon the feeling that the verbal threat of filing a lawsuit against the contractor was insufficient action by which to be held liable for the resulting damage. (Wheeler-Fla)
W69-03435

DRAINAGE DISTRICT NO 48 OF DUNLIN COUNTY V SMALL (NUISANCE ACTION BY DRAINAGE DISTRICT TO ABATE PRIVATE LEVEE).

311 S W 2d 29-41 (Ct App Mo 1958).

Descriptors: *Missouri, *Levees, *Abatement, Judicial decisions, Flood control, River regulation, Competing uses, Relative rights, River basins, Flood plains, Navigable rivers, Drainage districts, Easement, Swamp.

In a suit by the plaintiff drainage districts against the defendant landowners, the districts sought to have a private levee declared a nuisance and asked for its abatement. The district claimed that it possessed an easement for flowage purposes over all the lands in the area including the lands owned and impounded by the defendants. All the lands in question are swamp and overflow lands in the St. Francis River basin. The trial court found for the defendants, and the question on appeal was whether the plaintiff acquired flowage rights or easements over the defendants' lands when the member flood control districts were enlarged via successive consolidations. The court refused to find that the defendants' lands were contained within the channel of the river which would make them subject to the exclusive control of the plaintiff districts. The defendants' lands had devalued in ownership from the United States to the county and by private sale to the defendants. The court found that, when the districts were first formed, the lands now owned by the defendants were owned by the county, and that the condemnation notice published by the district was insufficient to alert the county. As notice had not been given the county, such notice could not be held against the defendants who were the grantees of the county. The recital 'to all other persons interested' contained in the notice issued by the plaintiffs was not sufficient to include owners of land not located within the strip of land actually condemned for the purpose of erecting a levee and drainage ditch. The judgment for the defendants was affirmed. (Blunt-Fla)
W69-03437

SHOWS V CITY OF HATTIESBURG (NEGLIGENT MAINTENANCE OF DRAINAGE DITCH).

97 So 2d 366-368 (Miss 1957).

Descriptors: *Mississippi, Judicial decisions, *Ditches, *Cities, Legal aspects, Maintenance, Operation and maintenance.
Identifiers: *Sidewalks, Personal injuries.

This is an action brought by a parent for personal injuries to his minor son. The child became tangled in grass growing between a walkway and a drainage ditch and fell into the ditch. The ditch had been constructed and maintained by the city. Plaintiff alleged negligence on the part of the city. The ditch was an open one, filled with debris, which ran parallel to a street and dirt walkway across the street from a public school. The court held that the city was liable for injuries which resulted from negligent maintenance of its streets and sidewalks. (Sisserson-Fla)
W69-03438

DISPOSITIONS OF STATE LAND.

N C Gen Stat secs 146-5, 146-6, 146-8, 146-12, 146-13 (1964).

Descriptors: *North Carolina, *Swamps, *Canals, Legislation, Beds, Regulations, Taxes, Navigation, Drainage, Navigable waters, *Fill, Administrative agencies, Islands, Minerals, Permits.
Identifiers: *Title to raised lands, State lakes.

The state may reserve the following powers when it sells swamp lands: (1) to make reasonable regulations respecting the repair or enlargement of canals cut by the state; (2) to impose taxes on lands benefited by the canals; (3) to maintain the free navigation of the canals; (4) to regulate the drainage into the canals; (5) to insure that the roads along the canal banks are public. This article establishes rules for determining the ownership of land raised from navigable water. The state is authorized to dispose mineral deposits in state lands under water, but this shall be subject to all rights of navigation and other conditions imposed by the state. The Department of Administration may grant easements in lands covered by navigable waters or state lakes to adjoining riparian owners, but they shall not impair navigation. A permit is required in order to erect any structure in or upon the waters of any state lake. (Childs-Fla)
W69-03440

WOLFSEN V UNITED STATES (RIVER DIVERSION).

162 F Supp 403-440 (Ct Cl 1958).

Descriptors: Judicial decisions, Legal aspects *California, *Central Valley Project, Riparian rights, Foreign waters, Federal government, Water rights, Projects, *Diversion loss return, *Irrigation water, Rivers, Federal Reclamation Law, Diversion.
Identifiers: Foreign waters doctrine.

Plaintiffs, riparian land owners, brought an action for damages against the United States for impairment of water rights which resulted from a diversion of the San Joaquin River for governmental purposes and the substitution of water from the Sacramento River. Plaintiffs' deed contained riparian water rights to the San Joaquin River subordinated to the water rights of the grantor. They obtained irrigation water from Salt Slough, a branch channel of the San Joaquin. Plaintiffs' assertion of damages rested on the ground that their riparian rights were in the San Joaquin and the substitution of the water from the Sacramento operated to divest them of their rights based on the foreign waters doctrine which allows one who discharges foreign waters into a stream to take them away with impunity. The court found that the United States faithfully fulfilled its guarantee to provide substitute waters, and that any impairment of the landowner's rights was at most a technicality. The court held that the foreign waters doctrine did not apply, and the United States could not with impunity take away substitute waters. Detailed findings of fact are included in the opinion. (Mc-Ica-Fla)
W69-03441

MOULTON V BUNTING MCWILLIAMS PO NO 658 (DIVERSION OF NON-NAVIGABL STREAM).

213 Ga 859, 102 SE 2d 593-595 (1958).

Descriptors: *Georgia, *Natural flow doctri *Riparian rights, *Diversion, Judicial decisio Riparian waters, Dams, Non-navigable waters, teration of flow, Obstruction to flow, Reasona use, Relative rights.

Plaintiff sought to recover damages against def dants by reason of their maintaining a dam ac an unnamed, non-navigable stream. Plaintiff leged this diverted the natural flow of the wa thus depriving him of his right to the normal natural flow of water through his premises. He sought an injunction to enjoin defendants f maintaining the dam. The defendants answe that at the time the dam was constructed, the pl tiff had no riparian rights in the stream, becau that time he did not own, but merely leased, land. The court held that running water on lan longs to the owner of the land, and the diversio obstruction of a stream so as to impede its cou a trespass upon the lower riparian owner's pro ty. The legal and equitable relief sought by plaintiff was based upon his rights as a ripa owner. However, at the time the suit was institu the plaintiff did not own the property. There the court held that he was not entitled to the sought. Subsequent acquisition of title pendin suit did not cure this deficiency. (Scott-Fla)

9-03443

NICIPAL AND PARISH BRIDGES.
-RS 48:831, 48:859 (1965).

criptors: *Louisiana, *Legislation, Water law, ıways, *Bridges, *Bridge construction, Cities, als, Channels, Lakes, Administrative agencies, of Mexico, Bays, Bayous, Riparian rights, s, Local governments, Tunnels, Legal aspects, ırian lands, Eminent domain.

parish or municipality of the State of Loui- a is authorized to construct, acquire, improve, ate, and maintain tunnels, causeways, bridges, ıy combination of such facilities, including all ssary approaches, fixtures, accessories, and pment, in, over, through, or under the water- of the state. A parish may purchase any lands, tures, rights of way, franchises, servitudes, and r interests in lands, including lands under water riparian rights, deemed necessary for the con- tion of the bridge. The State of Louisiana con- to the use of all lands lying under water which within the state and are necessary to the con- tion of any such bridge. All bridges con- ted by a parish must first receive the approval e department of highways. (Watson-Fla)
-03445

VITUDES WHICH ORIGINATE FROM THE URAL SITUATION OF THE PLACES.
- C C Art 660-661 (1967).

riptors: *Louisiana, *Natural flow doctrine, governments, Riparian land, Riparian waters, ian rights, Dams, Relocation, Flow, Flow Relative rights, *Alteration of flow, *Ob- tion to flow, Reasonable use, Legislation, aspects, Diversion.

wer riparian owner is required to receive s that flow naturally from upper riparian . The lower riparian owner is prohibited from ing any structure to prevent the natural flow water. The upper riparian owner may not do ing to make the flow more burdensome. ian owners may use the running water for ir- on and other purposes. Riparian owners may ıe water that runs over their lands, but cannot t or change its direction: Such water must be ıed to its ordinary channel where it leaves the r's land. (Scott-Fla)
03446

TS OF USUFRUCTUARY.
- C C Art 553 (1967).

iptors: *Louisiana, Boundaries (Property), s, Islands, *Relative rights, State govern- , *Accretion (Legal aspects), *Usufructuary Alluvion channels, Legislation, Legal ts, Riparian rights, Riparian land.
fiers: Treasures.

ser of land also gets the use of accreted land, as no right to islands formed in a stream op- the land. Such islands belong to the riparian s. Furthermore, the user has no right, not the right of enjoyment, to treasures which e discovered on land which he is using, unless s discovered the treasures himself. In the case, he shall have the rights of one who has treasure lost by another. (Scott-Fla)
03447

T OF ACCESSION - IMMOVABLES.

C Arts 509-518 (1967).

iptors: *Louisiana, *Boundaries (Property), rship of beds, Relative rights, Riparian land, governments, *Accretion (Legal aspects), erosion, Banks, Navigable waters, Navigable Streambeds, Islands, Sand bars, Rivers, ation, Legal aspects, Non-navigable waters, ion, Deltas, Alluvial channels.

Accretions formed successively and imperceptively to any soil situated on the shore of any body of water are called alluvion. Alluvion belongs to the owner of the soil situated on the edge of the water. The same rule applies to derilictions formed by running water retiring slightly from one of its shores and encroaching on the other. If the water suddenly carries away an identifiable tract of land, the owner may claim his property within one year, or any time before the person to whose land the removed soil unites takes possession of the same. Islands and sand bars, not attached to the bank, formed in the beds of navigable waterways, belong to the state. Islands and sand bars formed in non-navigable streams are the property of the riparian landowners, and are apportioned according to specified rules. If a river or stream changes its course and surrounds the property of an owner of the shore, making it an island, the owner shall keep his property. If a river or stream changes course, the owners of the land newly occupied by the stream shall take the former bed of the stream as indemnifiation. If the stream returns, they shall retake their former property. (Scott-Fla)
W69-03448

THINGS - DIVISION OF THINGS.
LSA - CC Arts 450-453, 455, 457 (1967).

Descriptors: *Louisiana, Admiralty, Local governments, *Ownership of beds, *Public rights, *Public benefits, Recreation, Riparian waters, Riparian land, State governments, Oceans, Seashores, Highwater mark, Navigable rivers, Navigable waters, Harbors, River beds, Public lands, Banks, Levees, Legislation, Legal aspects, Usufructuary right.

Running water and the sea and its shores belong to and may be used by everyone. The sea shore extends from the water to the high water mark during the winter. Use of the sea shore is subject to the police power of the municipality within which it is located. Navigable rivers, seaports, roadsteads and harbors, and riverbeds, so long as they are covered with water, are public property; everyone has a right to fish in same. The use of the banks of navigable rivers or streams is also public; everyone has a right to land his vessels, load and unload his vessels, and to dry his fishing nets thereon. The ownership of the banks nevertheless belongs to those who own the adjacent land. The banks of a river or stream are construed as that which usually contains it, except, where there are levees established by law, the levees shall form the banks. (Scott-Fla)
W69-03449

FERRIES, CANALS AND PUBLIC LANDINGS.
Mass Ann Laws Ch 88, secs 12-19 (1967).

Descriptors: Canals, Cities, Waterway, *Local governments, Regulation, *Tidal waters, Low water mark, Boundaries, Legislation, Legal aspects, *Sites, *Locating.
Identifiers: Landing places.

Section 12 establishes the procedure to be followed by a city council or the selectmen of a town in order to erect a fence along a waterway deemed dangerous. Section 13 deals with the procedure for erecting a fence if an order to so do by the city council or the selectmen is not complied with. Section 14 sets out the task of every city or town where the tide ebbs and flows to provide at least one common landing place. Section 15 concerns the potential role of the county commissioners in selecting or approving a common landing place. Section 16 provides that when ten or more inhabitants of a county represent that the exact location of a common landing area cannot be readily ascertained, the county commissioners shall ascertain the correct location. Section 17 deals with the procedure for discontinuance of a common landing place. Section 18 requires, regarding appeals from these sections, that a sufficient recognizance be given to the county to cover the appeal costs. Section 19 concerns the making of rules and regulations governing the use of a common landing place. (Carruthers-Fla)
W69-03451

GENERAL DRAINAGE.

Fla Stat secs 298.40-298.81 (1967).

Descriptors: *Taxes, Ditches, *Drainage district, Lakes, *Legislation, Drainage, *Florida, Canals, Land tenure, Dredging.
Identifiers: Bonds, Everglades Drainage District, Florida drainage association.

Landowners in the drainage district may construct ditches through the property of intervening landowners to reach the public ditches. Various procedures are provided for obtaining land for the drainage district. Civil and criminal liability is established for willfully damaging or obstructing drainage canals, works, etc. The owner is defined as the owner of the freehold estate. The composition and powers of the State Board of Drainage Commissioners are described. The drainage of any lake greater in area than two square miles is prohibited without the consent of all the owners of the abutting property. This section is not applicable to the Everglades Drainage District. Foreclosure proceedings by the district are described. It is expressly provided that special legislation may increase or decrease the powers of a drainage district. (Childs-Fla)
W69-03453

GENERAL DRAINAGE.

Fla Stat secs 298.01-298.25 (1967).

Descriptors: *Florida, *Drainage district, *Land reclamation, Wetlands, Condemnation, Land surveys, Bridges, Legislation, Taxes.
Identifiers: *Overflowed lands, Drainage plan.

The methods and requirements for the formation of a drainage district are provided. The general purposes are to protect and reclaim overflowed lands. If the costs of a district exceed the benefits it will give, then the circuit courts will order it to dissolve. Adjacent districts may consolidate if the owners of a majority of the acreage vote to do so. The life of a district may be extended. No appeal from any action under this chapter will act as supersedeas. The procedure for electing the board of supervisors is explained and their powers are enumerated. The board appoints a chief engineer, who submits reports on his land surveys, drainage plan and controls all engineering work. All other employees are selected by the board. The board possesses broad reclamation powers, which extend to land outside the district. The requirements for bridge construction are described. They must conform to the engineer's specifications. Their cost is to be borne by the landowner. If they are constructed in counties having at least 130,000 residents, then the county engineer and county commissioners must approve the specifications. (Childs-Fla)
W69-03454

GENERAL DRAINAGE.

Fla Stat secs 298.26-298.39 (1967).

Descriptors: *Land appraisal, Watercourses, Damages, Benefits, Condemnation, *Land reclamation, Drainage systems, Canals, Ditches, Costs, Land, *Taxes, Land tenure, Financing, *Florida.

All taxes are uniform and are not to exceed fifty cents per acre. Existing canals, ditches, drainage systems or watercourses may be incorporated into the drainage plan. Commissioners appointed by the Circuit court appraise condemned lands, assess benefits and damages and estimate the cost of works. Lands outside the district that are benefited may be incorporated within the district. The court will make this decision. Property which is needed

will be condemned whether inside or outside the district. Interested parties may appeal any decision to the district court. When property is not benefited, the taxes assesssed will be returned. Taxation of all land, including state property, is taxed in proportion to the benefits received. The methods for payment and collection of these taxes are provided for. The rights accruing to the district when taxes are not paid are defined. (Childs-Fla)
W69-03455

DECLARATION OF POLICY.
N Y Soil Conserv Dist Law sec 2 (McKinney 1949).

Descriptors: *New York, *Conservation, *Public health, *Water policy, Soil conservation, Water conservation, Wildlife conservation, Flood control, Legislation, Erosion control, Water control, Maintenance, Dams, Reservoirs, Natural resources, Navigability, Water resources development, Drainage, Land management.

The policy of the Legislature of New York is to provide for soil conservation control and prevent soil erosion, preserve natural resources, assist in the control of floods, assist in the drainage of agricultural lands, prevent impairment of dams and reservoirs, assist in maintaining the navigability of rivers and harbors, preserve wildlife, and to promote and protect the health, safety, and general welfare of the people of New York. (Sisserson-Fla)
W69-03456

USE AND PROTECTION OF WATERS.
N Y Conserv Law sec 429a (McKinney 1967).

Descriptors: *New York, *Legislation, Permits, *River flow, *Riverbeds, Water resources, Water management (Applied), Legal aspects, Streambeds, Streams, Administrative agencies.

New York prohibits the changing or disturbance of the course of any stream or the removal from its bed of any material without a permit from the Water Resources Commission. The Commission will consider the probable effect of an alteration on the public and natural resources before issuance of the permit. The Commission may hold a public hearing if it feels that damage may result from the proposed alteration. No permit is required of any state department, state public corporation or any public corporation which has entered into a written memorandum of understanding with the Commission. Emergency work may be undertaken notwithstanding the above, provided the Commission is informed of such action within 48 hours after commencement and 48 hours after completion of such work by registered mail or telegraph. (Molica-Fla)
W69-03457

PUNISHMENT FOR VIOLATIONS.
N Y Conserv Law sec 429-f (McKinney 1967).

Descriptors: *New York, *Legislation, Permits, *River flow, *River beds, Water resources, Water management (Applied), Legal aspects.

Anyone changing or altering the course of any stream or removing material from its bed without first obtaining a permit to do so from the Water Resources Commission is guilty of a misdemeanor, and subject to a fine of $500 and/or imprisonment not to exceed one year. An agent or employee of such person who knowingly violates the act and a prime contractor of such person who knowingly or unknowingly violates the act, is also guilty of a misdemeanor. (Molica-Fla)
W69-03458

UNLAWFUL INTERFERENCE WITH IMPROVEMENT WORKS.
N Y Conserv Law sec 617 (McKinney 1967).

Descriptors: *New York, Legislation, State governments, *Conservation, Administrative agencies, Water resources, *Utilities, Dams, Dikes, Gates, Channels, Obstruction to flow, Streams, *Construction, Rivers, Legal aspects, Beds.

Anyone who, without the consent of the commission, damages, alters, changes, or interferes with any works constructed under this article; or who opens or closes a gate or gates in any dam, dike or headrace constructed under this article; or who obstructs any channel constructed under this article, shall be guilty of a misdemeanor. After an improvement of a channel or watercourse has been authorized, it shall be unlawful for anyone to construct any dam or other structure on the bed of or across such stream until the commission has found that such construction will not unduly affect the proposed or completed project. (Scott-Fla)
W69-03459

WATER SUPPLY.
N Y Conserv Law sec 835 Art 4 secs 4.1, 4.2 (McKinney Supp 1968).

Descriptors: *New York, Civil law, Legislation, State governments, Administrative agencies, Conservation, Planning, Water resources, Water conservation, *Water supply, Water utilization, *Water storage, *Discharge (Water), Dams, Reservoirs, Public health, Recreation, Regulated flow, Legal aspects, Management, Water pollution control, Economics.

The conservation commission shall have the power to develop and implement projects and plans for using water of the basin for domestic, municipal, agricultural and industrial water supply. In so doing, the commission may obtain and maintain dams, reservoirs, and other facilities and related structures both on the river and off. The commission may also control such structures for the storage and release of waters, for regulation of flows and supplies of surface and ground waters of the basin, for the protection of public health, welfare, economic development, recreation, and for the abatement of pollution. (Scott-Fla)
W69-03461

WITHDRAWAL AND DIVERSION FROM PROTECTED AREAS.
N Y Conserv Law sec 835 Art 11 secs 11.1, 11.2, 11.3, 11.4, 11.5 (McKinney Supp 1968).

Descriptors: *New York, Civil law, Legislation, State governments, Administrative agencies, *Conservation, Planning, Natural resources, Water resources, Water conservation, *Withdrawal, *Diversion, Reasonable use, Droughts, Permits, Regulation, Flow augmentation, Legal aspects, Water shortage.

The conservation commission has the power to regulate and control withdrawals and diversions from surface and ground waters of the basin. This power is delegable. If the commission determines that a water shortage is threatened or developing, any such affected area may be designated as a protected area. The protected status of the area continues until terminated by the commission. In these protected areas, no person may divert or withdraw water for any purpose in excess of the quantities prescribed in the commission's general regulations, except pursuant to a properly-issued permit. Should a drought or other emergency cause an actual and immediate shortage of water, the commission may, upon declaration of an emergency, for the limited period of the emergency, further modify any allocations, diversions, and releases previously granted. (Scott-Fla)
W69-03462

OPERATION OF HYDRO-ELECTRIC PLANTS AT CRESCENT AND VISHER FERRY CONTROL OF SARANAC LAKE LOCKS.
N Y Canal Law secs 130, 132 (McKinney Supp 1968), 1 p.

Descriptors: *New York, Legislation, Canals, Dams, *Hydroelectric power, *Hydroelectric plants, Lakes, *Locks, Maintenance, Administrative agencies, Management, Legal aspects, Repairing.

Section 130 gives the commissioner of transportation charge of the hydroelectric plant constructed for the development of electric energy from water power at the Crescent and Vischer Ferry dams. He shall exercise the same powers over them that he has over other structures on the canal and they shall be maintained and operated as part of the canal system. Section 132 gives the commissioner of transportation the same control over the lock system of the Saranak Lake as he has over the canal system. He is authorized to make any improvements and repairs as may be necessary, and all expenses incurred will be defrayed from money available for maintenance of the canal system. (Shevin-Fla)
W69-03467

ACCELERATING OR IMPEDING FLOW OF MINERAL WATERS.
N Y Pub Lands Law sec 90 (McKinney 1951).

Descriptors: *New York, *Mineral waters, *Pumping, Salts, Wells, Water types, Well regulation, Flow augmentation, Natural flow, Gases, Legal aspects, *Legislation.
Identifiers: Carbonic acid.

Accelerating or impeding the natural flow of mineral waters holding in solution natural mineral salts and an excess of carbonic acid gas is declared unlawful. (Childs-Fla)
W69-03471

WASTE OF MINERAL WATERS HOLDING SALTS AND EXCESS CARBONIC ACID GAS.

N Y Pub Land Law sec 92-a (McKinney 1951).

Descriptors: *New York, *Pollution, *Mineral water, Salts, Gases, Administrative agencies, Administrative regulation, Springs, Water types, *Legislation, Legal aspects.
Identifiers: Carbonic acid.

The waste of mineral waters holding in solution natural mineral salts and an excess of carbonic acid gas is unlawful. The permitting of the flow of such mineral waters, except for immediate sale, for longer than twenty-four hours in any one month, is presumptive evidence of the waste thereof. (Childs-Fla)
W69-03472

CENTRAL NEW YORK BROADCASTING CORP V STATE (STATE NOT LIABLE FOR DAMAGES FLOWING FROM FEDERALLY-CONTROLLED FLOOD CONTROL PROJECT).

158 N Y S 2d 650-654 (App Div 1957).

Descriptors: Federal government, State government, *New York, Water resources development, Flood prevention act, Flood control, Flood, *Spring flood, *Erosion, Damages, Legal aspects, Judicial decisions, Water law, Third party effects, Flood damage, *Construction.
Identifiers: Army engineers, Negligence.

Plaintiff sued State of New York for damages caused by erosion on plaintiffs' property caused by negligent construction of a flood control project. The court found that the work was done in connection with federal-state program of flood control under the general jurisdiction of the U S Army and immediate supervision of the Chief of Engineers. The court held that as the state merely supplied the land but was not in control of the land or the project, it incurred no liability for injuries 'flowing' from the project. Damage occurred during a spring flood when the project was unfinished. The court found no defect in the project plans or construction

d that the damage was not reasonably foreseea-
, thus no negligence was established. (Graham-
)
69-03473

ENNEDY-CHAMBERLIN DEVELOPMENT CO
SNURE (MUNICIPAL DRAINAGE SYSTEMS).

2 Md 369, 129 A 2d 142-148 (Ct App 1957).

scriptors: Judicial decisions, Legal aspects,
laryland, *Cities, Erosion, Damages, *Drainage
tems, Surface drainage, Drainage practices,
iddance (Legal aspects), Surface waters,
ghways, Discharge (Water).

aintiffs, lower land owners, sought to enjoin de-
dent city from constructing new roads on ad-
ent upper land, which would increase the flow of
ainage water over their land, until such time as
fendents agreed to revise a proposed drainage
tem so that their property would not be
maged. There was no present invasion of the pro-
rty rights of plaintiffs and therefore the situation
l not merit judicial interference with the comple-
n of the proposed public improvements. The
urt said the plaintiffs could seek redress in the fu-
e for any damages they might suffer because of
e completed improvements. However, generally,
municipality is not liable for damages from in-
eased flow arising from the regular course of mu-
cipal expansion, unless it collects and casts a sub-
ntially increased volume of water onto adjacent
d. (Molica-Fla)
69-03479

STUDY OF THE DRAINAGE OF IRRIGATED
ND DUNES USING AN ELECTRICAL RE-
STANCE ANALOGUE,
ater Conservation and Irrigation Commission,
ustralia); and Melbourne Univ., Parkville (Aus-
lia). Dept of Agricultural Engineering.
G. Mein, and A. K. Turner.
Hydrol, Vol 6, No 1, pp 1-14, Jan 1968. 14 p, 9
, 13 ref.

escriptors: *Resistance, *Analog models,
Dunes, *Electrical resistance, Irrigation effects,
rainage, Model studies.
entifiers: *Artificial drainage, New South Wales,
permeable layer.

e drainage of irrigated sand dunes by means of
electrical resistance analog is described. Sand
nes to be irrigated in New South Wales can be
scribed as having an impermeable layer
presented by either a horizontal plane at the
se, or a plane parallel to a sloping face. The ar-
icial drainage of these dunes differs from situa-
ns covered by formulae commonly used for flat
nd. The electrical resistance analog is shown to
suitable for studying sand dune problems. The
alog solutions are compared with the theoretical
edictions of the appropriate formulae. Based on
sults obtained, recommendations are made on
e best means of draining these sand dunes. (L-
varias-USGS)
69-03526

PTIMAL CONTROL OF LINKED RESER-
OIRS,
Vater Planning for Israel Ltd. Tel Aviv; and Water
esearch Association, Medmenham (England).
or primary bibliographic entry see Field 06A.
or abstract, see .
69-03571

VATER RESOURCES DEVELOPMENT BY
HE U.S. ARMY CORPS OF ENGINEERS IN IL-
INOIS.
orps of Engineers, Chicago, Ill.
or primary bibliographic entry see Field 06B.
or abstract, see .
69-03591

PROBLEMS OF MAINTAINING BAYS AND ESTUARIES--A PANEL, SAN FRANCISCO BAY,
Joseph E. Bodovitz.
32nd North American Wildlife and Natural Resources Conference, San Francisco, California, Transactions, March 13-15, 1967, pp 120-126.

Descriptors: *California, *Coastal engineering, *Land reclamation, Land management, Recreation, Regions, Southwest U. S., Pacific coast region, Geographical regions, Bays, Bodies of water, Management, Engineering, Property values, Wildlife, Animals, Fish, Aquatic animals, Aquatic life.

As a result of extensive diking and filling, San Francisco Bay has been reduced to 1/3 the size it was at the time of the Gold Rush. This steady filling of the Bay has prompted a detailed study and plan for the Bay waters and shoreline, scheduled for completion in January, 1969. At present the five harmful effects of land reclamation as it exists in the San Francisco Bay are: (1) esthetics and real estate values go down, (2) recreation uses are cut by the present inaccessibility of the Bay, (3) only 75 square miles of marsh and tidelands remain to support fish and wildlife, and (4) the population will double by mid-twenty-first century, and the waters of the Bay are steadily decreasing.
W69-03616

FISH AND MAN, CONFLICT IN ATLANTIC ESTUARIES,
For primary bibliographic entry see Field 05G.
For abstract, see .
W69-03627

CLOSING OF THE SEA ARMS.
Dienst der Zuiderzeewerken, The Hague, Netherlands, July, 1967.

Descriptors: *Coastal engineering, *Benefits, *Costs, *Commercial fishing, *Foreign countries, Standing waters, Shore protection, Dam construction, Land reclamation, Drainage, Reservoirs, Engineering, Lakes, Construction, Recreation, Transportation, Geographical regions, Regions, Bodies of water, Impoundments, Surface waters.

There are many tangible advantages to the construction of new sea walls to close the sea arms in the Netherlands Delta area: (1) The existing coastline will be shortened, thus decreasing the force of the ocean on the land; (2) Security against floods will be increased; (3) A fresh water supply can gradually be built up in reservoirs created by the enclosures; (4) Land reclamation from presently unindated areas provides more living space for overcrowded areas; (5) Creation of new recreational areas will result; (6) Increased efficiency of transportation in the Delta area. These advantages are offset by losses which will be suffered by the commercial fisheries in the Delta; however, it is felt that the advantages gained justify this liability.
W69-03630

THE DUTCH TURN THE TIDE.
Fortune, Vol 77, No 3, March 1968, pp 132-137.

Descriptors: *Dams, *Dikes, *Coastal structures, *Flow control, Land reclamation, Structures, Foreign projects, Engineering structures, Hydraulic structures, Earthworks, Embankments, Retaining walls, Walls, Control, Water control, Commercial shellfish, Animals, Aquatic animals, Aquatic life, Invertebrates, Shellfish, Costs.

This is a short discussion, with photographs, of the Dutch overhauling their system of dams and dikes to control the movement of fresh and salt water through the delta (area 1,900 square miles). Eighteen miles of dams will cost $800 million dollars. The damming will necessitate the relocation of a multimillion-dollar shellfish culture.
W69-03652

ACTION ON ILLEGAL DREDGING AND FILLING IN THE AREA OF HEMPSTEAD, N.Y.
R. Fitt.
Estuarine Hearings, Subcommittee on Fisheries and Wildlife Conservation of the Committee on Merchant Marine and Fisheries, House of Representatives, 90th Congress, Serial No. 90-3, March, 1967.

Descriptors: *Dredging, *Landfills, *Local governments, *Legal aspects, *New York, Federal government, Navigable waters, Bodies of water, Governments, Appalachian Mountain region, Geographical regions, Great Lakes region, Northeast U. S., Regions.

The town of Hempstead, New York, issued permits to dredge navigable waters within the town limits. In the first case, a permit was issued after work had begun; in the second case, the work was completed, after which a letter was sent to the Corps of Engineers showing extent of the dredged area. In general, punitive action is not taken for an infraction of this nature unless the work is found to be detrimental. If corrective measures are called for, the Corps tries to have it done voluntarily. If this fails, the Department of Justice must take action.
W69-03665

POTENTIAL FRESHWATER RESERVOIR IN THE NEW YORK AREA,
Robert D. Gerard.
Science, Vol 153, No 3138, August 19, 1966, pp 870-871.

Descriptors: *New York, *Reservoir construction, *Fresh water, *Dams, Appalachian Mountain region, Geographical regions, Great Lakes region; Northeast U. S., Water management, Water types, Construction, Management, Engineering structures, Hydraulic structures, Structures, Hydrologic budget, Regions.

Estimates of the water budget of Long Island Sound suggest that it could become the largest reservoir in the United States, with freshwater surplus equal to 12 times the present needs of New York City. The engineering aspects of this undertaking are within the scope of present technology. The dam structures required to isolate this area from the sea could serve as important highway links in place of highway-bridge projects presently under study.
W69-03700

4B. Groundwater Management

WATER SUPPLY (STORAGE AND RELEASE OF WATERS).
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03301

INTERNATIONAL CONFERENCE ON WATER FOR PEACE 1967.
For primary bibliographic entry see Field 06B.
For abstract, see .
W69-03305

INVESTIGATION OF THE TECHNICAL FEASIBILITY OF STORING FRESH WATER IN SALINE AQUIFERS,
Louisiana State Univ., Baton Rouge. Water Resources Research Inst.
For primary bibliographic entry see Field 02F.
For abstract, see .
W69-03336

WITHDRAWAL AND DIVERSION FROM PROTECTED AREAS.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03462

GROUND WATER RECHARGE, DEVELOPMENT AND MANAGEMENT,
California Univ., Berkeley; and California State Dept. of Water Resources, Sacramento.

Proc 6th Bien Groundwater Recharge Conf, California Univ., Berkeley, Sept 13-14, 1967, 180 p, 1968. Total 4 fig, 28 ref, 1 append.

Descriptors: *Planning, *Water resources development, Administration, Forecasting, Governments, Legislation, Management, Programs.
Identifiers: Symposia, Groundwater resource development.

A conference was held at the University of California, Berkeley, to discuss planning in groundwater resource development. Specific topics were establishment of objectives at the national, state and local level; policies; implementation of policy by legislation and engineering works; and practical constraints such as laws, economic feasibility, social goals, role of the user, technical feasibility, and institutional arrangement. The orientation of the papers in the conference was not to the specialist in the field of the speaker, but to workers in all the other fields presented at the conference for their general backgrounds to aid in solving water management, policy, and planning problems. (Knapp-USGS)
W69-03540

4C. Effects on Water OF Man's Non-Water Activities

DEPARTMENT OF NATURAL RESOURCES.
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-03256

DUTIES OF THE DEPARTMENT OF PUBLIC WORKS RELATIVE TO COMMONWEALTH LANDS, CERTAIN ISLANDS, AND PROPERTY IN PLYMOUTH.

Mass Ann Laws, ch 91, secs 2, 2A (1967).

Descriptors: *Massachusetts, *Legislation, Islands, *Administrative agencies, Shores, Tidal waters, Grants, Encroachment, Navigation, Riparian rights, Great ponds, Piers, Tourism, Recreation facilities, State jurisdiction, *Public lands.

The Department of Public Works of Massachusetts has charge, except as otherwise provided, of rights in lands, flats, shores, and tide waters belonging to the commonwealth. The department must ascertain the rights of the commonwealth in such property, and its extent and location. The department must prevent encroachment and trespass against the commonwealth's property. It may sell and convey, lease, or improve such lands for the benefit of the commonwealth if it will not impair navigation or riparian rights. The department also has charge of the lands, pier, structures, and other property belonging to the commonwealth in the town of Plymouth, which were acquired, built or improved by the Pilgrim tercentenary commission. All conveyances, contracts, and leases for more than five years, made under this section, shall be subject to the approval of the governor and council. (Watson-Fla)
W69-03258

POWERS OF THE DEPARTMENT OF PUBLIC WORKS AS TO PR PORT OF BOSTON HARBOR.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03259

POTENTIAL IMPACT OF FOREST FERTILIZATION ON RANGE, WILDLIFE, AND WATERSHED MANAGEMENT,
Southeastern Forest Experiment Station, Franklin, N. C.
J. B. Hilmon, and J. E. Douglass.
Proc Symp on Forest Fertilization, Apr 1967, Gainesville, Fla TVA Nat Fert Dev Cntr, Muscle Shoals, Ala, 1968. pp 197-202.

Descriptors: *Wildlife habitat, *Land use, *Forestry, Ecology, Ecosystems, *Fertilization, Watershed management, Water chemistry, Water quality.
Identifiers: *Forest fertilization.

Increasing demands for water, forage and wildlife have increased emphasis on multiple-use management of forest lands. Such management requires a much fuller understanding of the forest ecosystem and the effects which disturbances such as fertilization have on it. This paper reviews some of the potential impacts of forest fertilization on forage, wildlife and water and is based primarily on results of recent research at Fort Myers, Florida; Tifton, Georgia; and the Coweeta Hydrologic Laboratory, Franklin, North Carolina.
W69-03383

C AND W COAL CORPORATION V SALYER (DESTRUCTION OF UNDERGROUND STREAM).

200 Va 18, 104 SE 2d 50-55 (1958).

Descriptors: *Virginia, *Underground streams, *Percolating water, *Water law, Judicial decisions, Mining, Strip mines, Subsurface drainage, Subsurface streams, Water sources.

Plaintiff owned land adjacent to defendant's open pit coal mine. Plaintiff sued for damages for destruction of a strema on her property allegedly caused by defendant's mining operations. The stream was fed from some underground source. Evidence showed that the strata of coal being mined near plaintiff's property started downward toward plaintiff's premises; and underground water flowed with the slant of the strata. The court ruled that unless it could be shown that the underground water flowed in a defined and known channel, it would be presumed to be percolating water. Percolating waters are those which ooze, seep, or filter through the soil beneath the surface either without a defined channel or in a course that is unknown and not discoverable without excavation. Since defendant could not, in this case, have ascertained the existence, location, and flow of the underground stream by a reasonable examination of the surface of the earth, the court held that no liability obtained. (Scott-Fla)
W69-03444

URBAN WATER RESOURCES RESEARCH; SYSTEMATIC STUDY AND DEVELOPMENT OF LONG-RANGE PLANS, FIRST YEAR REPORT, SEPTEMBER, 1968.
American Society of Civil Engineers, New York. Urban Hydrology Research Council.
For primary bibliographic entry see Field 06B.
For abstract, see .
W69-03506

NORTHWOOD GAGING INSTALLATION, BALTIMORE-INSTRUMENTATION AND DATA,
American Society of Civil Engineers Program Office, Cambridge, Mass.
For primary bibliographic entry see Field 02E.
For abstract, see .
W69-03507

OAKDALE GAGING INSTALLATION, CHICAGO-INSTRUMENTATION AND DATA,
American Society of Civil Engineers Program Office, Cambridge, Mass.
For primary bibliographic entry see Field 02E.
For abstract, see .
W69-03508

RESPONSE CHARACTERISTICS OF URBAN WATER RESOURCE DATA SYSTEMS,
Florida Univ., Gainesville. Dept. of Environmental Engineering.
For primary bibliographic entry see Field 07A.
For abstract, see .
W69-03509

A CRITICAL REVIEW OF METHODS OF MEASURING DISCHARGE WITHIN A SEWER PIPE,
Illinois Univ., Urbana.
For primary bibliographic entry see Field 07B.
For abstract, see .
W69-03510

THE NATURE OF CHANGES IN URBAN WATERSHEDS AND THEIR IMPORTANCE IN THE DECADES AHEAD,
American Society of Civil Engineers Program Office, Cambridge, Mass.
M. B. McPherson.
ASCE Tech Mem No 5, Urban Water Resources Res Program, Dec 1968. 18 p, 3 tab, 23 ref. OWRR: 14-01-0001-1585, USGS: 14-08-0001-11257.

Descriptors: *Urbanization, *Urban sociology, *Water resources development, Social aspects, Drainage systems, Human population, Land use, Sewers, Utilities, Water utilization, Water supply, Aesthetics, Water reuse, Water quality.
Identifiers: Urban hydrology.

Urban changes, largely social and economic, that affect urban hydrology are discussed in a survey and bibliography of urban sociology and recent urban history largely consisting of quotations and reviews of non-engineering and non-hydrological literature. Urban expansion is considered largely a function of development of new forms and trends of use of high-speed urban transport; one important period of growth was associated with development of streetcar systems and another with the personal automobile. The urban areas of the country are growing rapidly with trends of increasing urbanization added to increasing growth of suburbs. Urban problems of crowding, water supply, waste disposal, and general environmental quality are growing even faster than the cities. The need for comprehensive planning rather than solving single problems such as waste disposal or water supply is stressed. The environment of cities is a function of all social and physical factors. Hydrological problems can be solved only as part of the total environmental problem. (Knapp-USGS)
W69-03511

URBAN HYDROLOGY OF THE HOUSTON, TEXAS METROPOLITAN AREA-COMPILATION OF BASIC DATA-1966,
Geological Survey, Austin, Tex.
S. L. Johnson.
Prepared in cooperation with City of Houston, Tex. Geol Surv Duplicated Basic-Data Rep, 1968. 275 p, 13 fig, 12 tab, Charts, Hydrographs.

Descriptors: *Data collections, *Urbanization, *Hydrologic data, *Texas, Rainfall, Runoff, Stream gages, Hydrographs, Streamflow.
Identifiers: Houston (Texas).

Basic data of the urban hydrology of Houston, Texas, 1965-66, are compiled. Surface-water records are from gaging stations, crest-stage partial-record stations, rain gages, and miscellaneous sites. Each gaging-station record includes location, drainage area, gage type and history, average discharge, extremes, remarks, daily discharge, total discharge, mean discharge, annual maximum, minimum, and mean discharges, and peak discharges. Runoff and rainfall are computed for each drainage basin and

ydrographs and mass curves are drawn. A map of ach basin shows locations of all gages. (Knapp-SGS)
/69-03538

THE ROLE OF MAN IN ESTUARINE PROCESS-ES',
merican Association for the Advancement of cience, Washington, D. C.
or primary bibliographic entry see Field 06G.
or abstract, see .
/69-03638

D. Watershed Protection

LENDING FOREST USES,
outheastern Forest Experiment Station, Asheville, . C.; and Georgia Univ., Athens. School of orestry.
ohn D. Hewlett, and James E. Douglass.
S Department of Agriculture, Forest Service, esearch Paper SE-37, pp 1-15, July 1968. 15 p, 1 ap, 9 photo, 1 dwg, 4 tab, 2 chart.

escriptors: *Watershed management, Water yield nprovement, Watersheds (Basins), Water sports, ppalachian Mountain Region, Forest manage-ent, Wildlife management, Recreation.
dentifiers: *Southern Appalachian Mountain Re-on.

ompatibility of forest management practices on a 56-acre Southern Applachian watershed is ex-mined in this unique experiment to determine the easibility of intensive management for wood, ater, wildlife, and recreation. An efficient and sta-e access system is stressed, and the effect of vari-us woods practices on the four basic resources is ated. Increases are shown in water yield, game orage, quality timber growth, and general use of e area. Some unresolved conflicts among uses of e forest are revealed.
/69-03404

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification OF Pollutants

NSECTICIDES IN TILE DRAINAGE EF-LUENT,
alifornia Univ., Los Angeles. Dept. of Engineer-g; California Univ., Los Angeles. Water esources Center; and California State Dept. of Vater Resources, Fresno.
Villiam R. Johnston, F. T. Ittihadieh, and Kenneth . Craig.
Vater Resources Res, Vol 3, No 2, pp 525-537, 967. 13 p, 4 fig, 10 tab, 9 ref.

escriptors: *Insecticides, *Chlorinated hydrocar-on pesticides, *Drainage systems, Irrigation, alifornia, Pesticide residues, Adsorption, Soils, roundwater, Surface waters.
dentifiers: San Joaquin Valley (California), Irriga-on water.

rainage effluent from systems located on irrigated nd in the San Joaquin Valley of California was nalyzed for insecticide residues. Only relatively mall quantities of chlorinated hydrocarbon esidues were found in tile drainage effluent, but igher concentrations were found in effluent from pen drains where both surface and subsurface rainage waters were collected. Traces of residue ere found in the irrigation water applied to tile rained farms. When the concentration factor, the atio of depth of irrigation water applied to depth f drainage water removed on a unit basis is con-idered, the total quantity of insecticide residue in le drainage effluent does not exceed and is generally less than the total quantity of residue applied in the irrigation water. Tailwater or surface runoff contained from 7 to 12 times as much residue as the applied water when DDT was applied to the land and as much as 85 times more residue than the irrigation water when Lindane was applied to the land. Relatively large concentrations of residue were found in the surface soil of the area studied, even where no pesticides had been applied directly to the soil. (Knapp-USGS)
W69-03221

AMITROLE CONCENTRATIONS IN CREEK WATERS DOWNSTREAM FROM AN AERIALLY SPRAYED WATERSHED SUBBASIN,
Federal Water Pollution Control Administration, Corvallis, Oreg., and Astoria Department of Public Works, Oreg.
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-03226

THE PERSISTENCE OF SILVEX IN WATER AND HYDROSOIL,
Southeast Water Lab., Athens, Ga.
D. R. Cochrane, J. D. Pope, Jr., and H. P. Nicholson.
Water Resources Res, Vol 3, No 2, pp 517-523, 1967. 7 p, 2 fig, 6 tab, 1 ref.

Descriptors: *Pesticides, *Herbicides, *Aquatic weed control, *Pesticide residues, *Adsorption, Hydrolysis, Soils, Leaching.
Identifiers: *Silvex, *Hydrosoils.

The propylene glycol butyl ether ester of silvex, an herbicide useful to control aquatic plants, hydrolyzed almost totally to silvex acid in about two weeks when applied at the rate of 8 lbs/acre (acid equilvalent) to water overlying Cecil sandy clay loam, Lakeland loamy fine sand, and Brighton muck soils, in plastic pools. Silvex acid increased in concentration in water for a week and then dissipated gradually over a 19-week period. Apparent adsorption of both the ester and acid occurred on the hydrosoil and was followed by gradual diminution of both. Laboratory studies confirm that silvex acid can be adsorbed by the three soils. The possibility exists that silvex acid and/or a degradation product may be desorbed and readmitted to water. (Knapp-USGS)
W69-03240

THE DETERMINATION OF THE IONIZATION CONSTANT OF 2,4-D IN WATER,
Geological Survey, Denver, Colo.
R. L. Wershaw, M. C. Goldberg, and D. J. Pinckney.
Water Resources Res, Vol 3, No 2, pp 511-516, 1967. 6 p, 3 fig, 1 tab, 23 ref.

Descriptors: *Pesticides, *Surface waters, *Groundwater, *2-4 D, *Ionization, Pesticide residues, Pesticide kinetics, Pollutants, Water pollution sources.
Identifiers: *Ionization Constant, Kohlraush method.

The literature on the degradation of 2,4-D in water is reviewed and discussed, and a new determination of its ionization constant in water is presented. The compound 2,4-D (2,4-diclorophenoxyacetic acid) is the most widely used herbicide in the United States, and its widespread use may result in the applied compounds being carried or washed into nearby water courses, rivers, lakes, or groundwater reservoirs. Studies by various authors show that 2,4-D degrades within several weeks in soils; it can persist for up to 6 months or more in natural waters. The ionization constant of 2,4-D was redetermined at 25 deg C from conductivity measurements. A value for the ionization constant of 0.001169 was calculated when the equivalent conductance at infinite dilution of 2,4-D was computed from the equivalent conductance at infinite dilution of the sodium salt of 2,4-D, using the Kohlraush method of independent ion mobilities. These results differ from those obtained by other workers, who computed the equivalent conductance at infinite dilution of 2,4-D, using the equations derived by Fuoss and his co-workers for the conductance of strong electrolytes in polar solvents. (Knapp-USGS)
W69-03241

THE OCCURRENCE AND CHARACTERISTICS OF GROUND-WATER CONTAMINATION IN MASSACHUSETTS,
Massachusetts Univ., Amherst.
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-03312

STUDIES OF THE ANALYSIS OF PHOSPHATES IN ALGAL CULTURES,
Wisconsin Univ., Madison. Water Chemistry Lab.
G. Fred Lee, Nicholas L. Clesceri, and George P. Fitzgerald.
Int J Air Water Pollution, Vol 9, pp 715-722, 1965. 8 p, 1 fig, 5 tab, 8 ref.

Descriptors: *Algae, *Analytical techniques, *Cycling nutrients, *Eutrophication, *Phosphates, *Physiological ecology, Aquatic algae, Aquatic microbiology, Chlorophyta, Cyanophyta, Essential nutrients, Environmental effects, Nitrogen compounds, Nutrient requirements, Phosphorus compounds, Phosphorus, Phytoplankton.

Total phosphate analysis procedures were evaluated. It was found that the Standard Methods (1960) procedure of acid hydrolysis in 1 ml sulfuric acid (30%) was suitable for pyrophosphates and tripolyphosphates but not for total phosphate analysis of algae or algal extracts. Ashing (600 deg C, 1 hr), perchloric acid digestion (sulfuric acid plus nitric acid plus perchloric acid), and sulfuric plus nitric acid digestion gave satisfactory results. Supernatants from the green alga Chlorella pyrenoidosa (Wis 2005) did not affect orthophosphate analyses, but a consistant error (loss) was found when the supernatant of the blue-green alga Microcystis aeruginosa (Wis 1036) was tested. (Eichhorn-Wis)
W69-03358

THE EFFECT OF ALGAE ON BOD MEASUREMENTS,
Wisconsin Univ., Madison. Hydraulic Lab., and Wisconsin Univ, Madison. Sanitary Lab.
George P. Gitzgerald.
J Water Pollution Control Fed, Vol 36, No 12, pp 1524-1542, Dec 1964. 19 p, 7 fig, 4 tab, 18 ref. Engineering Experiment Station Reprint No. 728.

Descriptors: *Biochemical oxygen demand, *Chlorella, *Photosynthetic oxygen, Algae, Analytical techniques, Aquatic algae, Aquatic bacteria, Aquatic microbiology, Bioassay, Chlorophyta, Cyanophyta, Environmental effects, essential nutrients, Freeze drying, Freeze-thaw tests, Harvesting of algae, Nuisance algae, Nutrient requirements, Physiological ecology, Phytoplankton, Sewage bacteria, Sewage treatment, Water pollution, Water pollution control, Water pollution effects, Water pollution treatment.

The 5-day, 20 deg C BOD of the green alga Chlorella pyrenoidosa (Wis 2005) was compared when the algae had been grown in different culture media. The relative growth and relationships between growth measurements are presented. The activity of chlorella in BOD tests was independent of the volume of settled sewage seed. Algae from pure cultures had the same BOD as algae from cultures seeded with sewage bacteria; the BOD of culture supernatants was decreased to one-fifth by bacteria added to the cultures. Dead algae had 4 times the BOD of live algae. Oxygen produced by algae after 2-hr incubation in light was used to follow the photosynthetic capacity of algae during incubation tests in the dark for as long as 16 days.

Chlorella could still produce oxygen after 16 days in the dark and for at least 7 days after the BOD bottles became anaerobic. The BOD of chlorella varied between 0.09 and 0.19 mg oxygen used per milligram (dry weight) of suspended solids per liter for 5 days at 20 deg C. The results for algae from different culture media and different species are presented. (Eichhorn-Wisc)
W69-03362

COPPER IN LAKE MUDS FROM LAKES OF THE MADISON AREA,
Wisconsin Univ., Madison. State Lab. of Hygiene.
M. Starr Nichols, Theresa Henkel, and Dorothy McNall.
Trans Wis Acad Sci Arts Lett, Vol 38, pp 333-350, 1946. 18 p, 6 fig, 9 tab, 4 ref.

Descriptors: *Lakes, *Mud, *Copper, Copper sulfate, Algal control, Algicides, Trace elements, Cores, Wisconsin, Bottom sediment, Benthic fauna.
Identifiers: *Madison (Wis), Nuisance odors, Lake Mendota (Wis), Lake Monona (Wis), Lake Wingra (Wis), Lake Kegonsa (Wis), Lake Waubesa (Wis), Precipitation.

The amount of copper sulfate applied annually from 1925-1944 to Madison, Wis, lakes is given. Much of the copper sulfate added to lake waters of notable alkalinity was precipitated as a basic copper compound. From Lake Mendota, Lake Monona, Lake Wingra, Lake Waubesa and Lake Kegonsa the bottom muds at various water depths were analyzed for total and soluble copper. Core samples of lake muds from the various lakes were also taken. Lake Monona has received copper sulfate treatment for algal control for a much longer period than the other lakes, and this is reflected in the higher concentrations of copper found in the layers of mud of Lake Monona. The greatest concentration of copper is found in the deeper part of the lake. The copper content of the Lake Monona core penetrated to a depth of 8 feet. Action by burrowing fauna may have caused mixing of the upper layers to this depth. It appears that by far the greatest amount of copper applied remains as a deposit in the mud of the lake. (Eichhorn-Wisc)
W69-03366

THE EFFECT OF DILUTION MEDIA ON THE BOD OF ALGAE,
Wisconsin Univ., Madison. Hydraulic Lab; and Wisconsin Univ., Madison. Sanitary Lab.
Mary M. Allen, George P. Fitzgerald, and Gerard A. Rohlich.
Engineering Experiment Station Reprint No. 697. J Water Pollution Control Fed, Vol 36, No 8, pp 1049-1056, Aug 1964. 8 p, 3 tab, 11 ref.

Descriptors: *Biochemical oxygen demand, *Photosynthetic oxygen, *Chlorella, Algae, Analytical techniques, Aquatic algae, Aquatic bacteria, Aquatic microbiology, Bioassay, Chlorophyta, Cyanophyta, Diatoms, Environmental effects, Essential nutrients, Harvesting of algae, Nuisance algae, Nutrient requirements, Physiological ecology, Phytoplankton, Sewage, Sewage bacteria, Sewage treatment, Water pollution, Water pollution control, Water pollution effects, Water pollution treatment.

The 5-day, 20 deg C BOD of Chlorella pyrenoidosa (Wis 2005) averaged 0.11 mg of oxygen used per milligram of algae when tested in BOD dilution water but was 0.25 mg of oxygen used per milligram of algae when tested in fresh lake water. The photosynthetic capacity (milligrams of oxygen produced in 2 hours in light per milligram of algae) of algae incubated 5 days in the dark in lake water was nearly the same as algae incubated in dilution water. The addition of major or minor nutrients and added buffer capacity to standard dilution water did not increase the algal BOD. The organisms present in lake waters had little effect on algal BOD. When BOD was measured in algal culture medium, the same rate as in dilution water was obtained. Deionized lake water made up to standard dilution water gave same BOD of algae as in dilution water prepared with distilled water. It is concluded that some heat-stable factor that cannot pass through ion exchange column affected the algal BOD or that the natural ratios of ions in lake waters are essential for maximum activity of algae in BOD. (Eichhorn-Wisc)
W69-03371

EXTRACTIVE AND ENZYMATIC ANALYSES FOR LIMITING OR SURPLUS PHOSPHORUS IN ALGAE,
Wisconsin Univ., Madison. Water Chemistry Lab; and Wisconsin Univ., Madison. McArdle Memorial Lab.
George P. Fitzgerald, and Thomas C. Nelson.
Engineering Experiment Station Reprint No. 909. J Phycol, Vol 2, No 1, pp 32-37, 1966. 6 p, 1 fig, 2 tab, 33 ref.

Descriptors: *Analytical techniques, *Bioassay, *Enzymes, *Nutrient requirements, *Phosphorus compounds, Algae, Aquatic algae, Aquatic microbiology, Aquatic productivity, Aquatic weeds, Chlorophyta, Cyanophyta, Diatoms, Cycling nutrients, Environmental effects, Essential nutrients, Nutrients, Phosphorus, Phosphates, Physiological ecology, Phytoplankton, Rooted aquatic plants, Eutrophication.

An extractive procedure for detection of surplus-stored phosphorus (luxury consumption) in algae and an enzymatic analysis for conditions of phosphorus-limited growth in algae have been evaluated. A simple 60-min boiling water extraction of algae known to contain surplus phosphorus separates essential phosphorus compounds and surplus-stored phosphorus compounds. Surplus phosphorus compounds can be measured in the extract as orthophosphate. Extracts of algae limited in their growth by the amount of available phosphorus contain little or no orthophosphate. Limitation of algal growth by phosphorus supply induces the enzyme alkaline phosphatase. The activity of this enzyme can be measured at pH 9 using phosphorus-nitrophenylphosphate as substrate. Algae which were phosphorus-limited and contained no extractable orthophosphate have as much as 25 times more alkaline phosphatase activity than algae with surplus available phosphorus. Comparative results are presented of extract and enzyme analyses of 9 species of algae from laboratory cultures and algae from 3 lakes before and after incubation in limiting or surplus phosphorus in the laboratory. Concentrations of more than 0.08 mg phosphate-phosphorus per 100 mg of algae extracted indicate algae contained surplus phosphorus. (Eichhorn-Wisc)
W69-03373

SURVEILLANCE OPERATIONS IN THE CONTROL OF WATER POLLUTION ON A NATIONAL SCALE,
For primary bibliographic entry see Field 05G.
For abstract, see .
W69-03584

'FINITE-DIFFERENCE MODELLING OF RIVER AND ESTUARY POLLUTION',
Stanford Univ., Calif.
David A. Bella, and William E. Dobbins.
PROCEEDINGS OF THE NATIONAL SYMPOSIUM ON ESTUARINE POLLUTION, August 23-25, 1967, pp 612-645.

Descriptors: *Mathematical models, *Dissolved oxygen, *Waste assimilation, Biochemical oxygen demand, Mathematical studies, Model studies.

One dimensional dynamic model for describing the mass balance in an estuary is described. It is shown that the resulting differential equations are too complicated for analytical solution. Numerical solution techniques are presented.
W69-03690

5B. Sources of Pollution

CONVECTIVE SALT DIFFUSION IN A RADIAL SUBSURFACE STREAM IN RELATION TO THE PROTECTION OF SUBSURFACE WATERS FROM CONTAMINATED DISCHARGES,
F. M. Bochever, and A. Ye. Oradovskaya.
Transl from Doklady Vodgeo, No. 13, pp 159-180, 1966. Soviet Hydrol: Selec Pap, Issue No 4, pp 416-431, 1967. 16 p, 5 fig, 1 tab, 17 ref.

Descriptors: *Diffusion, *Porous media, *Groundwater movement, *Path of pollutants, Injection wells, Waste disposal, Subsurface waters.
Identifiers: USSR, Radial diffusion equations.

Methods are given for calculation of radial solute diffusion allowing for sorption in porous media. Examples of such diffusion are found near subsurface waste injection wells. Solutions are developed for varying and unvarying concentrations of injected fluids. (Knapp-USGS)
W69-03212

FATE OF DDT AND NITRATE IN GROUND WATER,
Robert S. Kerr Water Research Center, Ada, Okla.; and Southwestern Great Plains Research Center, Bushland, Tex.
Marion R. Scalf, Victor L. Hauser, and Leslie G. McMillion.
Rep, April 1968. 46 p, 29 fig, 3 tab, 33 ref.

Descriptors: *Artificial recharge, *Nitrates, *DDT, Pesticides, Groundwater movement, Aquifers, Injection, Tritium, Tracers, Groundwater, Texas.
Identifiers: *Contaminant movement, Contaminant retention.

Knowledge of the movement, degradation, and disappearance of toxic materials in an aquifer being artificially recharged is of vital importance. Data are presented on the movement, adsorption, and release of nitrate and DDT under actual recharge conditions in the Ogallala Aquifer at Bushland, Texas. Specific concentrations of tritiated water (used for tracer), DDT, and nitrate were added to the recharge water taken from an irrigation well 2,280 feet from the recharge point. Chemical and hydrologic parameters were continually measured at the recharge and nearby observation wells during the 10-day recharge period and the subsequent 12-day withdrawal period. The amount of tritium recovered demonstrated that 94 percent of the recharge water was recovered. Nitrate loss due to denitrification was not evidenced. However, the behavioral pattern at the observation wells indicated the movement of nitrate was not the same as that of the tritiated water. The DDT apparently was adsorbed to the aquifer material close to the recharge well, because no significant amounts reached the observation well 33 feet away. The DDT concentration in the pumped water was 16 times the recharge concentration during the first hour of pumping, but then decreased to below the recharge concentration. Concentrations after two days of pumping became erratic, apparently as a result of disturbances in the aquifer structure. Apparently, a major portion of DDT introduced during recharge was not recovered during pumping but remained in the aquifer. (Steinhilber-USGS)
W69-03219

INSECTICIDES IN TILE DRAINAGE EFFLUENT,
California Univ., Los Angeles. Dept. of Engineering; California Univ., Los Angeles. Water Resources Center; and California State Dept. of Water Resources, Fresno.
For primary bibliographic entry see Field 05A.
For abstract, see .
W69-03221

AMITROLE CONCENTRATIONS IN CREEK WATERS DOWNSTREAM FROM AN AERIALLY SPRAYED WATERSHED SUBBASIN,
Federal Water Pollution Control Administration, Corvallis, Oreg., and Astoria Department of Public Works, Oreg.
Richard B. Marston, Donald W. Schults, and Tamotsu Shiroyama.
Pesticides Monit J, Vol 2, No 3, pp 123-128, Dec 1968. 6 p, 4 tab, 10 ref.

Descriptors: *Herbicides, *Water sources, *Pesticide kinetics, *Municipal water, Weed control, Spraying, Path of pollutants, Persistence.
Identifiers: *Amitrole.

The herbicide amitrole, aerially sprayed on 100 acres of a subbasin in the Astoria, Oreg., watershed in a silvicultural attempt to control salmonberry, was found in measurable amounts in samples of water near the downstream edge of the sprayed area during and for 5 days after spraying. The maximum concentration of 155 ppb was found 30 min. after application began' however, it decreased to 26 ppb by the end of the 2-hr application and to non-detectable amounts by the sixth day after spraying. No amitrole was detected in the samples from a test station 1.8 mi below the sprayed area during or at any time after the spraying. (Knapp-USGS)
W69-03226

EFFECTS OF CONSTRUCTION ON FLUVIAL SEDIMENT, URBAN AND SUBURBAN AREAS OF MARYLAND,
Johns Hopkins Univ., Baltimore, Md.
For primary bibliographic entry see Field 02J.
For abstract, see .
W69-03227

GEOPHYSICAL SURVEYS IN THE VICINITY OF SANITARY LANDFILLS IN NORTHEASTERN ILLINOIS,
Illinois State Geological Survey, Urbana.
Keros Cartwright, and Murry R. McComas.
Ground Water, J Tech Div Nat Water Well Ass, Vol 6, No 5, pp 23-30, Sept-Oct 1968. 8 p, 8 fig, 11 ref.

Descriptors: *Landfills, *Waste disposal, *Path of pollutants, *Groundwater, Soil temperature, Resistivity, Water table, Groundwater movement, Illinois.
Identifiers: Winnetka (Ill), Woodstock, Elgin.

Electrical earth resistivity and soil temperature surveys were conducted in the vicinity of four sanitary landfills in northeastern Illinois to test the possibility of detecting and tracing any chamical or temperature alteration of groundwater by leachates from buried refuse. Reference data on water quality, levels, and movement were provided by a system of monitor wells drilled for a hydrogeologic study of the landfills. The resistivity survey in homogeneous silty sand outwash traced mineralized water from the landfill for a distance of more than 1,000 feet. Apparent resistivity values were one fourth those obtained from unaffected areas. Interpretations of groundwater flow and location of discharge boundaries from the geophysical data agree with interpretations based on the monitor well data. The soil temperature survey indicate the presence of a halo of higher temperatures around the landfill and indicated areas of surface recharge. The geophysical surveys show, in general, that chemically altered water is traceable in uniform earth materials where the depth of the water table is constant. (Knapp-USGS)
W69-03236

NUMERICAL SOLUTIONS FOR DISPERSION IN POROUS MEDIUMS,
Massachusetts Inst. of Tech., Cambridge. Hydrodynamics Lab.
Uri Y. Shamir, and Donald R. F. Harleman.
Water Resources Res, Vol 3, No 2, pp 557-581, 1967. 25 p, 14 fig, 2 tab, 19 ref.

Descriptors: *Dispersion, *Diffusion, *Porous media, *Groundwater movement, *Water pollution, Path of pollutants, Digital computers, Computer programs.
Identifiers: Numerical methods.

A numerical method is presented for the solution of problems of dispersion in steady 3-dimensional potential flow fields in porous mediums, in which the miscible fluids have the same density and viscosity. The method is developed and tested for 2-dimensional problems, and the extension to 3 dimensions is presented. Emphasis is put on the efficiency of the numerical scheme and on its generality. It is shown to be independent of the geometry of the flow field. The computer program for carrying out the computations as described is tested with simple problems, for which exact or approximate analytical solutions exist. It is also used to obtain solutions to a few problems for which no other solution is known. (Knapp-USGS)
W69-03237

HYDROLOGIC DATA COLLECTION IN TIDAL ESTUARIES,
Federal Water Pollution Control Administration, Cincinnati, Ohio.
For primary bibliographic entry see Field 02L.
For abstract, see .
W69-03239

THE PERSISTENCE OF SILVEX IN WATER AND HYDROSOIL,
Southeast Water Lab., Athens, Ga.
For primary bibliographic entry see Field 05A.
For abstract, see .
W69-03240

THE DETERMINATION OF THE IONIZATION CONSTANT OF 2,4-D IN WATER,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 05A.
For abstract, see .
W69-03241

DISCHARGE OF OIL ON SURFACE WATERS - DOUBLE TORT LIABILITY FOR DAMAGES.

Mass Ann Laws ch 91, secs 59, 59A (1967).

Descriptors: *Massachusetts, Legislation, Water law, *Water pollution, Tidal waters, Rivers, Oil, *Oil wastes, Oily water, Insects, Mosquitoes, *Damages, Lakes.
Identifiers: Bilge water.

It is unlawful to discharge oil into or on the waters of any lake, river, tidal waters, or flats of the Commonwealth of Massachusetts if the discharge constitutes a pollution or contamination of the waters, a nuisance, or is injurious to the public health. Any person violating this section may be fined up to $500. This section is not construed to prohibit the use of oil for the extermination of mosquitoes or other insects. Any person who violates this section is also liable in tort for double the amount of damages to the person whose property is damaged. (Watson-Fla)
W69-03274

DUNLAP LAKE PROPERTY OWNERS ASS'N, INC V CITY OF EDWARDSVILLE (ABATEMENT OF POLLUTION).

22 Ill App 2d 95, 159 NE 2d 4-6 (1959).

Descriptors: *Illinois, *Bypasses, *Sewers, *Pollution abatement, Judicial decisions, Local governments, Sewage districts, State governments, Sanitary engineering, Disposal, Effluents, Public health, Sewage, Waste water (Pollution), Lakes, Storm drains, Sewerage, Damages, Water pollution, Water pollution sources, Administrative agencies.

Plaintiff, a non-profit corporation, sued to enjoin defendant from further using a sanitary sewer bypass which allegedly caused sewage to flow into a private lake. The lake was used by area residents for all household purposes, including drinking, as well as for swimming and boating. The by-pass is part of the city's combined storm sewer and sanitary sewer system. When the level in the sanitary sewer reaches a certain height at the point of a bypass because of a stoppage or an overloading caused by heavy rain, the sanitary sewer overflows into the storm sewer; at one particular by-pass, the storm sewer empties into a natural watercourse or ditch which, in turn, empties into plaintiff's lake. The injunction was denied, because plaintiff had not demonstrated actual and substantial injury. The court held that speculative or anticipated damage, as shown in the instant case by plaintiff, is not properly the subject of a permanent injunction proceeding brought by individuals. While plaintiff had shown that the defendant had created a condition whereby diluted sewage could, on infrequent occasions, flow into plaintiff's lake, there was no actual evidence of pollution. The court concluded that pollution control and abatement are best left to the appropriate specialized state agency, except in cases of flagrant and obvious pollution. (Scott-Fla)
W69-03278

STEARNS V STATE (DIVERSION OF SEWAGE EFFLUENT INTO CLEAN RIVER BY ORDER OF ADMINISTRATIVE AGENCY).
274 Wisc 101, 79 N W 2d 241-246 (1956).

Descriptors: *Wisconsin, Judicial decisions, Water law, *Administrative agencies, Water pollution, *Eminent domain, Rivers, *Sewage disposal, Urbanization, Legal aspects, Sewage effluents, Sanitary engineering, Municipal wastes, Diversion, Ditches, Damages, Legislation, Cities, State governments.

The Wisconsin Committee on Water Pollution ordered the Madison Metropolitan Sewerage District to submit plans to eliminate the discharge of sewage effluent into certain lakes in the Madison area. Pursuant to the order, the district submitted plans to divert the effluent into a creek and river which bordered the plaintiff's property. The plaintiff protested the decision of the district. The trial court and the Supreme Court of Wisconsin affirmed the decision of the district holding that the evidence supported the decision. The supreme court stated that as industrial and urban communities grow, the need to dispose of wastes necessarily invades the property rights of the surrounding people. Although a Wisconsin statute prohibits water pollution, it is allowed if done pursuant to law. No mention was made of compensation to the landowners for lost riparian rights. (Watson-Fla)
W69-03296

RECOVERY OF BACTERIAL PATHOGENS FROM HIGH QUALITY SURFACE WATER,
Colorado State Univ., Fort Collins.
J. F. Fair, and S. M. Morrison.
Water Resources Res, Vol 3, No 3, pp 799-803, 1967. 5 p, 2 tab, 5 ref. Grant WP-00679.

Descriptors: *Water quality, *Aquatic microbiology, *Pathogenic bacteria, *Wildlife, *Livestock, Salmonella, Potable water.
Identifiers: Arizona group pathoginic organisms.

An investigation of the presence of enteric disease producing bacteria in a high quality mountain stream in Colorado yielded 11 isolants of members of the genus Salmonella and 51 isolants of organisms belonging to the Arizona group. An improved method for the recovery of these organisms from high quality water was developed and used successfully. The presence of these potentially pathogenic bacteria, which appeared to be the result of contamination by wild or domestic animals, may be a potential hazard to public health.
W69-03311

THE OCCURRENCE AND CHARACTERISTICS OF GROUND-WATER CONTAMINATION IN MASSACHUSETTS,
Massachusetts Univ., Amherst.
Ward S. Motts, and Marvin Saines.
Water Resources Research Center Publ No 7, Jan 1969. 70 p. OWRR Project A-004-Mass.

Descriptors: *Water quality, *Groundwater, *Massachusetts, Water pollution, Path of pullutants, Chlorides, Iron, Domestic wastes, Sewage.
Identifiers: *Groundwater contamination.

The history of contamination of groundwater supplies in Massachusetts is reviewed and the present quality of water supplies is compiled and related to geomorphology, bedrock geology, and human activity. Geomorphic areas of groundwater discharge, including swamps and floodplains generally have greater percentages of iron, manganese, and low pH than areas of groundwater recharge. Four major hydrochemical facies in glacial-outwash and in alluvial aquifers correlate with bedrock geology: (1) a widespread acidic facies characterized by low pH and soft water with high iron and manganese; (2) an alkaline facies of western Massachusetts and (3) of eastern Massachusetts both characterized by high pH and hard water; and (4) an alkaline facies of the Connecticut Valley characterized by high pH and mostly soft water. From 1850 to 1966, a 4 to 10-fold increase of chlorides in public water supplies occurred throughout the state, accompanied by an accelerated chloride increase from about 1954 through 1966. If this increase continues at the same rate, widespread aquifers that contain potable water could be in danger of becoming unusable. A major severe groundwater contamination problem of the state if high iron content that increases with depth in crystalline basement, occurs in many swamps, and is common where organic material is interbedded in sediments near discharge areas. Corrosive water of low pH is a serious problem in some aquifers where organic material is present. Fecal pollution has occurred where rocks have fracture porosity as in the vicinity of the towns of Berlin and Granby, Massachusetts.
W69-03312

THE DISTRIBUTION OF EXCESS TEMPERATURE FROM A HEATED DISCHARGE IN AN ESTUARY,
John Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
For primary bibliographic entry see Field 02L.
For abstract, see .
W69-03341

EFFECT OF WATER SAMPLE PRESERVATION METHODS ON THE RELEASE OF PHOSPHORUS FROM ALGAE,
Wisconsin Univ., Madison. Water Chemistry Lab.
G. P. Fitzgerald, and S. L. Faust.
Engineering Experiment Station Reprint No. 995. Limnol Oceanogr, Vol 12, No 2, pp 332-334, April 1967. 3 p, 2 tab, 9 ref.

Descriptors: *Analytical techniques, *Cycling nutrients, *Eutrophication, *Phosphorus compounds, *Water pollution sources, Algae, Algal control, Algal poisoning, Algicides, Aquatic algae, Bioassay, Chlorophyta, Cyanophyta, Diatoms, Disinfection, Environmental effects, Essential nutrients, Freeze drying, Freeze-thaw tests, Inhibition, Nutrient requirements, Phosphorus, Phosphates, Physiological ecology, Phytoplankton.

Recommended methods for preserving water samples before analysis were used to demonstrate that if algae are not removed from the samples before preservation, phosphate will be released by treated algae. The amount of phosphate-phosphorus (in milligrams per 100 mg algae) released by different algal species varied from 0.01-0.017 for overnight refrigeration at 3-5 deg C to 0.38-0.78 after 60-min extraction in boiling water bath. Freezing (-15 deg C) overnight, chloroform saturation, and an organic mercury algicide also caused the release of phosphate-phosphorus. It is concluded that the release of phosphorus from algae could be significant unless the algae are removed before the samples are preserved for storage. (Eichhorn-Wisc)
W69-03370

STREAM CONTAMINATION BY HERBICIDES AFTER FALL RAINS ON FOREST LAND,
Pacific Northwest Forest and Range Experiment Station, Corvallis, Oreg.
Logan A. Norris.
Res. Prog. Rep., Western Soc. of Weed Sci. 1968:33-34.

Descriptors: *Water pollution, *Forest management, *Aminotriazole, *2-4 D, *2-4-5 T, Overland flow, Watershed management, Chemicals, Agricultural chemicals, Pesticides, Pesticide residues, Aquatic life.

Fall rains will not result in appreciable contamination of streams flowing through forest areas treated with phenoxy or amitrole herbicides in spring or early summer. Unless heavy application is made directly to the stream, the major potential for stream contamination is from heavy rain or land movement resulting in heavy overland flow of water and sediment shortly after herbicides are applied.
W69-03381

RESIDUES OF HERBICIDES AND DIESEL OIL CARRIERS IN FOREST WATERS,
Pacific Northwest Forest and Range Experiment Station, Corvallis, Oreg.
Robert F. Tarrant, and Logan A. Norris.
(Residues in Forest Waters Proc. Herbicides and Vegetation Mgt. Symp., Oregon State Univ. (1967): 94-102.

Descriptors: *Herbicides, *Solvents, *Water pollution, *Forest management, Pesticides, Oil, 2-4-5 T, 2-4 D, Aminotriazole, Phenolic pesticides, Agricultural chemicals, Chemicals, Fish, Pesticide residues, Pesticide toxicity, Aquatic life, Watershed management.

A summary of evidence from research indicates that many herbicides and their carriers, when used in a responsible manner, can be employed in forest vegetation control with minimum impact on water quality. Carelessly applied chemicals can cause significant damage to water quality and aquatic organisms. Much of today's research in the field of herbicide use is directed toward developing new chemicals and techniques of use that will overcome past problems. Along with increased attention to improving chemical brush control practices, the concept of large-scale brush eradication itself needs reappraisal.
W69-03397

GROWTH AND NUTRIENT UPTAKE OF IRRIGATED YOUNG PONDEROSA PINE AFTER FERTILIZER TREATMENTS,
Pacific Northwest Forest and Range Experiment Station, Corvallis, Oreg.
Robert F. Tarrant, and Roy R. Silen.
Reprint from Soil Sci. Soc. Amer. Proc. 1968, 30 (6):796-799, illus.

Descriptors: *Forest management, *Nitrogen compounds, *Phosphorus compounds, *Irrigation effects, Oregon, Soil contamination, Ponderosa pine trees, Soil chemistry, Soil improvement, Fertilizers, Nutrient requirements, Watershed management, Agricultural chemicals.

On a Deschutes loamy sand soil in central Oregon, height and diameter growth of irrigated young ponderosa pine increased linearly as amount of N fertilizer was increased from 0 to 400 lb/acre. Addition of P fertilizer in various combinations with N either increased or decreased tree growth depending on rates used. However, even the unfertilized but irrigated trees, measured as controls in this study, grew much faster than unirrigated trees nearby. After 6 years, soil that had received heaviest N applications contained little more N than did unfertilized soil. Soil that had received heaviest applications of P had about 11% more N. The amount of P was not different between unfertilized soil and that receiving heaviest N treatment. However, in soil receiving heaviest P treatments the amount of soil P was 91 lb/acre--more than 5 times that of unfertilized soil.
W69-03398

CHEMICAL BRUSH CONTROL AND HERBICIDE RESIDUES IN THE FOREST ENVIRONMENT,
Pacific Northwest Forest and Range Experiment Station, Corvallis, Oreg.
L. A. Norris.
Proc. Herbicides and Vegetation Mgt. Symp., Oregon State Univ. (1967):103-123.

Descriptors: *2-4 D, 2-4-5 D, *Aminatriazole, Fish, Chemicals, Agricultural chemicals, *Forest management, *Water pollution sources, Oregon, Watershed management, Pesticides, Pesticide residues, Aquatic life.
Identifiers: Amitrole.

As determined from monitoring studies in western Oregon, the use of herbicides on forest lands constitutes little or no threat to native fish populations or down-stream water users. In eastern Oregon, herbicide residue concentrations exceeded 1 p.p.m. in a few instances, a concentration under which some short-term damage to fish might result. In most instances, however, the length of persistence was such that the hypothetical biologically safe limit was exceeded for only a few days at most. After forest spraying, some herbicide will appear in nearly all streams which flow by or through treated areas. Nearly all of this residue results from direct application of spray materials to water surfaces. The maximum concentration is a function of the proportion of the watershed treated, the amount of live stream included in the unit, the ratio of the surface area of the stream to its volume, and the degree to which brush overhanging the stream intercepts spray materials. The length of persistence is a function of the hydrologic nature of the area treated.
W69-03399

NITROGEN CONTENT OF PRECIPITATION IN A COASTAL OREGON FOREST OPENING,
Pacific Northwest Forest and Range Experiment Station, Corvallis, Oreg.
Robert F. Tarrant, K. C. Lu, W. B. Bollen, and C. S. Chen.
Tellus 1968. XX (3):554-556.

Descriptors: *Chemistry of precipitation, Precipitation (Atmospheric), Organic compounds, *Sea spray, *Nitrogen compounds, Nitrogen cycle, *Rain forests, Ecology, Watershed management, Oregon.
Identifiers: *Forest environment, Organic debris.

Precipitation was collected and analyzed in a coastal Oregon forest opening from June 1963 through May 1964. Very little NO2-N or NO3-N was found, and no NH4-N was found at any time. Of the total N deposited in precipitation, 87 percent was in the organic form, the major source of which is believed to have been from pollen or other locally generated, airborne organic debris. The 1.49 kg/ha/year total N in precipitation did not constitute a significant accretion to the nitrogen economy of the forest ecosystem. (Author)
W69-03400

PESTICIDES IN FOREST WATERS--SYMPTOM OF A GROWING PROBLEM,
Pacific Northwest and Range Experiment Station, Corvallis, Oreg.
For primary bibliographic entry see Field 05C.
For abstract, see .
W69-03401

UTRIENT CYCLING BY THROUGHFALL ND STEMFLOW PRECIPITATION IN THREE OASTAL OREGON FOREST TYPES,
acific Northwest Forest and Range Experiment ation, Corvallis, Oreg.
obert F. Tarrant, K. C. Lu, W. B. Bollen, and C. Chen.
SDA Forest Serv. Res. Pap. PNW-54, 1968. 7 pp.

escriptors: Nitrogen compounds, *Cycling trients, Ecology, Chemicals, Rain forests, Throughfall, Conifers, Douglas fir trees, *Stemow, *Chemistry of precipitation, Oregon, ydrogen ion concentration.
entifiers: Alder.

oncentration of NO ion was much greater in emflow from conifers than in other precipitationrest type combinations, and that of NH ion was bstantially greater in alder stemflow and roughfall. Acidity of throughfall precipitation as not different from that of open-collected rainll. Stemflow was always more acid than the other vo forms of precipitation, but the ecological sigficance of this difference is not believed to be eat. The role of precipitation in N-cycling in ree coastal Oregon forest types appears to be inor in comparison with the much greater nounts of N cycled in litterfall.
/69-03402

OLLUTING STREAMS PROHIBITED.

Y Conservation Law sec 180 (McKinney 1968).

escriptors: *New York, Legislation, *Water poltion, *Fish, Trout, Fish hatcheries, Fish conservaon, Streams, Hudson River, Bodies of water, egal aspects, Water pollution control, Sewage, ivers, Pollutants, Fish toxins, Drainage.
entifiers: Mohawk River.

ection 180 provides pollution protection for fish. o sewage, drainage, deleterious or poisonous subances may be placed in any waters in such quantiies as may be injurious to fish life and propagation, injurious to the waters used by the state fish atcheries. Vessels may not dump oil, acid, etc into e waters of the Hudson or Mohawk rivers. urther, no solid substances, except snow or ice, ay be deposited in or on the banks of any stream habited by trout. (Sisserson-Fla)
/69-03468

ROTECTION OF WATERS; CESSPOOLS AND RAINS.

Y Conservation Law sec 324 (McKinney 1968).

escriptors: *New York, *Water pollution control, Shellfish, *Sewage disposal, Legislation, Legal spects, Drains, Commercial shellfish, Fish, Industial wastes, Waste disposal, Bodies of water, omestic wastes, Conservation, Cesspools.
dentifiers: Vessels, Dumping.

o garbage, sludge, refuse, or sewage, from any essel or building on land or water, which is injurius to the quality of shellfish or fish, shall be umped, thrown, or allowed to run into the waters the Marine District. (Sisserson-Fla)
/69-03470

TATE V KINSLEY (VIOLATION OF POLLUION STATUTE).

03 N J Super 190, 246 A 2d 764-766 (1968).

escriptors: *New Jersey, *Legislation, *Water ollution sources, *Landfills, Judicial decisions, Vater pollution, Water pollution control, Legal spects, Water pollution effects, State governents, Streams, Land development, Fish, Public ealth, Wildlife conservation, Birds.

efendant, as a result of his landfill operations, was harged with violation of a statutory prohibition of pollution of water. The statute made it unlawful to allow deleterious or poisonous substances to enter streams in quantities destructive of life or disturbing the habits of fish and birds inhabiting such waters. The municipal court found that defendant's landfill was the cause of the pollution, but held defendant not guilty because there was no proof of guilty knowledge. The county court reversed, and fined the defendant. The court said the statute involved was not criminal or quasi-criminal, but civil in nature, and, therefore, the state satisfied its burden of proof by providing the preponderance of the evidence. The court held that the statute involved was 'malum prohibitum,' which does not require knowledge or intent. (Wheeler-Fla)
W69-03475

DRAINS AND PROTECTION OF PUBLIC WATER SUPPLIES.
N Y State Sanitary Code Ch 6 reg 7, 8 (McKinney 1954).

Descriptors: *New York, *Watershed management, *Swimming pools, *Waste water disposal, Bodies of water, Lakes, Recreation facilities, Water supply, Public health, Legislation, Legal aspects, Administrative agencies, Reservoirs, Discharge (Water), Sewers, Drains, Regulation, Recreation wastes.

Regulation 7 requires that drainage from artificial swimming pools into sewers receiving domestic sewage must be discharged in such a manner that sewage cannot be siphoned, flooded, or otherwise introduced into the swimming pool. Regulation 8 states that swimming pools or bathing beaches located on the banks of a body of water used as a source of public water supply must be operated so as not to create a menace to such a supply. The rules enacted by the State Commissioner of Health to protect such water supplies shall be strictly observed. (Sisserson-Fla)
W69-03476

THROWING GAS TAR OR REFUSE INTO PUBLIC WATERS.
N Y Public Health Law sec 1300-b (McKinney 1968).

Descriptors: *New York, *Sewage disposal, *Wastes, *Bodies of water, Public health, Streams, Sewer, Legal aspects, Poisons, Sediment discharge, Industrial wastes, Sewage, Water pollution sources, Regulation, Legislation.
Identifiers: *Public waters, Offal, Gas tar, Misdemeanor.

A person who throws or deposits gas tar, offal, refuse or any other noxious, offensive, or poisonous substance into any public waters, or into any sewers or streams running into any public waters, is guilty of a misdemeanor. (Sisserson-Fla)
W69-03477

RELATIVE ABSORPTION OF STRONTIUM AND CALCIUM BY CERTAIN ALGAE,
Arizona Univ., Tucson. Dept. of Agricultural Chemistry and Soils.
Wallace H. Fuller, and James E. Hardcastle.
Reprint from Soil Sci Soc Amer Proc, Vol 31, No 6, pp 772-774, Nov-Dec 1967. 3 p, 2 fig, 2 tab.

Descriptors: *Soil algae, *Aquatic algae, Algae, Arid climates, Semiarid climates, *Absorption, *Calcium, Soil contamination, *Strontium radiosotopes, Cytological studies.
Identifiers: Nutrient media.

Soil algae appear in abundance in arid and semiarid lands where they form surface crusts of varying density and cling to stone surfaces and lime outcrops. The uptake of radiostrontium by 7 freshwater and desert algae with respect to their function in concentrating radioactive contamination products of uranium fission was evaluated. In addition, the interrelationships between the uptake by algae of strontium and calcium were studied. The objective was twofold: (1) to evaluate the capacity of certain arid land algae to distinguish between calcium and strontium in their metabolism, and (2) to evaluate the extent to which calcium enters into a competitive position in the absorption and concentration of strontium by algae cells. Uptake always favored calcium over strontium when the two elements were present in nutrient media together thereby modifying the hazard of strontium entering the food chain. (Affleck-Ariz)
W69-03491

IMPACT OF INSTITUTIONAL ARRANGEMENTS ON THE AVAILABLE ALTERNATIVE DEVELOPMENTAL PATHS FOR WATER ALLOCATION AND POLLUTION CONTROL IN THE COLORADO RIVER BASIN,
Battelle-Northwest, Richland, Wash.; and Northwestern Univ., Evanston, Ill.
For primary bibliographic entry see Field 06A.
For abstract, see .
W69-03492

INDUSTRIAL WASTE GUIDE ON THERMAL POLLUTION,
Federal Water Pollution Control Administration, Corvallis, Oreg. Pacific Northwest Water Lab.
Alden G. Christianson, and Bruce A. Tichenor.
Fed Water Pollut Contr Admin Rep, 112 p, Sept 1968. 6 fig, 11 tab, 91 ref.

Descriptors: *Thermal pollution, *Pollution abatement, Industrial wastes, Thermal powerplants, Industrial production, Water pollution effects, Legal aspects, Water Pollution control.
Identifiers: Thermal water pollution.

A guide to the sources, effects, and methods of control of thermal water pollution is presented to aid state, federal, and local regulatory personnel, community and regional planners, and industrialists in making sound decisions on handling hot discharges. A guide to more specific literature is included with a general description of the subject for the user's basic orientation. The general topics covered are heat loads from general industry, electric power, and manufacturing; physical, chemical, and biological effects; and methods of control and utilization of excess heat. A bibliography of 91 references is included. (Knapp-USGS)
W69-03537

EFFECTS OF STREAMFLOW REGULATION ON WATER QUALITY-THE TVA EXPERIENCE,
Milo A. Churchill.
For 8-Volume Proceedings see this issue, Field 06B, W69-03305. International Conference on Water for Peace, Vol 8, pp 118-131, 1968. 14 p, 11 ref.

Descriptors: *Water quality, *River regulation, *Reservoirs, *Tennessee Valley Authority Project, Conferences, Publications, Stream flow, Impoundments, Flood control, Thermocline, Stratification, Pollution, Dissolved oxygen, Biochemical oxygen demand, Water quality control, Thermal stratification, Impounded waters, Water storage.
Identifiers: Bacteriological effects, Dissolved minerals.

An understanding of the effects of impoundment on water quality is a prerequisite to sound planning for the conservation and development of water resources. A comprehensive body of knowledge has been assembled during 30 years of investigations of the changes in physical, bacteriological, chemical and other qualities of water produced by the TVA water control system. An understanding of thermal stratification in reservoirs and its influence is essential to understanding reservoir effects on the temperature of released water and on many other parameters of water quality. Storage impoundments have a marked effect on dissolved oxygen which in turn affects the capacity of water

released from impoundments to assimilate organic wastes and to support aquatic life. Storage impoundments serve as barriers between upstream bacterial pollution and downstream sites of water use. In a storage reservoir, variations in mineral concentrations are lessened so that water of more uniform quality results downstream. The effects discussed are those of the large storage reservoirs. The article also discusses the various effects on the same water qualities of small reservoirs used mainly for power. (Childs-Fla)
W69-03585

TEXTILE WASTES - A BIBLIOGRAPHY,
North Carolina State Univ., Raleigh. Dept. of Textile Chemistry.
Charles D. Livengood.
North Carolina Water Resources Research Inst. Report No. 18, 1968. OWRR Project A-006-NC.

Descriptors: *Industrial wastes, *Textiles, Water pollution, *Bibliographies.

This annotated bibliography contains 482 literature entries published after 1954 relating to textile wastes. It includes abstracts published in the Chemical Abstracts, Textile Technology Digest, Shirley Institute Abstracts, and Water Pollution Abstracts through June 1968. Each entry has been key-word coded and indexed. Coding was made compatible with the Thesaurus of Engineering Terms published by Engineers Joint Council.
W69-03597

BIOTIC RESPONSE TO POLLUTION REDUCTION IN A RIVER,
Michigan State Univ., Hickory Corners. W. K. Kellogg Biological Station.
For primary bibliographic entry see Field 05C.
For abstract, see .
W69-03602

THE POTOMAC ESTUARY - STATISTICS AND PROJECTIONS,
Johan A. Aalto.
Paper presented at Winter Meeting of the Interstate Commission on the Potomac Basin, Fredericksburg, Virginia, February 29, 1968.

Descriptors: *Statistics, *Water quality, *Biochemical oxygen demand, *Dissolved oxygen, *Forecasting, *Water pollution, E. Coli, Data collections, Oxygen demand, Plants, Coliforms, Bacteria, Microorganisms, Maryland, Virginia, Geographical regions, Regions, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Northeast U. S., Southeast U. S.

The author presents information on water quality and pollution loads in the Upper Potomac Estuary. The total load is eight times the assimilative capacity required to maintain a dissolved oxygen (DO) average of five mg/1. The median counts per 100 ml at Woodrow Wilson Bridge were 91,000 MPN coliforms and 24,000 MPN fecal coliforms (E. Coli). Minimum dissolved oxygen levels for 1965 and 1985 are also given.
W69-03603

'STATEMENT', IN CLEAN WATER FOR THE NATION'S ESTUARIES,
Federal Water Pollution Control Administration, Atlanta, Ga.
Walter Abbott.
Transcript of Public Meeting, Biloxi, Mississippi, January 17, 1968, pp 8-13.

Descriptors: *Mississippi, *Gulf of Mexico, *Economic justification, *Federal government, *Administration, Coastal plains, Geographical regions, Gulf coastal plain, State governments, Regions, Navigation, State jurisdiction, Governments, Eutrophication, Southeast U. S., Turbidity, Physical properties, Gulfs, Bodies of water, Surface waters, Waste water (Pollution), Liquids, Liquid wastes, Wastes, Water types.

From the standpoint of economics, the estuaries of Mississippi are best put to use as navigation channels and open sewers, recognizing that pollution growth is inevitable. The author sees no justification for federal intervention in the management of intrastate estuarine waters. Hypereutrophication concepts are derived from 'glacially formed, oligotrophic, northern lakes' which do not necessarily apply to Gulf of Mexico estuaries. He concludes, 'it would appear that decrease in freshwater influx, with associated decrease in turbidity, probably constitutes a far greater hypereutrophication menace than does inflow of domestic and industrial waste waters'.
W69-03605

'DISTRIBUTION OF POLLUTIONAL LOADINGS IN SUISUN BAY',
Stanford Univ., Calif.
Takashi Asano.
PROCEEDINGS OF THE NATIONAL SYMPOSIUM ON ESTUARINE POLLUTION, August 23-25, 1967, pp 441-461.

Descriptors: *Dye releases, *Dispersion, *Waste disposal, *Water quality, *California, Mathematical studies, Tracers, Water types, Analytical techniques, Tracking techniques, Flow, Inflow, Mixing, Geographical regions, Pacific coast region, Regions, Southwest U. S., Water pollution, Fresh water.

The California Department of Water Resources conducted a series of dye tracer studies during 1965 and 1966. The 1966 series was conducted jointly with the Federal Water Pollution Control Administration in the Lower Delta and Suisun Bay and in the United States Army Corps of Engineers' San Francisco Bay Model. The waste dispersive characteristics under various flow regimes and the specific effect of fresh water inflow upon the dispersion and transit of continuously discharged pollutants into the study area were investigated. Coordination of the actual waste loadings and dispersive information with proposed mathematical expressions was examined to reproduce present and future water quality conditions.
W69-03609

STATEMENT BEFORE THE SUBCOMMITTEE ON AIR AND WATER POLLUTION,
Lewis M. Cadwallader.
Committee on Public Works, U. S. Senate, Washington, D. C., April 17, 1968.

Descriptors: *Thermal pollution, *Cooling towers, *Maryland, *Thermal powerplants, *Pollution abatement, Electric powerplants, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Geographical regions, Northeast U. S., Regions, Engineering structures, Industrial plants, Powerplants, Structures, Water pollution, Waste disposal, Abatement.

Cadwallader states the pros and cons of cooling towers in an estuary. There are five factors to be considered when placing cooling towers in an estuary: (1) They introduce large volumes of water vapor to the environment which can produce local fogging or icing; (2) They produce concentrated liquid wastes which are a disposal problem; (3) They are aesthetically unpleasing; (4) They present construction problems due to the corrosiveness of the salt and brackish waters on the materials used in their construction; and (5) Their salt-water vapors are potentially dangerous to nearby crops and vegetation.
W69-03619

'ANALYZING STEAM ELECTRIC POWER PLANT DISCHARGES',
Stanford Univ., Calif.
John Eric Edinger, and John C. Geyer.
In PROCEEDINGS OF THE NATIONAL SYMPOSIUM ON ESTUARINE POLLUTION, August 23-25, 1967, pp 462-485.

Descriptors: *Discharge measurement, *Equations, *Hydroelectric plants, *Water cooling, *Temperature control, Thermal pollution, Water pollution, Cooling towers, Cooling water, Water types, Cooling, Powerplants, Engineering structures, Industrial plants, Structures, Electric powerplants, Afterbays, Estuarine environments, Aquatic environments, Environment.

The temperature distribution resulting from the advection, dispersion, and cooling of water from a steam-electric-powerplant condenser is analyzed for a station located on a peninsula and discharging near the midpoint of a small estuary. A theoretical temperature distribution equation is developed and used to predict within a mile of the discharge point for various levels of operation. Temperatures are related to an equilibrium temperature toward which water temperatures are driven by meteorological conditions.
W69-03655

EQUIPMENT FOR A DIRTY JOB.
Chemical Week, Vol 102, No 7, February 17, 1968, pp 69-81.

Descriptors: *Thermal pollution, *Equipment, Water pollution, Electric powerplants.

This article describes a variety of water pollution problems, as well as some equipment designed to alleviate these problems. With regard to thermal pollution, it is stated that electrical generating plants using nuclear or fossil fuels were among the first to be tagged as thermal polluters. However, a number of the process industries are also potential polluters, particularly if they are on small streams or form large industrial complexes that are highly geographically concentrated.
W69-03661

METROPOLITAN SEATTLE'S DUWAMISH ESTUARY WATER QUALITY PROGRAM,
C. V. Gibbs, and G. W. Isaac.
Water Pollution Control Federation, Journal, Vol 40, No 3, March, 1968, pp 385-394.

Descriptors: *Monitoring, *Rivers, *History, *Water quality control, *Washington, Bodies of water, Running waters, Streams, Surface waters, Water pollution control, Control, Quality control, Geographical regions, Pacific coast region, Pacific northwest U. S., Regions, Data collections, Statistics.

The Duwamish estuary study by the Municipality of Metropolitan Seattle is the most comprehensive municipally sponsored water quality study in the Pacific Northwest. The historical development of the river problem, present water quality-monitoring efforts, and results of the investigations are presented. Data collected will be used to guide the formulation of plans for future pollution-control measures.
W69-03667

THE HUDSON RIVER ESTUARY, A PRELIMINARY INVESTIGATION OF FLOW AND WATER-QUALITY CHARACTERISTICS,
For primary bibliographic entry see Field 02L.
For abstract, see .
W69-03668

TESTIMONY - PHILADELPHIA CONSERVATIONISTS, INC.,
Allston Jenkins.
Estuarine Hearings, Subcommittee on Fisheries and Wildlife Conservation of the Committee on Merchant Marine and Fisheries, House of Representatives, 90th Congress, Serial No 90-3, March, 1967.

Descriptors: *Dredging, *Estuarine environment, *Industrial plants, *Industrial water, *Delaware River, Electric powerplants, Powerplants, Aquatic

vironment, Environments, Conservation, ildings, Engineering structures, Structures, cks, Nuclear powerplants, Bodies of water, Instate rivers, Rivers, Running waters, Streams, rface waters, Delaware River Basin Commission, erstate commissions, River basin commissions, ter types.

e case histories of estuarine despoliation in the laware River estuary are presented. Case histos discussed include: (1) construction for refine-s, (2) dock and berthing facilities, (3) acquisin of land for a refinery tank farm and unloading ilities, and (4) acquisition of land for construct-a nuclear energy plant.
69-03684

EPING OIL OUT OF THE SEA.
ean Industry, Vol 2, No 11, November, 1967, pp -16.

scriptors: *Water pollution sources, *Oily ter, *Oil wastes, *Ships, Oil industry, Industries, ganic matter, Wastes, Transportation, Oil.

e authors discuss various sources of oil pollution: ker ballast and bilges, tanker disasters, sunken kers, natural oil seeps. Also discussed are vari-s means of combating oil spillage and ways of imving oil transporting.
69-03688

C. Effects of Pollution

TROPHICATION,
onsin Univ., Madison. Lab. of Limnology; and sconsin Univ., Madison. University-Industry search Program.
thur D. Hasler, and Marlette E. Swenson.
ence, Vol 158, No 3798, pp 278-282, 13 Oct 67. 5 p.

scriptors: *Conferences, *Eutrophication, Vater pollution control, Water pollution sources, ater pollution effects, Water quality.

e first international symposium on eutrophican convened at The University of Wisconsin, adison, during the period, 11-16 June 1967. me 600 water research scientists, industrial presentatives, state and federal governmental ofals, and others interested in water pollution con-l heard addresses by 36 invited specialists and ee governmental officials. Prior to the publican of detailed proceedings, scheduled to appear early 1968, authors have published this short scription of the activities of the symposium. ope of the addresses includes case history studies eutrophication; conditions in oligotrophic lakes; limentary history as relates to eutrophication; trophication in the Great Lakes region; identifiion of eutrophying processes; measurement of trophication rates; sources of plant nutrients; inences of micronutrients and growth factors; evention; correction; sewage treatment; agricul-al practices; zoning; positive characteristics of trophication; and systems analysis as a tool for dy and prediction. Symposium was sponsored by tional Academy of Sciences-National Research uncil cooperating with US Atomic Energy Comssion, US Department of the Interior. National ience Foundation, and Office of Naval Research. ichhorn-Wis)
69-03357

ETECTION OF LIMITING OR SURPLUS TROGEN IN ALGAE AND AQUATIC WEEDS,
sconsin Univ., Madison. Water Chemistry Lab.
orge P. Fitzgerald.
hycol, Vol 4, No 2, pp 121-126, 1968. 6 p, 4 fig, ab, 13 ref.

escriptors: *Algae, *Analytical techniques, quatic weeds, *Bioassay, *Essential nutrients, itrogen compounds, Aquatic algae, Aquatic crobiology, Chlamydomonas, Chlorophyta, Cyanophyta, Diatoms, Cycling nutrients, Environmental effects, Ammonia, Ammonium compounds, Nitrogen fixation, Nutrient requirements, Nutrients, Physiological ecology, Phytoplankton, Rooted aquatic plants, Bioindicators.

The rate of ammonium-nitrogen absorption by algae and aquatic weeds in the dark has been shown to be 4 to 5 times greater for plants which are nitrogen-limited than for plants with sufficient available nitrogen. Eight species of green algae, 2 blue-green algae, 2 diatoms, and 3 aquatic weeds were used to demonstrate the usefulness of the test in determining if available nitrogen was in surplus or limited supply in a particular environment. The test was shown not to differentiate between blue-green algae capable of fixing nitrogen (4 species) from media with nitrate-nitrogen or without combined nitrogen. The factors influencing the results of ammonium-nitrogen absorption tests have been investigated. In order to differentiate between plants with sufficient available nitrogen and those which are nitrogen-limited, the rate of ammonium-nitrogen absorption (0.1 mg nitrogen) over 1-hr incubation in the dark by 10-20 mg of algae or aquatic weed tissues is measured. The relatively simple analysis for ammonium-nitrogen in the samples makes it very easy to follow the changing nitrogen nutrition of plants in cultures with a limited nitrogen supply or in the presence of possible nitrogen sources. (Eichhorn-Wisc)
W69-03364

STREAM POLLUTION BY ALGAL NUTRIENTS,
Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
Werner Stumm, and James J. Morgan.
Sanitary Engineering Reprint No. 45. Trans 12th Ann Conf Sanitary Eng, Univ Kansas, pp 16-26, 1962. 11 p, 3 fig, 2 tab, 19 ref.

Descriptors: *Streams, *Water pollution effects, *Cycling nutrients, *Eutrophication, Algae, Aquatic algae, Aquatic bacteria, Aquatic microbiology, Balance of nature, Wisconsin, Bioassay, Biochemical oxygen demand, Environmental effects, Environmental sanitation, Essential nutrients, Harvesting of algae, Inhibition, Light penetration, Nitrogen compounds, Phosphorus compounds, Nutrient requirements, Photosynthetic oxygen, Water pollution control, Water pollution sources, Water pollution treatment, Pollution identification, Sewage, Sewage disposal, Sewage effluents, Sewage lagoons.
Identifiers: Madison (Wis).

Since organisms are consumed as well as produced, size of standing biomass may bear little relation to organism activity rate. Aerobic biological sewage treatment mineralizes oxidizable organic substances but eliminates only 20-50% of nitrogen and phosphorus compounds. In sewage treatment, carbon becomes limiting before nitrogen and phosphorus are incorporated into sludge. Increase of phosphorus from detergents may reach point where phosphorus could no longer be considered a limiting factor. Sewage stabilization ponds represent mixture of bacterial decomposition and algal growth, but, to remove nitrogen and phosphorus, algae must be separated from pond effluent. Decomposition of phytoplankton which settled to bottom of lake helps increase nutrient content of bottom waters during stagnation periods. Not all nutrients are regenerated. Madison, Wis, lakes retain 30-60% of nitrogen received. Contrasted with stabilization ponds, lake stagnation tends to separate autotrophs (algae) from heterotrophs (bacteria and animals). Relation between fertilization and algae is indicated by assumption that every ion of phosphorus added to water, if completely utilized for photosynthetic production, causes use of 16 nitrogen atoms and 106 atoms of carbon algal protoplasm. Complete oxidation of organic matter containing one atom of phosphorus requires 150 molecules of oxygen. Nutrient removal methods are reviewed. (Eichhorn-Wisc)
W69-03369

STREAM CONTAMINATION BY HERBICIDES AFTER FALL RAINS ON FOREST LAND,
Pacific Northwest Forest and Range Experiment Station, Corvallis, Oreg.
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-03381

RESIDUES OF HERBICIDES AND DIESEL OIL CARRIERS IN FOREST WATERS,
Pacific Northwest Forest and Range Experiment Station, Corvallis, Oreg.
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-03397

CHEMICAL BRUSH CONTROL AND HERBICIDE RESIDUES IN THE FOREST ENVIRONMENT,
Pacific Northwest Forest and Range Experiment Station, Corvallis, Oreg.
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-03399

PESTICIDES IN FOREST WATERS--SYMPTOM OF A GROWING PROBLEM,
Pacific Northwest and Range Experiment Station, Corvallis, Oreg.
Robert F. Tarrant.
Reprint from Soc. Amer. Foresters Proc. (1966):159-163.

Descriptors: *Pesticides, *Water pollution sources, *Forest management, *Water pollution control, Insecticides, Herbicides, DDT, 2-4 D, 2-4-5 T, Chemicals, Soil contamination, Watershed management.
Identifiers: *Forest environment, Forest waters.

In relation to other areas of the chemical pollution problem, the forest environment is generally in good condition, but this fortunate situation can operate to our disadvantage if we remain complacent. If forest watershed managers are to keep on top of the chemical pollution threat, we must: (1) Use chemicals with proper regard for their possible adverse effects on water quality; (2) Keep alert to sources of chemical pollution in the forest that are not under direct control of the forest manager; (3) Strengthen our programs leading to better public understanding of forest pollution and its problems; (4) Develop baseline values for forest water quality and monitor forest water systems to detect presence of chemical pollutants; and (5) Improve our research position to provide information leading to safe use of chemicals in the forest. (Author)
W69-03401

MAGNOLIA PETROLEUM CO V STINSON (NEGLIGENT POLLUTION OF STREAMS).

93 So 2d 815-820 (Miss 1957).

Descriptors: *Mississippi, *Water pollution, *Pollutant identification, *Poisons, Judicial decisions, Riparian rights, Legal aspects, Water pollution sources, Analytical techniques, Oil wells, Salinity, Streams, Gullies, Overflow, Riparian land, Pastures, Sheep, Cattle, Ruminants.
Identifiers: Negligence.

Plaintiff Stinson brought an action against an upstream oil well operator for injury to his sheep and cattle and damage to his pastures resulting from the negligent pollution of a stream which ran through Plaintiff's property. Defendant owned the property adjacent to appellee's land. An oil well on defendant's land was connected to the stream by a gully. Plaintiff discovered the pollution when he found a dead sheep and observed a mud formation in the stream. He traced the formation to defendant's well, adjacent to which there was a large pit used for mixing drilling muds. The mud and slime had overflowed into the gully and filtered into the

stream. Bags of drilling chemicals were on the ground around the pit and, due to recent heavy rain, the bags were opened and their contents spread about. Expert testimony established that Plaintiff's animals died from poisoning, and an analysis of the water showed that the same chemicals used in drilling were present in the water. A jury found for Plaintiff, and the supreme court upheld this verdict, stating that a riparian owner has the right to have the water of the stream come to him in its natural purity or its accustomed condition for his domestic use. The pollution here demonstrated constituted an actionable infringement on that right. (Sisserson-Fla)
W69-03439

ENVIRONMENTAL REQUIREMENTS OF BLUE-GREEN ALGAE.
Federal Water Pollution Control Administration, Corvallis, Ore.; Pacific Northwest Water Lab, and Washington Univ., Seattle.

Proceedings of a Symposium Corvallis Ore., Sept 23-24, 1966. Oct, 1967, 111 p.

Descriptors: *Cyanophyta, *Eutrophication, *Plankton, Algae, *Nutrient Requirements.
Identifiers: *Blue-green algae, *Alga blooms, Algae physiology.

The problem of accelerated eutrophication has many facets, and some are being examined through research to find the keys for solution. This symposium was held to fulfill the need to understand better the environmental requirements of blue-green algae. It contains eight papers by scientists who are concerned with the ecological control of algae blooms. Current knowledge on the subject has been evaluated and gaps identified for future investigation. The papers are followed by a general discussion and a specific discussion of nutrient measurement and nuisance control. (See also W69-03513 thru W69-03518)
W69-03512

WHY STUDY BLUE-GREEN ALGAE,
Washington Univ., Seattle. Dept. of Zoology.
W. T. Edmonson.
Symposium on Environmental Requirements of Blue-green Algae. Federal Water Pollution Control Admin, Pacific Northwest Water Lab, Corvallis, Ore, pp 1-6, Oct 1967. 6 p, 11 ref.

Descriptors: *Cyanophyta, *Eutrophication, *Physiological ecology, *Water pollution effects, Algae, Algal control, Harvesting, Aquatic algae, Aquatic animals, Aquatic microbiology, Aquatic productivity, Balance of nature, Cycling nutrients, Environmental effects, Environmental sanitation, Essential nutrients, Inhibition, Light intensity, Limnology, Nitrogen compounds, Nuisance algae, Nutrient requirements, Phosphorus compounds, Photosynthetic oxygen, Phytoplankton, Plankton, Pollutant identification, Sewage effluents, Sewage disposal, Water pollution control, Water pollution sources.
Identifiers: Lake Washington.

In 1950, L Washington had only 1,500,000 cubic microns per milliliter of phytoplankton, 15% of which were blue-green algae. In 1962, it had 10,500,000 cubic microns per milliliter of which 95% were blue-green algae, and the appearance of the lake stimulated the construction of an expensive sewage diversion program. The blue-greens attract attention because of the public nuisance they cause due to their ability to float and to concentrate downwind; they have special nutritional properties, are conspicuous in extreme kinds of habitats, and are important in forming and stabilizing soil. The colonial species of blue-greens are less readily eaten by some zooplankton, which may be a factor in their survival. The relationship between high nutrient waters and presence of blue-green algae is discussed, and it is pointed out that the blue-green, Oscillatoria agardhii, remained in L Washington, when nitrogen and phosphorus levels were very low. The key to dominance of algal species may be in the proportion of nutrients more than in quantity. More information is needed concerning antibiotic substances produced by algae. (For main entry see W69-03512)
W69-03513

PROBLEMS IN THE LABORATORY CULTURE OF PLANKTONIC BLUE-GREEN ALGAE,
Manchester College, North Manchester, Ind.
William R. Eberly.
Symposium on Environmental Requirements of Blue-Green Algae, Federal Water Pollution Control Admin, Pacific Northwest Water Lab, Corvallis, Ore, pp 7-34, Oct 1967. 28 p, 15 fig, 1 tab, 16 ref.

Descriptors: *Cyanophyta, *Physiological ecology, *Phytoplankton, *Cultures, Algae, Aquatic productivity, Cycling nutrients, Environmental effects, Essential nutrients, Eutrophication, Inhibition, Light intensity, Light penetration, Limnology, Nitrogen compounds, Nutrient requirements, Photosynthetic, Oxygen, Plankton, Water pollution effects.
Identifiers: Algal taxonomy, Algae identification.

Surface blooms are usually dominated by either Chroococcales (microcystis) or filamentous forms (Anabaena or Aphanizomenon), whereas deep-water blooms are nearly always Oscillatoria. The author is concerned with the Oscillatoria associated with deep-water oxygen maxima (10-12 deg C, light 1% of surface intensity). Graphs are presented showing the rates of growth (OD) for a number of Oscillatoria isolates and the effects of initial inoculation level, pH, soil extract, temperature, and light intensity in ASM and ASM-1 media. The taxonomic implications of these findings are discussed. Also considered is the problem of how algae in nature maintain their position, whereas in laboratory cultures considerable turbulence is required to keep them suspended. Other problems reviewed are the relation between bacteria and algae, the almost unialgal blooms occurring in nature, and the relations between light and temperature. Author points out that with an increase of nutrients (eutrophication) light and temperature optimal might be raised with the result that the maximum concentration of algae would move closer to the surface. Seasonal downward movements of a bloom of Oscillatoria during the summer depletion of nutrients is described. (For main entry see W69-03512)
W69-03514

ASPECTS OF THE NITROGEN NUTRITION OF SOME NATURALLY OCCURRING POPULATIONS OF BLUE-GREEN ALGAE,
Alaska Univ., College. Inst. of Marine Science.
Vera A. (Dugdale) Billaud.
Symposium on Environmental Requirements of Blue-green Algae, Federal Water Pollution Control Admin, Pacific Northwest Water Lab, Corvallis, Ore. pp 35-53, Oct 1967. 19 p, 5 fig, 6 tab, 19 ref.

Descriptors: *Cyanophyta, *Nitrogen compounds, *Nutrient requirements, *Physiological ecology, Algae, Analytical techniques, Aquatic algae, Aquatic microbiology, Aquatic weeds, Balance of nature, Bioassay, Chlorophyta, Diatoms, Cycling nutrients, Environmental effects, Essential nutrients, Eutrophication, Inhibition, Light intensity, Light penetration, Limnology, Nitrogen cycle, Nitrogen fixation, Nutrients, Photosynthetic oxygen, Phytoplankton, Plankton, Rooted aquatic plants, Alaska.
Identifiers: Smith Lake (Alaska).

It is well established that nitrogen-fixing blue-green algae increase the nitrogen content of waters, and it is assumed that this nitrogen is available upon degradation, to other algal species. Experiments in Smith Lake, central Alaska, indicate that an Anabaena population develops within a few days after ice breakup. During the summer, a steady, lower level of Aphanizomenon growth occurs. The initial nitrogen used by Anabaena is ammonium-nitrogen; then nitrogen fixation becomes important, at one point accounting for half the nitrogen assimilated. The first Anabaena filaments growing on ammonium-nitrogen have no heterocysts; they appear at the time nitrogen fixation occurs. The population of Aphanizomenon is very stable and appears to be controlled by grazing by dense population of zooplankton. Nitrogen fixation in significant rates only occurs during the Anabaena bloom. In another lake, Aphanizomenon occurs in anoxic, deeper waters. The presence of combined nitrogen sources does not appear to prevent nitrogen-fixing blooms from developing. (For main entry see W69-03512)
W69-03515

ENVIRONMENTAL REQUIREMENTS OF THERMOPHILIC BLUE-GREEN ALGAE,
Oregon Univ., Eugene, Dept. of Biology.
Richard W. Castenholz.
Symposium Environmental Requirements of Blue-Green Algae, Federal Water Pollution Control Admin, Pacific Northwest Water Lab, Corvallis, Ore. pp 55-79, Oct 1967. 25 p, 4 fig, 1 tab, 53 ref.

Descriptors: *Cyanophyta, *Physiological ecology, *Saline water, *Thermal water, Algae, Aquatic algae, Aquatic microbiology, Balance of nature, Bioassay, Chlorophyta, Diatoms, Environmental effects, Inhibition, Light, Light intensity, Light penetration, Limnology, Photosynthetic oxygen, Temperature, Thermal pollution, Thermal springs, Thermal stress.

Thermophilic algae are designated as those whose optimum temperature is above 45 deg C. The green mats formed in hot springs above 45 deg C may persist because of the absence of grazers. Thermophilic algae must be able to withstand the very high light intensities of the shallow spring waters. There is a great similarity in the flora of hot springs throughout the world. Hot springs provide very constant temperature habitats, but some blue-green thermophiles can withstand temperature shocks as great as room temperature to 70 deg C without effect. The highest temperature for consistent survival appears to be 74-75 deg C, but this limit may depend upon water chemistry. Details of observations on temperatures as related to habitats are presented and reviewed. The correlations of growth and light intensities found in field and laboratory studies are discussed. (For main entry see W69-03512)
W69-03516

GROWTH REQUIREMENTS OF BLUE-GREEN ALGAE AS DEDUCED FROM THEIR NATURAL DISTRIBUTION,
Humboldt State Coll., Arcata, Calif.
William C. Vinyard.
Symposium on Environmental Requirements of Blue-Green Algae, Federal Water Pollution Control Admin, Pacific Water Lab, Corvallis, Ore, pp 81-85, Oct 1968. 5 p, 2 ref.

Descriptors: *Eutrophication, *Cyanophyta, *Physiological ecology, Algae, Analytical techniques, Aquatic algae, Aquatic microbiology, Balance of nature, Cycling nutrients, Environmental effects, Essential nutrients, Chlorophyta, Diatoms, Inhibition, Light, Light intensity, Light penetration, Limnology, Nutrient requirements, Nutrients, Photosynthetic oxygen, Phytoplankton, Saline water, Ecological distribution, California.

Organic pollution almost always insures an overabundance of blue-green algae. Also, excessive growth of cyanophytes occurs during periods when high temperatures and light intensities prevail. Because not all species of cyanophytes have nuisance significance, their taxonomy assumes some importance. Author indicates that knowledge relating to taxonomy is deficient and that modern studies relating systematics to physiological and other cultural requirements are needed. Information pertaining to the geographical distribution of

e algae is also required. Species of blue-greens dominate in sump ponds of non-brine oil fields taining crude oils and tars, some occurring at bottom under the heavy scum of black tar, con-ons which present the algae with little or no t and minimal possibility of gaseous diffusion or out of the medium. In Freshwater Lagoon, a tively cool coastal environment near Orick, f, a nearly continuous bloom, including Micro-is, Coelosphaerium and Anabaena, occurred some five years. (For main entry see W69-12)
9-03517

CENT ADVANCES IN THE PHYSIOLOGY BLUE-GREEN ALGAE,
pps Institution of Oceanography, La Jolla, f.
nund Holm-Hanson.
nposium on Environmental Requirements of e-Green Algae, Federal Water Pollution Con- Admin, Northwest Water Lab, Corvallis, Ore, 7-96, Oct 1967. 10 p.

criptors: *Aquatic microbiology, *Physiologi- ecology, *Cyanophyta, Algae, Analytical niques, Aquatic algae, Bioassay, Cycling ients, Environmental effects, Essential ients, Eutrophication, Freeze drying, Freeze-v tests, Freezing, Light intensity, Light penetra-, Limnology, Nitrogen compounds, Nitrogen tion, Nutrients, Nutrient requirements, tosynthetic oxygen, Phytoplankton, orophyta.

ne of the subjects discussed are the morphology lue-green algae compared to related algae or teria, the undefined manner in which blue-en algae move, and their microelement nutri-. Presented are details of work on the resistance lue-green algae to freezing and freeze-drying, ecially algae isolated in Anarctica. Additions of se serum, glycerol, milk powder, etc, may help survival of green algae; but they do not help e-greens. The question is raised as to what form arbon the blue-greens can utilize; at pH 11 most on is present as carbonate ions. Results of ex-ments on the organic nutrition of Nostoc are sented which indicate that this alga can utilize cose in the light but little or none in the dark. r main entry see W69-03512)
9-03518

DUSTRIAL WASTE GUIDE ON THERMAL LLUTION,
eral Water Pollution Control Administration, rvallis, Oreg. Pacific Northwest Water Lab.
primary bibliographic entry see Field 05B.
abstract, see .
9-03537

E EFFECTS OF THERMAL POLLUTION ON VER ICE CONDITIONS,
d Regions Research and Engineering Lab., nover, N. H.
.. Dingman, W. F. Weeks, and Y. C. Yen.
ter Resources Res, Vol 4, No 2, pp 349-362, 1968. 14 p, 7 fig, 1 tab, 21 ref.

scriptors: *Thermal pollution, *Thermal power-nts, *Nuclear powerplants, *Rivers, *Ice, vigation, St. Lawrence Seaway, Heat budget. ntifiers: Thermal pollution site.

attempt is made to calculate the length of the free reach that develops during the winter ow a thermal pollution site on a river. A dif-ential equation for the steady-state heat balance a volume element of a river is developed. Heat es due to evaporation, convection, long- and rt-wave radiation, and other processes, are eval-ed by an empirical or theoretical expression. e two principal limitations in accurately calcu-ng downstream temperature changes are related difficulties in evaluating the degree of lateral ing in natural rivers and the convective and evaporative heat losses under unstable atmospheric conditions. Observations of lengths of ice-free reaches on the Mississippi River are in good agreement with the calculated values. Significant portions of the St. Lawrence Seaway can be kept ice-free by the installation of nuclear reactors at appropriate locations.
W69-03546

COMPUTATION OF REAERATION COEFFICIENTS FOR A RIVER SYSTEM IN NORTHEASTERN NEW JERSEY,
Geological Survey, Trenton, N. J.
Thomas J. Buchanan.
Geol Surv Res 1968, Prof Pap 600-D, pp D42-D44, 1968. 3 p, 2 fig, 1 tab, 2 ref.

Descriptors: *Reaeration, *Rivers, *New Jersey, Duration curves, Streamflow, Velocity, Depth.
Identifiers: Reaeration coefficients, Passaic River (New Jersey), Empirical methods.

Based on an empirical relationship, reaeration coefficients are computed for 16.8 mi of a river system in northeastern New Jersey for 3 different duration points- 50%, 80%, and 90%. The procedures used in obtaining the data and the results of the computations are shown. Discharges for the subreaches ranged from 16 cfs to 740 cfs, and the reaeration coefficients ranged from .0031 per day to 9.78 per day. The method used has accuracy limitations, but as long as this limitation is recognized by the users, the method and procedures outlined are an inexpensive and rapid way to determine reaeration coefficients for a stream system. (USGS)
W69-03561

BIOTIC RESPONSE TO POLLUTION REDUCTION IN A RIVER,
Michigan State Univ., Hickory Corners. W. K. Kellogg Biological Station.
Allen W. Knight, and George H. Lauff.
Project Termination Report, July 1967, Washington, D. C., 56 p, 16 tab, 10 fig, 14 ref. OWRR Project A-010-Mich.

Descriptors: *Stream pollution, *Pollution abatement, River, Effects of pollution.

A study of the Kalamazoo River was conducted to ascertain the conditions existing just prior to the initiation of a pollution abatement program. The river was found to be grossly polluted in a 20 mile stretch below the City of Kalamazoo. The decomposition of organic matter in the water and in extensive silt accumulations frequently depleted the dissolved oxygen for 20 miles or more below Kalamazoo. Sewage fungus covered the surface of the sludge deposits and stationary objects in the water while extensive numbers of sludge worms frequently occurred as an enormous red fringe along the river margins. Only a few of the more tolerant macroinvertebrates and fish occurred in the very polluted zone. In the lower reaches of the river considerable self-purification was accomplished and a return of many of the macroinvertebrates and game fish was noted. The river prior to its discharge into Lake Michigan has accomplished considerable self-purification but carried a large load of suspended and dissolved materials into Lake Michigan.
W69-03602

'PREDICTING DIURNAL VARIATIONS IN DISSOLVED OXYGEN CAUSED BY ALGAE IN ESTUARINE WATERS, PART I',
Stanford Univ., Stanford, California.
Richard C. Bain, Jr.
PROCEEDINGS OF THE NATIONAL SYMPOSIUM ON ESTUARINE POLLUTION, August 23-25, 1967, pp 250-279.

Descriptors: *Phytoplankton, *Dissolved oxygen, *Algae, *Diurnal distribution, *California, Estimating equations, Oxygenation, Standing crop, Microenvironment, Aquatic life, Environment, Microorganisms, Water chemistry, Plants, Southwest U. S., Regions, Pacific coast regions, Geographical regions, Photosynthesis, Chemical reactions, Zooplankton, Animals, Aquatic animals, Photosynthetic oxygen, Gases, Oxygen, Oxygen demands, Eutrophication.

Eutrophic environments are often dominated by planktonic algal populations (phytoplankton) which can cause diurnal variations in dissolved oxygen concentrations through respiratory activity and photosynthesis. Photosynthetic oxygenation and respiratory deoxygenation rates of estuarine phytoplankton were measured at various standing crop (chlorophyll) levels. Oxygen production and consumption rates for actively growing phytoplankton populations were related to standing crop at 20 C and nonlimiting light. Variations in algal photosynthetic production rate as related to light adaption, age of cells, nutrition, temperature, and algal type are discussed. Light-production relationships (based on oceanographic literature) were used to estimate total production of a well-mixed system. Streeter-Phelps equations were modified to include phytoplankton production and respiration rates in formulations designed to predict dissolved oxygen concentrations over a 24 hour period. An example is given, and the resulting dissolved oxygen prediction is compared with field measurements from a tidal reach of the San Joaquin River, California.
W69-03611

'MIXING OF COLUMBIA RIVER AND OCEAN WATERS, SUMMER',
Stanford Univ., Calif.
T. John Conomos, and M. Grant Gross.
In PROCEEDINGS OF THE NATIONAL SYMPOSIUM ON ESTUARINE POLLUTION, August 23-24, 1967, pp 486-516.

Descriptors: *Water circulation, *Columbia River basin, *Nutrients, *Eutrophication, Circulation, Regions, River basins.

This paper reviews recent work on the Columbia River estuary and the nearby Northeast Pacific Ocean. Particular attention is focused on circulation and mixing near the river mouth and on those factors controlling the supply, distribution, and utilization of plant nutrients (nitrate, inorganic phosphate, and reactive silicate) in this area during the summers of 1965 and 1966. The processes discussed here will also affect other substances discharged into the coastal ocean, making it possible, in some cases, to predict their behavior by analogy with the known behavior of these naturally occurring materials.
W69-03632

CONSEQUENCES OF MAJOR SPILLS ON INDUSTRIAL USES OF SEAWATER.
National Security Industrial Association, Washington, D. C.

In MARINE, ESTUARIAN, AND RIPARIAN POLLUTION DISASTERS AND THEIR CONSEQUENCES, Ocean Resources Subcommittee Meeting, December 11, 1967.

Descriptors: *Industrial water, *Water pollution sources, *Ships, *Water pollution effects, Saline water, Navigation, Environmental effects, Water types, Transportation, Oil industry, Mineral industry, Industries, Non-consumptive use, Efficiencies, Water utilization, Transportation.

The article classifies water shipments into three groups: (1) petroleum and by-products, (2) natural ores, and (3) foods. Spillage of each type of cargo has a different effect on seawater; each effect is described.
W69-03633

CONDITION OF THE QUAHOG, MERCENARIA MERCENARIA, FROM POLLUTED AND UNPOLLUTED WATERS,
R. A. Copper, S. B. Chenoweth, and N. Marshall.
Chesapeake Science, Vol 5, No 4, Winter, 1964, pp 155-160.

Descriptors: *Clams, *Water pollution effects, *Environmental effects, Pollutants, Water pollution, Animals, Aquatic animals, Aquatic life, Benthic fauna, Benthos, Commercial shellfish, Invertebrates, Mollusks, Shellfish, Water quality, Estuarine environment, Aquatic environment, Environment.

The authors suggest that if environmental conditions which have been altered by pollution are beneficial to quahog clams, it is not evident from comparisons of the quality of meats from clams from polluted areas as opposed to clams from unpolluted areas.
W69-03635

PRELIMINARY ASSESSMENT OF THE ENGLISH SOLE IN PORT GARDNER, WASHINGTON,
T. Saunders English.
Water Pollution Control Federation, Journal, Vol 39, No 8, August, 1967, pp 1337-1350.

Descriptors: *Pulp wastes, *Commercial fish, *Water pollution effects, *Washington, Water pollution sources, Trawling, Industrial wastes, Wastes, Animals, Aquatic animals, Aquatic life, Fish, Wildlife, Geographical regions, Pacific coast region, Pacific northwest U. S., Regions, Fishing, Competing uses, Efficiencies, Water utilization.

The biological effects of pollution in Puget Sound have been the subject of considerable dispute for many years, and more recently the subject of considerable research effort. This article presents preliminary results of research on the effects of a major sulfite paper mill submarine outfall on a single important species of finfish, the English sole. The author concludes that the multiple use of Port Gardner for receiving pulp and paper mill effluents and commercial trawling for English sole does not appear to be harmful to the fishery. The shallow area near the deep-diffuser outfall appears to be a source of young English sole recruited to an increasingly productive commercial stock. Unless some unexpected discontinuity becomes apparent, the complete life cycle of the English sole seems to be represented in Port Gardner.
W69-03660

BIOLOGICAL EFFECTS OF SPOIL DISPOSAL IN CHESAPEAKE BAY,
David A. Flemer, W. L. Dovel, H. T. Pfitzenmeyer, and D. E. Ritchie, Jr.
Journal of the Sanitary Engineering Division, Vol 94, No SA4, August, 1968, pp 683-706.

Descriptors: *Eutrophication, *Sedimentation, *Water quality, *Water pollution, *Waste disposal, Environment, Aquatic environment, Geographical regions, Coastal plains, Atlantic coastal plain, Wildlife, Estuarine environment, Ecology, Growth stages, Fish, Plants, Streamflow, Water analysis, Water chemistry, Regions, Larvae, Phytoplankton, Flow, Channel flow, Zooplankton, Animals, Aquatic animals, Aquatic life, Plankton, Analysis, Sediment distribution, Sediment transport.

Field studies were made on the biota of the upper Chesapeake Bay under a design related to the shallow water disposal of channel sediments. No gross effects were observed on the phyto-zooplankton fish, eggs, and fish larvae of adult fishes. Some bottom animals were smothered over a wide area. Several benthic species survived deposition and certain species began repopulation soon after deposition.
W69-03666

SAVE-THE-SALMON PROJECT ON THE ST. JOHN RIVER,
G. J. Gillespie.
Fisheries of Canada, Vol 20, No 4, October, 1967, pp 9-11.

Descriptors: *Salmon, *Hydroelectric plants, *Multiple-purpose projects, *Fish conservation, Sport fish, Fish hatcheries, Fish management, Fish migration, Electric powerplants, Engineering structures, Industrial plants, Powerplants, Structures, Afterbays, Animals, Aquatic animals, Aquatic life, Fish, Salmonids, Wildlife, Conservation, Wildlife conservation, Projects, Management.

The author describes a joint project between Canada's Department of Fisheries and the New Brunswick Electric Power Commission to conserve fish which would otherwise be destroyed by a power plant. The author feels that the results of this project should have widespread consequences in regard to fish conservation practices.
W69-03669

STATEMENT BEFORE THE SUBCOMMITTEE ON AIR AND WATER POLLUTION,
John W. Gore.
Committee on Public Works, U. S. Senate, Washington, D. C., April 17, 1968.

Descriptors: *Virginia, *Maryland, *Thermal powerplants, *Heated water, *Environmental effects, Southeast U. S., Bays, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Geographical regions, Northeast U. S., Regions, Fisheries, Commercial fisheries, Benefits, Electric powerplants, Engineering structures, Industrial plants, Powerplants, Structures, Temperature, Water types.

The thermal effects of a large electric-generating plant on Chesapeake Bay are discussed. The conclusion is that the effluent from the plant would be more pure than natural bay water, and the discharge of warm water would not be detrimental to the ecology of the Bay. Instead, winter fisheries could be created.
W69-03670

'STATEMENT',
Federal Water Pollution Control Administration, Atlanta, Ga.
John M. Henderson.
In CLEAN WATER FOR THE NATION'S ESTUARIES, Proceedings of the Georgia Public Meeting, Jekyll Island, Georgia, February 29, 1968. 9 p.

Descriptors: *Water pollution effects, *Enteric bacteria, *Diseases, *Recreation, *Shellfish, *Commercial fishing, Water quality, Sewage bacteria, Sewage effluents, Bacteria, Microorganisms, Plants, Effluents, Aquatic animals, Aquatic life, Animals, Fishing, Industries.

This paper is concerned with filth-borne (enteric) disease occurrence and related procedures and standards for determining the safety of estuarine waters for recreational use or shellfish growing. The term 'filth-borne (enteric)' disease is intended to include all diseases contracted as a result of sewage pollution or other fecal pollution and not merely those diseases which are confined to the gastro-intestinal tract of man. These two subjects, recreational water use and shellfish production and consumption, have points in common and also distinct differences between them as they relate to human disease.
W69-03678

INTERIM REPORT ON GROSS PHYSICAL AND BIOLOGICAL EFFECTS OF OVERBOARD SPOIL DISPOSAL.
Chesapeake Biological Laboratory, Natural Resources Institute, University of Maryland, Ref No 67-34, May, 1967.

Descriptors: *Sediments, *Dredging, *Water pollution effects, *Aquatic plants, *Aquatic animals, Sediment control, Growth stages, Fish eggs, Channel improvement, Hydrography, Geology, Phytoplankton, Zooplankton, Larvae, Eggs, Bays, Bodies of water, Maryland, Appalachian Mountain region, Sediment discharge, Control, Atlantic coastal plain, Coastal plains, Geographical region, Northeast U. S., Regions, Hydrologic aspects, Aquatic life, Plankton, Plants, Animals, Benthos.

This interim report describes the effects associated with 1966 channel dredging in Chesapeake Bay. The effects considered were on geology and hydrography, phytoplankton, benthos, zooplankton, fish eggs and larvae, and adult fish. Observed effects of the disposal were summarized by the authors as: (1) Fine sediments from the channel were released in shoal water, over similar sediments, as a semi-liquid mixture, (2) Sediments were spread over an area at least five times as large as the designated disposal area, (3) There was a highly localized release of nutrient chemicals, roughly equivalent to a sewer outfall from a town of about 10,000 people, (4) No gross effect was observed on the microscopic plants and animals in the water, nor on the eggs and larvae of fish, nor on adult fish held in cages near the outfall or caught near the area, (5) Some bottom animals were smothered over a wide area, so that a significant loss occurred. Some species survived deposition, and certain species began repopulation soon after deposition.
W69-03682

'U. S. COAST GUARD REPORT OF WAKE ISLAND OIL SPILL',
National Security Industrial Association, Washington, D. C.
William A. Jenkins.
In MARINE, ESTUARIAN, AND RIPARIAN POLLUTION DISASTERS AND THEIR CONSEQUENCES, Ocean Resources Subcommittee Meeting, December 12, 1967.

Descriptors: *Oil wastes, *Disasters, *Foreign countries, *Water pollution, Beaches, Air pollution, Environmental effects, Geographical regions, Regions, Organic matter, Wastes.

The Wake Island oil spill is described in great detail. All the repercussions of this disaster are discussed: (1) air pollution, (2) shoreline pollution, and (3) small boat harbor pollution. The problem was alleviated by the passage of a typhoon which scoured away much of the polluted area.
W69-03685

'ENVIRONMENTAL REACTION TO WATER POLLUTION',
National Security Industrial Association, Washington, D. C.
Kenneth E. Biglane.
MARINE, ESTUARIAN, AND RIPARIAN POLLUTION DISASTERS AND THEIR CONSEQUENCES, Ocean Resources Subcommittee Meeting, December 12, 1967.

Descriptors: *Water pollution effects, *Environmental effects, *Water pollution, *Disasters, Social aspects.

The author states that an accidental or sudden release of pollutants to the aquatic environment usually causes a more spectacular reaction by the inhabitants or users of the resource than does the continuous discharge which slowly erodes the quality of the resource. The recovery of the resource from both sudden release and continuous waste discharges is dependent upon the type and quantity of material released. Usually, one thinks of the environment recovering much faster from the effects of a sudden and non-recurring waste discharge. Several types of sudden release of shock-type discharges and their primary and secondary effects on the aquatic environment are discussed.
W69-03693

TRIENT ASSIMILATION IN A VIRGINIA
AL SYSTEM',
ford Univ., Calif.
ris L. Brehmer.
CEEDINGS OF THE NATIONAL SYMPOSI-
ON ESTUARINE POLLUTION, August 23-
967, pp 218-237.

criptors: *Water properties, *Nutrients, *Vir-
, Nitrogen compounds, Phosphorus, Nuisance
e, Salts, Tides, Southeast U. S., Regions, Geo-
hical regions, Coastal plains, Atlantic coastal
, Inorganic compounds, Metals, Plankton,
atic life, Zooplankton, Aquatic animals,
nals, Appalachian Mountain region.

study was conducted to assess nutrient as-
ation and phytoplankton response in the tidal
es River Estuary and in the Nansemond Estua-
tributary to the James. The assimilation of
gen and phosphorus was measured for a
od of one year in each of the above two river
ems. It was determined that the nutrient as-
lation capacity of estuarine waters varies
onally, being greatest in the winter, even
gh fresh water discharge levels may remain
ly constant. Date indicate that water contain-
dissolved solids of marine origin may be able to
nilate higher nutrient levels than fresh water
out producing aquatic nuisance conditions.
-03695

. Waste Treatment Processes

C LAKE TAHOE WATER RECLAMATION
NT,
sell L. Culp., and Ralph E. Roderick.
er Pollution Control Federation, Journal, Vol
No 2, February, 1966, pp 147-155.

criptors: *Tertiary treatment, *Desalination,
ater reuse, *Treatment facilities, *Cost com-
sons, Waste water treatment, Sewage treat-
t, Waste treatment, Demineralization, Separa-
techniques, Water purification, Water treat-
t, Effluents.

authors describe the new tertiary sewage treat-
t plant of South Tahoe Public Utility District
ch produces a high quality, colorless, odorless
ent. The article presents construction and
rating cost estimates for plants of 2.5, 10.0,
, 100.0, and 200.0 mgd capacity, and for vary-
degrees of treatment. A principal conclusion is
the total cost of providing the maximum quali-
rtiary treatment with this process would vary
n 24 cents to 37 cents/cap/month, depending
he size of the treatment plant. This estimated
is based upon an average estimated effluent
me of 100 gpd per capita. The authors also
clude that 'tertiary treatment provides an
nomic advantage over desalination as a source
vater, since wastewater can be renovated for
10-15 percent of the latest realistic estimates
st for desalination'.
-03640

ME ECONOMIC ASPECTS OF ADVANCED
STE TREATMENT,
ert K. Davis.
ter Pollution Control Federation, Journal, Vol
No 12, December, 1965, pp 1617-1628.

criptors: *Waste water treatment, *Capital
s, *Operating costs, *Water quality control,
w augmentation, Costs, Alternative costs,
nomic efficiency, Methodology, Quality con-
, Control, Waste treatment, Regulation, Water
tment, Maryland, Virginia, Appalachian Moun-
region, Atlantic coastal plain, Coastal plains,
graphical regions, Northeast U. S., Regions,
theast U. S., Flow control.

earch aimed at achieving least cost systems of
aining a given water quality control objective in
Potomac Estuary is discussed. Basic economic concepts involved in determining trade offs between flow augmentation and waste treatment are presented. One principal conclusion is that higher levels of waste treatment, together with low-flow augmentation, appear to have a place in the solution of water quality management problems of the sort represented by this illustrative case. The study's view of the waste treatment process is unconventional in nature, in that it finds discontinuous operation of certain processes in the plant and possibly more than one level of intensity of operation as desirable. The reasons for this are substantial differences in capital costs and operating costs among the various processes. The first concerns the advantages of substituting operating costs for capital costs, such as might be done in a choice between chemical precipitation and additional aeration capacity for the advanced treatment. For sanitary engineers, the study states the conclusion of interest is that in the design of treatment processes to respond to variations in pollution conditions there needs to be great weight attached to the advantages of processes which incur relatively high operating costs and relatively low capital costs. Cost data are presented to support these conclusions.
W69-03644

SEATTLE'S EFFORTS IN RESTORATION OF BAYS AND ESTUARIES,
For primary bibliographic entry see Field 05G.
For abstract, see .
W69-03683

REGIONAL CONSTRUCTION REQUIREMENTS FOR WATER AND WASTEWATER FACILITIES 1955-1967-1980,
K. L. Kollar, and August F. Volonte.
Report, Business and Defense Services Administration, Water Industries and Engineering Services Division, October, 1967.

Descriptors: *Waste water treatment, *Investment, *Forecasting, *Construction costs, Waste treatment, Water treatment, Costs, Treatment facilities.

This Department of Commerce study provides historical construction-cost data from 1955 to 1966 and a projection of requirements from 1967 to 1980. Population projections and wastewater investment requirements by major census regions are given. A breakdown by investment requirements for collection systems, treatment plants, and treatment plant equipment is included.
W69-03698

PROBABILISTIC ANALYSIS OF WASTE WATER TREATMENT AND DISPOSAL SYSTEM,
Veerasamy Kothandarman.
Illinois Univ, Urbana, Research Report No 14, June, 1968.

Descriptors: *Oxygen sag, *Recreation, *Oxygenation, *Statistical models, Mathematical models, Probability, Biochemical oxygen demand, Oxygen demand, Aeration, Mathematical studies, Model studies, Waste water treatment, Waste treatment, Water treatment.

This work attempts to predict dissolved oxygen deficits in a stream with known initial conditions by taking into account the variations in deoxygenation and reaeration coefficients. A hypothetical stream situation is used to establish the significance in predicting dissolved oxygen deficit. Statistical models are formulated and tested for the variations in these coefficients using published data. Simulation techniques using the Monte Carlo method are employed in predicting the probabilistic variation in dissolved oxygen deficits for known initial conditions, and the results are verified with the survey data observed for the Ohio River-Cincinnati Pool reach. The predicted results using probabilistic model are found to agree with the observed values within practical limits and give more consistent results than conventional methods.
W69-03699

5E. Ultimate Disposal of Wastes

FEASIBILITY CRITERIA FOR SUBSURFACE WASTE DISPOSAL IN ILLINOIS,
Illinois State Geological Survey, Urbana.
Robert E. Bergstrom.
Ground Water, J Tech Div Nat Water Well Ass, Vol 6, No 5, pp 5-9, Sept-Oct 1968. 5 p, 3 fig, 1 ref.

Descriptors: *Injection wells, *Waste disposal, *Illinois, Aquifers, Aquicludes, Well regulations, Water resources, Groundwater.
Identifiers: *Subsurface waste disposal, Feasibility investigations.

The criteria for feasibility of waste disposal by injection wells in Illinois and the suitability of various geologic formations for disposal are reviewed. Favorable geohydrologic conditions--specifically the presence of a variety of permeable formations that contain nonpotable water and are well confined from shallow to great depth - make waste disposal by wells feasible in much of the southern two-thirds of Illinois. Natural safeguards permit disposal wells to be planned with conventional engineering precautions and only a minimal program of preoperational testing. In much of the northern third of the State, the permeable rocks contain potable water to great depth, and there is moderate to high development of the groundwater resource because of urban and industrial concentration. Exhaustive testing, substantial proof of acceptable site conditions, and incorporation of optimum engineering safeguards are considered necessary before the State regulatory agency can authorize installation. (Knapp-USGS)
W69-03251

ROCK MECHANICS IN THE DISPOSAL OF RADIOACTIVE WASTES BY HYDRAULIC FRACTURING,
Oak Ridge National Lab., Oak Ridge, Tenn. Health Physics Div.
For primary bibliographic entry see Field 08E.
For abstract, see .
W69-03522

5F. Water Treatment and Quality Alteration

STRIPPING EFFLUENTS OF NUTRIENTS BY BIOLOGICAL MEANS,
Wisconsin Univ., Madison. Sanitary Lab.
George P. Fitzgerald.
Trans of the Seminar on Algae and Metropolitan Wastes, Robert A Taft San Engr Ctr, Cincinnati, 1961. pp 136-139, 5 fig.

Descriptors: *Nutrient requirements, *Eutrophication, *Water pollution control, *Water pollution treatment, Algae, Algal control, Analytical techniques, Aquatic algae, Aquatic microbiology, Balance of nature, Bioassay, Biochemical oxygen demand, Chlorophyta, Cycling nutrients, Environmental effects, Essential nutrients, Environmental engineering, Harvesting algae, Nitrogen compounds, Phosphorus compounds, Photosynthetic oxygen, Physiological ecology, Phytoplankton, Sewage, Sewage bacteria, Sewage disposal, Sewage effluents, Sewage lagoons, Sewage treatment, Water pollution, Water pollution sources.

Laboratory experiments with the green alga Chlorella pyrenoidosa (Wis 2005) have shown this alga would first absorb the ammonium-nitrogen, then nitrite-nitrogen and nitrate-nitrogen from secondary sewage effluents. Less than 0.5 mg/liter of any of the nitrogen or phosphorus of the effluent remained in solution after 17 days of culture. Growth of Chlorella paralleled nitrogen and phosphorus removal in primary and secondary effluent. Growth in secondary effluent could be stimulated by the addition of carbon dioxide to air.

The operation of a 1/2-acre stabilization pond for nutrient removal by algae in the pond indicated that a succession of algal species took place despite a continuous supply of nutrients. The average nitrogen removal throughout the year is about 30%, with summer removals reaching about 70%. There were only 33 days during 1956 and 76 days during 1957 when nitrogen removal exceeded 50%. Phosphorus removal coincided with periods of high pH. During early winter, pond effluent contained higher levels of phosphorus than influent due to dissolution of precipitated phosphorus. (Eichhorn-Wisc)
W69-03374

5G. Water Quality Control

THE EFFECT OF TURBULENCE ON BACTERIAL SUBSTRATE UTILIZATION,
Georgia Inst. of Tech., Atlanta. School of Engineering; and Georgia Inst. of Tech., Atlanta. Water Resources Center.
John T. Marlar.
Georgia Inst Tech Water Resource Center Rep No. WRC-0568, Dec 1968. 110 p, 23 fig, 3 tab, 66 ref, 3 append.

Descriptors: *Bacteria, *Oxygen demand, *Turbulence, Reaeration, Kinetics, Growth rates.
Identifiers: Bacterial growth kinetics.

A laboratory study was made of the interaction of a heterogeneous population of bacteria with a glucose substrate. The effect of turbulence on substrate utilization was shown by a series of tests with different turbulence levels, in which deoxygenation and reaeration were monitored continuously. Initial bacterial concentration is an important growth rate variable and methods were developed to predict its effect. Oxygen utilization was directly proportional to substrate utilization and did not follow first order kinetics; the equation developed for bacterial growth kinetics was based on Monod's equation. Bacterial growth rate and the rate of substrate removal increased with turbulence. (Knapp-USGS)
W69-03343

POLLUTION CONTROL - PLANNING A NATIONAL PROGRAM,
Federal Water Pollution Control Administration, Washington, D. C.
Allan Hirsch.
For eight vol Proceedings see this issue, Field 06B, W69-03305. International Conference on Water for Peace, Vol 8, pp 140-151, (1968.) 12 p, 6 ref.

Descriptors: *Water pollution control, *Water policy, *Water quality, *Future planning (Projected), Regulation, Water law, Pollution abatement, Water pollution treatment, Water pollution effects, Sewage treatment, Wastes treatment, Waste disposal, Legislation, Data collection, Water allocation (Policy), Long-term planning.
Identifiers: Water pllution policy, Regional pollution control.

To meet the present and future demands for more effective pollution control, planning on a national scale must precede any proposals. Therefore, general policies and approaches rather than techniques of program planning are discussed. Federal planning in pollution control has not diminished and should not diminish the state and local role; rather, it should be increased through federal incentive and leadership. There are 5 areas of planning in which progress is needed: (1) constructing and operating waste treatment works; (2) developing and applying new and improved technology through research and development; (3) providing an adequate supply of trained manpower; (4) collecting and evaluating pollution control data; (5) developing regional pollution control systems on a coordinated basis. Long-range planning must be preceded by setting water quality standards with rigid associated compliance plans. The author concludes that the near future will bring, through planned programs, control of conventional pollution and the ability to cope with new sources of pollution. (Helwig-Fla)
W69-03410

FENWICK V BLUEBIRD COAL COMPANY (MINE WASTES).

12 Ill App 464, 140 NE 2d 129-133 (4th Dist Ct Ill 1957).

Descriptors: *Illinois, *Coal mine wastes, *Natural flow doctrine, *Mine drainage, Pollutants, Water pollution, Water pollution effects, Mine wastes, Mine water, impaired water quality, Drainage systems, Surface runoff, Surface waters, Watercourses (Legal aspects).
Identifiers: Mineral impurities, Coal washer.

In an action now on appeal by timberland owners against coal companies for damage to growing timber, plaintiffs alleged that the timber damage resulted from the mineral impurities the coal companies permitted to drain upon plaintiffs' lands from their coal mining operations. Defendants contended that there was no evidence upon which a determination regarding damages could legally rest. The Illinois Appellate Court held for the plaintiffs after disposing of several procedural issues raised by defendants. The court stated that every owner of land through which water flows, either as surface water or in a stream, has the right to have the same flow in its natural state, which extends to the quality as well as the quantity of the water. One who pollutes or contaminates the water is liable to those injured thereby. (Carruthers-Fla)
W69-03425

POLLUTION CONTROL.

N Y Conserv Law sec 801 art 5 secs 5.1, 5.2, 5.3, 5.4 (McKinney 1967).

Descriptors: *Delaware River Basin Commission, Legislation, *Interstate compacts, Water policy, Pollution abatement, *Water pollution control, Pollutants, Administrative agencies, Legal aspects, Sewage.

The Commission has authority to undertake investigations and to acquire and operate facilities to control present or potential pollution conditions in the basin. The standard of control is that pollution originating from a signatory state shall not injuriously affect waters of the basin. After a public hearing the Commission may classify the waters of the basin and establish standards for treatment of pollutants entering the waters of the basin. The signatories agree to cooperate and enact the necessary legislation to further the goals of the compact. The Commission may by order enjoin the discharge of pollutants into the waters of the basin. Such an order is subject to judicial review. (Molica-Fla)
W69-03460

INDUSTRIAL WASTE GUIDE ON THERMAL POLLUTION,
Federal Water Pollution Control Administration, Corvallis, Oreg. Pacific Northwest Water Lab.
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-03537

COMPUTATION OF REAERATION COEFFICIENTS FOR A RIVER SYSTEM IN NORTHEASTERN NEW JERSEY,
Geological Survey, Trenton, N. J.
For primary bibliographic entry see Field 05C.
For abstract, see .
W69-03561

SURVEILLANCE OPERATIONS IN THE CONTROL OF WATER POLLUTION ON A NATIONAL SCALE,
James H McDermott.
For 8-Volume Proceedings see this issue, Field 06B, W69-03305. International Conference on Water for Peace, Vol 8, pp 71-80, 1968. 10 p, 8 ref.

Descriptors: *Water pollution, *Monitoring, *Sampling, *Water quality control, Conferences, Publications, Standards, Administrative agencies, Water Quality Act, data collection, On-site inspections, Statistics, State governements, Legislation, Water pollution control, Waste treatment, Water utilization.
Identifiers: Potomac River, Clean Water Restoration Act.

Surveillance practiced by the Federal Water Pollution Control Administration involves information collection to determine the status of water pollution control. Two categories of statistics are collected: (1) water uses, waste treatment, control facilities and economic conditions; (2) the evaluation of water quality on a point basis. This provides a quantitative check on pollution control progress. In order to monitor in-stream conditions for immediate relation to the established water quality standards, the following activities are pursued: (1) a Water Quality Compliance System which consists of monitoring stations; (2) Oil Pollution Act Laboratory Services to detect and analyze petroleum compounds; (3) Specialized Analytical Services; (4) Analytical Quality Control; (5) Data Evaluation and Control. A map is included locating the monitoring stations in the major basins. General criteria for the operation of a surveillance system are presented. The Potomac Monitoring System is explained to illustrate the use of automatic instrumentation. States can best conduct three levels of surveillance: (1) On-site inspection of municipal and industrial waste handling; (2) monitoring individual plant effluent lines; (3) examination of the receiving body to assure adopted water quality standards. (Childs-Fla)
W69-03584

'ESTUARINE OXYGEN RESOURCES--PHOTOSYNTHESIS AND REAERATION',
Stanford Univ., Stanford, California.
Thomas E. Bailey.
PROCEEDINGS OF THE NATIONAL SYMPOSIUM ON ESTUARINE POLLUTION, August 23-25, 1967, pp 310-330.

Descriptors: *Reaeration, *Photosynthesis, *Oxygenation, *Diffusion, *California, *Water quality, Pacific coast region, Dissolved oxygen, Chemical reactions, Chlorophyll, Magnesium compounds, Southwest U. S., Geographical regions, Regions, Water properties, Organic compounds, Pigments, Plant pigments, Solar radiation, Radiation, Temperature, Water temperature.

This paper presents a discussion of the primary sources of oxygen supplied to the Sacramento-San Joaquin Estuary and Suisun Bay system through photosynthesis and reaeration. Results of field surveys are presented. Changes in oxygen levels due to photosynthesis can be predicted by an empirical equation as a function of chlorophyll concentration, solar intensity, light extinction coefficient, temperature, and water depth. It was concluded, however, that reaeration and diffusion rates are too complex to be predicted reliably by empirical relationships and that direct field measurements must be made to obtain reliable data.
W69-03610

ECONOMIC CONSIDERATIONS OF WATER POLLUTION CONTROL,
Samuel S. Baxter.
Water Pollution Control Federation, Journal, Vol 37, No 10, October, 1965, pp 1363-1369.

Descriptors: *Cost-benefit ratio, *Water pollution control, *Economic justification, Beneficial use, Control, Water pollution treatment, Water treatment, Cost-benefit analysis.

r-pollution-control expenditures should be ed on the basis of a favorable benefit-cost The author considers the following four top- th respect to pollution-control expenditures: he purposes and uses expected of receiving ns. (2) The actual benefits and improvements ed from the stream if a higher degree of treat- is used. (3) The relation between the costs enefits from different degrees of treatment. he relation of the costs and benefits of pollu- ontrol to the costs and benefits of other civic ams.
03613

TEMENT',
al Water Pollution Control Administration, ta, Ga.
Burbanck.
CLEAN WATER FOR THE NATION'S UARIES, Proceedings of the Georgia Public ng, Jekyll Island, Georgia, February 20, pp 25-30.

iptors: *Water quality control, *Model stu- *Water pollution control, Food chains, Geor- Vater pollution treatment, Water treatment, r pollution sources, Appalachian Mountain n, Atlantic coastal plain, Coastal plains, Geo- ical regions, Regions, Southeast U. S., Con- Soil conservation, Water resources develop- Resource development.

roblem of pollution should be faced with two tives: (1) To clean up areas such as Delaware where pollution has become extensive and (2) actice conservation in areas that still approxi- natural conditions. A multi-disciplinary l approach for the management of estuaries is able, since there are so many aspects of pollu- nd varied effects from it.
03617

PROBLEM OF PESTICIDES IN ESTUA-

A. Butler.
mposium on Estuarine Fisheries, American ries Society, Special Publication No 3, 1966, 0-115.

riptors: *Pesticide toxicity, *Water pollution ts, *Estuarine environment, *Aquatic animals, ironmental effects, Pesticides, Water pollu- Toxicity, Toxins, Mortality, Morbidity, Fish- Water pollution sources, Pesticide residues, tic environment, Environment, Animals, tic life, Pollutants, Regions, Seasonal, omic impact, Marine animals.

ite two decades of research, the extent and im- nce of pesticide pollution in estuaries are y understood. Laboratory studies of their and chronic toxicity indicate that pesticides be the cause of ill-defined but significant mor- , loss of production, and, perhaps, changes in irection of natural selection in estuarine fau- reliminary investigations show the need for a nuing surveillance program to identify the nal and geographical distribution of pesticide tion in estuaries.
-03618

NOMICS OF WATER POLLUTION CON- L,
y N. Castle.
r Pollution Control Federation, Journal, Vol lo 5, May, 1966, pp 789-793.

riptors: *Economic efficiency, *Water pollu- control, *Water quality control, Resource allo- n, Water quality, Control, Quality control, lation, Administration.

article is a brief, concise, and well-written ex- ion of the relationship of market economics to nal water quality management, and of the ble techniques and institutions for resolving the problem of external diseconomies which stem from water pollution. Arguments are presented for and against (1) detailed administrative regulation, (2) maintenance of minimum standards, and (3) basin-wide or regional organizations, as appropriate approaches to the external diseconomies problem. It is concluded that the latter approach is superior to the former two.
W69-03623

FISH AND MAN, CONFLICT IN ATLANTIC ESTUARIES,
J. Clark.
American Littoral Society, Special Publication No 5, 1967.

Descriptors: *Estuarine fisheries, *Estuarine environment, *Environmental effects, *Productivity, *Fish harvest, Commercial fishing, Commercial shellfish, Sport fishing, Conservation, Landfills, Mining, Control, Navigation, Water control, Fisheries, Aquatic environment, Environment, Water pollution, Aquatic animals, Animals, Aquatic life, Aquatic plants, Plants, Atlantic coastal plain, Coastal plains, Geographical regions, Regions, Fishing, Industries, Invertebrates, Shellfish, Value.

This report is a discussion of the estuarine environment specifically as it relates to salt water fish, and the effect that human progress has on that environment. The conflicts are discussed between the need for conservation of our estuarine resources and the need for progress, particularly in the areas of land fill, navigation, gravel and sand mining, mosquito control and marsh impoundment, highway construction, and water control. It is argued that even small amounts of damage to estuarine areas can lead to widespread damage to an estuarine resource. A discussion of the economic value of fisheries is provided. It is stated that at least $75 million worth of estuarine dependent fish are landed each year along the Atlantic coast. A review of the activities of each of the Atlantic coastal states in relation to conservation of the estuaries is given.
W69-03627

CLEAN WATER FOR THE NATION'S ESTUARIES.
Federal Water Pollution Control Administration, Atlanta, Ga.

PROCEEDINGS OF THE PUERTO RICO PUBLIC MEETING, NATIONAL ESTUARINE POLLUTION STUDY, SANTUREE, PUERTO RICO, April 22, 1968.

Descriptors: *Puerto Rico, *Waste water disposal, *Water pollution control, *Industrial wastes, *Sewage effluents, Water quality control, Geographical regions, Islands, Regions, Waste disposal.

The papers presented at this meeting are chiefly concerned with industrial and sewage pollution of the bays and inlet of densely populated Puerto Rico. A need for water pollution control within the limitations of the budget and the necessity for industrial expansion is discussed.
W69-03629

MARINE SHIPPING INDUSTRY - EFFECTS AND IMPACTS ON THE CHESAPEAKE BAY,
James B. Coulter.
Governor's Conference on Chesapeake Bay, Wye Institute, Queen Anne's County, Maryland, September 12-13, 1968.

Descriptors: *Legislation, *Water pollution, *Channel improvement, *Commercial fishing, *Maryland, Bodies of water, Water sports, Recreation, Navigation, Dredging, Desilting, Sewage effluents, Separation techniques, Fishing, Bays, Oily water, Waste disposal, Sewage disposal, Effluents, Industries, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Geographical regions, Northeast U. S., Regions, Navigable waters.

Actions to be taken by State and Federal Governments regarding water pollution and shipping channel and harbor improvements in the Chesapeake Bay area are outlined. Legislation is required to free the harbor of pollutants such as floating litter, sewage, and industrial wastes.
W69-03636

THE CONDITION OF THE CHESAPEAKE BAY,
For primary bibliographic entry see Field 06B.
For abstract, see .
W69-03637

'PLANNING A WATER QUALITY MANAGEMENT SYSTEM: THE CASE OF THE POTOMAC ESTUARY',
Robert K. Davis.
In WATER RESEARCH, pp 99-121. Johns Hopkins Press, Baltimore, Maryland, 1966.

Descriptors: *Alternative costs, *Maryland, *Virginia, *Water quality, *Water management, *Dissolved oxygen, Cost-benefit analysis, Costs, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Geographical regions, Northeast U. S., Regions, Southeast U. S., Management.

The author describes a study of the cost of alternative systems for dissolved oxygen management in the Potomac Estuary being conducted by Resources for the Future, Inc. He explains the theoretical basis and strategy of the study and presents preliminary cost estimates of achieving a specified goal for dissolved oxygen by a number of alternative methods.
W69-03643

SOME ECONOMIC ASPECTS OF ADVANCED WASTE TREATMENT,
For primary bibliographic entry see Field 05D.
For abstract, see .
W69-03644

DELAWARE ESTUARY COMPREHENSIVE STUDY--PRELIMINARY REPORT AND FINDINGS.
Report, Federal Water Pollution Control Administration, Department of the Interior, Washington, D. C., June 29, 1966.

Descriptors: *Water quality control, *Cost-benefit analysis, *Delaware River, Northeast U. S., New Jersey, Employment, Forecasting, Ecology, Control, Quality control, Bodies of water, Interstate rivers, Rivers, Running waters, Streams, Surface waters, Atlantic coastal plain, Delaware, Economic prediction, Coastal plains, Geographical regions, Regions.

This is a preliminary report which consists of a general review of the Delaware Estuary Comprehensive Study together with the alternative water quality goals, costs, and benefits and control schemes that were considered. The study covers the length of the Delaware River from Trenton, New Jersey, to Liston Point, Delaware.
W69-03645

'STATEMENT',
Federal Water Pollution Control Administration, Atlanta, Ga.
Jack Different.
In CLEAN WATER FOR THE NATION'S ESTUARIES, Transcript of Public Meeting, Biloxi, Mississippi, January 17, 1968, pp 6-8.

Descriptors: *State governments, *Planning, *Mississippi, *Gulf of Mexico, *Water pollution effects, Water pollution control, Commercial fishing, Recreation, Fishing, Industries, Bodies of water, Gulfs, Surface waters, Governments, Coastal plains, Geographical regions, Regions, Gulf coastal plain, Southeast U. S.

The Gulf Regional Planning Commission identifies four estuarine zones: (1) Pascagoula River, with a drainage basin which contains densely developed urban areas, industrial concentrations, and extensive marsh areas; (2) Biloxi Bay, surrounded for much of its length by urban development, a planned industrial area, and a major steam-generating electric power station; (3) Bay of St. Louis, also flanked in part by urban development, only limited areas of which are adequately served by sanitary sewage collection, treatment, and disposition treatments; (4) Pearl River, a major stream with a number of urban centers and industrial installations of its middle reaches. The Regional Planning Commission is primarily concerned with the degrading effects of estuarine pollution on (1) commercial fisheries, including shellfish, (2) recreation, and (3) aesthetics, including real estate values.
W69-03649

RESEARCH PROBLEMS IN WATER QUALITY AND RECREATION,
E. D. Eaton.
Conference on Water Quality and Recreation in Ohio, Water Resources Center, The Ohio State University, Columbus, Ohio, June 15, 1966.

Descriptors: *Water quality control, *Recreation, Water resource development, Control, Quality control, Resource development, Water pollution, Water pollution effects, Cost-benefit analysis, Water management (Applied), Management.

About $107 million were budgeted for water resources research for the 1967-68 fiscal year. There were two directions being pursued in research in water quality management: (1) To decrease the amount and potency of pollution reaching stream channels, and (2) To handle waste streams and receiving waters so as to minimize deleterious effects. Cost-benefit evaluations of recreation programs are more difficult to maintain than an evaluation of the benefits of water quality management. There are many problems involved in such an attempted evaluation.
W69-03653

THE MOLLUSCAN SHELLFISH INDUSTRY, CURRENT STATUS AND TRENDS,
For primary bibliographic entry see Field 06B.
For abstract, see .
W69-03659

METROPOLITAN SEATTLE'S DUWAMISH ESTUARY WATER QUALITY PROGRAM,
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-03667

'GEORGIA WATER QUALITY CONTROL BOARDS STATEMENT TO THE NATIONAL ESTUARINE STUDY REPORT',
Federal Water Pollution Control Administration, Atlanta, Ga.
R. S. Howard.
In CLEAN WATER FOR THE NATION'S ESTUARIES, Proceedings of the Georgia Public Meeting, Jekyll Island, Georgia, February 29, 1968, pp 1-4.

Descriptors: *Water quality control, *Georgia, *Pollution abatement, *Sewage, *Sewage treatment, *Industrial wastes, *Legislation, Radioactivity effects, Fish, Shellfish, Water pollution treatment, Water treatment, Control, Quality control, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Geographical regions, Regions, Southeast U. S., Zoning, Toxicity, Pesticides, Marshes, Wetlands, Abatement, Waste treatment, Tidal marshes, Social values, Wastes, Economic impact, Values, Aesthetics.

Georgia has 2000 square miles of estuarine zone (including salt marshes) on 115 miles of seacoast. Seafood production has declined drastically in the last 40 years due to contamination and pollution from sewage and industrial pollution. The State Water Quality Control Board makes the following recommendations for the preservation of estuarine water quality: (1) Federal and state governments should clean up existing pollution from sewage and industrial wastes, (2) Undertake research on the effects of pollutants, from sewage and industrial wastes, on the marine biota of estuaries, (3) Investigate the possibility of blending certain waste discharges to offset individual pollutional effects, (4) Conduct social and economic studies to develop the values of estuaries for various uses and for aesthetic considerations, and determine the practicality of the zoning concept as opposed to the multiple use philosophy, (5) Establish a pesticide monitoring and sampling program, especially through the spring and summer seasons, (6) Develop a shellfish and fish sampling program to study the effects of radiation and pesticides on fish, shellfish, and other marine life, and (7) Determine the volume and patterns of flows in tidal basins.
W69-03679

SEATTLE'S EFFORTS IN RESTORATION OF BAYS AND ESTUARIES,
Gary W. Isaac, and Curtis P. Leiser.
32nd North American Wildlife and Natural Resources Conference, San Francisco, California, Transactions, March 13-15, 1967, pp 127-137.

Descriptors: *Washington, *Sewage treatment, *Water pollution control, Pacific northwest U. S., Civil engineering, Waste treatment, Engineering, Algae, Plants, Control, Pollution abatement, Abatement, Pacific coast region, Regions, Geographical regions, Bays, Bodies of water.

Citizens in the Seattle area, which is comprised of 14 cities, initiated the legislation and voted into being a metropolitan municipal corporation, specifically to deal with the pollution problem, but able also to expand to alleviate other regional difficulties as they would arise. An operating treatment agency and four engineering firms composed a master plan which is detailed in this paper. The cost of the plan was estimated at $125,000,000. The pollution control program will continue in three major parts: (1) Emission controls applied to industrial waste discharges at the source, (2) Treatment plant control and monitoring by personnel attached permanently to plant operations, (3) A separate force to monitor the receiving waters for biological nutrient and physical parameters.
W69-03683

06. WATER RESOURCES PLANNING

6A. Techniques OF Planning

AN EXTENSION TO THE THOMAS-FIERING MODEL FOR THE SEQUENTIAL GENERATION OF STREAMFLOW,
Washington Univ., Seattle; and Washington Water Research Center, Pullman.
For primary bibliographic entry see Field 02A.
For abstract, see .
W69-03307

ANALYZING SUBSURFACE FLOW SYSTEMS WITH ELECTRIC ANALOGS,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 02F.
For abstract, see .
W69-03310

A STUDY TO DETERMINE THE COSTS OF WATER IN INDUSTRIAL USES,
Rice (Cyrus W.) and Co., Pittsburgh, Pa.
For primary bibliographic entry see Field 06C.
For abstract, see .
W69-03322

OPTIMIZATION TECHNIQUES FOR HYDROLOGIC ENGINEERING,
Corps of Engineers, Sacramento, Calif. Hydrologic Engineering Center.
Leo R. Beard.
Water Resources Res, Vol 3, No 3, pp 809-815, 1967. 7 p, 1 fig, 9 ref.

Descriptors: *Optimization, *Systems analysis, *Digital computers, *Hydrologic aspects, *Water resources, Water utilization, Planning, Engineering, Model studies, Computer models.
Identifiers: *Hydrologic engineering, Optimization procedures.

Optimization processes show considerable promise for a reasonable solution of the increasingly complex design and operation problems that occur in water resources engineering. Gradient methods of optimization should appeal to the engineer, because the methods can be used within the framework of traditional engineering analyses (e. g., multipurpose sequential routing or system simulation), where the components of the system can be changed in successive trials to obtain the best combination most rapidly. They can most easily be adapted to practical complex problems and appear to require minimum programming and computation time. Because of the large amount of computation involved, optimization procedures almost always require the use of high-speed digital computers.
W69-03329

SELECTED BIBLIOGRAPHY ON HYDROLOGICAL CONTROL BY RESERVOIR OPERATION,
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03376

ANALYSIS OF A WATER STORAGE RESERVOIR SYSTEM,
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03377

LINEAR RANDOM MODELS OF ANNUAL STREAMFLOW SERIES,
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03379

IMPACT OF INSTITUTIONAL ARRANGEMENTS ON THE AVAILABLE ALTERNATIVE DEVELOPMENTAL PATHS FOR WATER ALLOCATION AND POLLUTION CONTROL IN THE COLORADO RIVER BASIN,
Battelle-Northwest, Richland, Wash.; and Northwestern Univ., Evanston, Ill.
Jmes P. Heaney, Robert S. Gemmell, Abraham Charnes, and Harold B. Gotaas.
Proc Third Annual Amer Water Resources Conf, pp 84-91, 1967. 8 p, 3 tab.

Descriptors: *Institutional constraints, *Water allocation (Policy), Planning, *Water pollution control, *Colorado River Basin, Beneficial use, Water policy, Water law, Colorado River Compact, Economic impact, Mathematical models, *Water resources development, Arid lands, Water quality, Interstate compacts, Public rights, River basin development, Irrigated land.

Selected results were presented from mathematical programming model for river basin planning that was applied to the Colorado River Basin. The primary mechanism for allocation of water has been the Colorado River Compact. The analysis made assumed intrastate allocation followed optimal allocation dictated by the model, which was not the case. Effect of water quality and public policy on water allocation were also reviewed. (Affleck Ariz)
W69-03492

TE DIFFERENCING METHODS,
cultural Research Service, Beltsville, Md.
ograph Lab.
rimary bibliographic entry see Field 07C.
bstract, see .
03519

E SERIES ANALYSIS,
gical Survey, Arlington, Va.
Matalas.
r Resources Res, Vol 3, No 3, pp 817-829,
13 p, 28 ref.

riptors: *Time series analysis, *Hydrologic
ts, Statistical methods, Forecasting, Correla-
analysis, Stochastic processes, Mathematical
ls.
ifiers: Hydrologic sequences.

aracteristic feature of hydrologic events is that
are not independently distributed in time. The
e of linear dependence between events k time
apart is measured by the serial correlation
cient. This correlation, which tends to
ase with an increase in k, is attributed to
ge processes in the atmosphere or within the
age basin. The correlation measures the
e of redundancy of information yielded by
hydrologic event. This redundancy implies
statistical parameters computed from a
nce of events are less reliable than is in-
ed by the sequence length. Hydrologic
nces are formulated in terms of generating
ls to account for serial dependence between
s, to allow prediction of events at future time
s, and to assess the effect of serial dependence
drologic studies.
03524

ANCE SPECTRUM ANALYSIS,
nal Center for Atmospheric Research,
der, Colo.
R. Julian.
r Resources Res, Vol 3, No 3, pp 831-845,
15 p, 6 fig, 27 ref.

riptors: *Time series analysis, *Hydrologic
ts, *Statistical methods, Correlation analysis,
astic processes, Random processes, Hydrolo-

ifiers: Hydrologic systems, Spectral analysis,
nce spectrum analysis.

nnotated review of the use of variance spec-
analysis for hydrological problems is
nted. Spectrum and cross-spectrum analyses
e used to analyze random or stochastic com-
nts in time and space series. Time-series
iques are used to allow the interdependence
ccessive observations to be taken into account
ng standard statistical tests that assume inde-
ent observations, to account for interdepen-
of observations in terms of the physical
s of phenomena, and to predict future values
e time series. Nonrandom components in
logical time series, for instance, periodic
ges of concentrations of pollutants in estua-
nay easily be found. Several other examples of
led periodicities are given. Spectral
iques may be used in digital generation of
nflow records. (Knapp-USGS)
03525

AMIC MODEL OF THE ECONOMY OF SUSQUEHANNA RIVER BASIN,
lle Memorial Inst., Columbus, Ohio.
rimary bibliographic entry see Field 06B.
bstract, see .
03570

MAL CONTROL OF LINKED RESERS,
r Planning for Israel Ltd. Tel Aviv; and Water
rch Association, Medmenham (England).
nweig, and J. A. Cole.
r Resources Research, Vol 4, No 3, pp 479-
June 1968. 19 p, 3 fig, 5 tab, 13 ref.

Descriptors: *Computers, Constraints, *Conjunctive use, Digital computers, Dynamic programming, Inflow, *Reservoirs, Storage.
Identifiers: *Linked systems, Frequency distribution, *Optimal control policies, Matrices, Serial correlation.

Control rules for linked reservoirs meeting a common demand are evaluated for a two storage case. Draw-off can be made from either of the reservoirs directly to supply, and transfers are permitted from the smaller to the larger reservoirs. Dynamic programming is effective in selecting the optimal control rules, for any stage of reservoir contents, given a defined objective of operation. The objective is expressed in monetary terms, relating to transmission, purification, or shortage costs, which are to be minimized in the long term. The case considered allows monthly inflows to the reservoirs to be treated as random variates; first order serial correlation of inflows is expressed by using 'high' or 'low' inflow distributions, according to whether the previous month's inflow was above or below its mean. Present worth factors, switch-on costs, and costs of shortage that vary nonlinearly with total deficit can all be brought into the reckoning.
W69-03571

OPTIMIZATION OF BRANCHING MULTISTAGE SYSTEMS: A REPLY TO A COMMENT BY D P LOUCKS,
Texas A and M Univ., College Station; and Texas Univ., Austin.
W. L. Meier Jr., and C. S. Beightler.
Water Resources Research, Vol 4, No 6, pp 1385-1386, December 1968. 2 p, 7 ref.

Descriptors: *Optimization, *Dynamic programming, Linear programming.
Identifiers: *Multistage structure, *Partial optimization, Nonlinear programming, Simultaneous optimization, Lagrange multiplier.

Water resource systems and their component subsystems usually exhibit multistage structures. Although their complexity and high dimensionality tax the capacity of our sophisticated analytical techniques and computational equipment, the partial optimization procedure of dynamic programming affords the ability to effect the optimization of complex structures recursively. This decomposition can often make a seemingly impossible problem tractable. Loucks misinterprets the authors' intent pertaining to linear and nonlinear programming. The authors feel linear programming can be used for water resource problems if the objective function and all constraints are linear, or if the nonlinearities of the objective function or constraints can be approximated via linear functions. The use of the Lagrange multiplier is not practical in complex problems. Unlike simultaneous optimization techniques, where all decision variables are directed toward their optimum values simultaneously, partial optimization, of which dynamic programming is an example, decomposes the problem into simpler subproblems which are analyzed sequentially by partially optimizing single, or groups of, variables while the effects of interactions among the variables are maintained. (Loeb-Rutgers)
W69-03580

SIMULATION OF A WATER RESOURCES SYSTEM,
Washington Univ., Seattle. Fisheries Research Inst.
Donald E. Bevan, and Gerald J. Paulik.
Washington Water Research Center, Completion Report, February 5, 1969. 11 p. OWRR Project A-003-Wash.

Descriptors: *Computer, Flow, Water quality, Estuaries, Fish populations, Fish management, Systems analysis, Simulation analysis, Simulation, Computer models, Washington.

Project goals were to develop theory and methodology needed for computer simulation modeling of water resource systems with significant biological components. Research completed under project is summarized below: (1) A series of simulation models representing population dynamics of a freshwater zooplankton population was developed in DYNAMO. (2) The problem of determining maximum sustainable physical yield from a mixture of fish stocks of differing sizes and productivities was analytically solved, and FORTRAN IV programs were written in which solution was employed. (3) A computer simulation model of seaward migration of fish through a river and estuary was written in DYNAMO. (4) A DSL-90 computer simulation model of flow in a series of contiguous reaches of a river was developed. (5) A system for processing and analyzing data obtained from automatic water quality monitors in order to provide necessary information for proper management of an estuary was developed. (Lenarz-Wash)
W69-03601

'NUMERICAL SOLUTION OF THE UNSTEADY, ESTUARY DISPERSION EQUATION',
Stanford Univ., Calif.
For primary bibliographic entry see Field 02L.
For abstract, see .
W69-03675

'FINITE-DIFFERENCE MODELLING OF RIVER AND ESTUARY POLLUTION',
Stanford Univ., Calif.
For primary bibliographic entry see Field 05A.
For abstract, see .
W69-03690

6B. Evaluation Process

DELAWARE RIVER BASIN COMPACT.

N Y Conserv Law sec 801 (McKinney 1967).

Descriptors: *New York, Civil law, Legislation, State governments, Federal government, Administrative agencies, Conservation, Water resources, Planning, *Water resources development, Water supply, *Water policy, Administration, Delaware, Pennsylvania, New Jersey, United States, Public benefits, *River basin commissions, Legal aspects.

The Delaware River Basin Compact was adopted for the purposes of the conservation, utilization, development, management and control of the basin. It was thought that comprehensive multiple purpose planning would bring the greatest benefits and produce the most efficient service in the public interest. The program, as administered by a basin-wide agency, should provide flood damage reduction; conservation and development of surface and ground water supply for municipal, agricultural, and industrial uses; development of water recreation facilities; promotion of forest land management, soil conservation, and watershed projects; protection and aid to fisheries; development of hydroelectric power potentialities; control of salt water movement; abatement and control of water pollution; and regulation of streamflows aimed at attaining these goals. Members of the compact include New York, Delaware, New Jersey, Pennsylvania, and the United States. The federal government, recognizing a national interest in the basin, has authorized the Army Corps of Engineers, with the aid of the departments of Agriculture, Commerce, Health, Education and Welfare, Interior, and the Federal Power Commission, to make comprehensive surveys and reports concerning the waters of the basin. Concurrent legislation was passed by all members in order to create the compact. (Scott-Fla)
W69-03299

INTERNATIONAL CONFERENCE ON WATER FOR PEACE 1967.
Available from the Superintendent of Documents, U. S. Gov't Printing Office, Wash., D. C., at $60 per set. Sold in sets only. Washington; U. S. Gov't Printing Office, 1968, 8 vols.

Descriptors: Water Resources Planning, *Water Management, *Water Desalination, Groundwater, Flood Control, Irrigation, Water Pollution, Weather Modification, Water Conservation.
Identifiers: *Water for Peace, International Water Conference.

The purposes of the conference were to identify water problems, exchange knowledge, discuss goals and explore action programs in the furtherance of a worldwide cooperative effort aimed at the solution of water problems. More than 600 technical papers were accepted for publication by the conference. Of these, 193 were presented orally. Also included were 52 'Country Situation Papers,' which described water problems of various nations, solutions attempted and proposed plans for the future. The following topics were covered: Basic Data for Water Programs; Concepts and Prodecures; Desalting; Economic Considerations; Education and Training for Water Programs; Evaporation Control; Financing Considerations; Flood Control; Geoeconomic; Governmental Agencies; Groundwater; Inland Waterway Transportation; International Agencies; International Programs; Irrigation; Maintaining Water Quality; Multiple Purposes; Needs and Programs; Organizing for Water Programs; Piping Design; Planning and Developing Water Programs; Pollution Control; Reuse of Water; Role and Development; Systems and Analyses; Water Conservation Techniques; Water Law and Legislation; Water Quality Considerations; Water Quality Control; Water Quantity Forecasting; Watershed Management; Water Supply; Water Supply Technology; Water User Agencies; Water User Education; and Weather Modification.
W69-03305

MODERN HYDROLOGICAL RESEARCH METHODOLOGY ON RIVERS IN RUMANIA (IN RUMANIAN),
National Council of Engineers and Technical Scientists, Bucharest (Rumania).
Gheorghe Platagea.
Hidrotehnica, Gospararirea Apelor, Meteorologia, (Bucharest) Vol 12, No 7, pp 356-358, Jul 1967. 7 tab, 2 graphs, 6 ref.

Descriptors: *River basin development, *Hydrologic data, Infiltration, Runoff, Water loss, Evapotranspiration.
Identifiers: *Rumania, *Jiu River, Hydrographic data.

Hydrological research in Rumania is conditioned by such factors as construction requirements and volume of investments. Research in the period 1957-1965 covered 1,451 parameters concerning maximum-, average-, and minimum discharge rates and related hydrological factors. Typical of such analyses were: the Jiu basin for a 15-year period to measure daily average discharge and volume; maximum discharge during 1961-66 for 6 hydrographic systems; and daily discharge according to volume for a one-year period at 13 hydrographic stations. To justify economic expenditures, gaps in knowledge were investigated about such phenomena as: infiltration, water loss to soil, environmental conditions on ground and surface water, surface water loss through evapotranspiration, subsurface runoff, and related hydrological factors in the geographical area. The research generated by economic requirements will serve as a basis for completing the projected hydrological data network in Rumania. (Llaverias-USGS)
W69-03314

OPTIMIZATION TECHNIQUES FOR HYDROLOGIC ENGINEERING,
Corps of Engineers, Sacramento, Calif. Hydrologic Engineering Center.
For primary bibliographic entry see Field 06A.
For abstract, see .
W69-03329

POLLUTION CONTROL - PLANNING A NATIONAL PROGRAM,
Federal Water Pollution Control Administration, Washington, D. C.
For primary bibliographic entry see Field 05G.
For abstract, see .
W69-03410

REGIONAL WATER RESOURCE DEVELOPMENT IN THE FEDERAL SYSTEM,
W. Kiechel.
For eight vol. Proceedings see this issue, Field 06B, W69-03305. International Conference on Water For Peace, Vol 5, pp 628-636 (1968). 9 p.

Descriptors: *Water conservation, *Water resources development, *Regional analysis, *Geographical regions, Project purposes, Climatic zones, State governments, Government finance, inter-agency co-operation, TVA project, Legislation, Project planning, Interstate compacts, Interstate commissions, Interstate rivers.

In order to effectively develop and preserve our water resources, we must develop a system of regional control. To be effective, regionalism must proceed beyond planning. It must cut across all levels of government institutions. Some executive agencies working in the area of water resource development have long been organized on a regional basis. Any arrangement must be integrated with the federal system and made consistent with the constitutional and legal framework thereof. Legal institutions and concepts of water law differ from state to state, yet water flows and precipitates without regard to national, state, or local boundaries. A senate committee found that by 1980 five major regions of the United States will have an inadequate water supply. Other areas will have adequate water only if they invest billions in pollution control, storage reservoirs, and recycling. The evolution of different systems of water law in the various states demonstrates how traditional legal institutions have been influenced by climatic conditions. The climate governs and controls the water supply in given regions; hence, the need for regional water resource development. The only effective program will be a federal-state program designed to balance the varying needs of the regions on a national basis. The national program must be responsive to regional, state, and local needs. (Stewart-Fla)
W69-03411

CONSERVATION AND WATER RESOURCES PLANS.
N Y Conserv Law sec 835 Art 14 secs 14.1, 14.2 (McKinney Supp 1968).

Descriptors: *New York, *Conservation, *Water resources, *Planning, Civil law, Legislation, State governments, Administrative agencies, Natural resources, Water conservation, Water quality, Water supply, Long term planning, Water resources development, Public utilities, Basins, Water quality control, Legal aspects.

The conservation commission shall adopt and develop a comprehensive plan for immediate and long range development and use of water resources of the basin. This shall include all public and private facilities thought necessary. Before the plan is adopted, the commission should hold public hearings, consult with water users, public bodies, and public utilities and consider their recommendations. Any private or public facilities may be added to the plan based solely on the discretion of the commission provided they do not or would not significantly affect the water resources of the basin. The commission should also adopt a water resources program based on the above comprehensive plan. This water resources plan should deal with the quality and quantity of water resources needed for the period of the plan and the existing and proposed facilities required to satisfy such needs. A separate statement of the projects proposed to be undertaken by the commission should also be made. (Scott-Fla)
W69-03463

SOLVING THE ARID STATES' PROBLEMS,
California State Dept. of Water Resources, Sacramento.
William R. Gianelli.
Proc Third Annual Amer Water Resources Conf, Amer Water Resources Assoc, pp 23-27, 1967. 5 p.

Descriptors: *Arid lands, *California, Colorado River, Interstate compacts, *Water transfer, Water utilization, Surplus water, *Water resources development, Pumping plants, Aqueducts, Southwest U.S., Water law.
Identifiers: Central Arizona Project, North Coastal River Project (California).

A variety of programs used and planned by California to solve its water problems were discussed. The first was the State Water Project which transports surplus water from northern California to the heavily populated areas of southern California utilizing a system of aqueducts and pumping plants. By 1972 this project financed by 31 agencies will bring adequate water as far as San Bernardino County and continue to do so until 1990. The second was the North Coastal River project which will provide additional water in 1985. The third was the Central Arizona Project which was discussed with respect to legislative problems and lack of cooperation among southwestern and western states. (Affleck-Ariz)
W69-03493

URBAN WATER RESOURCES RESEARCH; SYSTEMATIC STUDY AND DEVELOPMENT OF LONG-RANGE PLANS, FIRST YEAR REPORT, SEPTEMBER, 1968.
American Society of Civil Engineers, New York. Urban Hydrology Research Council.

New York, American Society of Civil Engineers, 1968, various paging. OWRR Contract No. 14-01-0001-1585.

Descriptors: *Rainfall-runoff relationship, *Urbanization, *Systems analysis, *Drainage engineering, Data collection, Storm runoff, Urban sociology, Community development.
Identifiers: *Urban hydrology.

Systematic study and development of long-range programs by the ASCE Urban Hydrology Research Council for the OWRR are described and cover the first year of work. Objective of the research is to provide guidelines for initiating and expanding long-range studies in urban water problems. The U. S. Geological Survey is studying data requirements. First year emphasis was on subjects requiring earliest consideration, such as urban storm drainage. An assessment is given of the potentials, liabilities, and available knowledge of the rainfall-runoff-water quality process; and model requirements for process simulation are detailed. Immediate research needs with regard to damage evaluation are given; and the utilization of storage to ameliorate flooding is outlined. The principal non-hydrologic aspects of urban water are listed, and include administration of works, economics of planning and operation, financing of systems, recreational facilities, planning and operation, and sociological problems. Report contains 11 appendices, each with technical papers dealing with the appendix subject. (Lang-USGS)
W69-03506

DYNAMIC MODEL OF THE ECONOMY OF THE SUSQUEHANNA RIVER BASIN,
Battelle Memorial Inst., Columbus, Ohio.
H. R. Hamilton, S. E. Goldstone, and F. J. Cesario.
Battelle Memorial Institute, Columbus, Ohio, 1966. 336 p, 111 tab, 89 fig, append.

Descriptors: *Model studies, Computer models, Mathematical models, Regional analysis, Regions, River basins, River basin development, Forecasting, *Economic predictions, Water resources,

r quality, Water shortages, Population, an population, Employment, Planning, In-, Water supply, Water utilization, Industries.
ifiers: *Susquehanna River Basin, Economic th, Dynamic model, Demographic charac-ics.

report summarizes a three-phase research pro- in which a dynamic, mathematical model of conomy of the Susquehanna River Basin was loped. The model is capable of generating omic and water-use projections for the Basin r a wide variety of alternative assumptions. following are the major conclusions of the rch: (1) the water resources of the Basin ap- adequate to support economic growth for the eeable future without the construction of r systems if river works; (2) the water quality e Basin is generally good except for the occur- e of acid-mine drainage in the West and North ches; (3) water shortages are caused more by sufficiency of investment in water treatment distribution systems than by a shortage of r resources and (4) the usefulness of computer lation for regional economic and regional rces studies has been demonstrated.
-03570

IONAL JURISDICTION AND THE USE OF SEA,
mission on Marine Science, Engineering and urces, Washington, D. C.
s M. Alexander.
onal Resources Journal, Vol 8, No 3, pp 373- July 1968. 28 p.

riptors: *Water utilization, Jurisdiction, Legal cts, *International law, International waters, sportation, Commercial fishing, Mining, Mili- aspects, Water resources, United States.
tifiers: National jurisdiction, Scientific rch.

United States uses the sea for transportation, nercial fishing, mining, scientific research and ary operations. The nature and extent of the try's jurisdiction in the marine environment is rime importance because of the effects this ju- ction has on its opportunities for the use of the resources. US policy on jurisdictional matters e sea rests on two principal bases: the interna- l regulations contained in the four Geneva ventions, and the bilateral and multilateral eements which this nation has made with other s concerning specific uses of the sea. The omic, scientific and military uses which most tries including the US are not seriously ham- d by inadequate international rules and regula- at the present time. However, there is reason ticipate future problems.
-03572

EFIT COST ANALYSIS: A METHOD TO IONSTRATE THE IMPORTANCE OF TER RESOURCES DEVELOPMENT,
uth J. Wagner.
3-Volume Proceeding see this issue, Field 06B, -03305. International Conference on Water eace, Vol 7, 1968, pp 189-193. 5 p, 3 ref.

riptors: *Cost-benefit analysis, Project ning, Water resource development, Planning, blic health, *Budgeting, Constraints.
tifiers: American Indians, Alaska natives.

etary resources of the world are generally in- cient to develop fully all human and natural urces during a short span of time. Therefore, petition will continue to exist in obtaining ncial support to develop such resources, includ- water resources. The ability of water resources elopers to meet that competition will largely rmine that portion of total available financial urces that is committed to water development. heme of planning consisting of nine sequential s is presented: One step, benefit-cost analysis, nsidered in a simplified form to illustrate the process. Three alternative plans of action are presented and the benefits versus the cost of each are compared for the purpose of selecting the most favorable plan of action.
W69-03574

PUBLIC OBJECTIVES IN WATER RESOURCES DEVELOPMENT,
Gus Norwood.
For 8-Volume Proceedings see this issue, Field 06B, W69-03305. International Converence on Water for Peace, Vol 6, 1968, pp 738-47. 10 p.

Descriptors: *Water resources development, Planning, Water policy, Federal project policy, Costs, Discount rate.
Identifiers: Opportunity cost.

Long term, overall benefits to society suggest a public policy of optimum development of water resources or at least leaving the door open so as to permit future optimum development. Continued accelerating population growth and the loss of natural resources point toward optimum development as an imperative public policy. General public objectives of the efficient use of water resources on a balanced, multiple purpose basis for 'the greatest good of the largest number of people for the longest time' might include other specific public objectives which might govern the timing of construction, such as consideration of fiscal policy, full employment, balance of trade, income redistribution, expansion of the public and private economy and opening new areas for human habitation. Such objectives generally cannot be met under the narrow classical economics of the market place 'opportunity cost of money.' (Winn-Rutgers)
W69-03575

APPLICATION OF MARGINAL ECONOMIC ANALYSIS TO RESERVOIR RECREATION PLANNING,
Kentucky Univ., Lexington. Water Resources Inst.
John Ellis Sirles, III.
Water Resources Institute, Research Report No 12, 1968. 99 p, 19 tab, 14 fig, 31 ref. OWRR Project A-006-KY.

Descriptors: Recreation demand, Recreation facilities, Reservoir design, Reservoir sites, Reservoir storage, Marginal costs, Benefits, *Resource development.
Identifiers: Capacity coefficients, Crowding, *Visitation rates, Esthetic values, Potential visitation, *Outdoor based recreation.

Recreation visitation and cost data at three reservoirs in the Ohio River Valley (Rough River, Dewey, and Winton Woods) were analyzed in an attempt to derive a method by which the optimum level of reservoir recreation development could be determined by marginal economic analysis. The visitation data were used to estimate annual cost and marginal costs as functions of annual visitation. Marginal cost and marginal benefit data were combined to find the optimum size. Potential visitation to Winton Woods was estimated, and the marginal benefit per visitor was estimated from travel costs. The potential visitation was combined with the distribution factors for Rough River and Dewey to get the time distribution for reservoir use. Actual visitation was combined with the distribution factors at Winton Woods to get the time distribution of use at actual conditions. This allowed reduction in potential benefits due to crowding to be estimated. Marginal cost curves are combined with marginal benefit curves to find the optimum visitation to a site. This optimum implies a required reservoir size which can be estimated by use of the distribution factors and capacity coefficients. (Sokoloff-Rutgers)
W69-03576

ESTIMATION OF RECREATIONAL BENEFITS AT SOME SELECTED WATER DEVELOPMENT SITES IN CALIFORNIA,
Planmetrics, Berkeley, Calif.
Leonard Merewitz.
Berkeley, Calif, Planmetrics, 1968. 66 p, 2 fig, 27 tab.

Descriptors: Recreation, *Recreation demand, Benefits, Recreation facilities, Market values, Value, Income, Population, Human population, Cost.
Identifiers: *Recreation benefits, Consumer surplus, Recreation substitutes.

The major results of this study of six water development sites are as follows: (1) estimates on the extent to which cost discourages attendance at the sites were obtained, (2) population size, population density and income were other variables used to explain attendance, (3) the availability of recreation substitutes, as defined in this study, did not influence attendance, (4) ownership of water craft appeared to influence water-based recreational attendance, (5) the consumers' surplus estimates obtained were about two and one-half times larger than the market value estimates of the benefits and (6) market value calculations for the five sites in California showed that the prices which would maximize revenue were potentially collectible. The variance in these prices suggested that uniform prices should not be charged. (Winn-Rutgers)
W69-03578

ECONOMIC VALUE OF IRRIGATION WATER,
Angel M. Maqueda.
For 8-Volume Proceedings see this issue, Field 06B, W 69-03305. Int Conference on Water for Peace, Washington, 1968, Vol 6, pp 722-728. 7 p, 7 tab.

Descriptors: Farm management, *Investment, *Irrigation programs.
Identifiers: *Value, *Arrid lands, Factor of production.

In arrid countries irrigation water is the principal limiting factor in agricultural production. The costs of the irrigation water do not reflect the economic importance of such water to the national economy. The minimum value of irrigation water is the sum of the annual costs of implementing the irrigation project plus annual operating and maintenance costs. The maximum value of irrigation water is the minimum value plus the difference in profits obtained from crops grown on irrigated land and those which result from crops grown on the same land without irrigation. There are three different amounts for the value of water: a minimum amount which is the rate charged for irrigation, a maximum amount which would attribute to the irrigation water, the increase in profits; and, a weighted value which attributes only a part of the increase in profits to the irrigation water. (Grossman-Rutgers)
W69-03582

WATER QUALITY MANAGEMENT IN THE DELAWARE RIVER BASIN,
Ralph Porges.
For 8-Volume Proceedings see this issue, Field 06B, W69-03305. International Conference on Water for Peace, Vol 8, pp 47-60, 1968. 14 p, 4 fig.

Descriptors: *Water quality control, *Delaware River Basin Commission, *Standards, *Administration, Conferences, Publications, Municipal wastes, Industrial wastes, Waste treatment, Pollution, Interstate commissions, Interstate compacts, Dissolved oxygen, Oxygen deman, Administrative agencies, Water pollution control, Cities, Waste disposal, Water resources development.
Identifiers: Delaware River Basin Compact.

The Delaware River drains a region of ample water resources. Many water quality problems exist encompassing protection of municipal and industrial water supplies, acid mine drainage control, recreation, saline waters' encroachment, natural shellfish beds, maintenance and passage of fish and the discharge and disposal of the generally treated wastes from people and industries. Control mechanisms include federal, state, and local agen-

cies. Municipalities and industry have participated by waste management programs. The Delaware River Basin Commission was created by the four basin states in 1961. Part of the Commission's responsibilities is the maintenance of a comprehensive plan of water resources development, including water quality management. The federal Water Pollution Control Act of 1965 requires the states to hold public hearings to determine the water uses of interstate streams, establish stream criteria, and develop an implementation program. The states and the Commission are undertaking to develop a water quality management program. Water quality standards have been adopted for the estuary and bay which, after approval by the Federal Water Pollution Control Administration, will be implemented. (Childs-Fla)
W69-03583

PLANNING FOR MULTI-PURPOSE DEVELOPMENT OF WATER AND RELATED LAND RESOURCES IN THE UPPER MISSISSIPPI RIVER BASIN,
James S. King.
For 8-Volume Proceedings see this issue, Field 06B, W69-03305. International Conference on Water for Peace, Vol 8, pp 445-454, 1968. 10 p.

Descriptors: *Multiple purpose, *Mississippi river basin, *Resource allocation, *Water resources, Conferences, Publications, Planning, Land resources, Model studies, Decision making, Administration, Investment, Economic efficiency, Water conservation, Water quality, Water supply, Multi-purpose projects, Water resources development, Project planning.

Comprehensive water and related land resource planning in the upper Mississippi River Basin is a technique of decision-making pertaining to the allocation of scarce resources among competing claims. The ultimate objective of planning is to provide a sound basis on which public investment decisions can be made. The study discusses various principles and problems of planning. First, flexibility must be maintained even though the broad objective is long-range national efficiency. Second, there must be a clear definition of the overall study objective to permit development of criteria for the field planning group's use. Third, no specific approach is appropriate for all studies. Fourth, clear channels of communication must be maintained. Fifth, the hydrological boundary is the most logical study boundary. Sixth, there is difficulty in maintaining interest among participants. Seventh, for efficient comprehensive studies a separate task force in a central location should be created. Eighth, there must be recognition that alternative means may reach the same goals. Ninth, planning for planning's sake is inadequate. Finally, development of water and related land resources in relation to potential and needs distinguishes the river basin approach from single-purpose water development. (Childs-Fla)
W69-03586

PLANNING FOR MULTIPLE-PURPOSE DEVELOPMENT,
Joseph L. Ignazio.
For 8-Volume Proceedings see this issue, Field 06B, W69-03305. International Conference on Water for Peace, Vol 8, pp 455-468, 1968. 14 p.

Descriptors: *River basins, *Multiple-purpose, *Project planning, *Water resources, Conferences, Publications, Administration, Water development, Interstate rivers, Floods, Pollution, Water supply, Droughts, Encroachment.
Identifiers: Connecticut River Basin, Connecticut River Study, Federal Water Resources Planning Act.

Through the use of comprehensive planning for the Connecticut River Basin, water management problems can be more adequately handled. Some of the current problems are in the resource areas of flood control, land management, navigation, recreation, water supply, low flow augmentation, water quality and the outstanding problem of pollution. The broad objectives of this study are to establish a plan for the best way to utilize water in the basin. Developmental problems have been divided into four topics: natural, man-made, institutional, and economic. Study management problems occur largely in the delineation, selection and coordination of the various efforts made by the participants. The manager of a water resources study has various planning tools to reconcile the supply and demand for water resources: economic projections, supply and demand analysis and system analysis techniques. Tributaries with a sizable natural surface supply, through proper storage and regulations of flow, can permit a higher stream use. The recommended basin plan will be made of several integrated projects divided into those developments for urgent consideration or a timetable of 1980 and will indicate potentials to meet needs through the year 2020. (Childs-Fla)
W69-03587

INTERGOVERNMENTAL RELATIONSHIPS IN THE ADMINISTRATION OF WATER RESOURCES,
Illinois Univ., Urbana. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-03590

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN ILLINOIS.
Corps of Engineers, Chicago, Ill.

U.S. Army Engineer Division, North Central, Chicago, Illinois, 1967, 90 pp, 1 map, 31 photo, 6 tab.

Descriptors: Illinois, Basins, Developed waters, *Navigation, Flood protection, Shore protection, Repairing, Costs, *Water resources development, *Project planning, *Channel improvements.
Identifiers: Army Corps of Engineers.

The report describes projects completed in Illinois by the Army Corps of Engineers, projects underway, active authorized projects, navigation projects under special continuing authorities, flood plain information studies, and survey investigations underway. Projects completed include sixteen navigation projects, seventy-one flood control projects and Devil's Kitchen Dam. Eight navigation projects, twenty-eight flood control projects and a beach erosion control project on the Illinois shore of Lake Michigan are underway. Four navigation projects, eight flood control projects, and the shore protection project on Lake Michigan at Evanston are active authorized projects. Other authorized projects include four navigation projects and fifteen flood control projects. Navigation projects under special continuing authorities include three small navigation projects, five small flood control projects, a discussion of emergency repairs and rescue, and a list of snagging and clearing projects and their costs. Flood plain information studies include descriptions of two completed studies, one on the Des Plaines River, the other on the Little Calumet and tributaries, and a description of one study underway on the North Chicago Branch River. Survey investigations underway include the locality, purpose, and status of investigations on navigation, flood control, comprehensive basin studies, and special studies on the navigation season and water levels of the Great Lakes. (Gossen-Chicago)
W69-03591

SAN FRANCISCO BAY PLAN.
San Francisco Bay Conservation and Development Commission, Calif.

San Francisco Bay Conservation and Development Commission, January 1969, 41 p, 19 map, 13 fig, 8 photo, 1 append.

Descriptors: Wildlife conservation, Landfills, *Water quality, *Administrative agencies, *Project planning, Recreation, Fishing, Water sports, Inlets, *Public benefits, *Cost sharing.
Identifiers: San Francisco Bay.

This is a regional plan based on the recognition of the Bay as a single body of water and that changes in one part may affect other parts. Regarding the Bay as the most valuable natural asset of the region, the plan attempts to safeguard this asset for future generations and to maintain it for the highest public good. Indiscriminate bay filling is restricted to uses which will provide public benefits that could not be obtained without filling. These public benefits are: (1) adequate port terminals; (2) land for industry that require access to shipping channels; (3) recreational opportunities; (4) airport terminals and runways; (4) freeway route - if no feasible alternatives are available; and (5) developing public access to the Bay. The plan further proposes maintaining prime wildlife refuges and diked-off areas around the Bay and adding to the existing refuge system. The cost of the plan will be financed by private investment, some by joint private-public efforts and some will depend on public funds. The administrative funds necessary to keep the plan current and to help implement it is estimated at 400 to 500,000 per year. A major recommendation of the plan is the creation by the State legislature of a governmental agency to carry out the plan. (Starr-Chicago)
W69-03592

WATERSHED, FLOOD PROTECTION, AND RECREATION DEVELOPMENT IN ATCHISON, KANSAS,
League of Women Voters Education Fund, Omaha, Nebr.
A. J. Mangelsdorf.
League of Women Voters Education Fund, Lower Missouri River Basin Seminar, Land and Water for Tomorrow, Omaha, Nebraska, 1967. 9 pp.

Descriptors: Decision-making, *Project planning, *Watershed management, Flood damage, Flood protection, *Area redevelopment, Recreation facilities, Financing, Financial feasibility.
Identifiers: Atchison (Kansas), Central Business Districts.

The city of Atchison, like most older communities, was plagued with a deteriorating central business district. Because of the inability to agree on a common program to mitigate the problem, nothing was done to renew the downtown area. In July, 1958, Atchison, located in the White Clay, Brewery Creeks Watershed, was flooded twice with total damages exceeding four million dollars, the city faced, not merely the decay of its downtown area, but the actual rebuilding of its commercial district and the development of a program to protect against future ravages by flood. President Eisenhower declared Atchison a disaster area. By doing so, he opened the door for a joint urban renewal project in the hard-hit downtown area and a flood control program. This was the first urban renewal project in the United States to deal with a commercial area. Financing, feasability, recreational benefits, and the citizens' planning of the projects are discussed. Volunteers petitioned for creation of a Watershed District. A retired army officer, Brigadier General A. D. Warnock, was particularly effective in petitioning, chairing the Watershed Board, and acting as the city's contracting officer. (Gossen-Chicago)
W69-03593

SOCIOLOGICAL FACTORS IN WATERSHED DEVELOPMENT,
Mississippi State Univ., State College. Water Resources Research Inst.
Kenneth Wilkinson, and Lucy W. Cole.
Water Resources Research Institute, Mississippi State University, July 1967, 48 p, 113 ref.

Descriptors: Watershed management, Social adjustment, Water resources development, River

development, Mississippi watersheds, arch and development, Project planning, i-purpose projects, Watershed protection and l prevention act.
tifiers: Community responses, Voluntary or-zations.

report is the second phase of a research pro- to assess the influence of community struc- on the effectiveness of local watershed lopment. The research deals with the sociolog- spects of watershed development at a commu- evel. Objectives of the research are as follows: esent a strategy and frame of reference for in- tion between sociologists and water manage- professionals; to review sociological literature ater resources; and to present methodology indings of empirical work. Approaches toward search interpretation process are presented. interactional or field-theory approach is used e research reported. The theory is a develop- al model of action which emphasizes change. ological and related studies of water resources ritically reviewed and related to the frame of ence -- strategy and approach -- of the rch. Studies described are in water resources lopment planning, river basin studies, and watersheds. A final section describes infor- on collected on small watersheds in Mississip- Abodeely-Chicago)
-03594

RGETOWN WATERFRONT.
getown Planning Council, Washington, D. C.

getown Planning Council, 1640 Wisconsin , N. W., Washington, D. C., 1965, 12 p, 5 fig, 4 , 1 append.

riptors: *Highway relocation, *Scenic ease- s, Project planning, Underground structures, nal historic parks, Zoning-industries.
tifiers: *Waterfront development.

report, prepared for Secretary of the Interior l, gives the history of Georgetown, relates the nt deterioration of its waterfront and defines resent opportunity to reclaim the waterfront s historic and scenic value. Two recommenda- of the National Planning Commission en- age present action: (1) that industry be ved from the waterfront, and (2) that the D. ighway Department design a new facility for ncreasing traffic. The report illustrates present ng regulations. It discusses the existing ted freeway, and gives the economic ad- ages of a river tunnel. It discusses the human ntages of a designed community, and con- es with four recommendations: (1) that the of Georgetown which represents the old rt be designated a national historic site, (2) the Potomac Freeway be located in a tunnel, hat the scenic easement process be used to rol future development within this historic site, (4) that the Secretary of the Interior use the c easement power to prevent development h does not conform to the above until the rnmental process begins. The council later ap- ed a list of objectives for the Georgetown area, a comparison of highway solutions, a of tentative land use, and a summation of the natives and their implications. (Gossen- ago)
-03595

MPREHENSIVE RIVER BASIN PLANNING: ARKANSAS-WHITE-RED BASINS INTER- NCY COMMITTEE EXPERIENCE,
igan Univ., Ann Arbor. Inst. of Public Ad- stration.
ert H. Pealy.
tute of Public Administration, University of igan, Ann Arbor, 1959, 71 p, 21 ref.

criptors: *Inter-agency cooperation, Federal rnment, Planning, Methodology, *Legislation, duling, Arkansas, River Basin development.

The report evaluates the work of the Arkansas-White-Red Basins Inter-Agency Committee, which was created to devise a long-range 'comprehensive' plan for the development of water and related land resources of the AWR basins. The real importance of the AWRBIAC is not the plan itself but its possible use as a guide to future basin planning. Described is the problem of coordinating different federal agencies represented in the committee, the inability to define the work 'comprehensive', the committee's legislative history, its organization and procedure, its financing and cost, its restriction by a rule of unanimous agreement, and its restriction by law from reexamining existing projects. Two specific controversies are related to illustrate the inner strife of the committee. The difficulty of agreeing upon a completion schedule is discussed. The final conception of the plan and its justification is stated. The uneasiness of the Bureau of the Budget over the committee's difficulties and its consequent intervention is discussed. This, together with the President's intervention, gave the committee impetus to bring their study to an end. Two recommendations are made for future committees: (1) that a chairman have final authority to make decisions, and (2) that such a committee not be restricted by proviso clauses; the unanimity rule is still under discussion. (Gossen-Chicago)
W69-03596

NARRAGANSETT BAY: A MARINE USE PROFILE,
Lewis M. Alexander.
Office of Naval Research. Contract No. Nonr-396 (09), NR-389-134, June, 1966.

Descriptors: *Commercial shellfish, *Commercial fish, *Estuarine fisheries, *Rhode Island, *Competing uses, Marine fisheries, Sport fishing, Fisheries, Shellfish, Aquatic life, Invertebrates, Animals, Aquatic animals, Wildlife, Fish, Water pollution, Hurricanes, Regions, Northeast U. S., New England, Geographical regions, Aquatic productivity, Productivity, Exploitation, Silting, Sedimentation, Efficiencies, Water utilization.

A portion of this report deals with the commercial fish and shellfish industries of Narragansett Bay, Rhode Island. Trends in values of commercially exploitable resources are discussed. Some of the factors seen limiting the industries or causing declines in fisheries production are pollution, hurricanes, silting, and over-exploitation of the resource. Conflicts between users of the resources are discussed, and the need for more studies of management problems is mentioned.
W69-03606

ANNUAL REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY, ON CIVIL WORKS ACTIVITIES.
Report, Corps of Engineers, Department of the Army, 1966.

Descriptors: *Harbors, *Rivers, *Water resources development, *Federal government, *Planning, *Federal budgets, *Data collections, Forecasting, Governments, Animals, Navigation, Beach erosion, Hydroelectric power, Recreation, Wildlife, Channel improvement, Electric power, Resource development, Administration, Flood control, Control, Water control, Bodies of water, Running streams, Streams, Surface waters, Erosion, Future planning (Projected), Long-term planning, Project planning, Short-term planning.

The civil work activities of the Department of the Army, as carried out by the Corps of Engineers during fiscal year 1965, are reported. Volume 1 reviews overall program status, accomplishments, and planning to meet existing and future needs and presents summary data on water resource development by the Corps. Volume 2 contains detailed information on individual projects and activities by ports and harbors. During fiscal year 1965, expenditures were $1,198.5 million on the civil works program. Of this amount, $1,167 million was spent for rivers and harbors and flood control.
W69-03608

ECONOMIC CONSIDERATIONS OF WATER POLLUTION CONTROL,
For primary bibliographic entry see Field 05G.
For abstract, see .
W69-03613

BOATING FACILITIES.
Outdoor Boating Club of America, Chicago, Illinois, Vols 1-8, 1959-1967.

Descriptors: *Recreation facilities, *Boating, *Marinas, *Boat-launching ramps, *Profit, *Prices, Recreation, Water sports, Water pollution, Statistics, Data collections.

The Outdoor Boating Club of America compiles information and reprints on boating and related facilities in periodic publications. Eight volumes, spanning the period 1959-1967, have been published to date. The reprints contain information on the economics of building and operating marinas. Other topics include: pollution and the marina, launching-ramp construction, marina profits, marina prices, profits of dry-land marinas, the marina and the community--feasibility and benefits, marina management, boating facilities found at marinas, 'From marsh to marina', 'A marina is good for a city', and 'Do marinas pay their way'.
W69-03615

ESTUARIES: A NEGLECTED RESOURCE COMPLEX,
S. A. Cain.
Commercial Fisheries Review, Vol 28, No 10, October, 1966, pp 27-34.

Descriptors: *Monetary benefits, *Commercial fishing, *Fish harvest, Direct benefits, Sport fishing, Management, Coastal marshes, Salt marshes, Benefits, Income, Return (Monetary), Value, Commercial fish, Fishing, Industries, Recreation, Water sports, Bodies of water, Surface waters, Marshes, Wetlands, Coasts, Massachusetts, Geographical regions, New England, Northeast U. S., Regions, Atlantic Ocean, Oceans, Pacific Ocean, Gulf of Mexico, Gulfs.

This article discusses some of the values and current problems associated with estuaries. The author states that: (1) A salt marsh in Massachusetts can yield $300/year of seafood. (2) North Atlantic coast commercial finfish landings averaged 1.6 billion pounds in a recent 10-year period; shellfish contributed about 107 million pounds, with a monetary value of $90 million. (3) In a typical year, seafood landings produced 2.2 billion pounds on the Atlantic coast; Gulf coast, 1.4 billion pounds; Pacific coast (Hawaii excluded), 1.1 billion pounds. The total worth was $362 million. (4) In 1960, three million fishermen spent more than $1/3 billion on sport fishing on the Atlantic coast.
W69-03620

COMPREHENSIVE PLANNING IN RELATION TO THE RISE AND MANAGEMENT OF ESTUARIES,
Henry P. Caulfield, Jr.
A Symposium on Estuarine Fisheries, American Fisheries Society, Special Publication No 3, 1966, pp 121-126.

Descriptors: *Management, *Planning, *Future planning (Projected), *Long-term planning, *Administration, Economic justification, Project planning, Decision making, Methodology, Feasibility, Productivity, Economic efficiency.

The use and management of estuaries involve some unique physical and analytical problems not normally encountered by water planners traditionally concerned with river basins. Nevertheless, the basic analytical framework which has evolved over time in seeking solutions to river basin problems is equally applicable to estuarine problems. This framework requires an understanding of (1) fundamental objectives of planning, development, and

management; (2) standards and criteria for translating these objectives into specific plans for improvement measures; and (3) processes and techniques of analysis in plan formulation to achieve stated objectives. Developing computational techniques enables persons to apply standards and criteria to an expanded array of alternative solutions and to a greater choice of selected objectives. The opportunity to achieve optimal solutions is thereby enhanced.
W69-03624

THE TEXAS BASINS PROJECT,
Charles R. Chapman.
A Symposium on Estuarine Fisheries, American Fisheries Society, Special Publication No 3, 1966, pp 83-92.

Descriptors: *Texas, *Commercial fishing, *Sport fishing, *Project planning, *Human population, *Water requirements, Tributaries, Bodies of water, Canal construction, Project feasibility, Planning, Feasibility, Running water, Streams, Coastal marshes, Fishing, Industries, Recreation, Water sports, Estuarine environment, Estuarine fisheries, Central U. S., Coastal plains, Geographical regions, Gulf coastal plain, Regions, Southwest U. S., Marshes, Wetlands, Population, Fisheries, Fish harvest.

The proposed Texas-Basin-Project is a multiphased plan to establish 18 reservoirs to supply fresh water to a trans-Texas canal intercepting tributary discharges to all of the coastal marshes of the state. The project's area of influence, development plan, stages of construction, and operation are discussed. A general description is given of the Texas coastal fisheries. To date, the take of commercial species has been only partially exploited; and, although the trend is upwards, the overall harvest may more than double over the next three or four decades provided suitable environmental conditions in the estuary can be maintained. Estimates and projections of population, water requirements, etc., are presented for the years 1960 and 2010. By 2010 the Texas estuaries may be called upon to provide about 17-million man-days of angling as compared to the present seven million man-days of sport-fishing for estuarine species.
W69-03625

CHESAPEAKE BAY STUDY TASK GROUP ON FLOOD CONTROL, NAVIGATION, EROSION, FISHERIES--MINUTES OF THE FIRST MEETING.
Corps of Engineers, Department of the Army, Baltimore, Maryland, April 18, 1968.

Descriptors: *Maryland, *Flood control, *Navigation, *Erosion, *Fisheries, Federal government, Governments, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Geographical regions, Northeast U. S., Regions, Control.

The primary discussion topics of the meeting reported were as follows: (1) Authorization and objectives of the Chesapeake Bay Study; (2) Studies that could be made with the use of a hydraulic model of the Chesapeake Bay; (3) Conversion of model data to prototype requirements; (4) Organization of task groups; (5) Outline of report to be submitted by the Corps to the Committee on Multiple Use of the Coastal Zone.
W69-03626

ECONOMICS OF OUTDOOR RECREATION,
Marion Clawson, and Jack L. Knetsch.
Johns Hopkins Press, Baltimore, Maryland, 1966.

Descriptors: *Economic impact, *Recreation demand, *Resource allocation, *Water resources, Recreation, Recreation facilities, Social aspects, Natural resources, Land use, Demand, Supply, Resources, Costs, Benefits, Values.

This book is the most comprehensive coverage available on the economics of outdoor recreation. It includes references to most of the other major papers and reports on the subject. Demand and supply aspects of outdoor recreation are given coverage in depth. Discussion on demand includes the construction of demand curves and factors which are important in estimating demand. Alternatives to demand curves are also discussed. Recreation supply is analyzed from the perspectives of resource use, recreation quality, and description of existing areas. Economic considerations in outdoor recreation include: the value of land and water resources when used for recreation; economic impacts on local areas; costs and investment considerations; and pricing and paying for outdoor recreation facilities. Future aspects include policy issues and research.
W69-03628

THE OYSTER-BASED ECONOMY OF FRANKLIN COUNTY, FLORIDA,
M. Colberg, and D. M. Windham.
Report, Department of Health, Education and Welfare, Washington, D. C., 1966.

Descriptors: *Florida, *Oysters, Animals, Aquatic animals, Aquatic life, Benthic fauna, Benthos, Commercial shellfish, Invertebrates, Marine animals, Mollusks, Shellfish, Employment opportunities, Human resources, Industries, Management, Fish management, Industrial production, Benefits, Labor, Economic impact, Atlantic coastal plain, Coastal plains, Geographical regions, Gulf coastal plain, Regions, Southeast U. S.

This is a study of the importance of the oyster industry, economically and socially, to the residents of Franklin County, Florida. A general description of the county and the operation of the oyster industry in the county is provided. Graphs and tables on the income of a variety of sources to the county, as well as information on per capita income, are given. Comparisons with income from the oyster industry are made. Values added to oysters at various stages of production and distribution are discussed.
W69-03631

THE CONDITION OF THE CHESAPEAKE BAY,
Eugene Cronin.
32nd North American Wildlife and Natural Resources Conference, San Francisco, California, Transactions, March 13-15, 1967, pp 137-150.

Descriptors: *Maryland, *Water values, *Transportation, *Recreation, *Bays, *Aquatic productivity, *Sanitary engineering, *Statistics, *Waste disposal, Erosion, Appalachian Mountain region, Alantic coastal plain, Coastal plains, Geographical regions, Northeast U. S., Regions, Social values, Water utilization, Water resources, Navigable waters, Commercial fishing, Fishing, Bodies of water, Productivity, Efficiencies, Engineering, Resources, Effluents, Animal ecology, Plant ecology, Fishing, Data collections, Values, Ecology.

The author reviews the principal uses of the Chesapeake Bay and their outlook for the future: (1) Transportation - In 1964, 107,253,730 tons were handled by Baltimore and Norfolk. Baltimore alone receives approximately 5,000 ocean-going ships per year. Other uses are affected through transportation uses of the Bay, mainly through pollution by bilge pumping, overboard spillage, and channel deepening and maintenance. (2) Biotic Yield - Oyster production has been decimated by excessive exploitation and other species have been reduced by tributary dams and pollution, but changes in gear have vastly increased the catch of menhaden soft shell clams and crabs. (3) Recreation and Esthetics. (4) Waste Disposal - The Baltimore-Washington area expects its population to double from 1960 to 1985. There are three alternatives to the problem of waste disposal given in the paper. (5) The author cites other changes in the Bay which are potentially damaging to the area: (a) Destruction and conversion of marshland; (b) Diversion and damming of tributaries; (c) Invasion of water plant and animal life; (d) Land and shore erosion.
W69-03637

THE ENCLOSURE OF THE ZUIDERZEE AND THE RECLAMATION OF THE IJSSELMEER.
Dienst Der Zuiderzeewerken, The Hague, Netherlands, No 37, November, 1967.

Descriptors: *Land reclamation, *Benefits, *Foreign countries, Coastal engineering, Drainage, Engineering, Geographical regions, Regions.

This bulletin describes how the enclosure of the Zuiderzee and the reclamations in the IJsselmeer were carried out. Benefits derived from this project are listed, and the progress reports of the individual polders are given. A set of maps illustrates operations in various stages of completion.
W69-03657

THE MOLLUSCAN SHELLFISH INDUSTRY, CURRENT STATUS AND TRENDS,
J. B. Engle.
National Shellfish Association, Proceedings, No 56, May, 1966, pp 13-21.

Descriptors: *Commercial shellfish, *Clams, *Oysters, *Aquatic productivity, *Economic impact, Mollusks, Fish management, Productivity, Animals, Aquatic animals, Aquatic life, Benthic fauna, Benthos, Invertebrates, Shellfish, Marine animals, Water pollution, Water control, Control, Predation, Animal parasites, Bays, Bodies of water, Gulf of Mexico, Gulfs, Surface waters.

Comparative information is provided on the internal status of commercial shellfisheries in the United States. The oyster resource has not been adequately managed in the Chesapeake Bay, the area of greatest potential production, accounting for 50% of the total U. S. oyster production in this century. Chesapeake Bay oyster production today is only 10% of that in 1900. Production, while declining in the Chesapeake region, and even more so in the Middle Atlantic and New England regions, has increased considerably in the Gulf of Mexico and Pacific regions. At certain regions, and during certain periods, poor management, or no management at all, has contributed to the decline. In addition, such elements as (1) pollution due to population increase and lagging sanitation improvements, (2) the 'so-called improvements' of waterfronts for navigational, industrial, and domestic purposes, and the control of headwater impoundments for power, flood-control and increased water requirements, and (3) the difficulties of controlling parasites and predators have contributed to the decline of production. One other significant factor is the sales competition from more conveniently packaged and usable foods. The increase in production in the Gulf States has been stimulated by a drop in production in the northern areas, particularly the Chesapeake Bay. Clam production, including razor, soft shell and hard clams has increased somewhat. Of the estuarine species, the hard clam is important economically to the Middle Atlantic and New England area primarily. Many who formerly depended on oysters have converted to hard clamming as a significant adjunct to their business. Soft-shell clam production has increased, largely due to the hydraulic dredge recently developed in Maryland. Clamming is relatively unimportant on the West Coast as far as total U. S. production.
W69-03659

ESTUARIES: IRREPLACEABLE ENVIRONMENTS.
Gulf Review, Vol 2, No 1, September, 1967, pp 1-2.

Descriptors: *Economic impact, *Gulf of Mexico, *Reviews, Water resources development, Bodies of water, Gulfs, Surface waters.

article emphasizes the economic importance stuaries and lists several current comprehensive ies on estuaries and estuarine zones.
-03662

VERNMENT, INDUSTRY AND SCIENCE DY POTENTIAL OF SEAWEEDS.
eries of Canada, Vol 19, No 11, May, 1967, pp

criptors: *Marine plants, *Aquatic productivi- *Value, Marine fisheries, Submerged plants, ts, Aquatic plants, Aquatic life, Productivity, er utilization, Fisheries, Efficiencies, Geo- hical regions, Regions, Atlantic Ocean, Bodies ater, Oceans, Surface waters.

he present time, seaweeds along Canada's At- c coast are worth about $1 million per year. It ated that the resource is under-utilized and has able possibilities as a cash crop.
-03672

F OF MEXICO IS STILL BOOMING.
nore, Vol 27, No 7, June 20, 1967, pp 60-69.

criptors: *Oil industry, *Oil reservoirs, *Oil , *Gulf of Mexico, *Data collections, urces, Drilling, Natural gas, Oil, Wells, Drill s, Louisiana, Texas, Florida, Industries, Ex- ation, Gases, Organic compounds, Natural urces, Coastal plains, Geographical regions, coastal plain, Regions, Southeast U. S., Gulfs, es of water, Surface waters, Oil field.

offshore oil potential of the Gulf of Mexico is ined, and drilling forecasts and completions abulated. Louisiana reserves are compared to United States reserves, and sizes of produc- wells are discussed.
-03673

NOMIC ASPECTS OF THE DELAWARE ER ESTUARY PROGRAM,
am B. Halladay.
r presented to the American Association of Engineers, 1967 Annual Convention, Cleve- Ohio, July 10-12, 1967.

riptors: *Cost-benefit analysis, *Delaware basin commission, *Delaware river, Water ty, Legislation, Management, Interstate com- ons, River basin commissions, Bodies of r, Interstate rivers, Rivers, Running waters, ms, Surface waters, Political aspects, omics.

author brings out the various cost-benefit rela- involved in the Delaware River Estuary. He ions the problem of emotion and politics often shadowing need and economic fact in water ty legislation.
-03674

SERVATION AND MANAGEMENT OF SHORE AND UNDERWATER AREAS FOR LIC ENJOYMENT,
ge B. Hartzog, Jr.
American Conference on Conservation of ewable Natural Resources, International Union the Conservation of Nature and Natural urces, San Carlos de Bariloche, Rio Negro, ntina, No 3361-368, March 27-April 2, 1968.

riptors: *Recreation facilities, *Underwater, shores, *Land use, *National seashores, Natu- esources, Ecology, Management, Coastal en- ring, Engineering, Water pollution, Parks, ts, Shores, Resources.

acreage of seacoast available for public enjoy- is rapidly decreasing, due to three major fac- (1) Real estate speculation and private owner- of ocean front property; (2) Water pollution; Coastal engineering (draining, dredging, filling, building). What land is left for public recrea- tion should be scrupulously managed to maintain the ecological balance, as well as protect the interests of the seaside vacationer. Underwater parks are a recent development which can expand the recreational (and educational) use of a seaside park.
W69-03676

INDEX OF SELECTED OUTDOOR RECREATION LITERATURE, VOLUME II.
Bureau of Outdoor Recreation, Washington, D. C.

Report No 7000-70847, March, 1968.

Descriptors: *Abstracts, *Recreation, Documentation, Bibliographies.

This is a compilation of abstracts of articles, books, conference proceedings, directories, documents, reports, speeches, yearbooks, and bibliographies of outdoor recreation literature.
W69-03681

BENEFIT-COST ANALYSIS FOR WATER RESOURCE PROJECTS: A SELECTED ANNOTATED BIBLIOGRAPHY.
Tennessee Valley Authority, Knoxville, Tennessee, October, 1967.

Descriptors: *Cost-benefit analysis, *Water resources development, *Bibliographies, *Water pollution control, Abstracts, Documentation, Control, Navigation, Flood control, Water control, Recreation, Appreciation, Real property, Property values, Value, Forecasting, Evaluation.

The bibliography is divided into six major subject categories: (1) Basic works; (2) Flood control; (3) Navigation; (4) Pollution (quality) control; (5) Recreation; (6) Land value enhancement. Within each subject category the abstracts are placed under the following headings: (1) Definition; (2) Forecasting demand; (3) Benefit measurement and/or cost determination; (4) Evaluation techniques; (5) Decision criteria.
W69-03691

WHAT ARE WE LEARNING FROM ECONOMIC STUDIES OF WATER QUALITY,
Allen V. Kneese.
Engineering Progress, Vol XXI, No 6, June, 1967, pp 5-18.

Descriptors: *Water policy, *Water quality, *Costs, *Industrial water, *Indirect benefits, Institutional constraints, Water pollution effects, Economic efficiency, Benefits, Social aspects, Social values, Values, Water types, Constraints, Cost analysis, Analysis, Mathematical studies, Cost comparisons, Economic impact, Recreation.

The author maintains that 'economics' is often defined only in narrow terms relating to financial returns. In water resource terms the results are often the assumption that certain benefits fall in the social realm, but are not economic in nature. The author maintains that it is often possible to impute economic values to so-called social benefits and thus evaluate them rigorously. A review of economic studies on water quality leads the author to the following conclusions: (1) Industrial costs relating to water intake are surprisingly insensitive to the quality of intake water, (2) Poor water intake quality does result in extra costs for municipal use, but these costs are usually small in relation to the cost of upstream treatment, (3) Some evidence exists that reasonable values assigned to recreational use would justify increased treatment, at least in one area studied, (4) Too much emphasis is being placed on physical considerations in water quality management and not enough on economics. The problems of institutional arrangements needed to implant optimum standards are also discussed.
W69-03697

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

REGULATION OF WITHDRAWALS AND DIVERSIONS.
N Y Conserv Law sec 801, Art 10 secs 10.1, 10.2, 10.3, 10.4, 10.5 (McKinney 1967).

Descriptors: *New York, Civil law, Legislation, State governments, Administrative agencies, Conservation, Water resources, Planning, Water resources development, *Water policy, Administration, Droughts, *Withdrawals, Diversion, *Water shortage, River basin commissions, Surface waters, Legal aspects, Permits.

The commission may regulate and control withdrawals and diversions from surface and ground waters of the basin, and such power may be delegated. It may, after proper notice and public hearing, delineate areas where a water shortage has developed or is threatened so as to impair or conflict with the comprehensive plan; any such area may be designated a 'protected area.' This status may be terminated at the discretion of the commission. No one may divert or withdraw water from such protected areas except pursuant to a permit granted by the commission or any signatory state. In the event of a drought or other condition that causes or may cause an actual, immediate shortage of water in any part of the basin, the commission may designate the affected area and declare an emergency; in such a case, no water shall be withdrawn or diverted without the approval of the commission. Permits may be granted or denied so as to avoid such depletion in the protected or emergency area as will adversely affect the comprehensive plan or the equitable interests of other lawful users. (Scott-Fla)
W69-03303

A STUDY TO DETERMINE THE COSTS OF WATER IN INDUSTRIAL USES,
Rice (Cyrus W.) and Co., Pittsburgh, Pa.
Henry C. Bramer, and Donald J. Motz.
Report, Apr 18, 1968. 159 p, 2 fig, 14 tab, 16 ref, 2 append. 14-01-001-1581 (OWRR).

Descriptors: *Systems analysis, *Water costs, *Industrial water, Municipal water, Water reuse, Management, Model studies.
Identifiers: Industrial water costs, Systems approach.

A method developed through the systems approach, by which industrial water costs can be determined in a consistent, reliable manner for systems of any size and composition, is presented. The systems parameters are defined for use in a model which may easily be used in computers. The proper measure of costs is the generally accepted 'manufacturing cost' of a goods produced for sale. Relative costs of industrial water within and between several industries are shown and analyzed. Data from 22 industrial plants in the steel, petroleum, paper, and electric power industries were acquired on forms designed for use by experienced engineers. Checks for consistency, reliability, and accuracy were run. Flow diagrams show patterns of water use and reuse. Direct costs include purchased water, treatment chemicals, labor, and power. Other costs include taxes, overhead, depreciation, amortization, interest, and dividends. Direct costs are the greatest part of the total cost of low-cost water, but are very little of the cost of expensive water. Municipal water costs are similar to the overall industry average. (Knapp-USGS)
W69-03322

CITY OF EAST ORANGE V TOWNSHIP OF LIVINGSTON (TAX ASSESSMENT OF WATER RESERVE LANDS).

103 N J Super 109, 246 A 2d 722-728 (1968).

Descriptors: *New Jersey, Judicial decisions, *Assessments, Taxes, Water supply, *Legislation, Property values, Land appraisal, *Small watersheds, Legal aspects, Cities, Administrative agencies, Water resources, Evaluation, Real property.

The City of East Orange owned lands, located in the township of Livingston, which comprised portions of the East Orange Water Reserve. An expert valued these undeveloped water reserve lands for tax purposes. In so doing, he disregarded increased prices at which comparable properties were selling because city property was not on the market and could not enjoy increase in value. Livingston appealed from the judgment of the Division of Tax Appeals reducing the assessment from prior years. The appellate court reversed, and fixed a higher assessment. The court ruled that a statute did apply which stated that public water supply lands are taxable in the taxing district where located, without regard to any buildings or improvements thereon, in the same manner and to the same extent as the lands of private persons. The court ruled that the expert's valuation method for the lands was erroneous, and in violation of legislative mandate. As a matter of public interest, the court went on to fix a final assessment for the year in question. The final assessment took into consideration rising prices of other property in the area from sales for all permitted uses. (Wheeler-Fla)
W69-03442

ANDREWS V STATE (CONDEMNATION VALUE OF REALTY).
188 NYS 2d 854-865 (Ct Cl 1959).

Descriptors: *New York, *St. Lawrence River, *Appropriation, *Value, Legal aspects, Judicial decisions, Navigable waters, Riparian rights, Hydro-electric power, Resource development, Damages, River flow, Bridge construction, Eminent domain, State governments, Interest, Evaluation.
Identifiers: Fair market value.

This was an action to recover damages for the appropriation of real property for the improvement of the St. Lawrence River. The major problem before the court was the determination of the fair market value of the land appropriated. The state contended that the value of the land was merely that of like agricultural land. The Court of Claims, however, held that when a special aspect of the land, such as suitability for hydro-electric development, is neither conjectural nor speculative, that aspect must be considered in fixing the fair market value. The court also considered frontage on a navigable stream and ordinary reparian rights valued for their highest and best use in determining fair market value. The court concluded that a buyer would have contemplated use of the property for industrial and commercial purposes, including the development of the hydro-electric power of the St. Lawrence Seaway, and awarded damages and interest to the plaintiff. (Sisserson-Fla)
W69-03450

GRANTING REVOCABLE PERMITS.

N Y Canal Law secs 100 (McKinney Supp 1968), 1 p.

Descriptors: *New York, Legislation, Permits, *Canal structures, *Navigation, Transportation, Industrial use, Ice, Diversion, Banks, Industrial use (Water), Administrative agencies, State governments, Legal aspects.

The commissioner of transportation may issue revocable permits granting certain limited privileges if it can be done without detriment to canal navigation or damage to the banks. He shall determine the terms of such permits which may be issued for the temporary use of canal lands or structures and for the diversion of canal waters for sanitary, farm purposes, or industrial use. He may also issue permits to any person to cut, gather and haul away ice from the canals. Permits may be issued for the temporary use or occupation of canal terminals for the purpose of handling, storing or transferring freight in or for transit. All permits issued prior to the enactment of this statute and not cancelled are legalized and given the same effect as if the statue were in force on the day the permit was issued. No liability of any kind shall attach to or rest upon the state for any damage on account of the granting or revocation of any permits. (Shevin-Fla)
W69-03466

DISTRIBUTION OF COSTS OF MULTIPLE-PURPOSE HYDRAULIC PROJECTS,
Alberto Luis Grandi.
For 8-Volume Proceedings see this issue, Field 06B, W69-03305. International Conference on Water for Peace, Vol 8, 1968. pp 739-745, 7 p, 1 fig, 9 ref.

Descriptors: *Cost allocation, Costs, *Multiple purpose projects, Benefits, Specific costs.
Identifiers: Common costs, Marketability theory, Benefit theory, Installation use theory, Specific cost theory.

The task of allocating a cost to each use, function or benefit pertaining to a multiple-purpose hydraulic project is extremely complex. The major porblem consists in establishing an equitable distribution of the common costs of the installations shared by all users. The author reviews all the criteria which he has differentiated and concludes by stating that it should be considered axiomatic that the cost of any specific service provided by a multiple-purpose project should be less than the cost that would be entailed if separate installations were constructed. The author also cites foreign and national examples of the allocation of costs for this type of project.
W69-03577

THE BOATING BUSINESS (1966).

Boating Industry, Chicago, Illinois, 1966.

Descriptors: *Boating, *Statistics, Recreation, Marinas, Data collections, Water sports, Recreation facilities, Accidents, Expenditures, Foreign trade.

This is a yearly trade publication which presents statistics on the pleasure boating industry. The subjects covered include: use of recreation boats; sales of boats, motors, and equipment; retail expenditures; distribution of boats and motors by state; buyer characteristics; dealer characteristics; marinas; accidents; and foreign trade.
W69-03614

FISHING FLEET TRIES TO CAST OFF THE PAST.
Business Week, October 21, 1967, pp 94-98.

Descriptors: *Commercial fishing, *Competition, *Government supports, Competitive prices, Fishing, Fisheries, Water utilization, Efficiencies, Prices, Import, Foreign trade, International commissions, Marketing.

The author summarizes discussion held at a recent Commercial Fisheries Exposition. Foreign competition in fishing fleets sales and import of fish, and obsolescence in our own industry is leading to a decline in fisheries production in the U. S. Such things as government subsidization and international control are seen as the only hopes for the future.
W69-03664

CALIFORNIA SALMON LANDINGS, 1952 THROUGH 1965,
P. T. Jensen, and P. G. Scwartzell.
Fishery Bulletin, Vol 135, 1967, pp 43-57.

Descriptors: *Salmon, *Market value, *Fish harvest, *California, Commercial fishing, Sport fish, Fishing, Industries, Animals, Aquatic animals, Aquatic life, Fish, Wildlife, Sport fishing, Recreation, Water sports, Salmonids, Income, Return (Monetary), Value, Geographical regions, Pacific coast region, Regions, Southwest U. S.

Trends in landings and dollar values of salmon landed both commercially and by sport fishermen in California ports are provided for the years 1952-1965.
W69-03686

6D. Water Demand

MAIN I, A SYSTEM OF COMPUTERIZED MODELS FOR CALCULATING AND EVALUATING MUNICIPAL WATER REQUIREMENTS: VOLUME I-DEVELOPMENT OF THE MAIN SYSTEM; VOLUME II-DESCRIPTION OF THE MAIN I SYSTEM AND LIBRARY OF WATER USAGE PARAMETERS.
Hittman Associates, Inc., Columbia, Maryland.

Order from the Clearinghouse as PB 182 555, Vol. 1, PB-182 556, Vol. 2, $3.00 per volume in paper copy. $0.65 per volume in microfiche. HITTMAN Ass, Inc Rep No HIT-336, June 1968: Vol 1, 102 p, 18 fig, 12 tab, 92 ref, 4 append; Vol 2, 143 p, 53 fig, 4 append. OWRR: 14-01-001.

Descriptors: *Water management (Applied), *Water requirements, *Municipal water, *Computer models, *Computer programs, Digital computers, Forecasting, Statistics, Water utilization, Water demand.
Identifiers: *Municipal water requirement model.

A digital computer model for calculating, forecasting, and evaluating municipal water requirements is presented. The model is composed of a system of modular computer programs that calculate water usage for residential, commercial, industrial, and public-unaccounted segments of urban areas. The parameters include such items as: number of residences in each value range, population density, price of water, sewage disposal method, number of students, number of hospital beds, industrial population by type of industry, and geographic location of the urban area. A Library of Water Usage Parameters, on magnetic tape, contains usage coefficients, equation constants, and listings of the precipitation and potential evapotranspiration data for the entire United States that are required to relate and calculate municipal water usage from the various input parameters. Equations were derived using statistical techniques to relate water usage to the parameters with the greatest influence on usage. The MAIN I System was tested in Baltimore, Maryland and Park Forest, Illinois. In Baltimore, the calculated overall usage was about 77% greater than actual usage. In Park Forest, computed usage for four of the years was within 16% of actual usage and within 25% for the fifth year. The projection made for the last year was within 15% of the actual usage. A detailed explanation of the computer programs and the use of the System and the Library of Water Usage Parameters, with a flow chart documentation of all of the programs and the values in the Library, is included. For description of magnetic tapes associated with the report, see W69-03202. (Knapp-USGS)
W69-03201

MAIN I, A SYSTEM OF COMPUTERIZED MODELS FOR CALCULATING AND EVALUATING MUNICIPAL WATER REQUIREMENTS.
Hittman Associates, Inc., Columbia, Maryland.

Order from the Clearinghouse as PB-182 557, $150.00 2 reels. Hittman Associates, Inc. Magnetic Tapes: Tape One, Library of Water Usage Parameters; Tape Two, Source Language Programs, June, 1968. OWRR: 14-01-001.

scriptors: *Water management (Applied), ater requirements, *Municipal water, *Com- er models, *Computer programs, Digital com- ers, Forecasting, Statistics, Water utilization, ter demand.
ntifiers: *Municipal water requirement model.

e first magnetic tape contains the Library of ter Usage Parameters which is a listing of the ation constants, coefficients, and environmen- data used in making the calculations of water ge. The second magnetic tape contains the IN I Processor, which is the computer program t accepts the input data and inputs from the rary, performs the calculations and generates water usage reports. The 'MAIN I System' can un on an IBM 360 Model 40 or larger computer ing a minimum memory size of 120,000 bytes n-partitioned). It has also been run on a IVAC 1108 computer and with minor program difications could be run on other computers nparable in size to the IBM 360 Model 40. In nection with the development of the system, it found that about one man-month of effort was uired to collect and prepare the input data. Ac- running times for the system were about three utes on the UNIVAC 1108 and eight minutes a IBM 360 Model 50, per city. Explanation and umentation of the program are included in a -volume report (W69-03201).
9-03202

TER USE IN TENNESSEE, PART A- RICULTURAL WATER USE,
nessee Dept. of Conservation, Nashville. Div. Vater Resources.
ed M. F. Johnson, John M. Wilson, and Harry Nichols.
n Dep Conserv Div Water Resources Rep, 8. 34 p, 11 fig, 4 tab, 8 ref, 2 append.

criptors: *Water utilization, *Tennessee, Irriga- , Stock water, Precipitation (Atmospheric), al aspects, Regulation, Riparian rights, sonable use.
ntifiers: *Tennessee water-use registration law, ter-use survey.

mplement the water-use registration law which passed by the 1963 Tennessee General As- bly, the State Division of Water Resources un- ook a water-use survey in 1964. A question- e was distributed to all known water users and nerous personal contacts were made to check verify the returns as well as to interview the er users who were exempt from registration. survey of agricultural water users revealed that billion gal of water was required for watering stock, 3.1 billion gal was used for irrigation of and pastureland, and 30 million gal was used washing vegetables. The total acreage of cul- ed farmland in Tennessee appears to have reased 9% between 1958, the date of the last er-use survey, and 1964. During the same od the total irrigated acreage appears to have reased about 56%. The apparent sharp decline rigation is due chiefly to the abundance of rain- n 1964 in comparison with 1958.
9-03323

E ROLE OF INDUSTRIAL PROCESS ANGES IN AFFECTING WATER REQUIRE- NTS,
hington, State Univ., Pullman. Bureau of nomic and Business Research.
iam Iulo.
npletion Report, Washington Water Research ter, January 31, 1969. 23 p. OWRR Project A- WASH.

criptors: *Industrial water, *Water require- ts, Washington, Pacific Northwest U. S., nomics.

potential for affecting water requirements by ing processes of industrial activities is ex- ed. Industrial activities are defined broadly to include agricultural, mining and utility activities as well as manufacturing. Attention is concentrated on industrial activities of particular importance to Washington and Pacific Northwest. Thermal electric generation is considered important because of its anticipated growth in the future. Process change is discussed in relationship to establishment and the firm. The nature of process changes that can be instituted are enumerated. In addition, process changes that are outside area of responsibility of the firm and establishment are indicated. Direct control and indirect incentives are cited as being the two basic approaches to developing an optimization scheme for water use. A basic conclusion is that process change can be an important influence of water use in the long-run may be the most important determinant of industrial water requirements.
W69-03599

SUMMARY OF THE 1963 AND 1964 SOUTHERN CALIFORNIA INSHORE BAIT FISHERY,
K. D. Aasen.
California Fish and Game, Vol 53, No 1, 1967, pp 28-34.

Descriptors: *Commercial fishing, *Sport fishing, *California, *Bait fishing, *Statistics, Construction, Marinas, Geographical regions, Pacific coast region, Regions, Southwest U. S., Fishing, Industries, Recreation, Water sports, Harbors, Excavation, Recreation facilities, Military reservations, Federal reservations, Public lands, Data collections.

The distribution, method of catch, and the 1963 and 1964 catch statistics are given for the most commonly taken Southern California inshore bait species. The author states that the 180,000 pounds per year (valued at $90,000) is adequate to supply the needs of the sport fishermen at this time, however, many prime fishing areas are being lost due to construction of new harbors and marinas. Certain areas within the boundaries of military reservations, now closed to public access, might make alternative bait fishing sites.
W69-03604

INDUSTRY OUTLOOK/DIRECTION 1968,
J. E. Kastrop, and J. Scott.
Petroleum Engineer, Vol 40, No 1, January, 1968, pp 49-61.

Descriptors: *Oil industry, *Oil reservoirs, *Demand, *Costs, Secondary recovery (Oil), Flooding, Injection, Industries, Drilling, Natural gas, Gases, Organic compounds.

United States demand figures for oil and gas are related to known reserves. Drilling rig figures are tabulated showing types and numbers, depths and costs. Problems and location costs are discussed.
W69-03687

THE ECONOMICS OF RECREATION,
Norborne Berkeley, Jr.
Parks and Recreation, July, 1966, pp 549-550.

Descriptors: *Recreation demand, *Social participation, *Economic prediction, *Statistics, *Value, Economic impact, Recreation facilities, Demand, Forecasting, Data collections, Surveys, Parks.

The author says that, due to automation and the shorter work week, the average American is finding himself with more free time than ever before. Our economy is geared to expanding this free time and expanding use of that free time for active recreation. More than almost any other business field in the past twenty-five years, recreation has grown rapidly as a source of work and as an item in the budgets of most Americans. In 1964, there were approximately 35,000 full-time year-round workers in the specific field of recreation and about 100,000 part-time workers, plus millions whose jobs are indirectly dependent on recreation. And in that same year, Americans spent $24,000,000,000 on recreation, and increase of more than 500 percent since 1950. Gallup polls have found that these leisure time activities have provided an expanding 'leisure market' which by the end of 1969 will amount to an estimated 50,000,000,000.
W69-03692

6E. Water Law and Institutions

DEPARTMENT OF NATURAL RESOURCES.
Mass Ann Laws Ch 12, secs 9-16 (1967).

Descriptors: *Watershed protection and flood prevention act, *Legislation, *Administration, *Resources, *Massachusetts, Administrative agencies, Adoption of practices, Land resources, Water resources, Decision making, Conservation, Coordination, Legal aspects, Watershed management, Watersheds, Basins, Surface waters, Underground storage.

A Commissioner of Natural Resources, appointed by the Board of Natural Resources, is the chairman of a commission in charge of matters concerning watersheds, water systems, storage basins, underground and surface water supplies, and studies related to the water conservation and flood prevention needs of the State. The Commission: (1) proposes legislation designed to provide the State with a basic water policy; (2) acts as a coordinating agency between all the departments of the State; (3) cooperates with the Fed Gov and agencies of other states in carrying out water conservation and flood prevention programs; and (4) has supervisory responsibility over programs provided for by the Watershed Protection and Flood Prevention Act (P L 566-83d Cong 2nd S). Applications for assistance under the Act must be initiated by local organizations and filed with the Commission. The Commission may assume a proportionate share of the non-federal cost of installing any works of improvement. No person may engage in the business of drilling or digging wells unless he is registered with the Commission. (Molica-Fla)
W69-03255

DEPARTMENT OF NATURAL RESOURCES.
Mass Ann Laws Ch 12, secs 17, 18, 19, 22, 23, 24, 25 (1967).

Descriptors: *Legislation, *Administration, *Massachusetts, Coordination, Administrative agencies, Adoption of practices, *Land resources, *Water resources, Decision making, Conservation, Legal aspects.

The Dept of Natural Resources consists of a Public Access Board funded to provide for public access and related facilities in and to great ponds, inland waters, and coastal waters. The Division of Conservation Services administers laws relating to conservation districts and has a Committee for Conservation of Soil, Water, and Related Resources. The Committee establishes conservation districts, each composed of five supervisors who own or reside on land within the districts, to carry on the various duties and powers delegated to them. (Molica-Fla)
W69-03256

DEPARTMENT OF NATURAL RESOURCES.
Mass Ann Laws Ch 21, secs 1-2c (1967).

Descriptors: *Legislation, Planning, Administration, Coordination, Administrative agencies, Decision making, *Land resources, *Water resources, Conservation, *Massachusetts, Adoption of practices, Legal aspects.

The Department of Natural Resources exercises general care and authority over the natural resources and adjacent waters. Prior to the passage

of this act the Dept of Conservation held that authority now vested in the Dept of Natural Resources. The Dept consists of the divisions of Forests and Parks, Marine Fisheries, Law Enforcement, Fisheries and Game, Water Resources, and Conservation Services. The Dept, with the exception of the Divisions of Fisheries and Game and Water Resources, is controlled by a board of five members appointed by the governor for terms of five years. The Board must meet at least once a month, and its members may be removed for cause. (Molica-Fla)
W69-03257

POWER OF THE DEPARTMENT OF PUBLIC WORKS TO TAKE AND HOLD REAL ESTATE AND BUILD THEREON.
Mass Ann Laws, ch 91, sec 5 (1967).

Descriptors: *Massachusetts, *Legislation, *Eminent domain, *Administrative agencies, Easements, Condemnation, Piers, Highways, Channels, Railroads, Industrial plants, Docks.

With the consent of the governor and council, the Department of Public Works of the State of Massachusetts may take and hold by eminent domain, or acquire by purchase or otherwise, such real property and such rights and easements as the department may from time to time consider necessary for the purpose of constructing, or securing the construction or utilization of, piers; and in connection therewith, highways, waterways, railroads connections, storage yards, and sites for warehouses and industrial establishments. It may lay out and build thereon, and upon other land in its jurisdiction, such facilities mentioned above. However, if general plans, approved by the department, showing the proposed location and character of the facilities, are filed with the department by the owners or lessees of the property stating that they intend to build the proposed facilities, then the land will not be taken within 40 years after the date of filing the plans if substantial construction in accordance with the plans is actually begun in good faith within one year after approved by the department. The construction must be substantially finished within 5 years unless the department extends the time. (Watson-Fla)
W69-03260

DEVELOPMENT OF WATERFRONT FACILITIES - IMPROVEMENT AND PRESERVATION OF RIVERS, HARBORS, ETC.
Mass Ann Laws, ch 91, sec 9A, 10, 11 (1967).

Descriptors: *Massachusetts, *Legislation, *Administrative agencies, *Public lands, Harbors, Piers, Financing, Eminent domain, Easements, Tidal waters, Connecticut, Rivers, Channels, Banks, Navigation, Encroachment, Surveys, Streams, Great ponds, Intertidal areas, Shores, Beaches, Bridges, Culverts, Conduits, Pipes, Dams.

The Department of Public Works of the Commonwealth of Massachusetts is empowered to adopt a program of construction or reconstruction of piers and other waterfront terminal facilities at any port of the commonwealth after holding proper hearings. The department may use the power of eminent domain to acquire the needed land for such facilities. It also has general care and supervision of the harbors and tide waters of the commonwealth, the flats and lands flowed thereby, the waters and banks of the Connecticut River, the banks and waters of the nontidal portion of the Merrimack River, and all of the structures therein to prevent and remove any encroachment which might harm the water or its navigation. The department shall also undertake such construction and work for the improvement, development, maintenance and protection of tidal and non-tidal rivers and streams, great ponds, harbors, tide waters, foreshores and shores along public beaches as it deems reasonable and proper. The department, in pursuance of the work authorized, may construct, reconstruct, alter, and repair bridges, culverts, conduits, pipes, walls, and dams, and may do such other incidental works as may be deemed necessary for the improvement and safety of waterways. (Watson-Fla)
W69-03261

STRUCTURES THE DEPARTMENT OF PUBLIC WORKS MAY LICENSE TO BE ERECTED IN RIVERS AND STREAMS.
Mass Ann Laws ch 91, secs 12, 12A (1967).

Descriptors: *Massachusetts, *Legislation, *Administrative agencies, *Permits, Dams, Roads, Bridges, Landfills, Pile driving, Construction, Excavation, High water mark, Connecticut, Rivers, Banks, Flood control, Streams, Channels, Cities, Federal government, Stream improvement.

The Department of Public Works of the Commonwealth of Massachusetts may license and prescribe the terms for the construction or extension of a dam, road, bridge, or other structure; or the filling of land, the driving of piles, or the making of excavations, in, over or upon the waters below the high water mark of any river or stream within the commonwealth. This applies to rivers and streams with respect to which expenditures from federal, state or municipal funds have been made for stream clearance, channel improvement, or any form of flood control or prevention work. All structures constructed below the highwater mark of such rivers and streams described above without a license are deemed a public nuisance. The department has the power of license over structures identical to those listed above on the Connecticut River and designated portions of the Westfield River. (Watson-Fla)
W69-03262

LICENSES IN CONN RIVER, GREAT PONDS, AND TIDE WATERS AS TO BOOMS, PIERS, WHARVES, PIPE LINE, ETC.
Mass Ann Laws ch 91, secs 13, 14 (1967).

Descriptors: *Massachusetts, *Public lands, *Permits, Legislation, *Water law, Piers, Administrative agencies, Rivers, Great ponds, Tidal waters, High water mark, See walls, Dams, Bridges, Landfills, Riparian rights, Retaining walls, Docks, Connecticut, Pile driving, Excavation, Conduits.
Identifiers: Booms.

The Department of Public Works of the Commonwealth of Mass may license any person to construct and maintain booms in or across the Conn River, for periods of not more than 5 years, or to build and extend a wharf, pier, or shore wall below the high water mark of the river. It may also issue licenses to build or extend a wharf, pier, dam, wall, road, bridge or other structure, or to drive piles, fill land, or excavate in or over the waters of any great pond or tide water, below the high water mark, but not, except as specifically allowed by law, beyond any established harbor line. The department may also license and prescribe the terms for the construction or extension of a pipe line, conduit, or cable under tide water beyond any established harbor line, provided that such pipe line or conduit is entirely imbedded in the soil and does not occupy any part of the tide water; and the department may at any time require the removal or relocation of it if the channel changes or alterations must be made. (Watson-Fla)
W69-03263

LICENSES TO BE REVOCABLE AND TO EXPIRE IN FIVE YEARS - BOSTON HARBOR LICENSES - FORM, HOW GRANTED AND CONSTRUED.

Mass Ann Laws ch 91, secs 15-18 (1967).

Descriptors: *Massachusetts, *Legislation, *Permits, *Public lands, Docks, Administrative agencies, Bridges, Connecticut, Rivers, Tidal waters, Tides, Dams, Flow, Great ponds, High water mark, Pile driving, Landfills, Navigable waters, Riparian rights, Legal aspects, Cities, Inlets (Waterways).
Identifiers: *Boston Harbor, Harbor lines, Deeds, Registration.

Every license or authority issued by the Commonwealth of Massachusetts since 1868 as to rights in public lands controlled by the Department of Public works is revocable at the discretion of the general court, and shall expire in 5 years from its date. Excepted are valuable structures, fillings, or enclosures actually and in good faith built or made under the authority or license during its term. Any compensation paid for such license or authority must be repaid on revocation. All licenses or authorities granted in Boston Harbor are terminated or subject to forfeiture in the case of nonuse for an unreasonable time. No license or other authority to build structures upon or fill up or enclose any ground mentioned in this chapter shall be contrued to interfere with harbor lines established by law or the legal rights of any person. Procedures for the granting of licenses is outlined. Included in the procedure is notification to the aldermen or selectmen of any towns involved. Any license shall be void unless, within one year after its date, the license and the accompanying plan are recorded in the registry of deeds for the county or district where the work is to be performed. (Watson-Fla)
W69-03264

SURVEYS AND IMPROVEMENTS OF HARBORS - ESTABLISHMENT OF HARBOR LINES - GREAT PONDS DEFINED.

Mass Ann Laws ch 91, secs 31-36 (1967).

Descriptors: *Massachusetts, *Harbors, *Great ponds, *Damages, Legislation, Water law, Administrative agencies, Rivers, Financing, Eminent domain, Surveys, Connecticut, Maps, Storms, Federal government, Banks, Coasts, Docks, Piers.

The Department of Public Works of the Commonwealth of Massachusetts may make surveys and improvements for the preservation of harbors and may repair damages caused by storms along the coast line or river banks of the commonwealth. The department may take by eminent domain or purchase any land necessary for the improvements. The department is also instructed to survey that portion of the Connecticut River lying within the commonwealth. The department may also sell, at such prices and conditions as it prescribes, maps prepared by it in connection with waterways and public lands. The department may, after hearings with interested parties, prescribe lines in any harbor of the commonwealth. The general court must approve these lines. If the lines are approved, no wharf, pier, or other structure may extend into the harbor beyond the lines. The department may also apply to Congress for appropriations for the protection and improvement of any harbor in the commonwealth. Great ponds are defined as ponds containing in their natural state more than ten acres of land. (Watson-Fla)
W69-03270

REMOVAL OF WRECKS ON SHORES OR IN TIDE WATERS.
Mass Ann Laws ch 91, secs 38-45 (1967).

Descriptors: *Massachusetts, *Legislation, *Ships, *Navigation, Water law, Administrative agencies, Federal government, United States, Shores, Tidal waters, Rivers, River basins, Financing.
Identifiers: *Ship wrecks.

The Department of Public Works of the Commonwealth of Massachusetts is directed to see that all wrecked vessels on the shores or in the tide waters of the commonwealth are removed. If the owner of the vessel cannot be determined or if he does not remove it after notification, the department is empowered to remove the vessel. The owner is then liable for all the expenses incurred in the removal. If the owner does not pay the expenses within ten

vs after the removal is complete, the vessel may sold to cover the expenses. An insurer of the sel is not liable for the expenses of removal un- s he has exercised some act of ownership or con- l over the vessel or received the proceeds of the e. The department is also directed to make appli- ion to the government of the United States for nbursement of expenses of removal for which it able. (Watson-Fla)
9-03271

EAKING UP, DISPOSAL, AND GROUNDING CERTAIN FLOATING STRUCTURES - MOVAL OF WHALES.

ss Ann Laws ch 91, secs 46-49A (1967).

scriptors: *Massachusetts, *Ships, *Navigation, ermits, Legislation, Water law, Administrative ncies, Shores, Tidal waters, Boats, Disposal, vage value, Harbors, Financing, Safety, Public lth, Mammals.
ntifiers: *Whales.

e owners of any vessel, scow, lighter, or similar ting structure lying within any harbor of the mmonwealth of Mass who wish to break up and pose of their vessel must first obtain a license n the Department of Public Works. The license st state where and in what time period the work be done. If the work is not completed within specified time the department may complete work at the expense of the owner. Anyone who ts such work without a license is subject to a up to $500. Whoever grounds or abandons any sel, scow, lighter, or other floating structure in any harbor of the commonwealth or upon shores of the commonwealth without the per- sion of the owner shall be subject to a fine up to 0 unless the vessel is grounded because of an ergency. The Department of Public Works is ected to remove any whales or other mammals posited in the tidewaters or shores of the com- nwealth if the department deems it injurious to public health. (Watson-Fla)
9-03272

CENSING FOREIGN CORP ENGAGED IN RECKING OR SALVAGING - SUPERVISION TRANSPORTATION AND DUMPING OR EDGED MATERIAL - ARREST WITHOUT ARRANT.

ss Ann Laws ch 91, secs 50-58 (1967).

scriptors: *Massachusetts, Legislation, Water , Administrative agencies, *Permits, Boats, al waters, Ships, Navigation, Harbors, *Salvage ue, Navigable waters, United States, *Dredging, ancing, Inspection, Channels, Rivers, Bays.
ntifiers: *Arrest.

eign corporations engaging in the business of cking or salvaging in the navigable waters of the nmonwealth of Massachusetts must obtain a nse, which is good for one year. Failure to ob- the permit subjects the violator to a fine up to 0. The Department of Public Works has super- on over the transportation and dumping of all erial dredged in the tide waters of the common- lth or transported in boats to be dumped in the waters. The department may employ necessary pectors to accompany the boats. The person has the permit to dump must pay the cost of all ervision. Any officer qualified to serve criminal cess may, within his jurisdiction, arrest without arrant any person found in the act of com- ting a misdemeanor in or upon any of the rivers, bors, bays, or sounds of the commonwealth. atson-Fla)
9-03273

BLIC BEACHES - CONTROL, SUPERVI- N, AND PRESERVATION.

ss Ann Laws ch 91, secs 60-62 (1967).

Descriptors: *Massachusetts, Legislation, Water law, Administrative agencies, *Beaches, Recreation, *Recreational facilities, Oceans, *Scenery.

The control and supervision of all public beaches in the Commonwealth of Massachusetts, including the Salisbury Beach Reservation, is placed in the division of waterways of the department of public works. The department is authorized to make and enforce all necessary rules and regulations for the government and use of the beaches. The department is directed, while developing the beaches for recreational purposes, to preserve to the fullest extent possible all the beaches in their natural, simple, scenic beauty. (Watson-Fla)
W69-03275

IN RE NEVERSINK RIPARIAN SECTION NO 1 SULLIVAN COUNTY (CONDEMNATION PROCEEDINGS TO ACQUIRE ADDITIONAL WATER SUPPLY).
2 Misc 2d 38, 154 N Y S 2d 824-832 (Sup Ct 1954).

Descriptors: Eminent domain, Riparian Rights, Alteration of flow, *Condemnation value, Swimming, Water law, *New York, Administrative decisions, *Water supply, Recreation facilities, Easements, Comdemnation, Judicial decisions, Legal aspects, Public rights, *Diversion.

City of New York instituted condemnation proceedings to acquire additional water supply and moved to confirm commissioners' appraisals of properties of downstream riparian owners. The down stream owners filed a cross-motion to reject the appraisals. The Supreme Court held the appraisals were not inadequate, although not sufficient to pay for construction of an artificial bathing area to replace the natural swimming facilities which the river provided. Power of a court to reject commissioners' appraisals in condemnation proceedings is confined to narrow limits, and every intendment is in favor of the action of the commissioners. The appraisals must shock the conscience of the court or be grounded in a erroneous legal theory in order to be set aside. The true measure of damages for injury to lower riparian owner by a permanent diversion of water is the difference in value of the property before and after the diversion. (Hoffman-Fla)
W69-03276

PEOPLE V JOHNSON (TRESPASS ON PRIVATELY OWNED UNDERWATER LAND).
7 Misc 2d 385, 166 N Y S 2d 732-740 (Pol Ct 1957).

Descriptors: New York, Judicial decisions, *Navigable waters, *Shellfish, *Beds, Water law, Navigation, Fishing, Non-navigable waters, Legal aspects, Clams, Aquatic soils, Permits, Benefits, Public rights.
Identifiers: Ferae naturae, Trespass.

Three individuals pleaded guilty to trespass for raking shellfish upon posted and privately owned underwater land. The trial court denied their motions to arrest judgment, holding that the relative immobility of shellfish, their way of living in the land, and the landowner's ability to maintain more than nominal control over them makes 'clamming' less a utilization of public waters than an activity closely related to the ownership of the underlying land, and that the public right of fishing does not include raking for shellfish on private lands under navigable waters. Any implied license defendants previously had with regard to the privately owned underwater land ended when the owners posted a no trespassing sign. Land underlying navigable water is open to the public for activities closely related to the water, but, where the activity involves disturbance of the land not directly connected with enjoyment of the water, the character of the activity as private or public must be determined by ownership of land. (Hoffman-Fla)
W69-03277

ADAMS V CREWS (TITLE TO SUBMERGED LAND).

105 So 2d 584-593 (2d DCA Fla 1958).

Descriptors: *Florida, *Ownership of beds, *Lake beds, *Water law, Judicial decisions, Legal aspects, Public benefits, Navigable waters, Beds, Dredging, State governments, Riparian rights, Legislation, Administrative decisions.
Identifiers: State ownership, Public trust doctrine.

Plaintiffs owned property on the shore of a navigable lake. Defendants claimed title to a thirty-five acre tract which plaintiffs assert is all submerged land in the lake. When defendants began to dredge the lake bottom to obtain fill for their submerged land, plaintiffs requested an injunction to stop these. Plaintiffs asserted that tax deeds of the defendant's successor in title were void, and that the dredging and filling has interfered with and obstructed the use of the lake for navigation, recreation, and commerce. The court found that the tax deeds of the defendant's predecessor in title were issued by the trustees of the state's Internal Improvement Fund. However, this did not estop the state from asserting, through the Trustees of the Fund, the invalidity of the tax deed and the rights of the public to the submerged land as sovereignty land at a later date. The court held in this interlocutory appeal that the deeds were void, and the submerged land was vested in the state in trust for public usage. The decision of the lower court was affirmed. (Scott-Fla)
W69-03281

STEIN V BROWN PROPERTIES, INC (TITLE TO SUBMERGED LANDS).

104 So 2d 495-500 (Fla 1958).

Descriptors: *Florida, *Boundaries (Property), Judicial decisions, *Ownership of beds, State governments, Contracts, *Beds, Beds under water, Landfills, High water mark.

Plaintiff sued defendant for specific performance of a contract to convey land. One portion of the property was submerged land. Plaintiff also requested the court to determine the amount of land to which defendant held marketable title. The court found that the property involved was of three types: an upland portion, a part subject to overflow of the tides, and a portion submerged in the ocean. The court held that although the 'source' of title to submerged land adjacent to upland is the statutory right of raising it above the surface of the water by filling, no title is acquired until such submerged land is filled in or permanently improved. The fact that the original grant to defendant's predecessor in title contained a description of a specific number of acres did not give that party title to that portion of land under ocean or tidal waters, since such land remained vested in the state. Specific performance was granted only as to the upland portion of the land involved. (Scott-Fla)
W69-03283

EMINENT DOMAIN -- RIGHT OF; BY WHOM RIGHT MAY BE EXERCISED.
N C Gen Stat sec 40-2 (1967).

Descriptors: *North Carolina, *Eminent domain, *Legislation, Local governments, *Right-of-way, Sewage districts, State governments, Condemnation, Legal aspects, Utilities, Public utilities, Electric power, Water control, Water supply, Railroads, Conservation.

The right of eminent domain may be exercised for the purpose of constructing roads, canals, certain pipelines, lines of wires, and other works which involve a public use or benefit, by certain enumerated types of public and private bodies. These bodies include certain railroads, municipalities, public utilities, school districts, and governmental agencies. (Scott-Fla)
W69-03289

MCCORD V MISSOURI CROOKED RIVER BACKWATER LEVEE DISTRICT (MOTION TO ABATE CONDEMNATION PROCEEDINGS).
295 SW 2d 42-46 (Mo 1956).

Descriptors: *Missouri, *Condemnation, Judicial decisions, Legislation, Reclamation, Benefits, Assessments, Damages, Eminent domain, Legal aspects.
Identifiers: Levee district, Motion to abate.

Land owned by the respondents was assessed benefits in the amount of $2,988, and $601.40 was awarded as damages for the proposed taking of 7.29 acres of land by a levee district through a condemnation proceeding. The levee district has not, since the filing of the report of commissioners with the Clerk of the Circuit Court, paid respondents for the land proposed to be taken. Respondents brought this action to abate condemnation and to quiet title in themselves. Their claim was based on a statute requiring all sums awarded to be paid within 5 years from the date of filing the commissioners' report. The court held that this time period had reference to the date of filing in the office of the County Recorder rather than to the date of filing in the office of the Circuit Court. The court found for the levee district. (Childs-Fla)
W69-03292

SCHULTZ V WILSON (TIDAL WATERS).

44 N J Super 591, 131 A 2d 415-425 (App Div 1957).

Descriptors: Judicial decisions, Legal aspects, *New Jersey, *River beds, *Tidal waters, Riparian rights, Beds, *Ownership of beds, Navigable rivers, Administrative agencies.

Plaintiff filed objections to a statutory grant by the state of tidewater land to the defendant. Plaintiff claimed paramount title by reason of diverse conveyances dating back to an original grant from the Indian inhabitants. The court held that the legal right to the land was in the State and not the Indians. Plaintiff's contention that before the state can make a riparian land grant the river must be navigable, is without merit. All tidal rivers in New Jersey are public rivers and the criterion of navigability is rejected as a test of whether title to the beds are in the state. (Molica-Fla)
W69-03294

EXISTING RIGHTS AND REMEDIES PRESERVED; LIMITATIONS.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03297

VIOLATIONS AND CIVIL LIABILITY.
N Y Conserv Law sec 630 (McKinney 1967).

Descriptors: *New York, Legislation, State governments, Conservation, Water resources, *Administration, Administrative agencies, Legal aspects.
Identifiers: *Fines, Violators.

This section provides for fines to be levied against violators of Article 5. Such fines, if levied, are recoverable in an action instituted in the name of the water resources commission by the attorney general. An action for the recovery of a penalty under this section may be settled or compromised by the commission at any time prior to judgment being entered. (Scott-Fla)
W69-03298

PURPOSE AND FINDINGS.

N Y Conserv Law sec 801 Art 1 sec 1.3 (McKinney 1967).

Descriptors: *New York, Civil law, Legislation, State governments, Administrative agencies, Conservation, *Water resources, Planning, Water resources development, Water policy, *Administration, *Public benefits, *River basin commissions, Local governments, Legal aspects.

The legislatures of the signatory parties to the compact declare that the water resources of the basin are affected with a local, state, regional, and national interest. The signatory parties have the sovereign right and responsibility to control said water resources, and, by this compact, provide for a joint exercise of such powers in the common interests of the people of the region. A single administrative agency is essential for effective and economical direction, supervision, and coordination of efforts and programs of the federal, state, and local governments and of private enterprise. (Scott-Fla)
W69-03300

CONDEMNATION PROCEEDINGS, RIGHTS OF WAY AND EFFECT ON RIPARIAN RIGHTS.
N Y Conserv Law sec 801 Art 14 secs 14.14, 14.16, 14.17, 14.19 (McKinney 1967).

Descriptors: *New York, Civil law, Legislation, State governments, Administrative agencies, Conservation, Water resources, Planning, Water resources development, Water policy, Administration, *Condemnation, Riparian rights, *Right-of-way, Easements, River basin commissions, United States, Pipes, Conduits, Beds.

The Commission shall have the power to obtain, by condemnation, any interest in lands, submerged lands, and riparian and water rights. This grant of power includes, but is not limited to, the power to condemn any private property devoted to the public use. Such power shall be exercised in accordance with existing federal and state law. The Commission is granted the right to locate any lines, pipes, conduits, and similar facilities in, over, under, or across any street or highway dedicated to public use. Anyone violating, or attempting or conspiring to violate, any provision of this compact, or any rule, regulation or order of the commission shall be subject to certain enumerated penalties. Nothing in this compact shall be construed as affecting the existing law of the member states relating to riparian rights. (Scott-Fla)
W69-03304

INTERNATIONAL CONFERENCE ON WATER FOR PEACE 1967.
For primary bibliographic entry see Field 06B.
For abstract, see .
W69-03305

PUBLIC WORKS (ACQUISITION OF WATER RIGHTS FOR PUBLIC PURPOSES).
N J Stat Ann sec 40:137-1 (1967).

Descriptors: *New Jersey, *Navigable waters, *Riparian lands, *Public rights, Legislation, Docks, Bulkheads, Piers, Eminent domain, Condemnation, Local governments, Legal aspects, Construction.

This act authorizes towns fronting on navigable waters of this state to acquire riparian lands or lands underwater and other lands and rights in land incident thereto. Said towns are authorized to construct, establish, and maintain on such lands public docks, warehouses and other structures, wharves, piers, bulkheads and shipping facilities, and to regulate use of the same. (Shevin-Fla)
W69-03412

WATER FRONT IMPROVEMENTS.
N J Stat Ann secs 40:92-1--40:92.11 (1967).

Descriptors: *Legislation, *New Jersey, *Bulkheads, Engineering structures, Jetties, Administration, Governments, Local governments, Riparian waters, Atlantic Ocean, Legal aspects, Cities, Navigable waters, Financing, Maintenance, Maintenance costs.
Identifiers: *Water front improvement.

Sections 1 through 11 of chaper 92, title 40 pertain to water front improvements. Section 1 allows the governing body of any borough to construct and maintain bulkheads, jetties, and other works along any navigable waters other than the Atlantic Ocean. Section 2 provides that all improvements shall be covered by Chapter 56 of this title. Bonds for the cost of such improvements may be issued in accordance with the provisions of article 1 of chapter 1 of this title. Section 3 allows boroughs to accept contributions from the state or from the county toward the cost of the improvements. Section 4 empowers the governing body, by ordinance, to provide for the maintenance of existing bulkheads or other works within the borough. Section 5 provides that improvements to be made by landowners should be made within 60 days. Section 6 provides that, if the owners fail to maintain the bulkhead, the governing body shall have the work done and the cost thereof assessed upon the land. Such assessment shall become and remain a first and paramount lien. Section 7 empowers the governing power to issue improvment certificates to pay for the cost of maintaining bulkheads and other work. Section 7.1 provides for the acquisition by the governing body of any borough bordering on the Atlantic Ocean of land for purposes of establishing a place of resort for public health and recreation. Section 8 allows owners upon which assessment has been made to pay in yearly installments. Section 9 allows the governing body to build bulkheads, jetties, and other works along the Atlantic Ocean. Section 10 provides that all improvements shall be governed by chapter 56 of this title and bonds can be issued. Section 11 allows the borough to accept contributions from the State or county to pay for improvements. (Heckerling-Fla)
W69-03413

MUNICIPALITIES GENERALLY (PERMIT FOR BUILDING IN BED OF MAPPED STREET OR DRAINAGE RIGHT OF WAY).

N J Stat Ann sec 40:55-1.38 (1967).

Descriptors: *New Jersey, *Cities, *Drainage, *Permits, Legislation, State governement, Right-of-way, Legal aspects.
Identifiers: Municipal mapping.

Section 40:55-1.38 requires that a permit be obtained from a municipality authorizing the construction of any building upon a plot wherein lies the bed of a mapped street, drainage right of way, park or playground location. The issuance of such a permit is proper if the construction shall not cause more than a minimum change in the official map of the municipality and will increase the cost of opening such street or drain as little as is practicable. (Logan-Fla)
W69-03414

MUNICIPALITIES GENERALLY - GENERAL POWERS.

N J Stat Ann secs 40:48-7, 40:48-8.13 (1967).

Descriptors: *New Jersey, *Legislation, *Cities, *Taxes, State governments, Income, Construction, Repairing, Bulkheads, Jetties, Piers, Sewers, Sewer system, Drainage systems, Beaches, Operation and maintenance.

The New Jersey legislature authorizes taxation by municipalities and describes the purposes for which the resulting revenue is to be used. The purposed specified are: (1) the construction, reconstruction or repair of bulkheads, jetties, boardwalks, piers, streets, street-ends, sewers, sewer systems and drainage systems; (2) the repair of damage to beaches; (3) the construction, reconstruction or repair of any facility provided to attract patronage as a seaside or summer resort; (4) the payment of any principal or interest, or both, on indebtedness incurred for any of the foregoing purposes; (5) the payment of all administration costs. (Logan-Fla)
W69-03415

BLIC UTILITIES - ARTICLE 9 - BRIDGES, ADUCTS AND TUNNELS.
J Stat Ann secs 48:12-42 (1940); 48:12-41, 12-43--48:12-45 (1968-69 Supp).

scriptors: *New Jersey, *Legislation, *Bridge nstruction, *Piers, State governments, Bridges, ilroads, Ownership of beds, Navigable rivers, eams, Bays, Tunnels, Delaware River, Con-nnation, Tidal waters, Non-navigable waters, eration and maintenance.
ntifiers: Draw, Pivot draw.

icle 9 deals with railroad company handling of dges, viaducts, and tunnels. Section 48:12-41 es railroads the right to build piers, bridges, and ducts over and tunnels under any navigable or n-navigable stream, river, or bay. Specific uirements are set out for draws of bridges and ducts. Also, lands under water belonging to the e can be taken only with the consent of the state ess this land is twenty-five feet or more under bed of the water. Section 48:12-42 requires that navigable rivers, etc, the company must main-a lighting system to warn of the presence of a w and must keep some person at each bridge to n the draw for vessels passing beneath it. Sec-n 48:12-43 provides that if the company feels it npractical to construct a draw they may apply to state for a determination of the proper type ucture for that site. Section 48:12-44 allows for taking and condemnation of land by the com-y and contains specific provisions in respect to dges over the Delaware River. Section 48:12-45 horizes construction of tunnels; specifying, in ition the mode of construction. Also, the cedure for procurement of lands and easements n which such tunnels are constructed is set out.
gan-Fla)
9-03416

TER POWER COMPANIES ALONG TRIBU-RIES TO BARNEGAT BAY.

Stat Ann secs 48:14-20, 48:14-21.1 (1968-69 p).

criptors: *New Jersey, *Legislation, *Electric ver Industry, *Survey, State government, ers, Streams, Dams, Reservoirs, Ponds, Locks, irs, Bridges, Canals, Legal aspects.
ntifiers: Barnegat Bay.

icle 3 allows every water power company to struct a dam in any river or stream tributary of negat Bay and to examine and survey all posed sites for dams, reservoirs, ponds, locks, rs, gates, bridges, canals, race and power sta-s, as well as land which may be overflowed by ction of the dams. It also permits these compa-to take real property, rights, franchises, ileges, or easements necessary for the construc-of the above works. (Logan-Fla)
9-03417

WERAGE COMPANIES.

Stat Ann secs 4813-16 (1940), 48:13-9--48:13-1968-69 Supp).

criptors: *New Jersey, *Legislation, *Sewage ems, Pipelines, Conduits, Sewers, Eminent main, Surveys, Measurements, Mapping, Opera-and maintenance, Construction, Cities, Legal ects.
ntifiers: State corporations.

pter 13 sets out the powers and procedures nted to corporations organized by the State to dle all sewerage construction, operation, and ntenance. Every sewerage company so incor-ated may enter upon any lands in the neighbor-d of the municipality and make preliminary sur-s, examinations, explorations, measurements, levelings as necessary. The company may lay pipes and conduits under such public roads, ets, etc, as required. Such pipes shall be layed at t three feet below the surface after the State Department of Health receives and approves a map and specifications of the proposed system. Each sewerage utility has the right to exercise the power of eminent domain. In conjunction with the Board of Public Utility, the company may establish prices, rents or restrictions for use of the system by property owners. (Logan-Fla)
W69-03418

ECONOMIC DEVELOPMENT.

N J Stat Ann secs 13:1B-1, 13:1B-7, 13:1B-9--13:1B-13, 13:1B-47--13:1B-51 (1968).

Descriptors: *Legislation, *New Jersey, *Administrative agencies, *Natural resources, State government, Decision making, Programs, Economics, Riparian rights, Erosion control, Water resources development.

The purpose of this act is to establish the Department of Conservation and Economic Development. All the functions, powers, and duties of the Economic Council and Division of Commerce in the existing Department of Economic Development shall be transferred to Department of Conservation and Economic Development. All functions, powers, and duties of State Commissioner of Conservation of the existing State Department of Conservation and its councils are transferred to the new Department. The new Department shall, through the Division of Resource Development, formulate policies and conduct research in the area of conservation and protection of the state natural resources within the Division of Resource Development shall be established a council to help formulate policies for development of natural and economic resources. All functions, powers, and duties of the Division of Water Policy and Supply shall be exercised through that Division in the Department of Conservation and Economic Development. The Division shall have a council to formulate policies for preservation and improvement of state water supply facilities. The Council shall also study and make recommendations regarding the work of the Division. (Stewart-Fla)
W69-03419

DIVISION OF NAVIGATION
N J Stat Ann secs 13:1A=<*=B? +::1A-32.1 (1968).

Descriptors: *Legislation, *New Jersey, *Administrative agencies, *Decision making, Beach erosion, Riparian leases, State government, Occupations, Wages, Financing, Contract negotiations, Shoals, Reefs, Budgeting, Legal aspects.

This bill eliminates the Department of Commerce and Navigation and establishes a Division of Navigation under the Department of Conservation. Within this Division of Navigation is a Navigation Council which replaces the Board of Commerce and Navigation. Council members shall be appointed by the Governor and serve, without compensation, for 5 year terms. The functions, powers and duties, records and property of both the Department and Board of Commerce and Navigation shall be transferred to the Division of Navigation. No action shall be taken by the Council except upon approval of Commissioner of Conservation. The Council shall formulate comprehensive policies for prevention of beach erosion. The employees of both the Department and Board of Commerce and Navigation shall be transferred to the Division of Navigation without a change in salary or civil service status. All appropriations available to both the Department and Board of Commerce and Navigation are transferred to the Division of Navigation. The Department of Conservation, Division of Navigation, along with the Governor, may sell, let, lease, or grant any island, shoal or reef, situated in tidal waters which the State owns or has an interest, upon such terms as the interests of the State may require. (Stewart-Fla)
W69-03420

CONSERVATION AND DEVELOPMENT.
N J Stat Ann secs 13:1-11, 13:1-16, 13:1-18--13:1-20, 13:1A-8--13:1A-12 (1968).

Descriptors: *New Jersey, *Conservation, *Administrative agencies, *State governments, Legislation, Water resources development, Water conservation, Water supply, Administration, Legal aspects, Planning.
Identifiers: Passaic River, Water supply facilities.

The statutes of New Jersey, in setting up a Department of Conservation and Development, have provided for a Governing Board to control the activity of various divisions; one such is the Division of Water Policy and Supply. This Division consists of a nine man council appointed, with Senate approval, by the Governor. The Division serves to centralize all previous separate water managing agencies in the State, i.e. Delaware and Raritan Canal, State Water Policy Commission, and the Passaic Valley Flood Control Commission. The powers of the council are: (a) to Formulate comprehensive policies for the preservation and improvement of the water supply facilities of the state; (b) to survey the needs of the State for additional water supply facilities and formulate plans for the development of such facilities. (Logan-Fla)
W69-03421

BEACH FRONT REPAIR AND DREDGING OF STREAMS,

N J Stat Ann secs 12:6A-1--12:6A-4 (1968).

Descriptors: *Legislation, *New Jersey, *Erosion control, *Beach erosion, Windbreaks, Shore protection, Sea walls, Bulkheads, Jetties, Administrative agencies, State governments, Allotments, Dredging, Channel improvement, Bays, Inlets, Legal aspects, Atlantic Ocean, Sea water.

The purpose of this act is to prevent and correct erosion damage to the New Jersey coast and certain inland areas. The Act authorizes and empowers the State Department of Conservation and Economic Development to repair or construct bulkheads, seawalls, or any appurtenant structures on every shore front along the Atlantic Ocean and bay areas. This authorization also encompasses certain inland rivers and waterways as well as the upper and lower New York bay areas. The Division of Navigation is further authorized to use facilities and services of the Federal Government or any State, county, or municipality in New Jersey, as well as any funds now or later made available by any of the above sources for purposes of arresting beach erosion and protecting the water front generally. The Division of Navigation is further authorized to dredge and remove any obstructions in every New Jersey waterway to a depth and width to be determined by the Council of the Division. The Division is also empowered to erect such bulkheads or structures as are necessary to prevent erosion and to stabilize the shore in the vacinity of any inlet along the New Jersey coast. (Stewart-Fla)
W69-03422

NAVIGATION.
N J Stat Ann secs 12:4-1--12:4-15 (1968).

Descriptors: *Legislation, *New Jersey, *Navigable waters, *Waste disposal, Channel markers, Buoys, Ice jams, Sewerage disposal, Wharves, Piers, Obstructions to flow, Solid wastes, Legal aspects, Navigation.

The purpose of this legislation is to insure unhindered navigation in the New Jersey waterways. Any person may remove, provided there is minimal detriment to the owner, all trunks and limbs which interfere with navigation. Any person who carelessly or willfully breaks or destroys any buoy, beacon or other device fixed in navigable waters is subject to a $50 fine. The act also authorizes ice boats to keep the Delaware River open. The act establishes a procedure for removal of sunken or stranded ves-

sels from navigable waters. Any such vessels not removed within 30 days are forfeited to the state. The county removing any such forfeited vessel shall be reimbursed out of the state treasury but such amount shall not exceed $1000. Article 3 provides that no person shall throw or cause to be thrown or deposited any solid material of any kind into the navigable waters of specified bay areas. This prohibition does not apply to fishing rights and the discharge of sewerage by the city. Violation of the article is a misdemeanor and the commissioners of pilotage are authorized to seize and hold any vessel violating the above provisions. The commissioners of pilotage shall prosecute all violations of this article. Fines collected constitute a fund in the hands of commissioners from which to pay expenses of enforcement. (Stewart-Fla)
W69-03423

LICENSE FOR TAKING OYSTERS OR CLAMS.
N J Stat Ann secs 50:2-1--2, 50:2-6.1--6.2, 50:2-6.4 (1955).

Descriptors: *Legislation, *New Jersey, *Shellfish, *Dredging, Clams, Oysters, Permits, Commercial shellfish, Commercial fishing, Legal aspects, Atlantic Ocean, Boats.
Identifiers: Raritan Bay.

The cited sections refer generally to shellfish and shellfishing. Sections 50:2-1 through 50:2-6.4 refer to licenses for the taking of oysters or clams. In section 50:2-1, the statute provides that a license is required to catch or take oysters or clams from any natural oyster or clam grounds in New Jersey; section 50:2-2 provides that licenses will be issued only to state residents, except that a license will be issued to a nonresident for the months of June, July, August and September. New York citizens may have a license to take clams from Raritan Bay, but no nonresident license holder may sell the oysters or clams taken under the license; section 50:2-6 allows revocation of the abovementioned license if any provision of this title or any rule of regulation of the Board of Shell Fisheries is violated; section 50:2-6.1 allows no dredging of sea clams without a license. This license is valid only for the Atlantic Ocean, and no boat or vessel will be licensed unless its owner is a resident of New Jersey; section 50:2-6.2 provides that dredging may be only by a single dredge on each boat, and that dredging may not be done between June 1 and September 13 each year within one mile of mean low watermark; finally section 50:2-6.4 makes violators of this act, or of rules and regulations made and promulgated under it, liable to a fine of not less than $50.00 nor more than $300.00 for the first offense, not less than $100.00 nor more than $500.00 for any subsequent offense, and any penalty shall be collected or enforced in a summary manner, without a jury, in any court of competent jurisdiction. (Heckerling-Fla)
W69-03424

JERUZAL V HERRICK (STATUTORY AUTHORITY OF DRAIN COMMISSIONER).
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03426

STATE V 6.0 ACRES OF LAND (RIPARIAN OWNERS' RIGHT TO ACCRETION LAND).

139 A 2d 75-78 (N H 1958).

Descriptors: *New Hampshire, *Riparian rights, *Accretion (Legal aspects), *Boundary disputes, Judicial decisions, Rivers, Water law, High water mark, Banks, Boundaries (Property), Jetties, Dikes, State governments, Bulkheads, Legal aspects, Landfills, Alluvium, Riparian lands.

The State acquired title to a strip of land abutting the easterly side of the Hampton River to its mean high water mark. The westerly boundary line of this tract intersected the boundary line of the claimant's property, which was delineated by a wooden bulkhead. The bulkhead also bordered upon the river at its mean high water mark. The state filled in the land easterly of its strip. As part of the development project, the state built a rip-rap dike, parrallel with and some ten feet westerly of the western side line of the state's strip. It intersected the bulkhead at the edge of the claimant's property. The State then filled behind the dike. Later, six acres of land was formed by natural accretion caused by the ebb and flow of the river. The land thus formed adjoined the westerly face of the dike and connected with the southwesterly side of the bulkhead. The State petitioned for acquisition of the accretion. The lower court approved the master's ruling that the general principle governing the apportionment of accretion among adjoining riparian owners should be followed. The rule followed was, in the case of a bending shoreline, the dividing lines across the alluvion are laid down by connecting the extremities of the upland sides at the old shore with the point of division on the new shore as fixed by proportion. The appellate court affirmed, and disallowed claimant's claim to the entire accretion tract. (Wheeler-Fla)
W69-03428

TRANSFER OF CERTAIN POWERS, DUTIES, FUNCTIONS AND RESPONSIBILITIES OF THE DEPARTMENT OF CONSERVATION AND DEVELOPMENT.
N C Gen Stats sec 143-355 (1967).

Descriptors: *North Carolina, *Administration, *Well regulations, *Water permits, Legislation, Well permits, Planning, Water law, Water use, Drilling, Administrative agencies, State governments, Water resources development, Long-term planning.
Identifiers: *N C Dept of Water Resources.

Duties transferred from the Department of Conservation and Development to the Department of Water Resources include: (1) requesting the congressional delegation to apply for federal water funds; (2) planning long-range water resources programs; (3) preparing state legislation pertaining to water resources; (4) making hydrological engineering studies and reports; (5) maintaining harbors and channels; (6) preparing flood control and hurricane protection plans; (7) providing advice on tidewater, river and watershed development; (8) working with national agencies in development of water resources; and (9) planning long-range flood plain management programs. Other provisions include the requirement of annual registration with the Department of Water Resources of all persons engaged in well drilling with power equipment. All persons drilling wells must furnish the Department of Water Resources with sample of cutting from each well upon request. Data on each well drilled shall be reported to the Department within 30 days of completion. Persons withdrawing or using surface or ground water shall upon request report monthly to the Department of Water Resources the identity of the supply and amount of water used, water for domestic use being excluded. (Helwig-Fla)
W69-03429

FIVE LAKES OUTING CLUB V HORSESHOE LAKE PROTECTIVE ASS'N (OWNERSHIP OF NON-NAVIGABLE LAKES).

288 S W 2d 942-945 (Ark 1956).

Descriptors: *Arkansas, *Ownership of beds, *Navigable waters, Judicial decisions, Lakes, Levees, Prescriptive rights, Water level fluctuations, Legal aspects.

This action was brought to compel the owners of land on which four small lakes were located to remove the levees they had constructed across the end of two of these lakes at points where they joined a larger, navigable lake. The court held that though a rise in the water level in the navigable lake would cause a rise in the smaller lakes, the ownership of the smaller lakes was not affected. Though the state had acquired prescriptive title to certain lands inundated by a rise in the level of the adjoining navigable lake, title to the smaller lakes had not been acquired by prescription. Since the smaller lakes were not part of the navigable lake, the owners of title to the smaller lakes had the right to build levees across the lakes. (Childs-Fla)
W69-03433

TRI-COUNTY DRAINAGE DISTRICT V MORRISON (RIGHT OF A COUNTY TO WITHDRAW FROM ORIGINAL DRAINAGE DISTRICT).
295 S W 2d 781-790 (Ark 1956).

Descriptors: *Arkansas, Judicial decisions, *Taxes, Legislation, *Drainage districts, *Local governments, Legal aspects, Drainage system, Maintenance.

Two actions were consolidated for appeal. The first involves the question of the right of a county to withdraw from the original drainage district. State statute provides for such withdrawal providing the original district has no outstanding unpaid bonds or other evidences of indebtedness. Contingent claims against the district for attorneys' and engineering fees will not prevent a county from withdrawing from the district. The second question involves the power of the original drainage district to levy taxes on the land of all counties in the original district even though counties had subsequently withdrawn from such district. It was found by the court in accordance with state statute that the taxes were proper since they would finance cleaning of existing ditches to provide adequate outlets for the entire drainage system of the original district. (Childs-Fla)
W69-03436

PAINTER V PENNSYLVANIA PUBLIC UTILITY COMMISSION (PREFERENCE GIVEN EXISTING WATER COMPANIES IN GRANTING EXTENSIONS).
194 Pa Super 548, 169 A 2d 113-117 (1961).

Descriptors: *Pennsylvania, *Administrative agencies, *Permits, *Competition, Judicial decisions, Public utility districts, Regulation, Technical feasibility, Water zoning, Water supply, Alternative costs, Water rates.

A proceeding on an application by an existing water company for the right to serve additional adjacent territory, and subsequent applications by proposed new water companies to serve the same territory were brought by Plaintiff. The defendant, a public utility commission, granted the existing company's application, and the other applicants brought this action. This court affirmed, holding that the findings of the commission supported its granting the existing company's extension. The evidence supported the commission's contention that the facilities of the existing company were adequate to serve the added territory, and that the company selected was able to provide satisfactory service in the new area. The extent of competition in any field of public utility is a matter of administrative discretion vested in the commission. Generally competition among non-carrier public utilities is deleterious and not, except for rare instances in the public interest. An existing water company, ready, willing and able to extend its service into new territory, should be given preference over proposed competitors. (Blunt-Fla)
W69-03452

EFFECT AND ENFORCEMENT OF CONSERVATION LAWS.
N Y Conserv Law sec 835 Art 15 secs 15.17-15.19 (McKinney Supp 1968).

Descriptors: *New York, Civil law, *Legislation, State governments, *Conservation, Political

pects, Riparian rights, Administrative agencies, gulation, Legal aspects.
ntifiers: *Fines, Tort liability.

ese sections provide for fines to be levied upon lators of the state's conservation laws if the cific section violated does not do so itself. Such es, if levied, may be recovered by the conserva- n commission in its own name in any court of mpetent jurisdiction. The conservation commis- n shall incur tort liability for the negligent acts or issions of its agents, officers, and employees y to the extent prescribed by law with respect to nts, officers, and employees of the United tes. The conservation act shall not be construed affecting or in any way interfering with existing with respect to riparian rights. (Scott-Fla)
69-03464

APPROPRIATED STATE LANDS DEFINED.

Y Pub Lands Law sec 30 (McKinney 1951).

scriptors: *New York, *Legislation, *State vernments, *Land tenure, Canals, Administra- e agencies, Political aspects, Civil law, Land ssification, Legal aspects, Real property, Beds.
ntifiers: Unappropriated state land, Abandon- nt.

is section defines the term 'unappropriated state ds' as meaning all state lands belonging to the mmon school fund, all escheated lands, all lands nveyed to the state for the benefit of the canal d and not devoted in pursuance of law to any blic use, all lands purchased by and for the state the foreclosure of any mortgage given or loan of federal or state funds, all state lands lying hin the limits of any municipality not devoted to ublic use, and all other lands owned by the state ich are not directed by law to be kept for or ap- ed to any specific purpose, except lands under ter and abandoned canal lands, the disposition which is prescribed elsewhere, and the lands posed of under the salt springs law. The head of te departments having custody or jurisdiction er any state lands may abandon them by filing a tten declaration of abandonment. When such claration is approved by the board of commis- ners of the land office, such abandoned lands ll become unappropriated state lands, unless nstitutionally prohibited. (Scott-Fla)
69-03465

MBER OR BOATS FOUND ADRIFT.

Stat Ann secs 2A:44-53--2A:44-56 (1968).

scriptors: *New Jersey, *Water law, *Boats, quatic drift, Legislation, Lumber, Rivers, Drift- od.

y person taking up drift lumber, rails, posts, ats, scows, skiffs, or barges, which are found rift in any of the rivers or other waters of the te of New Jersey, may demand of and recover m the owner full compensation for his expense d labor. Amounts such as $.12 per log are then ed as constituting full compensation. The person ding the drift lumber or craft must follow the ocedures outlined in order to collect. He must t keep the lumber or craft for 6 days within 20 rds from the margin of the river where it was nd. If the value of the lumber or craft is less than he must keep it for 90 days, and then he can ap- priate it for himself if no one has claimed it. If value exceeds $5 the finder must advertise for weeks. If no one has claimed the lumber or craft er six weeks the finder may sell it at public auc- n and subtract his compensation and expenses m the proceeds. The remainder of the selling ce is held in trust by the finder for the owner for e year. After one year the finder becomes the al owner of the proceeds of the sale. The taking lumber or craft adrift without complying with s statute is a criminal offense. (Watson-Fla)
69-03474

SIRACO V VILLAGE OF WHITEHALL (NON-LIABILITY OF VILLAGE FOR FIRE DAMAGE RESULTING FROM VILLAGE'S FAULTY WATER SYSTEM).
5 A D 2d 925, 171 NYS 2d 1003-1004 (S Ct 1958).

Descriptors: *New York, Cities, Legislation, *Public utilities, Water law, *Water supply, Water contract, *Burning, Legal aspects, Water utilization, Maintenance.

Plaintiffs sued Village alleging liability for fire losses to plaintiffs' buildings. It was claimed that the Village breached its statutory duty requiring it to keep its water system in proper maintenance. As a result of the failure of the water system, the defendant was unable to extinguish a fire in plaintiffs' buildings. The court held that the Village had a duty to maintain a water and fire system but that this duty did not carry with it any liability for breach. The court stated that municipalities have not been made insurers of loss by fire. (Graham-Fla)
W69-03478

BERBERIAN V DOWD (ACCESS RIGHTS AND EASEMENTS ACROSS PRIVATE PROPERTY TO OCEAN).
247 A 2d 508-511 (RI 1968).

Descriptors: *Rhode Island, *Judicial decisions, *Easements, Legal aspects, Atlantic Ocean, Oceans, Right-of-way, Roads, Access routes, Real property.

Plaintiff brought an action to enjoin defendant from obstructing his use of a right-of-way easement which was included in a deed of land recently purchased by plaintiff. The easement guaranteed plaintiff access to the ocean along a strip of land which was only accessable from the public road, however, by a dirt road on defendant's property. Defendant erected a fence across the road. Plaintiff claims an easement over defendant's property leading to the ocean. The court held that plaintiff failed to show clear and satisfactory evidence of an existing easement. Notice was taken of a previous equity proceeding which permanently restrained the grantor of the strip of land easement from conveying any right to cross to defendant's road. (Holt-Fla)
W69-03480

NATIONAL JURISDICTION AND THE USE OF THE SEA,
Commission on Marine Science, Engineering and Resources, Washington, D. C.
For primary bibliographic entry see Field 06B.
For abstract, see .
W69-03572

WATER QUALITY MANAGEMENT IN THE DELAWARE RIVER BASIN,
For primary bibliographic entry see Field 06B.
For abstract, see .
W69-03583

HABEAS MARINUS: DUE PROCESS OF INNER-SPACE - A PROPOSAL,
Miami Univ., Coral Gables, Fla. School of Law.
Louis Kutner.
Miami Univ Law Rev, Vol 22, No 3, pp 629-673, Spring 1968. 45 p, 224 ref.

Descriptors: *Continental shelf, *International treaties, *International commissions, *International law, Mineralogy, Oil, Natural resources, International waters, Fishing, Foreign waters, Oceans, Technology, Jurisdiction, Exploitation, Water law, Law of the sea, Beds.
Identifiers: Sea-bed, Aquaculture.

Scientific and technological progress permits exploitation of the vast wealth under the seas. Submarine competition is not yet an issue among nations, although most states claim exlusive rights to the continental shelf contiguous to their coastline. The convention on the Continental Shelf has been adopted by some states to prevent conflict and provide for cooperation in the development of underseas recources. However, the convention merely lays down general principles, and for it to have meaningtul application, there must be recourse to an international tribunal. Such a tribunal in cases where an individual's freedom to use the seas is denied by a nation claiming exclusive rights to that part of the seas, would be impowered to issue a writ of Habeas Marinus, a close relation to the writ of World Habeas Corpus. This writ would give the tribunal jurisdiction, and the conflict would be resolved on grounds of due process - whether the infringement upon the nation claiming exclusive rights was reasonable. The writ could also be used to fill in present gaps regarding jurisdiction over acts committed on the high seas. (Hoffman-Fla)
W69-03588

INTERGOVERNMENTAL RELATIONSHIPS IN THE ADMINISTRATION OF WATER RESOURCES,
Illinois Univ., Urbana. Dept. of Agricultural Economics.
Norman G. P. Krausz.
Excerpted from WRC Research Report No. 18 (W69-03590). Water Resources Center, Summary Report, Sept 1968. 37 p. OWRR Project B-009-ILL.

Descriptors: *Jurisdiction, *Institutions, *Governments, *Planning, Control, Regulation, Inter-agency cooperation, Coordination, Attitudes, Water law, Administration, Cities water supply, Sewage treatment, Personnel, Flood control, Drainage, Soil conservation, Water conservation, Recreation, Navigation, Water pollution, Financing, Federal administrative agencies, Income, State administrative agencies, Federal-state jurisdiction.

A survey of 583 governmental bodies responsible for wate resources, and a study of 65 federal and state water use statutes are the basis of this report. All levels of governmental bodies show considerable dissatisfaction with the present water administration system. A need is felt for more state and local action and a structural consolidation at the local level. Larger representative agencies are required, together with planning and consolidation on a regional basis with the state playing a unifying role. The effect of recent federal water laws is to provide assisting funds to state and local agencies and to provide standards and criteria. Federal law requires little communication between federal water law agencies, and state agencies are largely uncoordinated and unregulated, and have small boundaries unrelated to water factors. The personnel that the agencies have are qualified, but the agencies are not fully staffed because the low pay scale and lack of funds. Federal grants to states are conditioned upon a particular need and are not continuous. The states must undertake new financial responsibility and appropriate funds for their water needs. (Hoffman-Fla)
W69-03589

INTERGOVERNMENTAL RELATIONSHIPS IN THE ADMINISTRATION OF WATER RESOURCES,
Illinois Univ., Urbana. Dept. of Agricultural Economics.
Norman G. P. Krausz.
For condensed version see Summary Report (W69-03589). Water Resources Center, Research Report No 18, Sept 1968. 336 p. OWRR Project B-009-ILL.

Descriptors: *Jurisdiction, *Institutions, *Governments, *Planning, Control, Regulation, Inter-agency corporation, Attitudes, Coordination.

Data for this report was obtained from 65 Federal and State laws, 73 conferences with government officials, and 583 survey questionnaires completed by officials of governmental units. Water resource

functions studied were soil and water conservation, sewage treatment, flood control, drainage, water supply, recreation and navigation. Significant dissatisfaction was found with the current structure and performance of the water system. The primary concern is for more State and local action and structural consolidation for more effective administration. The superimposition of Federal law and funds has been catalytic but also disruptive of relationships within the State. A State Water Code is needed to establish an orderly system of administration and to channel the Federal effort into a coordinated scheme of assistance and encouragement without detracting from its vitality or neglecting the standards and criteria imposed. Generally there is an external communication gap and a failure to recognize the interrlationships of water functions. A more formal and patterned system of communication should be established for all water related functional systems. (Heckerling-Fla)
W69-03590

COMPREHENSIVE RIVER BASIN PLANNING: THE ARKANSAS-WHITE-RED BASINS INTER-AGENCY COMMITTEE EXPERIENCE,
Michigan Univ., Ann Arbor. Inst. of Public Administration.
For primary bibliographic entry see Field 06B.
For abstract, see .
W69-03596

SOME CRITICAL PROBLEMS OF THE SHELLFISH INDUSTRY,
J. A. Carver, Jr.
National Shellfisheries Association, Proceedings, Vol 56, May, 1966, pp 9-12.

Descriptors: *Commercial shellfish, *Efficiencies, *Competition, *Legislation, *Technology, *Water policy, Economic efficiency, Fish management, Competing uses, Water utilization, Productivity, Management, Fisheries, Commercial fishing, Methodology, Industries, Industrial production, Water resources, Resources, Water management, Administration, Regulation, Water law, Animals, Aquatic animals, Aquatic life, Invertebrates, Shellfish.

Technological inefficiency as well as outdated legislation are seen as critical problems of the shellfish industry. The author states that technological inefficiency leads to an unfavorable competitive position. Conflicts between the shellfish industry and other uses of the water resource are discussed.
W69-03621

THE POLITICS OF BEAUTY,
Henry L. Diamond.
Parks and Recreation, February, 1966, pp 138-154.

Descriptors: *Aesthetics, *Governments, *Water pollution, *Urban renewal, Air pollution.

The author notes that all factions of society are becoming concerned about the quality of the country as well as the quantity of its gross national product. Such issues as air and water pollution and urban blight are receiving widespread attention from legislature and citizenry. If the citizen wants government to represent his interests, however, he must involve himself in politics. Two things are necessary for this involvement: (1) effective organization, and (2) information on issues.
W69-03648

FEDERAL COURT DECISION JEOPARDIZES CURRENT EFFORTS TO SAFEGUARD NATION'S ESTUARIES.
For primary bibliographic entry see Field 02L.
For abstract, see .
W69-03663

ACTION ON ILLEGAL DREDGING AND FILLING IN THE AREA OF HEMPSTEAD, N.Y.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03665

HOW TO STOP THE PILLAGE OF AMERICA,
Robert H. Boyle.
Sports Illustrated, Vol 27, No 24, December 11, 1967, pp 40-53.

Descriptors: *Thermal pollution, *Wetlands, *Conservation, *Legislation, Natural resources, Resources, Water pollution.

The author argues strongly for increased federal legislation to protect U. S. natural resources. He particularly urges Congressional legislation on thermal pollution and the protection of coastal estuaries and wetlands.
W69-03694

6F. Nonstructural Alternatives

FLOOD PLAIN INFORMATION, WILLAMETTE RIVER AND TRIBUTARIES IN MARION AND POLK COUNTIES, OREGON,
Corps of Engineers, Portland, Oreg.
For primary bibliographic entry see Field 02E.
For abstract, see .
W69-03539

LIMITING FACTORS IN HARBOR DEVELOPMENT,
William F. Cassidy.
Paper presented to the Tanker Conference of the American Petroleum Institute, May 10, 1966.

Descriptors: *Oil industry, *Competing uses, *Harbors, Channel improvement, Navigation, Industries, Transportation, Efficiencies, Water utilization.

General Cassidy maintains that the limit to channel and harbor deepening has been reached and urges the oil companies to seek alternatives for low cost shipping other than continued construction of several-hundred-thousand-ton tankers. Joint offshore pipeline loading facilities are one suggested solution. Port use conflicts are listed.
W69-03622

6G. Ecologic Impact of Water Development

A BIOLOGIST'S VIEWPOINT OF MAN-MADE CHANGES IN ESTUARIES,
G. W. Allen.
19th Annual Session Gulf and Caribbean Fisheries Institute (1966), Proceedings, September, 1967, pp 69-74.

Descriptors: *Aquatic productivity, *Direct benefits, *Ecology, *Environmental effects, Marine fisheries, Channel flow, Stream flow, Balance of nature, Real property, Industrial wastes, Mississippi River, Indirect benefits, Benefits, Productivity, Thermal pollution, Fisheries, Water pollution, Alteration of flow, Flow, Wastes, Surface waters, Streams, Running waters, Rivers, Interstate waters, Bodies of water, Encroachment, Saline water intrusion.

The author argues that no man-made changes in estuaries benefit estuarine production and that, in most cases, they harm it. He feels that these changes can come about in one of four ways: (1) channel and stream flow diversion, (2) industrial filling and encroachment, (3) pollution of all sorts, and (4) real estate development. It is stated that there is a point where the benefit ratio does not equal estuarine value, and that the value of estuaries will increase in direct proportion to their destruction by so-called improvements. The author feels that point has been reached.
W69-03607

'THE ROLE OF MAN IN ESTUARINE PROCESSES',
American Association for the Advancement of Science, Washington, D. C.
Eugene Cronin.
In ESTUARIES, No 83, 1967, pp 667-686.

Descriptors: *Management, *Social aspects, Resource allocation, Florida, Atlantic coastal plain, Coastal plains, Geographical regions, Gulf coastal plain, Regions, Southeast U. S., Louisiana, Foreign countries.

The effects of civilization on estuarine processes are described. The study is divided into three major phases: (1) The physical, chemical, and biological processes which are unusually significant in the estuary and which might be modified by man. (2) How human activities have affected these processes beyond the normal range of variation present in the virgin estuary. (3) The possibilities for future management of estuarine processes for optimal achievement of human values from estuaries. Among specific examples cited are: Tampa Bay (Florida), Lake Pontchartrain (Louisiana), Chesapeake Bay, and The Zuiderzee (Netherlands).
W69-03638

THE ECONOMIC IMPACT OF UNITED STATES OCEAN PORTS.
Report, Maritime Administration, U. S. Department of Commerce, Washington, D. C., 1966.

Descriptors: *Harbors, *Employment, *Transportation, *Economic impact, Ships, Channel improvements, Value, Income, Return (Monetary), Expenditures.

The study is the first of its kind in an attempt to portray the value of the port to the economic growth of the port community and its tributary territory. There are two tables presented in this publication. One table contains the information, by each individual port, on domestic employment attributable to U. S. export, the freight traffic and direct dollar value of cargo earnings for each port area. In addition, the table shows the passenger traffic of each port, as well as the total number of vessels passing through the port. Another table presents data pertinent to ports and states relative to port development expenditures, by type of terminal, between 1946 and 1962, total Federal funds expended on port channel improvements up to 1963, the cash value of port facilities, and the proposed Federal channel improvement expenditures for 1965.
W69-03654

'ASPECTS OF THE ESTUARINE ECOSYSTEM',
National Security Industrial Association, Washington, D. C.
Joel W. Hedgpeth.
In MARINE, ESTUARIAN, AND RIPARIAN POLLUTION DISASTERS AND THEIR CONSEQUENCES, Ocean Resources Subcommittee Meeting, December 13, 1967.

Descriptors: *Balance of nature, *Ecosystems, River flow, Water pollution effects, Channel flow, Water pollution, Environmental effects, Mollusks, Animals, Aquatic animals, Aquatic life, Invertebrates, Benthic fauna, Benthos, Flow, Estuarine environment, Aquatic environment, Environment.

Among the characteristics of the estuarine ecosystem are the occurrence of closely related species adjusted to the seasonal and nutrient cycles of the estuary, the seasonal replacement of various mass species, and the integrating effect induced by large populations of benthic mollusks, especially

sters and mussels. It is suggested that such a ue as gross photosynthesis is not a good indica- in itself of the state of this complex system. Fac- s causing the decline of productivity and ecolog- l health of several major estuarine ecosystems e discussed; these declines are primarily due to h works of man as alteration of river flow, anging shorelines by filling, and pollution.
9-03677

E OYSTER AND THE DREDGE OR 'BEAU- AND THE BEAST',
n W. Huston.
rld Dredging and Marine Construction, Vol 4, 2, March 1968, pp 30-31.

scriptors: *Oysters, *Dredging, *Ecology, uatic habitats, Animals, Aquatic animals, uatic life, Benthic fauna, Benthos, Commercial llfish, Invertebrates, Marine animals, Habitats, vironment, Mollusks, Shellfish, Silting, Sedimen- on, Toxicity, Turbidity, Physical properties, e cycles, Physiological ecology.

e author refutes complaints made by oyster ermen on the effects of dredging on oyster beds. nts covered are: toxicity, chemical changes, tur- ity, effect on life cycle, siltation, and physiologi- irritation.
9-03680

'ATEMENT',
deral Water Pollution Control Administration, anta, Ga.
primary bibliographic entry see Field 02L.
abstract, see .
9-03696

. RESOURCES DATA

. Network Design

DDERN HYDROLOGICAL RESEARCH THODOLOGY ON RIVERS IN RUMANIA RUMANIAN),
tional Council of Engineers and Technical entists, Bucharest (Rumania).
primary bibliographic entry see Field 06B.
abstract, see .
9-03314

RESERVOIR NETWORKS,
primary bibliographic entry see Field 04A.
abstract, see .
9-03378

SPONSE CHARACTERISTICS OF URBAN TER RESOURCE DATA SYSTEMS,
rida Univ., Gainesville. Dept. of Environmental gineering.
. Schaake, Jr.
CE Tech Mem No 3, Urban Water Resources Program, Aug 1968. 57 p, 10 fig, 15 tab, 8 ref. GS: 14-01-0001-1585.

scriptors: *Optimization, *Mathematical stu- s, *Economic feasibility, *Data processing, infall-runoff relationships, Urbanization, eam gages, Rain gages, Data collections, Hyeto- phs, Hydrographs, Statistical methods, chastic processes.
ntifiers: *Urban hydrology, Spectral analysis, a network response.

e characteristics of rainfall-runoff data and in- mental response are analyzed in a cost-effec- ness study of urban hydrology data-collection tems. Rainfall data characteristics are subdi- ed into rainfall measurement error, measure- nt criteria, and response of tipping bucket rain es. A stochastic model of rainfall is used to pre- rain-gage network response. Coefficients of iation of the ratio of measured intensity to average intensity at several operating gages in the Baltimore area are tabulated. The best urban runoff gaging system uses Parshall flumes. Measurement errors are analyzed and data from Northwood, a well-instrumented area in Baltimore, are tabulated and discussed. Rainfall and runoff data are analyzed by regression and spectral analyses, and shown by hyetographs and hydrographs. Water quality measuring and sampling systems are discussed and analyzed for optimum design. Economic and operations research approaches are outlined and recommended for optimization of urban hydrologic data systems. (K-napp-USGS)
W69-03509

INTERGOVERNMENTAL RELATIONSHIPS IN THE ADMINISTRATION OF WATER RESOURCES,
Illinois Univ., Urbana. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-03589

7B. Data Acquisition

SHORTCUTS AND SPECIAL PROBLEMS IN AQUIFER TESTS,
Geological Survey, Washington, D. C.
Ray Bentall.
U S Geol Surv Water-Supply Pap No 1545-C, 1963. 117 p, 31 fig, 4 plate, 17 tab, 27 ref.

Descriptors: *Test procedures, *Aquifer characteristics, *Drawdown, Well spacing, Artesian wells, Mathematical studies, Groundwater.
Identifiers: *Discharging wells, Nonequilibrium formula.

Seventeen specific problems in aquifer testing are illustrated by pertinent graphics and equations. Shortcuts cover such areas as: composite type curve for analyzing aquifer-test data; chart for computating drawdowns near a discharging well; slide rule to solve groundwater problems by nonequilibrium formula; application of nonequilibrium formula to groundwater problems; a simplified time- and distance-drawdown graph; storage coefficient determined from straight-line plots without extrapolation; special drawdown scales for predicting water-level changes in heavily pumped areas; type curves relating to single-boundary problems and nonsteady radial flow in an infinite leaky arterian aquifer; drawdown patterns in aquifers with straight-line boundary; the cone of depression and area of diversion around a discharging well in an infinite strip aquifer subject to uniform recharge; percentage of pumped water diverted; locus circles to locate hydrogeologic boundary; well spacing. (Llaverias-USGS)
W69-03231

USE OF THE ELECTRICAL RESISTIVITY METHOD FOR INVESTIGATING GEOLOGIC AND HYDROLOGIC CONDITIONS IN SANTA CLARA COUNTY, CALIFORNIA,
Leo M. Page.
Ground Water, J Tech Div Nat Water Well Ass, Vol 6, No 5, pp 31-40, Sept-Oct 1968. 10 p, 8 fig, 5 ref.

Descriptors: *Groundwater movement, *Resistivity, *Geophysics, *Flow nets, Artificial recharge, Water table, California, Observation wells.
Identifiers: Electrical resistance surveys, Wenner configuration, Schlumberger configuration.

Electrical resistivity methods for groundwater investigations are described, and typical examples of resistivity survey data checked against test drilling and well tests in Santa Clara County, California, are presented. A table shows correlations of resistivity data and percolation rates. The advantages of resistivity surveys are low cost, ease of operation, speed, and accuracy. The Wenner and Schlumberger electrode configurations are used. Flow nets were constructed with resistivity, test hole, and well survey data to evaluate artificial recharge and water spreading projects. (Knapp-USGS)
W69-03235

SOME STATISTICAL TOOLS IN HYDROLOGY,
Geological Survey, Washington, D. C.
H. C. Riggs.
Geol Surv Tech Water-Resources Invest, Book 4, Chapter A1, 1968. 39 p, 26 fig, 5 tab, 27 ref.

Descriptors: *Statistical methods, *Hydrologic data, Correlation analysis, Regression analysis, Digital computers, Hydrology, Analysis.
Identifiers: Technical manuals, Multivariate analysis, Variance, Covariance.

Background material needed for understanding the statistical procedures most useful in hydrology is given in detail. Detailed procedures, with examples, of regression analyses are presented. The analysis of variance and of convariance is described. The characteristics of hydrologic data and their statistical treatment are discussed. (K-napp-USGS)
W69-03344

MEASUREMENT OF PEAK DISCHARGE AT CULVERTS BY INDIRECT METHODS,
Geological Survey, Washington, D. C.
G. L. Bodhaine.
Geol Surv Tech Water-Resources Invest, Book 3, Chapter A3, 1968. 60p, 32 fig, 7 tab, 16 ref.

Descriptors: *Discharge measurement, *Peak discharge, *Stage-discharge relations, *Culverts, Control, Energy equation, Continuity equation.
Identifiers: Technical manuals, Indirect discharge measurements, Culvert flow.

U S Geological Survey methods for measurements of peak discharge at culverts are given. Culvert flow is classified into 6 types, discharge equations based on continuity and energy equations are given, and field procedures for measuring peak discharge using culverts are described. Discharge coefficients for a variety of culvert geometries and flow types are tabulated. Step-by-step computation procedures are given in detail in 10 examples. (K-napp-USGS)
W69-03345

GENERAL PROCEDURE FOR GAGING STREAMS,
Geological Survey, Washington, D. C.
R. W. Carter, and Jacob Davidian.
Geol Surv Tech Water-Resources Invest, Book 3, Chapter A6, 13p, 10 fig, 5 ref.

Descriptors: *Stream gages, *Control, Current meters, Discharge measurement, Gaging stations, Water levels, Stage-discharge relations.
Identifiers: Technical manuals, Stream gaging, Rating.

The objectives and procedures used in obtaining streamflow records are briefly described in an introduction to other more detailed chapters on stream gaging in the USGS series of technical manuals for water resources investigations. The topics surveyed are gaging site selection, artificial controls, stage measurement, discharge measurement, discharge ratings, computation and preparation of discharge records, and publication of records. (Knapp-USGS)
W69-03346

INTERAGENCY WATER RESOURCES RESEARCH AND DATA COLLECTION PROGRAM.
Wisconsin Dept. of Natural Resources, Madison; and Wisconsin Univ., Madison.
For primary bibliographic entry see Field 09D.
For abstract, see .

W69-03360

STREAMFLOW AND PRECIPITATION DATA INDEX,
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03380

VOLUMETRIC CALIBRATION OF NEUTRON MOISTURE PROBES,
Southeastern Forest Experiment Station, Franklin, N. C.
For primary bibliographic entry see Field 02G.
For abstract, see .
W69-03394

NORTHWOOD GAGING INSTALLATION, BALTIMORE-INSTRUMENTATION AND DATA,
American Society of Civil Engineers Program Office, Cambridge, Mass.
For primary bibliographic entry see Field 02E.
For abstract, see .
W69-03507

OAKDALE GAGING INSTALLATION, CHICAGO-INSTRUMENTATION AND DATA,
American Society of Civil Engineers Program Office, Cambridge, Mass.
For primary bibliographic entry see Field 02E.
For abstract, see .
W69-03508

A CRITICAL REVIEW OF METHODS OF MEASURING DISCHARGE WITHIN A SEWER PIPE,
Illinois Univ., Urbana.
H. G. Wenzel, Jr.
ASCE Tech Mem No 4, Urban Water Resources Res Program, Sept 1968. 20 p, 2 fig, 2 append. USGS: 14-08-0001-11257.

Descriptors: *Stream gages, *Flow measurement, *Flowmeters, *Closed conduit flow, *Sewers, Venturi meters, Tracers, Radioactivity techniques, Dyes releases, Tracking techniques, Research and development.
Identifiers: Rating curves, Urban hydrology.

Existing methods of measuring discharge of sewers are discussed with respect to the requirements and physical limitations imposed by their use in an urban study area, and rating curves for a suggested critical flow device are presented with recommendations for future research. The gage must have an output in the form of an electrical signal for recording, be automatically turned on and off, and need no attendant. Laboratory velocity probes are unsuitable because of clogging problems. Desired accuracy is 5% in discharge measurement over a large flow range. The device must be capable of installation in any existing sewer at reasonable cost. Weirs, depth gages, and velocity meters, the methods presently available, all have serious disadvantages and are not recommended. Tracer dilution methods as well as Venturi flumes and other critical flow devices are suggested for development. A pipe section with a narrow throat acts as a Venturi flume for open flow and as a Venturi meter for full flow. Plans and theoretical rating curves for such a device are shown. (Knapp-USGS)
W69-03510

METHODS OF MEASURING WATER LEVELS IN DEEP WELLS,
Geological Survey, Washington, D. C.
M. S. Garber, and F. C. Koopman.
Geol Surv Tech Water-Resources Invest, Book 8, Chapter A1, 1968.

Descriptors: *Water levels, *Instrumentation, *Deep wells, Water wells, Piezometers, Measurement, Equipment.
Identifiers: Technical manuals, Deep well measurements.

Deep well water level measurement devices and techniques are described. Accurate measurement of water levels deeper than 1,000 feet in wells requires specialized equipment. Corrections for stretch and thermal expansion of measuring tapes must be considered, and other measuring devices must be calibrated periodically. Borehole deviation corrections also must be made. Devices for recording fluctuation of fluid level usually require mechanical modification for use at these depths. A multichannel recording device utilizing pressure transducers has been constructed. This device was originally designed to record aquifer response to nearby underground nuclear explosions but can also be used for recording data from muti-well pumping tests. Bottom-hole recording devices designed for oil-field use have been utilized in a limited manner. These devices were generally found to lack the precision required in groundwater investigations at the Nevada Test Site but may be applicable in other areas. A newly developed bottom-hole recording pressure gauge of improved accuracy has been used with satisfactory results. (USGS)
W69-03535

CALIBRATION AND MAINTENANCE OF VERTICAL-AXIS TYPE CURRENT METERS,
Geological Survey, Washington, D. C.
George F. Smoot, and Charles E. Novak.
Geol Surv Tech Water-Resources Invest, Book 8, Chapter B2, 1968. 15 p, 5 fig, 1 tab, 3 ref.

Descriptors: *Current meters, *Instrumentation, *Calibrations, *Maintenance, Rotating meters, Velocity.
Identifiers: Technical manuals, Vertical axis current meters, Meter rating.

The procedures used in the manufacture and calibration of current meters are described and information pertinent to their proper maintenance and repair is presented. Recent intensive studies on the calibration of current meters and the effects of wear of the component parts on the performance of the meters have led to the adoption of new procedures for the manufacture, calibration, maintenance, and repair of meters. This chapter, therefore, updates the provisional manual 'Care and Rating of Current Meters' (1957) by including these new procedures. (USGS)
W69-03536

CURRENT TRENDS IN THE USE OF RADIOACTIVE TRACERS IN HYDROLOGIC INVESTIGATIONS,
International Atomic Energy Agency, Vienna (Austria).
T. Dincer, T. Florkowski, and E. Halevy.
For 8-Volume Proceedings, see this issue, Field 06B, W69-03305. Int Conf on Water for Peace, Wash, D.C., Vol 4, pp 332-341, 1967. 10 p, 30 ref.

Descriptors: *Tracers, *Radioisotopes, *Data collections, Path of pollutants, Groundwater movement, Streamflow, Sediment transport, Tracking techniques, Methodology, Safety factors.

Techniques in using artificial radioactive sources are described as well as their advantages and disadvantages and their role in water resources investigations. Radioactive tracers have been used for many years in measurement of stream discharge, determination of direction and rate of grounwater flow, tracing sediment transport in streams and estuaries, and in tracing movement of contaminants in ground and surface waters. Radioactive tracers offer great advantages in terms of distinct identification and precise measurement of the tracer. However, these advantages are offset to some extent by the need to observe rigid safety precautions and the need for cumbersome equipment. Radioactive tracers, therefore, have been limited to special uses where conventional hydrologic approaches are unsuitable. (USGS)
W69-03544

INTERGOVERNMENTAL RELATIONSHIPS IN THE ADMINISTRATION OF WATER RESOURCES,
Illinois Univ., Urbana. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-03589

INFRARED IMAGES OF THE KAU AND PUNA COASTLINES ON HAWAII,
Hawii Univ., Honolulu.
William M. Adams, and Larry K. Lepley.
Hawaii Water Resources Research Center, Tech Rpt. No 26, Dec 1968. 51 p, 9 fig, 7 ref. OWRR Project B-008-HI.

Descriptors: Coastlines, Infrared scanner, Puna, Kau, Hawaii, Mosiac, Images.

An infrared scanner has been flown over the coastline of the Puna and Kau Districts on the island of Hawaii using an Apache aircraft. The images were monitored in real time and selectively photographed. The flightline was made at an altitude from 10 to 11,000 feet. Each image represents a ground area about 1,000 feet on a side. The films of the images taken have been processed and catalogued. A few areas of special importance have had the images correlated into a mosaic to aid interpretation. The equipment used, the field procedures followed, and an index to the catalogued films are presented in this report. The image quality is illustrated by a few frames and mosaics. The procedure of obtaining infrared imagery is rather complex when taken in its entirety and much practice is necessary to achieve high-quality images. The greatest difficulty encountered was the high-level flightline required by a narrow angle lens on the scanner. At the time this study was made no wide-angle lens was available. At present, a wide angle lens is available. Any future surveys will use a wide angle lens to avoid the difficulties encountered because of the altitude.
W69-03600

7C. Evaluation, Processing AND Publication

FUNDAMENTALS OF HYDROLOGIC FORECASTING,
For primary bibliographic entry see Field 02E.
For abstract, see .
W69-03218

MONTHLY SURFACE-WATER INFLOW TO CHESAPEAKE BAY,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02E.
For abstract, see .
W69-03325

OPTIMIZATION TECHNIQUES FOR HYDROLOGIC ENGINEERING,
Corps of Engineers, Sacramento, Calif. Hydrologic Engineering Center.
For primary bibliographic entry see Field 06A.
For abstract, see .
W69-03329

LINEAR ANALYSIS OF HYDROGRAPHS,
Geological Survey, Champaign, Ill.
William D. Mitchell.
Water Resources Res, Vol 3, No 3, pp 891-895, 1967. 5 p, 4 fig, 1 tab, 5 ref.

Descriptors: *Hydrograph analysis, *Hydrographs, *Unit hydrographs, *Rainfall-runoff relationships, Storage, Routing, Flood routing, Streamflow forecasting.
Identifiers: Linear hydrograph, Linear analysis.

A linear hydrograph is described by the values of 5 parameters: the size of the drainage area, the

amount of rainfall excess, the duration of rainfall excess, the translation time, and a storage index. The unit hydrographs and other linear flood hydrographs may be computed by incorporating the values of the 5 parameters into a generalized dimensionless model hydrograph, using published tabulated model hydrograph values. Model hydrographs are dimensionless representations of the instantaneous translation hydrograph.
W69-03331

ELECTRIC ANALOG OF THREE-DIMENSIONAL FLOW TO WELLS AND ITS APPLICATION TO UNCONFINED AQUIFERS,
Geological Survey, Washington, D. C.
Robert W. Stallman.
Geol Surv Water-Supply Pap 1536-H, pp 205-242, 1963. 37 p, 16 fig, 5 tab, 12 ref.

Descriptors: *Analog models, *Groundwater movement, *Water level fluctuations, Water wells, Discharge (Water), Permeability, Porosity, Aquifers, Specific yield, Anisotropy, Drawdown, Hydrographs, Analytical techniques.
Identifiers: *Pumping test analysis, *Flow equations.

Electric-analog design criteria are established from the differential equations of groundwater flow for analyzing pumping-test data. A convenient analog design was obtained by transforming the cylindrical equation of flow to a recti-linear form. The design criteria were applied in the construction of an electric analog, which was used for studying pumping-test data collected near Grand Island, Nebraska. Data analysis indicated (1) vertical flow components near pumping wells in unconfined aquifers may be much more significant in the control of water-table decline than radial flow components for as much as a day of pumping; (2) the specific yield during the first few minutes of pumping appears to be a very small fraction of that observed after pumping for more than 1 day; and (3) estimates of specific yield made from model studies seem much more sensitive to variations in assumed flow conditions than are estimates of permeability. Analysis of pumping-test data where vertical flow components are important requires that the degree of anisotropy be known. A procedure for computing anisotropy directly from drawdowns observed at five points was developed. Results obtained in the analog study emphasize the futility of calculating unconfined aquifer properties from pumping tests of short duration by means of equations based on the assumptions that vertical flow components are negligible and specific yield is constant. (USGS)
W69-03356

STREAMFLOW DATA PROCESSING OPPORTUNITIES AND APPLICATION,
Southeastern Forest Experiment Station, Franklin, N. C.
A. R. Hibbert, and G. B. Cunningham.
Reprint from Proc. Int. Symp. Forest Hydrol., Penn State Univ 1965, 725-736, Pergamon Press, Inc. New York, 1967.

Descriptors: *Analog computers, *Data processing, *Computer programs, *Hydrologic data, Streamflow, Electronic equipment, Digital computers, Computers.
Identifiers: *Hydrologic analysis.

The techniques used at the Coweeta Hydrologic Laboratory for processing streamflow records from recorder charts and analog-to-digital recorder tapes to final discharge integration are discussed in detail. A computer method is presented for separating the stream hydrograph into parameters useful for evaluation and comparisons of streamflow response. Costs of equipment and data processing are also given.
W69-03389

FINITE DIFFERENCING METHODS,
Agricultural Research Service, Beltsville, Md. Hydrograph Lab.
D. L. Brakensiek.
Water Resources Res, Vol 3, No 3, pp 847-860, 1967. 14 p, 3 fig, 4 illus, 12 tab, 17 ref.

Descriptors: *Digital computers, *Hydrology, *Computer programs, *Numerical analysis, *Approximation method.
Identifiers: *Finite differencing methods, Finite calculus, Partial differential equations.

Today analytical techniques, numerical algorithms, and computation facilities have made it possible to solve many hydrologic problems. The emphasis on numerical solutions requires that the hydrologist have some basic knowledge of numerical methods, that is, the calculus of finite differences. Flow of water in its various phases comprises a large part of hydrologic studies. These processes described by partial differential equations (generally nonlinear) require finite difference approximations for tractable computations. Considerations of convergence, order of approximation, and stability of these difference quotients again require some background in finite difference methods. Through brief discussions, several examples, and a list of references, some of the above considerations are introduced.
W69-03519

TIME SERIES ANALYSIS,
Geological Survey, Arlington, Va.
For primary bibliographic entry see Field 06A.
For abstract, see .
W69-03524

VARIANCE SPECTRUM ANALYSIS,
National Center for Atmospheric Research, Boulder, Colo.
For primary bibliographic entry see Field 06A.
For abstract, see .
W69-03525

DIFFUSION AND SETTLING OF SEDIMENTS AT RIVER MOUTHS: A COMPUTER SIMULATION MODEL,
Stanford Univ., Calif. Dept. of Geology; and Stanford Univ., Calif. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02J.
For abstract, see .
W69-03542

AN EMPIRICAL FORMULA FOR DETERMINING THE AMOUNT OF DYE NEEDED FOR TIME-OF-TRAVEL MEASUREMENTS,
Geological Survey, Cheyenne, Wyo.
James F. Wilson, Jr.
Geol Surv Res 1968, Prof Pap 600-D, pp D54-D56, 1968. 3 p, 1 fig, 2 ref.

Descriptors: *Tracers, *Dye releases, *Velocity, Streamflow, Stream gages, Discharge measurements.
Identifiers: Empirical methods, Dye requirements, Time-of-travel measurements.

Data from time-of-travel measurements in a wide variety of streams are used empirically to relate the amount of rhodamine B dye required for slug injections to the volume of flowing water in a stream reach. The formula requires slight modification for low-flow or low-velocity measurements, or for use with Rhodamine WT, a newer dye for which sufficient field data are not yet available. (USGS)
W69-03565

INTERGOVERNMENTAL RELATIONSHIPS IN THE ADMINISTRATION OF WATER RESOURCES,
Illinois Univ., Urbana. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-03589

SIMULATION OF A WATER RESOURCES SYSTEM,
Washington Univ., Seattle. Fisheries Research Inst.
For primary bibliographic entry see Field 06A.
For abstract, see .
W69-03601

08. ENGINEERING WORKS

8A. Structures

WATER FRONT IMPROVEMENTS.
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-03413

WATER POWER COMPANIES ALONG TRIBUTARIES TO BARNEGAT BAY.
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-03417

BEACH FRONT REPAIR AND DREDGING OF STREAMS,
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-03422

HURRICANE DAMAGE TO STRUCTURES,
G. W. Cooper.
Ocean Industry, Vol 2, No 10, October, 1967, pp 30-34.

Descriptors: *Offshore platforms, *Hurricanes, *Damages, Ocean waves, Structures, Engineering structures, Hydraulic structures, Waves (Water), Storms, Tropical cyclones, Accidents.

These articles discuss various incidents of storm damage to offshore platforms and collision conflicts.
W69-03634

POTENTIAL FRESHWATER RESERVOIR IN THE NEW YORK AREA,
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03700

8B. Hydraulics

POTENTIAL FLOW AND SOIL STRUCTURE CHANGES,
Slovak Technical Univ., Bratislava (Czechoslovakia).
For primary bibliographic entry see Field 02F.
For abstract, see .
W69-03203

A CRITICAL REVIEW OF METHODS OF MEASURING DISCHARGE WITHIN A SEWER PIPE,
Illinois Univ., Urbana.
For primary bibliographic entry see Field 07B.
For abstract, see .
W69-03510

8D. Soil Mechanics

THE ENCLOSURE OF THE ZUIDERZEE AND THE RECLAMATION OF POLDERS IN THE YSSEL-LAKE.

Zuiderzee Polders Development and Colonization Authority, Zwolle, Netherlands, 1967.

Descriptors: *Land reclamation, *Soil mechanics, *Foreign countries, Coastal engineering, Drainage, Agricultural engineering, Engineering, Dredging, Geographical regions, Regions.

The economic significance of the reclamation works and the technical procedures of enclosure and reclamation operations are briefly described. Among procedures described are dredging, polder drainage, and soil shifting.
W69-03656

8E. Rock Mechanics AND Geology

ROCK MECHANICS IN THE DISPOSAL OF RADIOACTIVE WASTES BY HYDRAULIC FRACTURING,
Oak Ridge National Lab., Oak Ridge, Tenn. Health Physics Div.
W. C. McClain.
Felsmechanik und Ingenieurgeol, J Int Soc Rock Mech, Vol 6, No 3, pp 139-161, 1968. 23 p, 11 fig, 2 tab, 16 ref.

Descriptors: *Waste disposal, *Injection wells, *Rock mechanics, *Fractures (Geology), Permeability, Porosity, Stress.
Identifiers: *Hydraulic fracturing.

The ultimate capacity of a hydraulic-fracturing waste disposal facility is governed primarily by the integrity of the rocks overlying the injected wastes. The objective of the study was to analyze theoretically the stresses and strains generated by the injected wastes so that the failure mechanism could be predicted and the capacity of the injection well estimated. The surface uplifts at Oak Ridge National Laboratory's fracturing site were compared with theoretical curves obtained by assuming the uplifts to be inversely analogous to the subsidence which occurs over mining excavations. The most probably mechanism of failure of the rock appears to be by the formation of a vertical instead of a horizontal fracture. Fracture orientation is controlled primarily by the orientation of the principal stress field in the rock. Each successive waste injection slightly modifies this stress field toward a condition more favorable to the formation of a vertical fracture. The effect of repeated injections was evaluated for various assumed original stresses and the minimum ultimate capacity of the formation was estimated as 4 million gal. It is also possible to make recommendations to avoid, as far as possible, the conditions leading to failure and in this way increase the formation capacity.
W69-03522

8I. Fisheries Engineering

PROHIBITED ACTS.
N Y Conservation Law sec 275 (McKinney 1968).

Descriptors: *New York, Legislation, Legal aspects, Dams, *Fish, Bass, Trout, Lake trout, Salmon, *Fish conservation, Fish reproduction, Explosives, Governments, Electric power production, Impoundments, *Impounded waters, Permits, Administrative agencies.

Section 275 prohibits the taking of fish by use of explosives or by shutting or drawing off water. Bass, trout, lake trout, and salmon may not be disturbed on their spawning beds during the closed season. No person may draw off water held back by a dam if it will result in the loss of a substantial number of fish in the impoundment. This provision does not apply to governments or electric power producers; it shall not apply in the event of an emergency or to artificial or man-made bodies of water lying wholly within the boundaries of privately owned or leased lands. (Sisserson-Fla)
W69-03469

SAVE-THE-SALMON PROJECT ON THE ST. JOHN RIVER,
For primary bibliographic entry see Field 05C.
For abstract, see
W69-03669

09. MANPOWER, GRANTS, AND FACILITIES

9A. Education (Extramural)

EUTROPHICATION,
isconsin Univ., Madison. Lab. of Limnology; and Wisconsin Univ., Madison. University-Industry Research Program.
For primary bibliographic entry see Field 05C.
For abstract, see .
W69-03357

9D. Grants, Contracts, AND Research Act Allotments

INTERAGENCY WATER RESOURCES RESEARCH AND DATA COLLECTION PROGRAM.
Wisconsin Dept. of Natural Resources, Madison; and Wisconsin Univ., Madison.

Published by: Water Resources Ctr, Univ of Wisconsin, Madison.

Descriptors: *Wisconsin, *Data collections, *Research and development, *Planning, Water quality, Water pollution, Geochemistry, Lake shores, Wetlands, Pesticides, Rivers, Fisheries, Water resources, Eutrophication, Simulation analysis, Invertebrates, River basins, Hydrology, Wild rivers, Ground water.

Wisconsin's Interagency Water Resources Research and Data Collection Program was established in 1966 by an act of the state legislature. During the program's 3-yr history, the participating agencies have developed a joint statewide program that focusses attention on a number of Wisconsin's water problems. Participating agencies include: Bureau of Research and Division of Environmental Protection, both of the Wisconsin Department of Natural Resources, and the Geological and Natural History Survey and Water Resources Center, both of The University of Wisconsin. Coordinated activities of these agencies helped pervent overlapping of effort while permitting adequate coverage of selected topics. This publication includes short summaries of 36 projects supported under the program. Following titles selected from those included demonstrate the scope and diversity of the program: Trout Population Study in Relation to Organic Pollution; Evaluation of Lakeshore Development; Study of Removal of Nutrients, Detergents and Other Pollutional Materials by Sub-Surface Percolation; Research on Sewage Effluent Ponds; Movable Automatic Water Quality Monitoring; Survey of Pesticides in Benthic Invertebrates; Nitrate in Drinking Water Supplies; State-Wide Inventory of River Basins; Hydrology of a Wetland Area; Basin Hydrology of a Wild River; Geological Aspects of Lake Eutrophication; Geochemical Prospecting by Spring-Sampling in Zinc Mining Area.
W69-03360

10. SCIENTIFIC AND TECHNICAL INFORMATION

A DIRECTORY OF INFORMATION RESOURCES IN THE UNITED STATES: WATER.
National Referral Center for Science and Technology, Washington, D. C., September, 1966.

Descriptors: *Information retrieval, *Resources, *Bibliographies, Publications, Documentation.

This document lists organizations performing research or collecting data on water or water-related subjects. It is concerned with fresh water--the field of oceanography has been included.
W69-03650

SUBJECT INDEX

BATEMENT
DRAINAGE DISTRICT NO 48 OF DUNLIN COUNTY V SMALL (NUISANCE ACTION BY DRAINAGE DISTRICT TO ABATE PRIVATE LEVEE).
W69-03437 04A

BSORPTION
RELATIVE ABSORPTION OF STRONTIUM AND CALCIUM BY CERTAIN ALGAE,
W69-03491 05B

BSTRACTS
INDEX OF SELECTED OUTDOOR RECREATION LITERATURE, VOLUME II.
W69-03681 06B

CCRETION(LEGAL ASPECTS)
STATE V 6.0 ACRES OF LAND (RIPARIAN OWNERS' RIGHT TO ACCRETION LAND).
W69-03428 06E

RIGHT OF ACCESSION - IMMOVABLES.
W69-03448 04A

DMINISTRATION
DEPARTMENT OF NATURAL RESOURCES.
W69-03255 06E

W69-03256 06E

VIOLATIONS AND CIVIL LIABILITY.
W69-03298 06E

PURPOSE AND FINDINGS.
W69-03300 06E

TRANSFER OF CERTAIN POWERS, DUTIES, FUNCTIONS AND RESPONSIBILITIES OF THE DEPARTMENT OF CONSERVATION AND DEVELOPMENT.
W69-03429 06E

WATER QUALITY MANAGEMENT IN THE DELAWARE RIVER BASIN,
W69-03583 06B

'STATEMENT', IN CLEAN WATER FOR THE NATION'S ESTUARIES,
W69-03605 05B

COMPREHENSIVE PLANNING IN RELATION TO THE RISE AND MANAGEMENT OF ESTUARIES,
W69-03624 06B

DMINISTRATIVE AGENCIES
DUTIES OF THE DEPARTMENT OF PUBLIC WORKS RELATIVE TO COMMONWEALTH LANDS, CERTAIN ISLANDS, AND PROPERTY IN PLYMOUTH.
W69-03258 04C

POWERS OF THE DEPARTMENT OF PUBLIC WORKS AS TO PR PORT OF BOSTON HARBOR.
W69-03259 04A

POWER OF THE DEPARTMENT OF PUBLIC WORKS TO TAKE AND HOLD REAL ESTATE AND BUILD THEREON.
W69-03260 06E

DEVELOPMENT OF WATERFRONT FACILITIES - IMPROVEMENT AND PRESERVATION OF RIVERS, HARBORS, ETC.
W69-03261 06E

STRUCTURES THE DEPARTMENT OF PUBLIC WORKS MAY LICENSE TO BE ERECTED IN RIVERS AND STREAMS.
W69-03262 06E

COUNTIES, CITIES, AND TOWNS MAY APPROPRIATE MONEY FOR IMPROVEMENT OF WATERWAYS.
W69-03268 04A

STEARNS V STATE (DIVERSION OF SEWAGE EFFLUENT INTO CLEAN RIVER BY ORDER OF ADMINISTRATIVE AGENCY).
W69-03296 05B

ECONOMIC DEVELOPMENT.
W69-03419 06E

DIVISION OF NAVIGATION
W69-03420 06E

CONSERVATION AND DEVELOPMENT.
W69-03421 06E

PAINTER V PENNSYLVANIA PUBLIC UTILITY COMMISSION (PREFERENCE GIVEN EXISTING WATER COMPANIES IN GRANTING EXTENSIONS).
W69-03452 06E

SAN FRANCISCO BAY PLAN.
W69-03592 06B

MIRALTY
LEHIGH VALLEY RR V THE RUSSELL NO 1 (LIABILITY FOR DAMAGE CAUSED BY SUBMERGED PILINGS).
W69-03287 04A

SORPTION
THE PERSISTENCE OF SILVEX IN WATER AND HYDROSOIL,
W69-03240 05A

VERSE POSSESSION
LEAKE V RICHARDSON (TITLE TO PONDS BY ADVERSE POSSESSION AND PRESCRIPTION).
W69-03279 04A

AESTHETICS
THE POLITICS OF BEAUTY,
W69-03648 06E

AGRICULTURAL CHEMICALS
EVALUATION OF SOIL AMENDMENTS IN IMPERIAL VALLEY,
W69-03481 02G

AGRICULTURAL ENGINEERING
THE DELTA PROJECT.
W69-03646 02L

AGRICULTURE
WATER UTILIZATION IN GREENHOUSES ALTERNATIVES FOR AGRICULTURE IN ARID REGIONS,
W69-03486 03F

AIR ENTRAINMENT
THE EFFECTS OF ENTRAPPED AIR AND BAROMETRIC FLUCTUATIONS ON THE DRAINAGE OF POROUS MEDIUMS,
W69-03552 02G

AIR TEMPERATURE
ACCURACY OF EVAPOTRANSPIRATION DETERMINATIONS BY THE BOWEN RATIO METHOD,
W69-03504 02D

ALABAMA
DICKEY V HONEYCUTT (MINE DAMAGE TO WELLS).
W69-03282 02F

ALGA BLOOMS
ENVIRONMENTAL REQUIREMENTS OF BLUE-GREEN ALGAE.
W69-03512 05C

ALGAE
STUDIES OF THE ANALYSIS OF PHOSPHATES IN ALGAL CULTURES,
W69-03358 05A

DETECTION OF LIMITING OR SURPLUS NITROGEN IN ALGAE AND AQUATIC WEEDS,
W69-03364 05C

'PREDICTING DIURNAL VARIATIONS IN DISSOLVED OXYGEN CAUSED BY ALGAE IN ESTUARINE WATERS, PART I',
W69-03611 05C

ALGORITHMIC METHODS
AN EXTENSION TO THE THOMAS-FIERING MODEL FOR THE SEQUENTIAL GENERATION OF STREAMFLOW,
W69-03307 02A

ALLUVIAL CHANNELS
SEQUENTIAL STUDY OF DESERT FLOODING IN THE WHITE MOUNTAINS OF CALIFORNIA AND NEVADA,
W69-03222 02E

ALLUVIAL FANS
SEQUENTIAL STUDY OF DESERT FLOODING IN THE WHITE MOUNTAINS OF CALIFORNIA AND NEVADA,
W69-03222 02E

ALLUVION
RIGHT OF ACCESSION - IMMOVABLES.
W69-03448 04A

ALTERATION OF FLOW
MESSINGER V TOWNSHIP OF WASHINGTON (DRAINAGE LICENSE).
W69-03295 04A

SERVITUDES WHICH ORIGINATE FROM THE NATURAL SITUATION OF THE PLACES.
W69-03446 04A

ALTERNATIVE COSTS
'PLANNING A WATER QUALITY MANAGEMENT SYSTEM THE CASE OF THE POTOMAC ESTUARY',
W69-03643 05G

AMINATRIAZOLE
CHEMICAL BRUSH CONTROL AND HERBICIDE RESIDUES IN THE FOREST ENVIRONMENT,
W69-03399 05B

AMINOTRIAZOLE
STREAM CONTAMINATION BY HERBICIDES AFTER FALL RAINS ON FOREST LAND,
W69-03381 05B

AMITROLE
AMITROLE CONCENTRATIONS IN CREEK WATERS DOWNSTREAM FROM AN AERIALLY SPRAYED WATERSHED SUBBASIN,
W69-03226 05B

ANALOG COMPUTERS
ANALYZING SUBSURFACE FLOW SYSTEMS WITH ELECTRIC ANALOGS,
W69-03310 02F

STREAMFLOW DATA PROCESSING OPPORTUNITIES AND APPLICATION,
W69-03389 07C

ANALOG MODELS
ANALYZING SUBSURFACE FLOW SYSTEMS WITH ELECTRIC ANALOGS,
W69-03310 02F

ELECTRIC ANALOG OF THREE-DIMENSIONAL FLOW TO WELLS AND ITS APPLICATION TO UNCONFINED AQUIFERS,
W69-03356 07C

A STUDY OF THE DRAINAGE OF IRRIGATED SAND DUNES USING AN ELECTRICAL RESISTANCE ANALOGUE,
W69-03526 04A

ANALYTICAL TECHNIQUES
STUDIES OF THE ANALYSIS OF PHOSPHATES IN ALGAL CULTURES,
W69-03358 05A

DETECTION OF LIMITING OR SURPLUS NITROGEN IN ALGAE AND AQUATIC WEEDS,
W69-03364 05C

EFFECT OF WATER SAMPLE PRESERVATION METHODS ON THE RELEASE OF PHOSPHORUS FROM ALGAE,
W69-03370 05B

EXTRACTIVE AND ENZYMATIC ANALYSES FOR LIMITING OR SURPLUS PHOSPHORUS IN ALGAE,
W69-03373 05A

ANISOTROPY
STEADY UNSATURATED VERTICAL FLOW THROUGH MULTILAYERED SOIL,
W69-03209 02G

SEEPAGE FROM CHANNELS THROUGH LAYERED POROUS MEDIUMS,
W69-03554 02G

APPROXIMATION METHOD
FINITE DIFFERENCING METHODS,
W69-03519 07C

AQUATIC ALGAE
RELATIVE ABSORPTION OF STRONTIUM AND CALCIUM BY CERTAIN ALGAE,
W69-03491 05B

AQUATIC ANIMALS
THE PROBLEM OF PESTICIDES IN ESTUARIES,
W69-03618 05G

INTERIM REPORT ON GROSS PHYSICAL AND BIOLOGICAL EFFECTS OF OVERBOARD SPOIL DISPOSAL.
W69-03682 05C

AQUATIC DRIFT
LUMBER OR BOATS FOUND ADRIFT.
W69-03474 06E

AQUATIC MICROBIOLOGY
RECOVERY OF BACTERIAL PATHOGENS FROM HIGH QUALITY SURFACE WATER,
W69-03311 05B

RECENT ADVANCES IN THE PHYSIOLOGY OF BLUE-GREEN ALGAE,
W69-03518 05C

AQUATIC PLANTS
INTERIM REPORT ON GROSS PHYSICAL AND BIOLOGICAL EFFECTS OF OVERBOARD SPOIL DISPOSAL.
W69-03682 05C

AQUATIC PRODUCTIVITY
A BIOLOGIST'S VIEWPOINT OF MAN-MADE CHANGES IN ESTUARIES,
W69-03607 06G

THE CONDITION OF THE CHESAPEAKE BAY,
W69-03637 06B

THE MOLLUSCAN SHELLFISH INDUSTRY, CURRENT STATUS AND TRENDS,
W69-03659 06B

GOVERNMENT, INDUSTRY AND SCIENCE STUDY POTENTIAL OF SEAWEEDS.
W69-03672 06B

AQUATIC WEED CONTROL
THE PERSISTENCE OF SILVEX IN WATER AND HYDROSOIL,
W69-03240 05A

AQUATIC WEEDS
DETECTION OF LIMITING OR SURPLUS NITROGEN IN ALGAE AND AQUATIC WEEDS,
W69-03364 05C

AQUIFER CHARACTERISTICS
SHORTCUTS AND SPECIAL PROBLEMS IN AQUIFER TESTS,
W69-03231 07B

AQUIFERS
FLOW OF GROUNDWATER IN RELATIVELY THICK LEAKY AQUIFERS,
W69-03220 02F

INVESTIGATION OF THE TECHNICAL FEASIBILITY OF STORING FRESH WATER IN SALINE AQUIFERS,
W69-03336 02F

CLASSIFICATION OF WATER-BEARING STRATA BASED ON CONDITIONS OF FLOW OF WATER INTO WELLS,
W69-03523 02F

OCCURENCE OF GROUND WATER IN THE JUDITH RIVER FORMATION, NORTH-CENTRAL MONTANA,
W69-03545 02F

AREA REDEVELOPMENT
WATERSHED, FLOOD PROTECTION, AND RECREATION DEVELOPMENT IN ATCHISON, KANSAS,
W69-03593 06B

ARID CLIMATES
GERMINATION STUDIES ON ARID ZONE TREE SEEDS,
W69-03489 02I

MEASURING MOISTURE NEAR SOIL SURFACE...MINOR DIFFERENCES DUE TO NEUTRON SOURCE TYPE,
W69-03498 02G

THE WATER OUTPUT OF THE DESERT VEGETATION IN THE DIFFERENT MICROHABITATS OF WADI HOFF,
W69-03501 02I

ACCURACY OF EVAPOTRANSPIRATION DETERMINATIONS BY THE BOWEN RATIO METHOD,
W69-03504 02D

ARID LANDS
WATER UTILIZATION IN GREENHOUSES ALTERNATIVES FOR AGRICULTURE IN ARID REGIONS,
W69-03486 03F

SOLVING THE ARID STATES' PROBLEMS,
W69-03493 06B

ARKANSAS
FIVE LAKES OUTING CLUB V HORSESHOE LAKE PROTECTIVE ASS'N (OWNERSHIP OF NON-NAVIGABLE LAKES).
W69-03433 06E

LEEK V BRASFIELD (WRONGFUL FAILURE TO PERMIT DAM REPAIRS).
W69-03435 04A

TRI-COUNTY DRAINAGE DISTRICT V MORRISON (RIGHT OF A COUNTY TO WITHDRAW FROM ORIGINAL DRAINAGE DISTRICT).
W69-03436 06E

ARREST
LICENSING FOREIGN CORP ENGAGED IN WRECKING OR SALVAGING - SUPERVISION OF TRANSPORTATION AND DUMPING OR DREDGED MATERIAL - ARREST WITHOUT WARRANT.
W69-03273 06E

ARRID LANDS
ECONOMIC VALUE OF IRRIGATION WATER,
W69-03582 06B

ARTESIAN WELLS
OCCURENCE OF GROUND WATER IN THE JUDITH RIVER FORMATION, NORTH-CENTRAL MONTANA,
W69-03545 02F

TEMPERATURE VARIATIONS OF DEEP FLOWING WELLS IN SOUTH DAKOTA,
W69-03567 02F

ARTIFICIAL DRAINAGE
A STUDY OF THE DRAINAGE OF IRRIGATED SAND DUNES USING AN ELECTRICAL RESISTANCE ANALOGUE,
W69-03526 04A

ARTIFICIAL RECHARGE
FATE OF DDT AND NITRATE IN GROUND WATER,
W69-03219 05B

ASSESSMENTS
CITY OF EAST ORANGE V TOWNSHIP OF LIVINGSTON (TAX ASSESSMENT OF WATER RESERVE LANDS).
W69-03442 06C

BACTERIA
THE EFFECT OF TURBULENCE ON BACTERIAL SUBSTRATE UTILIZATION,
W69-03343 05G

BAIT FISHING
SUMMARY OF THE 1963 AND 1964 SOUTHERN CALIFORNIA INSHORE BAIT FISHERY,
W69-03604 06D

BALANCE OF NATURE
'ASPECTS OF THE ESTUARINE ECOSYSTEM',
W69-03677 06G

BANK EROSION
STABILIZING ERODING STREAMBANKS IN SAND DRIFT AREAS OF THE LAKE STATES.
W69-03405 02J

DEMOSKI V STATE (CLAIMS AGAINST STATE ATTRIBUTED TO FLOOD PROTECTION PLAN).
W69-03430 04A

RATES OF SLOPE DEGRADATION AS DETERMINED FROM BOTANICAL EVIDENCE, WHITE MOUNTAINS, CALIFORNIA,
W69-03527 02I

BANK STABILIZATION
STABILIZING ERODING STREAMBANKS IN SAND DRIFT AREAS OF THE LAKE STATES.
W69-03405 02J

BASEFLOW
FACTORS AFFECTING THE RESPONSE OF SMALL WATERSHEDS TO PRECIPITATION IN HUMID AREAS,
W69-03388 02E

BAYS
THE CONDITION OF THE CHESAPEAKE BAY,
W69-03637 06B

EACH EROSION
BEACH FRONT REPAIR AND DREDGING OF STREAMS,
W69-03422 06E

EACHES
PROHIBITION OF REMOVAL OF GRAVEL, ETC, FROM BEACHES REMOVAL OF NATURAL BARRIERS FROM EROSION BY THE SEA PENALIZED.
W69-03269 04A

PUBLIC BEACHES - CONTROL, SUPERVISION, AND PRESERVATION.
W69-03275 06E

ED LOAD
EXPERIMENTAL INVESTIGATION AND COMPUTATION OF THE VOLUME OF MATERIAL DERIVED FROM DEEP RAVINES IN FORECASTING THE SILTING OF RESERVOIRS ON MOUNTAIN RIVERS,
W69-03216 02J

EDS
PEOPLE V JOHNSON (TRESPASS ON PRIVATELY OWNED UNDERWATER LAND).
W69-03277 06E

STEIN V BROWN PROPERTIES, INC (TITLE TO SUBMERGED LANDS).
W69-03283 06E

ENEFITS
CLOSING OF THE SEA ARMS.
W69-03630 04A

THE ENCLOSURE OF THE ZUIDERZEE AND THE RECLAMATION OF THE IJSSELMEER.
W69-03657 06B

IBLIOGRAPHIES
SELECTED BIBLIOGRAPHY ON HYDROLOGICAL CONTROL BY RESERVOIR OPERATION,
W69-03376 04A

TEXTILE WASTES - A BIBLIOGRAPHY,
W69-03597 05B

A DIRECTORY OF INFORMATION RESOURCES IN THE UNITED STATES WATER.
W69-03650 10

ENVIRONMENTAL FACTORS IN COASTAL AND ESTUARINE WATERS BIBLIOGRAPHIC SERIES - VOLUME II. COAST OF WASHINGTON,
W69-03651 02L

BENEFIT-COST ANALYSIS FOR WATER RESOURCE PROJECTS A SELECTED ANNOTATED BIBLIOGRAPHY.
W69-03691 06B

IOASSAY
DETECTION OF LIMITING OR SURPLUS NITROGEN IN ALGAE AND AQUATIC WEEDS,
W69-03364 05C

EXTRACTIVE AND ENZYMATIC ANALYSES FOR LIMITING OR SURPLUS PHOSPHORUS IN ALGAE,
W69-03373 05A

IOCHEMICAL OXYGEN DEMAND
THE EFFECT OF ALGAE ON BOD MEASUREMENTS,
W69-03362 05A

THE EFFECT OF DILUTION MEDIA ON THE BOD OF ALGAE,
W69-03371 05A

THE POTOMAC ESTUARY - STATISTICS AND PROJECTIONS,
W69-03603 05B

LUE-GREEN ALGAE
ENVIRONMENTAL REQUIREMENTS OF BLUE-GREEN ALGAE.
W69-03512 05C

OATING
THE BOATING BUSINESS (1966).
W69-03614 06C

BOATING FACILITIES.
W69-03615 06B

OATS
LUMBER OR BOATS FOUND ADRIFT.
W69-03474 06E

OAT-LAUNCHING RAMPS
BOATING FACILITIES.
W69-03615 06B

ODIES OF WATER
THROWING GAS TAR OR REFUSE INTO PUBLIC WATERS.
W69-03477 05B

OG LAKES
PHOSPHORUS RELEASE FROM BOG LAKE MUDS,
W69-03363 02K

OGS
REFINEMENT OF PARAMETERS FOR CALCULATING EVAPORATION FROM BOGS ON THE BASIS OF OBSERVATIONS AT BOG STATIONS,
W69-03211 02D

OSTON HARBOR
LICENSES TO BE REVOCABLE AND TO EXPIRE IN FIVE YEARS - BOSTON HARBOR LICENSES - FORM, HOW GRANTED AND CONSTRUED.
W69-03264 06E

OUNDARIES(PROPERTY)
STEIN V BROWN PROPERTIES, INC (TITLE TO SUBMERGED LANDS).
W69-03283 06E

RIGHT OF ACCESSION - IMMOVABLES.
W69-03448 04A

BOUNDARY DISPUTES
STATE V 6.0 ACRES OF LAND (RIPARIAN OWNERS' RIGHT TO ACCRETION LAND).
W69-03428 06E

BRIDGE CONSTRUCTION
PUBLIC UTILITIES - ARTICLE 9 - BRIDGES, VIADUCTS AND TUNNELS.
W69-03416 06E

MUNICIPAL AND PARISH BRIDGES.
W69-03445 04A

BRIDGES
MUNICIPAL AND PARISH BRIDGES.
W69-03445 04A

BRISTLECONE PINE TREES
RATES OF SLOPE DEGRADATION AS DETERMINED FROM BOTANICAL EVIDENCE, WHITE MOUNTAINS, CALIFORNIA,
W69-03527 02I

BROWSE UTILIZATION
PERIODIC MOWINGS SUPPRESS TAMARISK GROWTH, INCREASE FORAGE FOR BROWSING,
W69-03496 02I

BUDGETING
BENEFIT COST ANALYSIS A METHOD TO DEMONSTRATE THE IMPORTANCE OF WATER RESOURCES DEVELOPMENT,
W69-03574 06B

BULKHEADS
WATER FRONT IMPROVEMENTS.
W69-03413 06E

BURNING
SIRACO V VILLAGE OF WHITEHALL (NON-LIABILITY OF VILLAGE FOR FIRE DAMAGE RESULTING FROM VILLAGE'S FAULTY WATER SYSTEM).
W69-03478 06E

BYPASSES
DUNLAP LAKE PROPERTY OWNERS ASS'N, INC V CITY OF EDWARDSVILLE (ABATEMENT OF POLLUTION).
W69-03278 05B

CALCIUM
RELATIVE ABSORPTION OF STRONTIUM AND CALCIUM BY CERTAIN ALGAE,
W69-03491 05B

CALIBRATIONS
CALIBRATION AND MAINTENANCE OF VERTICAL-AXIS TYPE CURRENT METERS,
W69-03536 07B

CALIFORNIA
SEQUENTIAL STUDY OF DESERT FLOODING IN THE WHITE MOUNTAINS OF CALIFORNIA AND NEVADA,
W69-03222 02E

WOLFSEN V UNITED STATES (RIVER DIVERSION).
W69-03441 04A

SOLVING THE ARID STATES' PROBLEMS,
W69-03493 06B

DECEMBER 1964, A 400-YEAR FLOOD IN NORTHERN CALIFORNIA,
W69-03560 02E

SUMMARY OF THE 1963 AND 1964 SOUTHERN CALIFORNIA INSHORE BAIT FISHERY,
W69-03604 06D

'DISTRIBUTION OF POLLUTIONAL LOADINGS IN SUISUN BAY',
W69-03609 05B

'ESTUARINE OXYGEN RESOURCES--PHOTOSYNTHESIS AND REAERATION',
W69-03610 05G

'PREDICTING DIURNAL VARIATIONS IN DISSOLVED OXYGEN CAUSED BY ALGAE IN ESTUARINE WATERS, PART I',
W69-03611 05C

PROBLEMS OF MAINTAINING BAYS AND ESTUARIES--A PANEL, SAN FRANCISCO BAY,
W69-03616 04A

ENGINEERING AND ECONOMIC FEASIBILITY STUDY FOR A COMBINATION NUCLEAR POWER-DESALTING PLANT.
W69-03658 03A

CALIFORNIA SALMON LANDINGS, 1952 THROUGH 1965,
W69-03686 06C

CANADA
THE CONTINENTAL USE OF ARCTIC-FLOWING RIVERS,
W69-03313 04A

CANAL STRUCTURES
GRANTING REVOCABLE PERMITS.
W69-03466 06C

CANALS
SEEPAGE FROM A CANAL INTO SOIL WITH SHALLOW WATER DEPTH,

W69-03204 02F

BURAS ICE FACTORY, INC V DEPARTMENT OF HIGHWAYS (EASEMENTS TO CANALS).
W69-03286 04A

DISPOSITIONS OF STATE LAND.
W69-03440 04A

CAPILLARY WATER
ON THE MECHANISM OF SUSPENDED CAPILLARY WATER AND PERCHED GROUNDWATER,
W69-03208 02F

CAPITAL COSTS
SOME ECONOMIC ASPECTS OF ADVANCED WASTE TREATMENT,
W69-03644 05D

CAVERN GEOMETRY
AN ANALYSIS OF THE MEANDERING TENDENCY OF SERPENTINE CAVE, N.S.W.,
W69-03532 02F

CENTRAL VALLEY PROJECT
WOLFSEN V UNITED STATES (RIVER DIVERSION).
W69-03441 04A

CHANNEL IMPROVEMENT
FLOOD-FLOW CHARACTERISTICS OF A RECTIFIED CHANNEL, JACKSON, MISSISSIPPI,
W69-03566 02F

MARINE SHIPPING INDUSTRY - EFFECTS AND IMPACTS ON THE CHESAPEAKE BAY,
W69-03636 05G

CHANNEL IMPROVEMENTS
WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN ILLINOIS.
W69-03591 06B

CHANNEL MORPHOLOGY
SEDIMENT TRANSPORT OF STREAMS IN THE WASHITA RIVER BASIN IN CADDO AND GRADY COUNTIES, OKLAHOMA,
W69-03326 02J

CHANNELS
SEEPAGE FROM CHANNELS THROUGH LAYERED POROUS MEDIUMS,
W69-03554 02G

CHEMICAL PRECIPITATION
CHARACTERISTICS OF SUBSURFACE WATERS HAVING A TENDENCY TO PRECIPITATE IN THE FILTER ZONES OF WELLS,
W69-03210 02F

CHEMISTRY OF PRECIPITATION
NITROGEN CONTENT OF PRECIPITATION IN A COASTAL OREGON FOREST OPENING,
W69-03400 05B

NUTRIENT CYCLING BY THROUGHFALL AND STEMFLOW PRECIPITATION IN THREE COASTAL OREGON FOREST TYPES,
W69-03402 05B

THE OCCURRENCE OF TRITIUM IN PRECIPITATION AND ITS SIGNIFICANCE IN HYDROLOGICAL INVESTIGATIONS,
W69-03555 02K

CHLORELLA
THE EFFECT OF ALGAE ON BOD MEASUREMENTS,
W69-03362 05A

THE EFFECT OF DILUTION MEDIA ON THE BOD OF ALGAE,
W69-03371 05A

CHLORINATED HYDROCARBON PESTICIDES
INSECTICIDES IN TILE DRAINAGE EFFLUENT,
W69-03221 05A

CHOWAN COUNTY(NORTH CAROLINA)
GROUNDWATER RESOURCES OF CHOWAN COUNTY, NORTH CAROLINA,
W69-03355 02F

CHRONOLOGY
RECENT DELTAIC DEPOSITS OF THE MISSISSIPPI RIVER THEIR DEVELOPMENT AND CHRONOLOGY,
W69-03230 02J

CIRCULATION
VERTICAL CURRENT STRUCTURE IN THE GREAT LAKES II. CURRENT METER STUDIES OFF SHEBOYGAN, WISCONSIN, AUGUST 1967,
W69-03334 02H

VERTICAL CURRENT STRUCTURE IN THE GREAT LAKES 1. CHARACTERIZATION OF THE CIRCULATION DYNAMICS OF LAKE MICHIGAN,
W69-03347 02H

VERTICAL CURRENT STRUCTURE IN THE GREAT LAKES III. DETERMINATION OF EDDY VISCOSITY AND EDDY DIFFUSIVITY IN LAKE MICHIGAN,
W69-03348 02H

VERTICAL CURRENT STRUCTURE IN THE GREAT LAKES IV. NUMERICAL EVALUATION OF STERN'S CALCULATION MODEL,
W69-03349 02H

VERTICAL CURRENT STRUCTURE IN THE GREAT LAKES V. THERMAL CURRENT STRUCTURE IN LAKE MICHIGAN, ASSOCIATED WITH THE SPRING WARM-UP SEASON--A THEORETICAL STUDY,
W69-03350 02H

CIRCULATION(PLANTS)
EFFECT OF EXTERNAL SALT CONCENTRATIONS ON WATER RELATIONS IN PLANTS II. EFFECT OF THE OSMOTIC DIFFERENTIAL BETWEEN EXTERNAL MEDIUM AND XYLEM ON WATER RELATIONS IN THE ENTIRE PLANT,
W69-03487 02I

CITIES
COUNTIES, CITIES, AND TOWNS MAY APPROPRIATE MONEY FOR IMPROVEMENT OF WATERWAYS.
W69-03268 04A

MUNICIPALITIES GENERALLY (PERMIT FOR BUILDING IN BED OF MAPPED STREET OR DRAINAGE RIGHT OF WAY).
W69-03414 06E

MUNICIPALITIES GENERALLY - GENERAL POWERS.
W69-03415 06E

CONSTRUCTION AND DEVELOPMENT OF EXCESS DRAINAGE FACILITIES - CONTRACTS.
W69-03431 04A

REGULATION OF OPEN WELLS, CESSPOOLS, BASINS OR SUMPS.
W69-03432 04A

SHOWS V CITY OF HATTIESBURG (NEGLIGENT MAINTENANCE OF DRAINAGE DITCH).
W69-03438 04A

KENNEDY-CHAMBERLIN DEVELOPMENT CO V SNORE (MUNICIPAL DRAINAGE SYSTEMS).
W69-03479 04A

CLAMS
CONDITION OF THE QUAHOG, MERCENARIA MERCENARIA, FROM POLLUTED AND UNPOLLUTED WATERS,
W69-03635 05C

THE MOLLUSCAN SHELLFISH INDUSTRY, CURRENT STATUS AND TRENDS,
W69-03659 06B

CLOSED CONDUIT FLOW
A CRITICAL REVIEW OF METHODS OF MEASURING DISCHARGE WITHIN A SEWER PIPE,
W69-03510 07B

COAL MINE WASTES
FENWICK V BLUEBIRD COAL COMPANY (MINE WASTES).
W69-03425 05G

COASTAL ENGINEERING
PROBLEMS OF MAINTAINING BAYS AND ESTUARIES--A PANEL, SAN FRANCISCO BAY,
W69-03616 04A

CLOSING OF THE SEA ARMS.
W69-03630 04A

COASTAL STRUCTURES
THE DUTCH TURN THE TIDE.
W69-03652 04A

COLOR
EVALUATION OF ORGANIC COLOR AND IRON IN NATURAL SURFACE WATERS,
W69-03558 03E

COLORADO
WATER RESOURCES DATA FOR COLORADO, 1967--PART 2. WATER QUALITY RECORDS.
W69-03319 02E

HYDROGEOLOGIC DATA FOR BACA AND SOUTHERN PROWERS COUNTIES, COLORADO,
W69-03530 02F

COLORADO RIVER BASIN
IMPACT OF INSTITUTIONAL ARRANGEMENTS ON THE AVAILABLE ALTERNATIVE DEVELOPMENTAL PATHS FOR WATER ALLOCATION AND POLLUTION CONTROL IN THE COLORADO RIVER BASIN,
W69-03492 06A

COLUMBIA RIVER BASIN
'MIXING OF COLUMBIA RIVER AND OCEAN WATERS, SUMMER',
W69-03632 05C

COMMERCIAL FISH
NARRAGANSETT BAY A MARINE USE PROFILE,
W69-03606 06B

PRELIMINARY ASSESSMENT OF THE ENGLISH SOLE IN PORT GARDNER, WASHINGTON,
W69-03660 05C

COMMERCIAL FISHING
SUMMARY OF THE 1963 AND 1964 SOUTHERN CALIFORNIA INSHORE BAIT FISHERY,
W69-03604 06D

ESTUARIES A NEGLECTED RESOURCE COMPLEX,
W69-03620 06B

THE TEXAS BASINS PROJECT,
W69-03625 06B

CLOSING OF THE SEA ARMS.
W69-03630 04A

MARINE SHIPPING INDUSTRY - EFFECTS AND IMPACTS ON THE

CHESAPEAKE BAY,
W69-03636 05G

FISHING FLEET TRIES TO CAST OFF THE PAST.
W69-03664 06C

'STATEMENT',
W69-03671 02L

W69-03678 05C

COMMERCIAL SHELLFISH
NARRAGANSETT BAY A MARINE USE PROFILE,
W69-03606 06B

SOME CRITICAL PROBLEMS OF THE SHELLFISH INDUSTRY,
W69-03621 06E

THE MOLLUSCAN SHELLFISH INDUSTRY, CURRENT STATUS AND TRENDS,
W69-03659 06B

'STATEMENT',
W69-03671 02L

COMPENSATION
ADDITIONAL COMPENSATION WHEN TITLE TO LAND IS IN THE COMMONWEALTH - UNAUTHORIZED ERECTIONS IN TIDE WATER TO BE PUBLIC NUISANCES.
W69-03267 04A

COMPETING USES
NARRAGANSETT BAY A MARINE USE PROFILE,
W69-03606 06B

LIMITING FACTORS IN HARBOR DEVELOPMENT,
W69-03622 06F

TIDAL MARSH - CONFLICTS AND INTERACTIONS,
W69-03641 02L

COMPETITION
PAINTER V PENNSYLVANIA PUBLIC UTILITY COMMISSION (PREFERENCE GIVEN EXISTING WATER COMPANIES IN GRANTING EXTENSIONS).
W69-03452 06E

SOME CRITICAL PROBLEMS OF THE SHELLFISH INDUSTRY,
W69-03621 06E

FISHING FLEET TRIES TO CAST OFF THE PAST.
W69-03664 06C

COMPUTER
SIMULATION OF A WATER RESOURCES SYSTEM,
W69-03601 06A

COMPUTER MODELS
MAIN I, A SYSTEM OF COMPUTERIZED MODELS FOR CALCULATING AND EVALUATING MUNICIPAL WATER REQUIREMENTS VOLUME I-DEVELOPMENT OF THE MAIN SYSTEM VOLUME II-DESCRIPTION OF THE MAIN I SYSTEM AND LIBRARY OF WATER USAGE PARAMETERS.
W69-03201 06D

MAIN I, A SYSTEM OF COMPUTERIZED MODELS FOR CALCULATING AND EVALUATING MUNICIPAL WATER REQUIREMENTS.
W69-03202 06D

ANALYZING SUBSURFACE FLOW SYSTEMS WITH ELECTRIC ANALOGS,
W69-03310 02F

DIFFUSION AND SETTLING OF SEDIMENTS AT RIVER MOUTHS A COMPUTER SIMULATION MODEL,
W69-03542 02J

COMPUTER PROGRAMS
MAIN I, A SYSTEM OF COMPUTERIZED MODELS FOR CALCULATING AND EVALUATING MUNICIPAL WATER REQUIREMENTS VOLUME I-DEVELOPMENT OF THE MAIN SYSTEM VOLUME II-DESCRIPTION OF THE MAIN I SYSTEM AND LIBRARY OF WATER USAGE PARAMETERS.
W69-03201 06D

MAIN I, A SYSTEM OF COMPUTERIZED MODELS FOR CALCULATING AND EVALUATING MUNICIPAL WATER REQUIREMENTS.
W69-03202 06D

STREAMFLOW DATA PROCESSING OPPORTUNITIES AND APPLICATION,
W69-03389 07C

FINITE DIFFERENCING METHODS,
W69-03519 07C

A PROCEDURE FOR COMPUTATION OF THE TOTAL RIVER SAND DISCHARGE AND DETAILED DISTRIBUTION, BED TO SURFACE,
W69-03541 02J

STREAMFLOW ROUTING (WITH APPLICATIONS TO NORTH CAROLINA RIVERS),
W69-03564 02E

COMPUTERS
OPTIMAL CONTROL OF LINKED RESERVOIRS,
W69-03571 06A

CONDEMNATION
MCCORD V MISSOURI CROOKED RIVER BACKWATER LEVEE DISTRICT (MOTION TO ABATE CONDEMNATION PROCEEDINGS).
W69-03292 06E

CONDEMNATION PROCEEDINGS, RIGHTS OF WAY AND EFFECT ON RIPARIAN RIGHTS.
W69-03304 06E

CONDEMNATION VALUE
IN RE NEVERSINK RIPARIAN SECTION NO 1 SULLIVAN COUNTY (CONDEMNATION PROCEEDINGS TO ACQUIRE ADDITIONAL WATER SUPPLY).
W69-03276 06E

CONFERENCES
EUTROPHICATION,
W69-03357 05C

CONIFEROUS FORESTS
EFFECTS OF SPECIES AND ARRANGEMENT OF FORESTS ON EVAPOTRANSPIRATION,
W69-03386 02D

CONJUNCTIVE USE
OPTIMAL CONTROL OF LINKED RESERVOIRS,
W69-03571 06A

CONSERVATION
CONSERVATION AND DEVELOPMENT.
W69-03421 06E

DECLARATION OF POLICY.
W69-03456 04A

UNLAWFUL INTERFERENCE WITH IMPROVEMENT WORKS.
W69-03459 04A

WITHDRAWAL AND DIVERSION FROM PROTECTED AREAS.
W69-03462 04A

CONSERVATION AND WATER RESOURCES PLANS.
W69-03463 06B

EFFECT AND ENFORCEMENT OF CONSERVATION LAWS.
W69-03464 06E

HOW TO STOP THE PILLAGE OF AMERICA,
W69-03694 06E

CONSTRUCTION
EFFECTS OF CONSTRUCTION ON FLUVIAL SEDIMENT, URBAN AND SUBURBAN AREAS OF MARYLAND,
W69-03227 02J

COUNTIES, CITIES, AND TOWNS MAY APPROPRIATE MONEY FOR IMPROVEMENT OF WATERWAYS.
W69-03268 04A

REGULATION OF OPEN WELLS, CESSPOOLS, BASINS OR SUMPS.
W69-03432 04A

UNLAWFUL INTERFERENCE WITH IMPROVEMENT WORKS.
W69-03459 04A

CENTRAL NEW YORK BROADCASTING CORP V STATE (STATE NOT LIABLE FOR DAMAGES FLOWING FROM FEDERALLY-CONTROLLED FLOOD CONTROL PROJECT).
W69-03473 04A

CONSTRUCTION COSTS
REGIONAL CONSTRUCTION REQUIREMENTS FOR WATER AND WASTEWATER FACILITIES 1955-1967-1980,
W69-03698 05D

CONSUMPTIVE USE
DETERMINING EVAPO TRANSPIRATION BY THE GRAVIMETRIC METHOD FOR THE WHEAT CROP IN THE IRRIGATION DISTRICT OF RIO YAQUI, SONORA, MEXICO.
W69-03497 02D

CONTAMINANT MOVEMENT
FATE OF DDT AND NITRATE IN GROUND WATER,
W69-03219 05B

CONTINENTAL SHELF
HABEAS MARINUS DUE PROCESS OF INNERSPACE - A PROPOSAL,
W69-03588 06E

CONTROL
GENERAL PROCEDURE FOR GAGING STREAMS,
W69-03346 07B

COOLING TOWERS
STATEMENT BEFORE THE SUBCOMMITTEE ON AIR AND WATER POLLUTION,
W69-03619 05B

COPPER
COPPER IN LAKE MUDS FROM LAKES OF THE MADISON AREA,
W69-03366 05A

COST ALLOCATION
DRAINAGE OF HIGHWAY.
W69-03288 04A

DISTRIBUTION OF COSTS OF MULTIPLE-PURPOSE HYDRAULIC PROJECTS,
W69-03577 06C

COST COMPARISONS
THE LAKE TAHOE WATER RECLAMATION PLANT,
W69-03640 05D

COST SHARING
SAN FRANCISCO BAY PLAN.
W69-03592 06B

COSTS
CLOSING OF THE SEA ARMS.

COS-DAT
W69-03630 04A

INDUSTRY OUTLOOK/DIRECTION 1968,
W69-03687 06D

WHAT ARE WE LEARNING FROM ECONOMIC STUDIES OF WATER QUALITY,
W69-03697 06B

COST-BENEFIT ANALYSIS
BENEFIT COST ANALYSIS A METHOD TO DEMONSTRATE THE IMPORTANCE OF WATER RESOURCES DEVELOPMENT,
W69-03574 06B

DELAWARE ESTUARY COMPREHENSIVE STUDY--PRELIMINARY REPORT AND FINDINGS.
W69-03645 05G

ECONOMIC ASPECTS OF THE DELAWARE RIVER ESTUARY PROGRAM,
W69-03674 06B

BENEFIT-COST ANALYSIS FOR WATER RESOURCE PROJECTS A SELECTED ANNOTATED BIBLIOGRAPHY.
W69-03691 06B

COST-BENEFIT RATIO
ECONOMIC CONSIDERATIONS OF WATER POLLUTION CONTROL,
W69-03613 05G

CROP PRODUCTION
EFFECT OF ORGANIC MATTER CONTENT OF THE SOIL ON INFILTRATION,
W69-03484 02G

CRYSTALLINE ROCKS
DEUTERIUM CONTENT IN NATURAL WATERS,
W69-03229 02K

CULTURES
PROBLEMS IN THE LABORATORY CULTURE OF PLANKTONIC BLUE-GREEN ALGAE,
W69-03514 05C

CULVERTS
MEASUREMENT OF PEAK DISCHARGE AT CULVERTS BY INDIRECT METHODS,
W69-03345 07B

CURRENT METERS
CALIBRATION AND MAINTENANCE OF VERTICAL-AXIS TYPE CURRENT METERS,
W69-03536 07B

CURRENTS(WATER)
VERTICAL CURRENT STRUCTURE IN THE GREAT LAKES II. CURRENT METER STUDIES OFF SHEBOYGAN, WISCONSIN, AUGUST 1967,
W69-03334 02H

VERTICAL CURRENT STRUCTURE IN THE GREAT LAKES 1. CHARACTERIZATION OF THE CIRCULATION DYNAMICS OF LAKE MICHIGAN,
W69-03347 02H

VERTICAL CURRENT STRUCTURE IN THE GREAT LAKES III. DETERMINATION OF EDDY VISCOSITY AND EDDY DIFFUSIVITY IN LAKE MICHIGAN,
W69-03348 02H

VERTICAL CURRENT STRUCTURE IN THE GREAT LAKES IV. NUMERICAL EVALUATION OF STERN'S CALCULATION MODEL,
W69-03349 02H

VERTICAL CURRENT STRUCTURE IN THE GREAT LAKES V. THERMAL CURRENT STRUCTURE IN LAKE MICHIGAN, ASSOCIATED WITH THE SPRING WARM-UP SEASON--A THEORETICAL STUDY,
W69-03350 02H

CUTTING MANAGEMENT
PERIODIC MOWINGS SUPPRESS TAMARISK GROWTH, INCREASE FORAGE FOR BROWSING,
W69-03496 02I

CYANOPHYTA
ACETYLENE REDUCTION BY NITROGEN-FIXING BLUE-GREEN ALGAE,
W69-03368 02K

IN SITU STUDIES ON (NITROGEN) FIXATION USING THE ACETYLENE REDUCTION TECHNIQUE,
W69-03372 02K

ENVIRONMENTAL REQUIREMENTS OF BLUE-GREEN ALGAE.
W69-03512 05C

WHY STUDY BLUE-GREEN ALGAE,
W69-03513 05C

PROBLEMS IN THE LABORATORY CULTURE OF PLANKTONIC BLUE-GREEN ALGAE,
W69-03514 05C

ASPECTS OF THE NITROGEN NUTRITION OF SOME NATURALLY OCCURRING POPULATIONS OF BLUE-GREEN ALGAE,
W69-03515 05C

ENVIRONMENTAL REQUIREMENTS OF THERMOPHILIC BLUE-GREEN ALGAE,
W69-03516 05C

GROWTH REQUIREMENTS OF BLUE-GREEN ALGAE AS DEDUCED FROM THEIR NATURAL DISTRIBUTION,
W69-03517 05C

RECENT ADVANCES IN THE PHYSIOLOGY OF BLUE-GREEN ALGAE,
W69-03518 05C

CYCLES
CYCLIC SEDIMENTATION,
W69-03353 02J

CYCLIC SEDIMENTATION
CYCLIC SEDIMENTATION,
W69-03353 02J

CYCLING NUTRIENTS
STUDIES OF THE ANALYSIS OF PHOSPHATES IN ALGAL CULTURES,
W69-03358 05A

PHOSPHORUS RELEASE FROM BOG LAKE MUDS,
W69-03363 02K

PHOSPHATE EQUILIBRIUM BETWEEN REDUCED SEDIMENTS AND WATER,
W69-03365 02K

STREAM POLLUTION BY ALGAL NUTRIENTS,
W69-03369 05C

EFFECT OF WATER SAMPLE PRESERVATION METHODS ON THE RELEASE OF PHOSPHORUS FROM ALGAE,
W69-03370 05B

NUTRIENT CYCLING BY THROUGHFALL AND STEMFLOW PRECIPITATION IN THREE COASTAL OREGON FOREST TYPES,
W69-03402 05B

DAM FAILURE
LEEK V BRASFIELD (WRONGFUL FAILURE TO PERMIT DAM REPAIRS).
W69-03435 04A

DAMAGES
SURVEYS AND IMPROVEMENTS OF HARBORS - ESTABLISHMENT OF HARBOR LINES - GREAT PONDS DEFINED.
W69-03270 06E

DISCHARGE OF OIL ON SURFACE WATERS - DOUBLE TORT LIABILITY FOR DAMAGES.
W69-03274 05B

TOWN OF MIAMI SPRINGS V LAWRENCE (DAMAGES FROM FLOODING).
W69-03284 04A

HURRICANE DAMAGE TO STRUCTURES,
W69-03634 08A

DAMS
THE DUTCH TURN THE TIDE.
W69-03652 04A

POTENTIAL FRESHWATER RESERVOIR IN THE NEW YORK AREA,
W69-03700 04A

DARCYS LAW
DETERMINATION OF THE HYDRAULIC CONDUCTIVITY OF UNSATURATED SOILS FROM AN ANALYSIS OF TRANSIENT FLOW DATA,
W69-03337 02G

DATA COLLECTIONS
MAGNITUDE AND FREQUENCY OF FLOODS IN THE UNITED STATES,
W69-03225 02E

CLIMATE AND SOIL MOISTURE EXTRACTION,
W69-03250 02G

WATER RESOURCES DATA FOR KENTUCKY, 1967--PART 1 SURFACE WATER RECORDS.
W69-03318 02E

WATER RESOURCES DATA FOR COLORADO, 1967--PART 2. WATER QUALITY RECORDS.
W69-03319 02E

WATER RESOURCES DATA FOR NEW YORK, 1967--PART 1. SURFACE WATER RECORDS.
W69-03320 02E

WATER RESOURCES DATA FOR MASSACHUSETTS, NEW HAMPSHIRE, RHODE ISLAND, VERMONT, 1967--PART 1. SURFACE WATER RECORDS, PART 2. WATER QUALITY RECORDS.
W69-03321 02E

GROUND WATER IN ONTARIO SOUTHWESTERN AREA, 1960-1963.
W69-03354 02F

INTERAGENCY WATER RESOURCES RESEARCH AND DATA COLLECTION PROGRAM.
W69-03360 09D

STREAMFLOW AND PRECIPITATION DATA INDEX,
W69-03380 04A

A FIRST-ORDER MARKOV MODEL FOR ASSESSING RAINFALL DISCONTINUITY IN CENTRAL AUSTRALIA,
W69-03494 02B

NORTHWOOD GAGING INSTALLATION, BALTIMORE-INSTRUMENTATION AND DATA,
W69-03507 02E

OAKDALE GAGING INSTALLATION, CHICAGO-INSTRUMENTATION AND DATA,
W69-03508 02E

HYDROGEOLOGIC DATA FOR BACA AND SOUTHERN PROWERS COUNTIES, COLORADO,
W69-03530 02F

URBAN HYDROLOGY OF THE HOUSTON, TEXAS METROPOLITAN AREA-COMPILATION OF BASIC DATA-1966,
W69-03538 04C

CURRENT TRENDS IN THE USE OF RADIOACTIVE TRACERS IN HYDROLOGIC INVESTIGATIONS,
W69-03544 07B

ANNUAL REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY, ON CIVIL WORKS ACTIVITIES.
W69-03608 06B

GULF OF MEXICO IS STILL BOOMING.
W69-03673 06B

TA PROCESSING
STREAMFLOW DATA PROCESSING OPPORTUNITIES AND APPLICATION,
W69-03389 07C

RESPONSE CHARACTERISTICS OF URBAN WATER RESOURCE DATA SYSTEMS,
W69-03509 07A

CIDUOUS FORESTS
EFFECTS OF SPECIES AND ARRANGEMENT OF FORESTS ON EVAPOTRANSPIRATION,
W69-03386 02D

CISION MAKING
DIVISION OF NAVIGATION
W69-03420 06E

EP WELLS
METHODS OF MEASURING WATER LEVELS IN DEEP WELLS,
W69-03535 07B

LAWARE
TIDAL MARSH - CONFLICTS AND INTERACTIONS,
W69-03641 02L

LAWARE RIVER
DELAWARE ESTUARY COMPREHENSIVE STUDY--PRELIMINARY REPORT AND FINDINGS.
W69-03645 05G

ECONOMIC ASPECTS OF THE DELAWARE RIVER ESTUARY PROGRAM,
W69-03674 06B

TESTIMONY - PHILADELPHIA CONSERVATIONISTS, INC.,
W69-03684 05B

LAWARE RIVER BASIN COMMISSION
WATER SUPPLY (STORAGE AND RELEASE OF WATERS).
W69-03301 04A

FLOOD PROTECTION.
W69-03302 04A

POLLUTION CONTROL.
W69-03460 05G

WATER QUALITY MANAGEMENT IN THE DELAWARE RIVER BASIN,
W69-03583 06B

ECONOMIC ASPECTS OF THE DELAWARE RIVER ESTUARY PROGRAM,
W69-03674 06B

LTAS
RECENT DELTAIC DEPOSITS OF THE MISSISSIPPI RIVER THEIR DEVELOPMENT AND CHRONOLOGY,
W69-03230 02J

DIFFUSION AND SETTLING OF SEDIMENTS AT RIVER MOUTHS A COMPUTER SIMULATION MODEL,
W69-03542 02J

MAND
INDUSTRY OUTLOOK/DIRECTION 1968,
W69-03687 06D

MONSTRATION WATERSHEDS
TEST OF A TRANSPIRATION INHIBITOR OF A FORESTED WATERSHED,
W69-03396 02D

NDROCHRONOLOGY
RATES OF SLOPE DEGRADATION AS DETERMINED FROM BOTANICAL EVIDENCE, WHITE MOUNTAINS, CALIFORNIA,
W69-03527 02I

SALINATION
DESALINATION AND ITS ROLE IN WATER SUPPLY.
W69-03351 03A

THE LAKE TAHOE WATER RECLAMATION PLANT,
W69-03640 05D

ENGINEERING AND ECONOMIC FEASIBILITY STUDY FOR A COMBINATION NUCLEAR POWER-DESALTING PLANT.
W69-03658 03A

SERT PLANTS
THE WATER OUTPUT OF THE DESERT VEGETATION IN THE DIFFERENT MICROHABITATS OF WADI HOFF,
W69-03501 02I

SERTS
HYDROGEOLOGY OF DESERT BASINS,
W69-03238 02F

UTERIUM
DEUTERIUM CONTENT IN NATURAL WATERS,
W69-03229 02K

ROLE OF STABLE HYDROGEN ISOTOPES IN THE STUDY OF GEOLOGICAL PROCESSES,
W69-03244 02F

DIFFUSION
THE DIFFUSION OF AIR THROUGH THE PORE WATER OF SOILS,
W69-03205 02A

CONVECTIVE SALT DIFFUSION IN A RADIAL SUBSURFACE STREAM IN RELATION TO THE PROTECTION OF SUBSURFACE WATERS FROM CONTAMINATED DISCHARGES,
W69-03212 05B

NUMERICAL SOLUTIONS FOR DISPERSION IN POROUS MEDIUMS,
W69-03237 05B

DISPERSION AT THE INTERFACE OF MISCIBLE LIQUIDS IN A SOIL,
W69-03548 02F

'ESTUARINE OXYGEN RESOURCES--PHOTOSYNTHESIS AND REAERATION',
W69-03610 05G

DIGITAL COMPUTERS
STEADY UNSATURATED VERTICAL FLOW THROUGH MULTILAYERED SOIL,
W69-03209 02G

THEORETICAL ANALYSIS OF REGIONAL GROUNDWATER FLOW. 2. EFFECT OF WATER-TABLE CONFIGURATION AND SUBSURFACE PERMEABILITY VARIATION,
W69-03243 02F

OPTIMIZATION TECHNIQUES FOR HYDROLOGIC ENGINEERING,
W69-03329 06A

FINITE DIFFERENCING METHODS,
W69-03519 07C

A PROCEDURE FOR COMPUTATION OF THE TOTAL RIVER SAND DISCHARGE AND DETAILED DISTRIBUTION, BED TO SURFACE,
W69-03541 02J

STREAMFLOW ROUTING (WITH APPLICATIONS TO NORTH CAROLINA RIVERS),
W69-03564 02E

DIKES
THE DUTCH TURN THE TIDE.
W69-03652 04A

DIMENSIONAL ANALYSIS
INVESTIGATION OF WATER ABSORPTION BY THE SOIL ON THE BASIS OF THE DIMENSIONAL THEORY,
W69-03215 02G

A REVIEW OF RAINFALL-RUNOFF, PHYSICAL MODELS AS DEVELOPED BY DIMENSIONAL ANALYSIS AND OTHER METHODS,
W69-03309 02A

DIRECT BENEFITS
A BIOLOGIST'S VIEWPOINT OF MAN-MADE CHANGES IN ESTUARIES,
W69-03607 06G

DISASTERS
'U. S. COAST GUARD REPORT OF WAKE ISLAND OIL SPILL',
W69-03685 05C

'ENVIRONMENTAL REACTION TO WATER POLLUTION',
W69-03693 05C

DISCHARGE COEFFICIENTS
FLOOD-FLOW CHARACTERISTICS OF A RECTIFIED CHANNEL, JACKSON, MISSISSIPPI,
W69-03566 02F

DISCHARGE MEASUREMENT
MEASUREMENT OF PEAK DISCHARGE AT CULVERTS BY INDIRECT METHODS,
W69-03345 07B

'ANALYZING STEAM ELECTRIC POWER PLANT DISCHARGES',
W69-03655 05B

DISCHARGE(WATER)
USE OF THERMAL MODEL TO INVESTIGATE THE THEORY OF TRANSIENT FLOW TO A PARTIALLY PENETRATING WELL,
W69-03254 02F

WATER SUPPLY.
W69-03461 04A

SLOPE-DISCHARGE RELATIONS FOR EIGHT RIVERS IN THE UNITED STATES,
W69-03521 02E

DISCHARGING WELLS
SHORTCUTS AND SPECIAL PROBLEMS IN AQUIFER TESTS,
W69-03231 07B

DISEASES
'STATEMENT',
W69-03678 05C

DISPERSION
NUMERICAL SOLUTIONS FOR DISPERSION IN POROUS MEDIUMS,
W69-03237 05B

DISPERSION AT THE INTERFACE OF MISCIBLE LIQUIDS IN A SOIL,
W69-03548 02F

THE INVESTIGATION OF WATER FLOW THROUGH POROUS MEDIUMS BY MEANS OF RADIOTRACERS,
W69-03551 02F

'DISTRIBUTION OF POLLUTIONAL LOADINGS IN SUISUN BAY',
W69-03609 05B

'NUMERICAL SOLUTION OF THE UNSTEADY, ESTUARY DISPERSION EQUATION',
W69-03675 02L

DISSOLVED OXYGEN
THE POTOMAC ESTUARY - STATISTICS AND PROJECTIONS,
W69-03603 05B

'PREDICTING DIURNAL VARIATIONS IN DISSOLVED OXYGEN CAUSED BY ALGAE IN ESTUARINE WATERS, PART I',
W69-03611 05C

'PLANNING A WATER QUALITY MANAGEMENT SYSTEM THE CASE OF THE POTOMAC ESTUARY',
W69-03643 05G

'FINITE-DIFFERENCE MODELLING OF RIVER AND ESTUARY POLLUTION',
W69-03690 05A

DISTRIBUTION PATTERNS
RELATIONS BETWEEN TOPOGRAPHY AND ANNUAL PRECIPITATION IN WESTERN OREGON AND WASHINGTON,
W69-03340 02B

DITCHES
RICE V STODDARD (DIRECTING RUNOFF TO DRAINAGE DITCH).
W69-03280 04A

SHOWS V CITY OF HATTIESBURG (NEGLIGENT MAINTENANCE OF DRAINAGE DITCH).
W69-03438 04A

DIURNAL DISTRIBUTION
'PREDICTING DIURNAL VARIATIONS IN DISSOLVED OXYGEN CAUSED BY ALGAE IN ESTUARINE WATERS, PART I',
W69-03611 05C

DIVERSION
IN RE NEVERSINK RIPARIAN SECTION NO 1 SULLIVAN COUNTY (CONDEMNATION PROCEEDINGS TO ACQUIRE ADDITIONAL WATER SUPPLY).
W69-03276 06E

MOULTON V BUNTING MCWILLIAMS POST NO 658 (DIVERSION OF NON-NAVIGABLE STREAM).
W69-03443 04A

WITHDRAWAL AND DIVERSION FROM PROTECTED AREAS.
W69-03462 04A

DIVERSION LOSS RETURN
WOLFSEN V UNITED STATES (RIVER DIVERSION).
W69-03441 04A

DOGWOOD
EFFECT OF LEAF AGING ON WATER DEFICIT-WATER POTENTIAL RELATIONSHIPS OF DOGWOOD LEAVES GROWING IN TWO ENVIRONMENTS,
W69-03393 02I

DRAINAGE
RICE V STODDARD (DIRECTING RUNOFF TO DRAINAGE DITCH).
W69-03280 04A

DRAINAGE OF HIGHWAY.
W69-03288 04A

MUNICIPALITIES GENERALLY (PERMIT FOR BUILDING IN BED OF MAPPED STREET OR DRAINAGE RIGHT OF WAY).
W69-03414 06E

THE EFFECTS OF ENTRAPPED AIR AND BAROMETRIC FLUCTUATIONS ON THE DRAINAGE OF POROUS MEDIUMS,
W69-03552 02G

DRAINAGE DISTRICT
GENERAL DRAINAGE.
W69-03453 04A

W69-03454 04A

DRAINAGE DISTRICTS
CONSTRUCTION AND DEVELOPMENT OF EXCESS DRAINAGE FACILITIES - CONTRACTS.
W69-03431 04A

TRI-COUNTY DRAINAGE DISTRICT V MORRISON (RIGHT OF A COUNTY TO WITHDRAW FROM ORIGINAL DRAINAGE DISTRICT).
W69-03436 06E

DRAINAGE ENGINEERING
URBAN WATER RESOURCES RESEARCH SYSTEMATIC STUDY AND DEVELOPMENT OF LONG-RANGE PLANS, FIRST YEAR REPORT, SEPTEMBER, 1968.
W69-03506 06B

DRAINAGE PATTERNS(GEOLOGIC)
A COMMENT ON HORTON'S LAW OF STREAM NUMBERS,
W69-03338 02E

DRAINAGE PROGRAMS
HUDSON V VILLAGE OF HOMER (RIGHT TO REMOVE DAM).
W69-03427 04A

DRAINAGE SYSTEM
JERUZAL V HERRICK (STATUTORY AUTHORITY OF DRAIN COMMISSIONER).
W69-03426 04A

DRAINAGE SYSTEMS
INSECTICIDES IN TILE DRAINAGE EFFLUENT,
W69-03221 05A

KENNEDY-CHAMBERLIN DEVELOPMENT CO V SNUBE (MUNICIPAL DRAINAGE SYSTEMS).
W69-03479 04A

DRAWDOWN
ANALYSIS OF SOME PUMPING TEST RESULTS,
W69-03206 02F

SHORTCUTS AND SPECIAL PROBLEMS IN AQUIFER TESTS,
W69-03231 07B

DREDGING
LICENSING FOREIGN CORP ENGAGED IN WRECKING OR SALVAGING - SUPERVISION OF TRANSPORTATION AND DUMPING OR DREDGED MATERIAL - ARREST WITHOUT WARRANT.
W69-03273 06E

LICENSE FOR TAKING OYSTERS OR CLAMS.
W69-03424 06E

FEDERAL COURT DECISION JEOPARDIZES CURRENT EFFORTS TO SAFEGUARD NATION'S ESTUARIES.
W69-03663 02L

ACTION ON ILLEGAL DREDGING AND FILLING IN THE AREA OF HEMPSTEAD, N.Y.
W69-03665 04A

THE OYSTER AND THE DREDGE OR 'BEAUTY AND THE BEAST',
W69-03680 06G

INTERIM REPORT ON GROSS PHYSICAL AND BIOLOGICAL EFFECTS OF OVERBOARD SPOIL DISPOSAL.
W69-03682 05C

TESTIMONY - PHILADELPHIA CONSERVATIONISTS, INC.,
W69-03684 05B

DROUGHT RESISTANCE
DROUGHT-ASSOCIATED MORTALITY OF RANGE GRASSES IN SOUTH TEXAS,
W69-03495 02I

DRY SEASONS
FREQUENCY OF WET AND DRY SPELLS AT FIVE STATIONS IN RAJASTHAN,
W69-03490 02B

DUNES
A STUDY OF THE DRAINAGE OF IRRIGATED SAND DUNES USING AN ELECTRICAL RESISTANCE ANALOGUE,
W69-03526 04A

MOVEMENT OF MOISTURE IN THE UNSATURATED ZONE IN A DUNE AREA, SOUTHWESTERN KANSAS,
W69-03556 02G

DUPUIT-FORCHHEIMER THEORY
EXPLANATION OF PARADOXES IN DUPUIT-FORCHHEIMER SEEPAGE THEORY,
W69-03242 02F

ON THE MEANING OF THE DUPUIT AND PAVLOVSKII APPROXIMATIONS IN AQUIFER FLOW,
W69-03252 02F

DYE RELEASES
AN EMPIRICAL FORMULA FOR DETERMINING THE AMOUNT OF DYE NEEDED FOR TIME-OF-TRAVEL MEASUREMENTS,
W69-03565 07C

'DISTRIBUTION OF POLLUTIONAL LOADINGS IN SUISUN BAY',
W69-03609 05B

DYER(ILLINOIS)
FLOODS IN DYER QUADRANGLE, NORTHEASTERN ILLINOIS,
W69-03327 02E

DYNAMIC PROGRAMMING
OPTIMIZATION OF BRANCHING MULTISTAGE SYSTEMS A REPLY TO A COMMENT BY D P LOUCKS,
W69-03580 06A

EASEMENTS
PUBLIC ACCESS TO GREAT PONDS.
W69-03265 04A

BURAS ICE FACTORY, INC V DEPARTMENT OF HIGHWAYS (EASEMENTS TO CANALS).
W69-03286 04A

BERBERIAN V DOWD (ACCESS RIGHTS AND EASEMENTS ACROSS PRIVATE PROPERTY TO OCEAN).
W69-03480 06E

ECOLOGY
A BIOLOGIST'S VIEWPOINT OF MAN-MADE CHANGES IN ESTUARIES,
W69-03607 06G

TIDAL MARSH - CONFLICTS AND INTERACTIONS,
W69-03641 02L

HE OYSTER AND THE DREDGE OR 'BEAUTY AND THE BEAST',
69-03680 06G

STATEMENT',
69-03696 02L

NOMIC EFFICIENCY
CONOMICS OF WATER POLLUTION CONTROL,
69-03623 05G

NOMIC FEASIBILITY
ESPONSE CHARACTERISTICS OF URBAN WATER RESOURCE DATA
YSTEMS,
69-03509 07A

NGINEERING AND ECONOMIC FEASIBILITY STUDY FOR A COMBINATION
UCLEAR POWER-DESALTING PLANT.
69-03658 03A

NOMIC IMPACT
CONOMICS OF OUTDOOR RECREATION,
69-03628 06B

HE ECONOMIC IMPACT OF UNITED STATES OCEAN PORTS.
69-03654 06G

HE MOLLUSCAN SHELLFISH INDUSTRY, CURRENT STATUS AND TRENDS,
69-03659 06B

STUARIES IRREPLACEABLE ENVIRONMENTS.
69-03662 06B

STATEMENT',
69-03671 02L

NOMIC JUSTIFICATION
STATEMENT', IN CLEAN WATER FOR THE NATION'S ESTUARIES,
69-03605 05B

CONOMIC CONSIDERATIONS OF WATER POLLUTION CONTROL,
69-03613 05G

NOMIC PREDICTION
HE ECONOMICS OF RECREATION,
69-03692 06D

NOMIC PREDICTIONS
NAMIC MODEL OF THE ECONOMY OF THE SUSQUEHANNA RIVER BASIN,
69-03570 06B

SYSTEMS
ASPECTS OF THE ESTUARINE ECOSYSTEM',
69-03677 06G

ICIENCIES
ME CRITICAL PROBLEMS OF THE SHELLFISH INDUSTRY,
69-03621 06E

CTRIC POWER INDUSTRY
ATER POWER COMPANIES ALONG TRIBUTARIES TO BARNEGAT BAY.
69-03417 06E

CTRIC POWER PRODUCTION
NGINEERING AND ECONOMIC FEASIBILITY STUDY FOR A COMBINATION
UCLEAR POWER-DESALTING PLANT.
69-03658 03A

CTRICAL RESISTANCE
STUDY OF THE DRAINAGE OF IRRIGATED SAND DUNES USING AN
LECTRICAL RESISTANCE ANALOGUE,
69-03526 04A

CTROMAGNETIC WAVES
EFLECTIVITY OF ELECTROMAGNETIC WAVES AT AN AIR-WATER
NTERFACE FOR PURE AND SEA WATER,
69-03598 01A

NENT DOMAIN
OWER OF THE DEPARTMENT OF PUBLIC WORKS TO TAKE AND HOLD
EAL ESTATE AND BUILD THEREON.
69-03260 06E

MINENT DOMAIN -- RIGHT OF BY WHOM RIGHT MAY BE EXERCISED.
69-03289 06E

TEARNS V STATE (DIVERSION OF SEWAGE EFFLUENT INTO CLEAN
IVER BY ORDER OF ADMINISTRATIVE AGENCY).
69-03296 05B

LOYMENT
HE ECONOMIC IMPACT OF UNITED STATES OCEAN PORTS.
69-03654 06G

ROACHMENT
DDITIONAL COMPENSATION WHEN TITLE TO LAND IS IN THE
OMMONWEALTH - UNAUTHORIZED ERECTIONS IN TIDE WATER TO BE
UBLIC NUISANCES.
69-03267 04A

ERIC BACTERIA
STATEMENT',
69-03678 05C

IRONMENTAL EFFECTS
HE HEAT RESISTANCE OF PLANTS, ITS DETERMINATION AND
ARIABILITY,
69-03485 02I

ROUGHT-ASSOCIATED MORTALITY OF RANGE GRASSES IN SOUTH
EXAS,
W69-03495 02I

A BIOLOGIST'S VIEWPOINT OF MAN-MADE CHANGES IN ESTUARIES,
W69-03607 06G

THE PROBLEM OF PESTICIDES IN ESTUARIES,
W69-03618 05G

FISH AND MAN, CONFLICT IN ATLANTIC ESTUARIES,
W69-03627 05G

CONDITION OF THE QUAHOG, MERCENARIA MERCENARIA, FROM
POLLUTED AND UNPOLLUTED WATERS,
W69-03635 05C

STATEMENT BEFORE THE SUBCOMMITTEE ON AIR AND WATER
POLLUTION,
W69-03670 05C

'ENVIRONMENTAL REACTION TO WATER POLLUTION',
W69-03693 05C

ENZYMES
EXTRACTIVE AND ENZYMATIC ANALYSES FOR LIMITING OR SURPLUS
PHOSPHORUS IN ALGAE,
W69-03373 05A

EQUATIONS
'ANALYZING STEAM ELECTRIC POWER PLANT DISCHARGES',
W69-03655 05B

EQUIPMENT
EQUIPMENT FOR A DIRTY JOB.
W69-03661 05B

EROSION
ERODIBILITY INDICES FOR WILDLAND SOILS OF OAHU, HAWAII, AS
RELATED TO SOIL FORMING FACTORS,
W69-03316 02J

PALEOECOLOGICAL STUDIES OF POTATO LAKE AND ITS ENVIRONS,
W69-03361 02J

CENTRAL NEW YORK BROADCASTING CORP V STATE (STATE NOT LIABLE
FOR DAMAGES FLOWING FROM FEDERALLY-CONTROLLED FLOOD CONTROL
PROJECT).
W69-03473 04A

CHESAPEAKE BAY STUDY TASK GROUP ON FLOOD CONTROL,
NAVIGATION, EROSION, FISHERIES--MINUTES OF THE FIRST
MEETING.
W69-03626 06B

EROSION CONTROL
BEACH FRONT REPAIR AND DREDGING OF STREAMS,
W69-03422 06E

ESSENTIAL NUTRIENTS
DETECTION OF LIMITING OR SURPLUS NITROGEN IN ALGAE AND
AQUATIC WEEDS,
W69-03364 05C

ESTIMATING
MONTHLY SURFACE-WATER INFLOW TO CHESAPEAKE BAY,
W69-03325 02E

ESTUARIES
SEDIMENTATION IN A MEANDERING ESTUARY,
W69-03228 02J

HYDROLOGIC DATA COLLECTION IN TIDAL ESTUARIES,
W69-03239 02L

MONTHLY SURFACE-WATER INFLOW TO CHESAPEAKE BAY,
W69-03325 02E

THE DISTRIBUTION OF EXCESS TEMPERATURE FROM A HEATED
DISCHARGE IN AN ESTUARY,
W69-03341 02L

ESTUARINE ENVIRONMENT
THE PROBLEM OF PESTICIDES IN ESTUARIES,
W69-03618 05G

FISH AND MAN, CONFLICT IN ATLANTIC ESTUARIES,
W69-03627 05G

ENVIRONMENTAL FACTORS IN COASTAL AND ESTUARINE WATERS
BIBLIOGRAPHIC SERIES - VOLUME II. COAST OF WASHINGTON,
W69-03651 02L

TESTIMONY - PHILADELPHIA CONSERVATIONISTS, INC.,
W69-03684 05B

'STATEMENT',
W69-03696 02L

ESTUARINE FISHERIES
NARRAGANSETT BAY A MARINE USE PROFILE,
W69-03606 06B

FISH AND MAN, CONFLICT IN ATLANTIC ESTUARIES,
W69-03627 05G

EUTROPHICATION
EUTROPHICATION,
W69-03357 05C

STUDIES OF THE ANALYSIS OF PHOSPHATES IN ALGAL CULTURES,
W69-03358 05A

EUT-FLO

PALEOECOLOGICAL STUDIES OF POTATO LAKE AND ITS ENVIRONS,
W69-03361 02J

PHOSPHATE EQUILIBRIUM BETWEEN REDUCED SEDIMENTS AND WATER,
W69-03365 02K

STREAM POLLUTION BY ALGAL NUTRIENTS,
W69-03369 05C

EFFECT OF WATER SAMPLE PRESERVATION METHODS ON THE RELEASE OF PHOSPHORUS FROM ALGAE,
W69-03370 05B

STRIPPING EFFLUENTS OF NUTRIENTS BY BIOLOGICAL MEANS,
W69-03374 05F

ENVIRONMENTAL REQUIREMENTS OF BLUE-GREEN ALGAE.
W69-03512 05C

WHY STUDY BLUE-GREEN ALGAE,
W69-03513 05C

GROWTH REQUIREMENTS OF BLUE-GREEN ALGAE AS DEDUCED FROM THEIR NATURAL DISTRIBUTION,
W69-03517 05C

'MIXING OF COLUMBIA RIVER AND OCEAN WATERS, SUMMER',
W69-03632 05C

BIOLOGICAL EFFECTS OF SPOIL DISPOSAL IN CHESAPEAKE BAY,
W69-03666 05C

EVAPORATION
REFINEMENT OF PARAMETERS FOR CALCULATING EVAPORATION FROM BOGS ON THE BASIS OF OBSERVATIONS AT BOG STATIONS,
W69-03211 02D

EVAPOTRANSPIRATION
INTERCEPTION BY EASTERN WHITE PINE,
W69-03315 02I

METEOROLOGICAL STUDIES IN THE MARMOT CREEK WATERSHED, ALBERTA, CANADA, IN AUGUST 1965,
W69-03330 02D

EFFECTS OF SPECIES AND ARRANGEMENT OF FORESTS ON EVAPOTRANSPIRATION,
W69-03386 02D

FOREST TREATMENT EFFECTS ON WATER YIELD,
W69-03387 03B

INTERCEPTION BY EASTERN WHITE PINE,
W69-03391 02I

PERIODIC MOWINGS SUPPRESS TAMARISK GROWTH, INCREASE FORAGE FOR BROWSING,
W69-03496 02I

DETERMINING EVAPO TRANSPIRATION BY THE GRAVIMETRIC METHOD FOR THE WHEAT CROP IN THE IRRIGATION DISTRICT OF RIO YAQUI, SONORA, MEXICO.
W69-03497 02D

ACCURACY OF EVAPOTRANSPIRATION DETERMINATIONS BY THE BOWEN RATIO METHOD,
W69-03504 02D

A SUGGESTED METHOD FOR ESTIMATING EVAPOTRANSPIRATION BY NATIVE PHREATOPHYTES,
W69-03557 02I

EXCESS WATER
CONSTRUCTION AND DEVELOPMENT OF EXCESS DRAINAGE FACILITIES - CONTRACTS.
W69-03431 04A

EXPERIMENTAL WATERSHEDS
THE INFLUENCE OF RAINFALL INTERCEPTION ON STREAMFLOW,
W69-03384 02I

FOREST TREATMENT EFFECTS ON WATER YIELD,
W69-03387 03B

TEST OF A TRANSPIRATION INHIBITOR OF A FORESTED WATERSHED,
W69-03396 02D

EXPLORATION
THERMAL PROSPECTING FOR GROUND WATER,
W69-03549 02F

EXPOSED TREE ROOTS
RATES OF SLOPE DEGRADATION AS DETERMINED FROM BOTANICAL EVIDENCE, WHITE MOUNTAINS, CALIFORNIA,
W69-03527 02I

FEDERAL BUDGETS
ANNUAL REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY, ON CIVIL WORKS ACTIVITIES.
W69-03608 06B

FEDERAL GOVERNMENT
DEMOSKI V STATE (CLAIMS AGAINST STATE ATTRIBUTED TO FLOOD PROTECTION PLAN).
W69-03430 04A

'STATEMENT', IN CLEAN WATER FOR THE NATION'S ESTUARIES,
W69-03605 05B

ANNUAL REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY, ON CIVIL WORKS ACTIVITIES.
W69-03608 06B

FERTILIZATION
POTENTIAL IMPACT OF FOREST FERTILIZATION ON RANGE, WILDLIFE, AND WATERSHED MANAGEMENT,
W69-03383 04C

FILL
DISPOSITIONS OF STATE LAND.
W69-03440 04A

FINES
VIOLATIONS AND CIVIL LIABILITY.
W69-03298 06E

EFFECT AND ENFORCEMENT OF CONSERVATION LAWS.
W69-03464 06E

FINITE DIFFERENCING METHODS
FINITE DIFFERENCING METHODS,
W69-03519 07C

FISH
POLLUTING STREAMS PROHIBITED.
W69-03468 05B

PROHIBITED ACTS.
W69-03469 08I

FISH CONSERVATION
PROHIBITED ACTS.
W69-03469 08I

SAVE-THE-SALMON PROJECT ON THE ST. JOHN RIVER,
W69-03669 05C

FISH HARVEST
ESTUARIES A NEGLECTED RESOURCE COMPLEX,
W69-03620 06B

FISH AND MAN, CONFLICT IN ATLANTIC ESTUARIES,
W69-03627 05G

CALIFORNIA SALMON LANDINGS, 1952 THROUGH 1965,
W69-03686 06C

FISHERIES
CHESAPEAKE BAY STUDY TASK GROUP ON FLOOD CONTROL, NAVIGATION, EROSION, FISHERIES--MINUTES OF THE FIRST MEETING.
W69-03626 06B

FLOOD CONTROL
FLOOD PROTECTION.
W69-03302 04A

CHESAPEAKE BAY STUDY TASK GROUP ON FLOOD CONTROL, NAVIGATION, EROSION, FISHERIES--MINUTES OF THE FIRST MEETING.
W69-03626 06B

FLOOD DAMAGE
NIMMONS V CITY OF LA GRANGE (ACTION BY LAND OWNER FOR FLOODING CAUSED BY CITY'S ROAD CONSTRUCTION).
W69-03293 04A

LEEK V BRASFIELD (WRONGFUL FAILURE TO PERMIT DAM REPAIRS).
W69-03435 04A

FLOOD PLAIN INFORMATION, WILLAMETTE RIVER AND TRIBUTARIES IN MARION AND POLK COUNTIES, OREGON,
W69-03539 02E

FLOOD FORECASTING
MAGNITUDE AND FREQUENCY OF FLOODS IN THE UNITED STATES,
W69-03225 02E

THE USE OF PRECIPITATION RECORDS FOR PEAK STREAMFLOW SYNTHESIS,
W69-03562 02A

FLOOD HEIGHT-FREQUENCY RELATIONS FOR THE PLAINS AREA IN MISSOURI,
W69-03563 02E

FLOOD HIGH-FREQUENCY-DRAINAGE AREA-RELATIONS
FLOOD HEIGHT-FREQUENCY RELATIONS FOR THE PLAINS AREA IN MISSOURI,
W69-03563 02E

FLOOD HYDROGRAPH
FLOOD HYDROLOGY OF SMALL WATERSHEDS--EVALUATION OF TIME PARAMETERS AND DETERMINATION OF PEAK DISCHARGE,
W69-03569 02E

FLOOD PLAINS
FLOOD PLAIN INFORMATION, WILLAMETTE RIVER AND TRIBUTARIES IN MARION AND POLK COUNTIES, OREGON,
W69-03539 02E

FLOOD PROTECTION
FLOOD PROTECTION.
W69-03302 04A

FLOOD ROUTING
STREAMFLOW ROUTING (WITH APPLICATIONS TO NORTH CAROLINA RIVERS),
W69-03564 02E

FLOODING
GRIFFITH V HUNT (JOINDER OF PARTIES IN SUIT FOR DAMAGES

USED BY OBSTRUCTION TO FLOW).
9-03434 04A

DS
QUENTIAL STUDY OF DESERT FLOODING IN THE WHITE MOUNTAINS
CALIFORNIA AND NEVADA,
9-03222 02E

GNITUDE AND FREQUENCY OF FLOODS IN THE UNITED STATES,
9-03225 02E

OODS IN DYER QUADRANGLE, NORTHEASTERN ILLINOIS,
9-03327 02E

OODS IN MCHENRY QUADRANGLE, NORTHEASTERN ILLINOIS,
9-03328 02E

OOD PLAIN INFORMATION, WILLAMETTE RIVER AND TRIBUTARIES IN
RION AND POLK COUNTIES, OREGON,
9-03539 02E

CEMBER 1964, A 400-YEAR FLOOD IN NORTHERN CALIFORNIA,
9-03560 02E

DWATER
OOD-FLOW CHARACTERISTICS OF A RECTIFIED CHANNEL, JACKSON,
SSISSIPPI,
9-03566 02F

IDA
AMS V CREWS (TITLE TO SUBMERGED LAND).
9-03281 06E

EIN V BROWN PROPERTIES, INC (TITLE TO SUBMERGED LANDS).
9-03283 06E

WN OF MIAMI SPRINGS V LAWRENCE (DAMAGES FROM FLOODING).
9-03284 04A

KE GIBSON LAND CO V LESTER (IRRIGATION BY PUMPING LOWERING
KE LEVEL).
9-03285 02H

YES V BOWMAN (RIPARIAN RIGHTS ON NAVIGABLE WATERS).
9-03290 04A

NERAL DRAINAGE.
9-03453 04A

9-03454 04A

9-03455 04A

E OYSTER-BASED ECONOMY OF FRANKLIN COUNTY, FLORIDA,
9-03631 06B

E HUDSON RIVER ESTUARY, A PRELIMINARY INVESTIGATION OF
OW AND WATER-QUALITY CHARACTERISTICS,
9-03668 02L

AUGMENTATION
HE ECONOMIC ASPECTS OF ADVANCED WASTE TREATMENT,
9-03644 05D

CHARACTERISTICS
CTORS AFFECTING THE RESPONSE OF SMALL WATERSHEDS TO
ECIPITATION IN HUMID AREAS,
9-03388 02E

CONTROL
E DUTCH TURN THE TIDE.
9-03652 04A

EQUATIONS
ECTRIC ANALOG OF THREE-DIMENSIONAL FLOW TO WELLS AND ITS
PLICATION TO UNCONFINED AQUIFERS,
9-03356 07C

MEASUREMENT
FECT OF SEDIMENT LOAD ON THE RATING CURVES OF 0.6-FOOT HS
UMES,
9-03403 02E

ALUATION OF SOIL AMENDMENTS IN IMPERIAL VALLEY,
9-03481 02G

CRITICAL REVIEW OF METHODS OF MEASURING DISCHARGE WITHIN A
WER PIPE,
9-03510 07B

METS
E OF THE ELECTRICAL RESISTIVITY METHOD FOR INVESTIGATING
OLOGIC AND HYDROLOGIC CONDITIONS IN SANTA CLARA COUNTY,
LIFORNIA,
9-03235 07B

METERS
CRITICAL REVIEW OF METHODS OF MEASURING DISCHARGE WITHIN A
WER PIPE,
9-03510 07B

D MECHANICS
REAMS-THEIR DYNAMICS AND MORPHOLOGY,
9-03248 02E

BAYS
A WATER INTRUSION INTO A FRESH WATER FOREBAY DUE TO WAVE
TION,
9-03531 02L

FORECASTING
THE NONLINEAR PREDICTION PROBLEM IN THE STUDY OF THE RUNOFF
CYCLE,
W69-03308 02A

THE POTOMAC ESTUARY - STATISTICS AND PROJECTIONS,
W69-03603 05B

REGIONAL CONSTRUCTION REQUIREMENTS FOR WATER AND WASTEWATER
FACILITIES 1955-1967-1980,
W69-03698 05D

FOREIGN COUNTRIES
CLOSING OF THE SEA ARMS.
W69-03630 04A

THE DELTA PROJECT.
W69-03646 02L

THE ENCLOSURE OF THE ZUIDERZEE AND THE RECLAMATION OF
POLDERS IN THE YSSEL-LAKE.
W69-03656 08D

THE ENCLOSURE OF THE ZUIDERZEE AND THE RECLAMATION OF THE
IJSSELMEER.
W69-03657 06B

'U. S. COAST GUARD REPORT OF WAKE ISLAND OIL SPILL',
W69-03685 05C

FOREST ENVIRONMENT
NITROGEN CONTENT OF PRECIPITATION IN A COASTAL OREGON FOREST
OPENING,
W69-03400 05B

PESTICIDES IN FOREST WATERS--SYMPTOM OF A GROWING PROBLEM,
W69-03401 05C

FOREST FERTILIZATION
POTENTIAL IMPACT OF FOREST FERTILIZATION ON RANGE, WILDLIFE,
AND WATERSHED MANAGEMENT,
W69-03383 04C

FOREST MANAGEMENT
STREAM CONTAMINATION BY HERBICIDES AFTER FALL RAINS ON
FOREST LAND,
W69-03381 05B

RESIDUES OF HERBICIDES AND DIESEL OIL CARRIERS IN FOREST
WATERS,
W69-03397 05B

GROWTH AND NUTRIENT UPTAKE OF IRRIGATED YOUNG PONDEROSA PINE
AFTER FERTILIZER TREATMENTS,
W69-03398 05B

CHEMICAL BRUSH CONTROL AND HERBICIDE RESIDUES IN THE FOREST
ENVIRONMENT,
W69-03399 05B

PESTICIDES IN FOREST WATERS--SYMPTOM OF A GROWING PROBLEM,
W69-03401 05C

FOREST SOILS
VOLUMETRIC CALIBRATION OF NEUTRON MOISTURE PROBES,
W69-03394 02G

FOREST TREATMENTS
FOREST TREATMENT EFFECTS ON WATER YIELD,
W69-03387 03B

FORESTRY
POTENTIAL IMPACT OF FOREST FERTILIZATION ON RANGE, WILDLIFE,
AND WATERSHED MANAGEMENT,
W69-03383 04C

FORESTS
HYDROLOGIC SUBSTANTIATION AND COMPUTATION OF THE REDUCTION
OF FORESTS AND THE EXPANSION OF NATURALLY WATERLOGGED AREAS
AFTER UNDERFLOODING IN RIVER SYSTEMS,
W69-03214 02A

METEOROLOGICAL STUDIES IN THE MARMOT CREEK WATERSHED,
ALBERTA, CANADA, IN AUGUST 1965,
W69-03330 02D

FRACTURES(GEOLOGY)
ROCK MECHANICS IN THE DISPOSAL OF RADIOACTIVE WASTES BY
HYDRAULIC FRACTURING,
W69-03522 08E

FRESH WATER
SEA WATER INTRUSION INTO A FRESH WATER FOREBAY DUE TO WAVE
ACTION,
W69-03531 02L

'NUMERICAL SOLUTION OF THE UNSTEADY, ESTUARY DISPERSION
EQUATION',
W69-03675 02L

POTENTIAL FRESHWATER RESERVOIR IN THE NEW YORK AREA,
W69-03700 04A

FRESH-WATER FOREBAY
SEA WATER INTRUSION INTO A FRESH WATER FOREBAY DUE TO WAVE
ACTION,
W69-03531 02L

FUTURE PLANNING(PROJECTED)
POLLUTION CONTROL - PLANNING A NATIONAL PROGRAM,
W69-03410 05G

COMPREHENSIVE PLANNING IN RELATION TO THE RISE AND MANAGEMENT OF ESTUARIES,
W69-03624 06B

GEOCHEMISTRY
APPLICATIONS OF FACTOR ANALYSIS IN STUDY OF CHEMISTRY OF GROUNDWATER QUALITY, MOJAVE RIVER VALLEY, CALIFORNIA,
W69-03253 02F

GEOGRAPHICAL REGIONS
REGIONAL WATER RESOURCE DEVELOPMENT IN THE FEDERAL SYSTEM,
W69-03411 06B

GEOMORPHOLOGY
STREAMS-THEIR DYNAMICS AND MORPHOLOGY,
W69-03248 02E

GEOPHYSICS
USE OF THE ELECTRICAL RESISTIVITY METHOD FOR INVESTIGATING GEOLOGIC AND HYDROLOGIC CONDITIONS IN SANTA CLARA COUNTY, CALIFORNIA,
W69-03235 07B

GEORGIA
NIMMONS V CITY OF LA GRANGE (ACTION BY LAND OWNER FOR FLOODING CAUSED BY CITY'S ROAD CONSTRUCTION).
W69-03293 04A

MOULTON V BUNTING MCWILLIAMS POST NO 658 (DIVERSION OF NON-NAVIGABLE STREAM).
W69-03443 04A

'STATEMENT',
W69-03647 02L

W69-03671 02L

'GEORGIA WATER QUALITY CONTROL BOARDS STATEMENT TO THE NATIONAL ESTUARINE STUDY REPORT',
W69-03679 05G

GERMINATION
GERMINATION STUDIES ON ARID ZONE TREE SEEDS,
W69-03489 02I

EFFECT OF HIGH TEMPERATURES ON MOISTURE DEPLETION, IMBIBITION AND GERMINATION OF SEEDS OF MIMOSA HAMATA WILLD,
W69-03503 02I

GOVERNMENT SUPPORTS
FISHING FLEET TRIES TO CAST OFF THE PAST.
W69-03664 06C

GOVERNMENTS
INTERGOVERNMENTAL RELATIONSHIPS IN THE ADMINISTRATION OF WATER RESOURCES,
W69-03589 06E

W69-03590 06E

THE POLITICS OF BEAUTY,
W69-03648 06E

GRASSED WATERWAYS
CONVERSION OF GULLIES TO VEGETATION-LINED WATERWAYS ON MOUNTAIN SLOPES,
W69-03406 04A

GRAVIMETRIC ANALYSIS
DETERMINING EVAPO TRANSPIRATION BY THE GRAVIMETRIC METHOD FOR THE WHEAT CROP IN THE IRRIGATION DISTRICT OF RIO YAQUI, SONORA, MEXICO.
W69-03497 02D

GREAT PONDS
PUBLIC ACCESS TO GREAT PONDS.
W69-03265 04A

STRUCTURES IN GREAT PONDS RESTRICTED - LOWERING WATERS REGULATED - SUPERVISION OF ERECTIONS - COMPENSATION FOR TIDE WATER DISPLACED.
W69-03266 04A

SURVEYS AND IMPROVEMENTS OF HARBORS - ESTABLISHMENT OF HARBOR LINES - GREAT PONDS DEFINED.
W69-03270 06E

GREENHOUSES
WATER UTILIZATION IN GREENHOUSES ALTERNATIVES FOR AGRICULTURE IN ARID REGIONS,
W69-03486 03F

GROUNDWATER
HYDROLOGIC SUBSTANTIATION AND COMPUTATION OF THE REDUCTION OF FORESTS AND THE EXPANSION OF NATURALLY WATERLOGGED AREAS AFTER UNDERFLOODING IN RIVER SYSTEMS,
W69-03214 02A

GROUND-WATER RESOURCES OF ISLAND COUNTY, WASHINGTON,
W69-03224 02F

HYDROLOGY OF BROOKHAVEN NATIONAL LABORATORY AND VICINITY, SUFFOLK COUNTY, NEW YORK,
W69-03232 02E

GEOPHYSICAL SURVEYS IN THE VICINITY OF SANITARY LANDFILLS IN NORTHEASTERN ILLINOIS,
W69-03236 05B

THE DETERMINATION OF THE IONIZATION CONSTANT OF 2,4-D IN WATER,
W69-03241 05A

APPLICATIONS OF FACTOR ANALYSIS IN STUDY OF CHEMISTRY OF GROUNDWATER QUALITY, MOJAVE RIVER VALLEY, CALIFORNIA,
W69-03253 02F

THE OCCURRENCE AND CHARACTERISTICS OF GROUND-WATER CONTAMINATION IN MASSACHUSETTS,
W69-03312 05B

AN AQUIFER TEST USED TO INVESTIGATE A QUALITY OF WATER ANOMALY,
W69-03335 02F

GROUND-WATER SURVEY, ODESSA-LIND AREA, WASHINGTON,
W69-03352 02F

GROUND WATER IN ONTARIO SOUTHWESTERN AREA, 1960-1963.
W69-03354 02F

GROUNDWATER RESOURCES OF CHOWAN COUNTY, NORTH CAROLINA,
W69-03355 02F

AN APPRAISAL OF THE GROUND-WATER RESOURCES OF THE UPPER SUSQUEHANNA RIVER BASIN IN PENNSYLVANIA,
W69-03528 02F

HYDROGEOLOGIC DATA FOR BACA AND SOUTHERN PROWERS COUNTIES, COLORADO,
W69-03530 02F

PRINCIPLES OF CHEMICAL COMPOSITION OF GROUNDWATERS (BASIC FACTORS), (IN RUSSIAN),
W69-03533 02K

OCCURENCE OF GROUND WATER IN THE JUDITH RIVER FORMATION, NORTH-CENTRAL MONTANA,
W69-03545 02F

THERMAL PROSPECTING FOR GROUND WATER,
W69-03549 02F

GROUNDWATER BASINS
HYDROGEOLOGY OF DESERT BASINS,
W69-03238 02F

GROUNDWATER CONTAMINATION
THE OCCURRENCE AND CHARACTERISTICS OF GROUND-WATER CONTAMINATION IN MASSACHUSETTS,
W69-03312 05B

GROUNDWATER MOVEMENT
ANALYSIS OF SOME PUMPING TEST RESULTS,
W69-03206 02F

CONVECTIVE SALT DIFFUSION IN A RADIAL SUBSURFACE STREAM IN RELATION TO THE PROTECTION OF SUBSURFACE WATERS FROM CONTAMINATED DISCHARGES,
W69-03212 05B

FLOW OF GROUNDWATER IN RELATIVELY THICK LEAKY AQUIFERS,
W69-03220 02F

USE OF THE ELECTRICAL RESISTIVITY METHOD FOR INVESTIGATING GEOLOGIC AND HYDROLOGIC CONDITIONS IN SANTA CLARA COUNTY, CALIFORNIA,
W69-03235 07B

NUMERICAL SOLUTIONS FOR DISPERSION IN POROUS MEDIUMS,
W69-03237 05B

EXPLANATION OF PARADOXES IN DUPUIT-FORCHHEIMER SEEPAGE THEORY,
W69-03242 02F

THEORETICAL ANALYSIS OF REGIONAL GROUNDWATER FLOW. 2. EFFECT OF WATER-TABLE CONFIGURATION AND SUBSURFACE PERMEABILITY VARIATION,
W69-03243 02F

ON THE MEANING OF THE DUPUIT AND PAVLOVSKII APPROXIMATIONS IN AQUIFER FLOW,
W69-03252 02F

USE OF THERMAL MODEL TO INVESTIGATE THE THEORY OF TRANSIENT FLOW TO A PARTIALLY PENETRATING WELL,
W69-03254 02F

ANALYZING SUBSURFACE FLOW SYSTEMS WITH ELECTRIC ANALOGS,
W69-03310 02F

ELECTRIC ANALOG OF THREE-DIMENSIONAL FLOW TO WELLS AND ITS APPLICATION TO UNCONFINED AQUIFERS,
W69-03356 07C

DISPERSION AT THE INTERFACE OF MISCIBLE LIQUIDS IN A SOIL,
W69-03548 02F

A DERIVATION OF DUPUIT SOLUTION OF STEADY FLOW TOWARD WELLS BY MATCHED ASYMPTOTIC EXPANSIONS,
W69-03550 02F

THE INVESTIGATION OF WATER FLOW THROUGH POROUS MEDIUMS BY MEANS OF RADIOTRACERS,
W69-03551 02F

SODIUM AS A CLUE TO DIRECTION OF GROUNDWATER MOVEMENT, NEVADA TEST SITE,
W69-03559 02F

OF MEXICO
ATEMENT', IN CLEAN WATER FOR THE NATION'S ESTUARIES,
-03605 05B

ATEMENT',
-03649 05G

UARIES IRREPLACEABLE ENVIRONMENTS.
-03662 06B

F OF MEXICO IS STILL BOOMING.
-03673 06B

'S EROSION
VERSION OF GULLIES TO VEGETATION-LINED WATERWAYS ON
NTAIN SLOPES,
-03406 04A

ATS
WATER OUTPUT OF THE DESERT VEGETATION IN THE DIFFERENT
ROHABITATS OF WADI HOFF,
-03501 02I

RS
ERS OF THE DEPARTMENT OF PUBLIC WORKS AS TO PR PORT OF
TON HARBOR.
-03259 04A

VEYS AND IMPROVEMENTS OF HARBORS - ESTABLISHMENT OF
BOR LINES - GREAT PONDS DEFINED.
-03270 06E

UAL REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY, ON
IL WORKS ACTIVITIES.
-03608 06B

ITING FACTORS IN HARBOR DEVELOPMENT,
-03622 06F

ECONOMIC IMPACT OF UNITED STATES OCEAN PORTS.
-03654 06G

I
DIBILITY INDICES FOR WILDLAND SOILS OF OAHU, HAWAII, AS
ATED TO SOIL FORMING FACTORS,
-03316 02J

IAN SMALL WATERSHED
OD HYDROLOGY OF SMALL WATERSHEDS--EVALUATION OF TIME
AMETERS AND DETERMINATION OF PEAK DISCHARGE,
-03569 02E

DS
IGH VALLEY BR V THE RUSSELL NO 1 (LIABILITY FOR DAMAGE
SED BY SUBMERGED PILINGS).
-03287 04A

HEAT RESISTANCE OF PLANTS, ITS DETERMINATION AND
IABILITY,
-03485 02I

FLOW
OF THERMAL MODEL TO INVESTIGATE THE THEORY OF TRANSIENT
W TO A PARTIALLY PENETRATING WELL,
-03254 02F

RESISTANCE
HEAT RESISTANCE OF PLANTS, ITS DETERMINATION AND
IABILITY,
-03485 02I

D WATER
TEMENT BEFORE THE SUBCOMMITTEE ON AIR AND WATER
LUTION,
-03670 05C

CIDES
TROLE CONCENTRATIONS IN CREEK WATERS DOWNSTREAM FROM AN
IALLY SPRAYED WATERSHED SUBBASIN,
-03226 05B

PERSISTENCE OF SILVEX IN WATER AND HYDROSOIL,
-03240 05A

IDUES OF HERBICIDES AND DIESEL OIL CARRIERS IN FOREST
ERS,
-03397 05B

AY RELOCATION
EGETOWN WATERFRONT.
-03595 06B

AYS
INAGE OF HIGHWAY.
-03288 04A

RIC FLOOD
EMBER 1964, A 400-YEAR FLOOD IN NORTHERN CALIFORNIA,
-03560 02E

RY
ROPOLITAN SEATTLE'S DUWAMISH ESTUARY WATER QUALITY
GRAM,
-03667 05B

N RIVER
HUDSON RIVER ESTUARY, A PRELIMINARY INVESTIGATION OF
W AND WATER-QUALITY CHARACTERISTICS,
-03668 02L

HUMAN POPULATION
THE TEXAS BASINS PROJECT,
W69-03625 06B

HURRICANES
HURRICANE 'BEULAH', SEPT. 8-21, 1967.
W69-03543 02B

HURRICANE DAMAGE TO STRUCTURES,
W69-03634 08A

HYDRAULIC CONDUCTIVITY
DETERMINATION OF THE HYDRAULIC CONDUCTIVITY OF UNSATURATED SOILS FROM AN ANALYSIS OF TRANSIENT FLOW DATA,
W69-03337 02G

HYDRAULIC FRACTURING
ROCK MECHANICS IN THE DISPOSAL OF RADIOACTIVE WASTES BY HYDRAULIC FRACTURING,
W69-03522 08E

HYDRAULIC MODELS
A REVIEW OF RAINFALL-RUNOFF, PHYSICAL MODELS AS DEVELOPED BY DIMENSIONAL ANALYSIS AND OTHER METHODS,
W69-03309 02A

HYDRAULIC SIMILITUDE
A REVIEW OF RAINFALL-RUNOFF, PHYSICAL MODELS AS DEVELOPED BY DIMENSIONAL ANALYSIS AND OTHER METHODS,
W69-03309 02A

HYDRAULICS
ON THE MEANING OF THE DUPUIT AND PAVLOVSKII APPROXIMATIONS IN AQUIFER FLOW,
W69-03252 02F

HYDROELECTRIC PLANTS
OPERATION OF HYDRO-ELECTRIC PLANTS AT CRESCENT AND VISHER FERRY CONTROL OF SARANAC LAKE LOCKS.
W69-03467 04A

'ANALYZING STEAM ELECTRIC POWER PLANT DISCHARGES',
W69-03655 05B

SAVE-THE-SALMON PROJECT ON THE ST. JOHN RIVER,
W69-03669 05C

HYDROELECTRIC POWER
OPERATION OF HYDRO-ELECTRIC PLANTS AT CRESCENT AND VISHER FERRY CONTROL OF SARANAC LAKE LOCKS.
W69-03467 04A

HYDROGEN ISOTOPES
THE OCCURRENCE OF TRITIUM IN PRECIPITATION AND ITS SIGNIFICANCE IN HYDROLOGICAL INVESTIGATIONS,
W69-03555 02K

HYDROGEOLOGY
HYDROLOGY OF BROOKHAVEN NATIONAL LABORATORY AND VICINITY, SUFFOLK COUNTY, NEW YORK,
W69-03232 02E

HYDROGEOLOGY OF DESERT BASINS,
W69-03238 02F

HYDROGRAPH ANALYSIS
LINEAR ANALYSIS OF HYDROGRAPHS,
W69-03331 07C

HYDROGRAPHS
LINEAR ANALYSIS OF HYDROGRAPHS,
W69-03331 07C

UNSTEADY, ONE-DIMENSIONAL FLOW OVER A PLANE-THE RISING HYDROGRAPH,
W69-03332 02E

SLOPE-DISCHARGE RELATIONS FOR EIGHT RIVERS IN THE UNITED STATES,
W69-03521 02E

HYDROLOGIC ANALYSIS
FACTORS AFFECTING THE RESPONSE OF SMALL WATERSHEDS TO PRECIPITATION IN HUMID AREAS,
W69-03388 02E

STREAMFLOW DATA PROCESSING OPPORTUNITIES AND APPLICATION,
W69-03389 07C

HYDROLOGIC ASPECTS
OPTIMIZATION TECHNIQUES FOR HYDROLOGIC ENGINEERING,
W69-03329 06A

TIME SERIES ANALYSIS,
W69-03524 06A

VARIANCE SPECTRUM ANALYSIS,
W69-03525 06A

HYDROLOGIC CYCLE
ROLE OF STABLE HYDROGEN ISOTOPES IN THE STUDY OF GEOLOGICAL PROCESSES,
W69-03244 02F

HYDROLOGIC DATA
MODERN HYDROLOGICAL RESEARCH METHODOLOGY ON RIVERS IN RUMANIA (IN RUMANIAN),
W69-03314 06B

SOME STATISTICAL TOOLS IN HYDROLOGY,
W69-03344 07B

STREAMFLOW DATA PROCESSING OPPORTUNITIES AND APPLICATION,
W69-03389 07C

AN APPRAISAL OF THE GROUND-WATER RESOURCES OF THE UPPER SUSQUEHANNA RIVER BASIN IN PENNSYLVANIA,
W69-03528 02F

URBAN HYDROLOGY OF THE HOUSTON, TEXAS METROPOLITAN AREA-COMPILATION OF BASIC DATA-1966,
W69-03538 04C

HYDROLOGIC ENGINEERING
OPTIMIZATION TECHNIQUES FOR HYDROLOGIC ENGINEERING,
W69-03329 06A

HYDROLOGIC SYSTEMS
THE NONLINEAR PREDICTION PROBLEM IN THE STUDY OF THE RUNOFF CYCLE,
W69-03308 02A

HYDROLOGY
STREAMS-THEIR DYNAMICS AND MORPHOLOGY,
W69-03248 02E

HYDROLOGY AND RESERVOIR CONTROL ON THE WISCONSIN RIVER BASIN,
W69-03375 04A

SELECTED BIBLIOGRAPHY ON HYDROLOGICAL CONTROL BY RESERVOIR OPERATION,
W69-03376 04A

ANALYSIS OF A WATER STORAGE RESERVOIR SYSTEM,
W69-03377 04A

FINITE DIFFERENCING METHODS,
W69-03519 07C

HYDROLOGY OF SURFACE MINING-A CASE STUDY,
W69-03547 02A

HYDROSOILS
THE PERSISTENCE OF SILVEX IN WATER AND HYDROSOIL,
W69-03240 05A

HYGROMETRY
ATMOSPHERIC HUMIDITY MEASUREMENT NEAR THE SNOW SURFACE,
W69-03409 02C

ILLINOIS
FEASIBILITY CRITERIA FOR SUBSURFACE WASTE DISPOSAL IN ILLINOIS,
W69-03251 05E

DUNLAP LAKE PROPERTY OWNERS ASS'N, INC V CITY OF EDWARDSVILLE (ABATEMENT OF POLLUTION).
W69-03278 05B

FLOODS IN DYER QUADRANGLE, NORTHEASTERN ILLINOIS,
W69-03327 02E

FLOODS IN MCHENRY QUADRANGLE, NORTHEASTERN ILLINOIS,
W69-03328 02E

PENWICK V BLUEBIRD COAL COMPANY (MINE WASTES).
W69-03425 05G

IMPERIAL VALLEY(CALIF)
EVALUATION OF SOIL AMENDMENTS IN IMPERIAL VALLEY,
W69-03481 02G

IMPOUNDED WATERS
PROHIBITED ACTS.
W69-03469 08I

INDIRECT BENEFITS
WHAT ARE WE LEARNING FROM ECONOMIC STUDIES OF WATER QUALITY,
W69-03697 06B

INDUSTRIAL PLANTS
TESTIMONY - PHILADELPHIA CONSERVATIONISTS, INC.,
W69-03684 05B

INDUSTRIAL WASTES
TEXTILE WASTES - A BIBLIOGRAPHY,
W69-03597 05B

CLEAN WATER FOR THE NATION'S ESTUARIES.
W69-03629 05G

'GEORGIA WATER QUALITY CONTROL BOARDS STATEMENT TO THE NATIONAL ESTUARINE STUDY REPORT',
W69-03679 05G

INDUSTRIAL WATER
A STUDY TO DETERMINE THE COSTS OF WATER IN INDUSTRIAL USES,
W69-03322 06C

THE ROLE OF INDUSTRIAL PROCESS CHANGES IN AFFECTING WATER REQUIREMENTS,
W69-03599 06D

CONSEQUENCES OF MAJOR SPILLS ON INDUSTRIAL USES OF SEAWATER.
W69-04633 05C

TESTIMONY - PHILADELPHIA CONSERVATIONISTS, INC.,
W69-03684 05B

WHAT ARE WE LEARNING FROM ECONOMIC STUDIES OF WATER QUALITY,
W69-03697 06B

INFILTRATION
INVESTIGATION OF WATER ABSORPTION BY THE SOIL ON THE BASIS OF THE DIMENSIONAL THEORY,
W69-03215 02G

DETERMINATION OF THE HYDRAULIC CONDUCTIVITY OF UNSATURATED SOILS FROM AN ANALYSIS OF TRANSIENT FLOW DATA,
W69-03337 02G

VOLUMETRIC CALIBRATION OF NEUTRON MOISTURE PROBES,
W69-03394 02G

EVALUATION OF SOIL AMENDMENTS IN IMPERIAL VALLEY,
W69-03481 02G

EFFECT OF ORGANIC MATTER CONTENT OF THE SOIL ON INFILTRATION,
W69-03484 02G

MOVEMENT OF MOISTURE IN THE UNSATURATED ZONE IN A DUNE AREA, SOUTHWESTERN KANSAS,
W69-03556 02G

INFORMATION RETRIEVAL
A DIRECTORY OF INFORMATION RESOURCES IN THE UNITED STATES WATER.
W69-03650 10

INJECTION WELLS
FEASIBILITY CRITERIA FOR SUBSURFACE WASTE DISPOSAL IN ILLINOIS,
W69-03251 05E

INVESTIGATION OF THE TECHNICAL FEASIBILITY OF STORING FRESH WATER IN SALINE AQUIFERS,
W69-03336 02F

ROCK MECHANICS IN THE DISPOSAL OF RADIOACTIVE WASTES BY HYDRAULIC FRACTURING,
W69-03522 08E

INSECTICIDES
INSECTICIDES IN TILE DRAINAGE EFFLUENT,
W69-03221 05A

INSTITUTIONAL CONSTRAINTS
IMPACT OF INSTITUTIONAL ARRANGEMENTS ON THE AVAILABLE ALTERNATIVE DEVELOPMENTAL PATHS FOR WATER ALLOCATION AND POLLUTION CONTROL IN THE COLORADO RIVER BASIN,
W69-03492 06A

INSTITUTIONS
INTERGOVERNMENTAL RELATIONSHIPS IN THE ADMINISTRATION OF WATER RESOURCES,
W69-03589 06E

W69-03590 06E

INSTRUMENTATION
SAMPLING THE SOIL SOLUTION FOR SALINITY APPRAISAL,
W69-03488 02G

METHODS OF MEASURING WATER LEVELS IN DEEP WELLS,
W69-03535 07B

CALIBRATION AND MAINTENANCE OF VERTICAL-AXIS TYPE CURRENT METERS,
W69-03536 07B

INTERCEPTION
INTERCEPTION BY EASTERN WHITE PINE,
W69-03315 02I

THROUGHFALL AND STEMFLOW IN A PINE-HARDWOOD STAND IN THE OUACHITA MOUNTAINS OF ARKANSAS,
W69-03339 02I

THE INFLUENCE OF RAINFALL INTERCEPTION ON STREAMFLOW,
W69-03384 02I

INTERCEPTION BY EASTERN WHITE PINE,
W69-03391 02I

DESIGN CRITERIA FOR INTERCEPTION STUDIES,
W69-03395 02I

INTERNATIONAL COMMISSIONS
HABEAS MARINUS DUE PROCESS OF INNERSPACE - A PROPOSAL,
W69-03588 06E

INTERNATIONAL LAW
NATIONAL JURISDICTION AND THE USE OF THE SEA,
W69-03572 06B

HABEAS MARINUS DUE PROCESS OF INNERSPACE - A PROPOSAL,
W69-03588 06E

INTERNATIONAL TREATIES
HABEAS MARINUS DUE PROCESS OF INNERSPACE - A PROPOSAL,
W69-03588 06E

INTERSTATE COMPACTS
WATER SUPPLY (STORAGE AND RELEASE OF WATERS).
W69-03301 04A

FLOOD PROTECTION.
W69-03302 04A

POLLUTION CONTROL.
W69-03460 05G

-AGENCY COOPERATION
PREHENSIVE RIVER BASIN PLANNING THE ARKANSAS-WHITE-RED
INS INTER-AGENCY COMMITTEE EXPERIENCE,
-03596 06B

-BASIN TRANSFERS
CONTINENTAL USE OF ARCTIC-FLOWING RIVERS,
-03313 04A

TMENT
NOMIC VALUE OF IRRIGATION WATER,
-03582 06B

IONAL CONSTRUCTION REQUIREMENTS FOR WATER AND WASTEWATER
ILITIES 1955-1967-1980,
-03698 05D

ATION
DETERMINATION OF THE IONIZATION CONSTANT OF 2,4-D IN
ER,
-03241 05A

ATION CONSTANT
DETERMINATION OF THE IONIZATION CONSTANT OF 2,4-D IN
ER,
-03241 05A

ATION
UND-WATER SURVEY, ODESSA-LIND AREA, WASHINGTON,
-03352 02F

ATION EFFECTS
WTH AND NUTRIENT UPTAKE OF IRRIGATED YOUNG PONDEROSA PINE
ER FERTILIZER TREATMENTS,
-03398 05B

TATISTICAL STUDY OF SOME INDICES OF SALINE WATER
IGATED SOILS OF RAJASTHAN,
-03482 03C

ATION PROGRAMS
NOMIC VALUE OF IRRIGATION WATER,
-03582 06B

ATION WATER
FSEN V UNITED STATES (RIVER DIVERSION).
-03441 04A

LUATION OF SOIL AMENDMENTS IN IMPERIAL VALLEY,
-03481 02G

D COUNTY(WASH)
UND-WATER RESOURCES OF ISLAND COUNTY, WASHINGTON,
-03224 02F

L
MATE AND SOIL MOISTURE EXTRACTION,
-03250 02G

IVER
ERN HYDROLOGICAL RESEARCH METHODOLOGY ON RIVERS IN
ANIA (IN RUMANIAN),
-03314 06B

IAL DECISIONS
BERIAN V DOWD (ACCESS RIGHTS AND EASEMENTS ACROSS PRIVATE
PERTY TO OCEAN).
-03480 06E

ERAL COURT DECISION JEOPARDIZES CURRENT EFFORTS TO
EGUARD NATION'S ESTUARIES.
-03663 02L

DICTION
ERGOVERNMENTAL RELATIONSHIPS IN THE ADMINISTRATION OF
ER RESOURCES,
-03589 06E

-03590 06E

CKY
NE V HAZARD COCA COLA BOTTLING WORKS (ACTION TO ENJOIN
TRUCTION TO NATURAL FLOW OF WATER).
-03291 04A

ER RESOURCES DATA FOR KENTUCKY, 1967--PART 1 SURFACE
ER RECORDS.
-03318 02E

TRINE ENVIRONMENT
RODUCTION TO PALEOLIMNOLOGY,
-03342 02J

BASINS
RODUCTION TO PALEOLIMNOLOGY,
-03342 02J

BEDS
MS V CREWS (TITLE TO SUBMERGED LAND).
-03281 06E

MICHIGAN
TICAL CURRENT STRUCTURE IN THE GREAT LAKES II. CURRENT
ER STUDIES OFF SHEBOYGAN, WISCONSIN, AUGUST 1967,
-03334 02H

TICAL CURRENT STRUCTURE IN THE GREAT LAKES 1.
RACTERIZATION OF THE CIRCULATION DYNAMICS OF LAKE
HIGAN,
-03347 02H

VERTICAL CURRENT STRUCTURE IN THE GREAT LAKES III.
DETERMINATION OF EDDY VISCOSITY AND EDDY DIFFUSIVITY IN LAKE
MICHIGAN,
W69-03348 02H

VERTICAL CURRENT STRUCTURE IN THE GREAT LAKES IV.
NUMERICAL EVALUATION OF STERN'S CALCULATION MODEL,
W69-03349 02H

VERTICAL CURRENT STRUCTURE IN THE GREAT LAKES V. THERMAL
CURRENT STRUCTURE IN LAKE MICHIGAN, ASSOCIATED WITH THE
SPRING WARM-UP SEASON--A THEORETICAL STUDY,
W69-03350 02H

LAKE STATES
STABILIZING ERODING STREAMBANKS IN SAND DRIFT AREAS OF THE
LAKE STATES.
W69-03405 02J

LAKES
COMPUTATION OF SEICHE VELOCITIES IN BODIES OF WATER WITH A
COMPLEX BOTTOM RELIEF,
W69-03217 02H

INTRODUCTION TO PALEOLIMNOLOGY,
W69-03342 02J

COPPER IN LAKE MUDS FROM LAKES OF THE MADISON AREA,
W69-03366 05A

RECENT SEDIMENTS OF THREE WISCONSIN LAKES,
W69-03367 02J

LAKE-STREAM SYSTEM
MICROSESTON DYNAMICS IN A SIMPLE SIERRA NEVADA LAKE-STREAM
SYSTEM,
W69-03359 02E

LAND APPRAISAL
GENERAL DRAINAGE.
W69-03455 04A

LAND RECLAMATION
GENERAL DRAINAGE.
W69-03454 04A

W69-03455 04A

PROBLEMS OF MAINTAINING BAYS AND ESTUARIES--A PANEL, SAN
FRANCISCO BAY,
W69-03616 04A

THE ENCLOSURE OF THE ZUIDERZEE AND THE RECLAMATION OF
POLDERS IN THE YSSEL-LAKE.
W69-03656 08D

THE ENCLOSURE OF THE ZUIDERZEE AND THE RECLAMATION OF THE
IJSSELMEER.
W69-03657 06B

LAND RESOURCES
DEPARTMENT OF NATURAL RESOURCES.
W69-03256 06E

W69-03257 06E

LAND TENURE
UNAPPROPRIATED STATE LANDS DEFINED.
W69-03465 06E

LAND USE
POTENTIAL IMPACT OF FOREST FERTILIZATION ON RANGE, WILDLIFE,
AND WATERSHED MANAGEMENT,
W69-03383 04C

CONSERVATION AND MANAGEMENT OF SEASHORE AND UNDERWATER AREAS
FOR PUBLIC ENJOYMENT,
W69-03676 06B

LANDFILLS
GEOPHYSICAL SURVEYS IN THE VICINITY OF SANITARY LANDFILLS IN
NORTHEASTERN ILLINOIS,
W69-03236 05B

STATE V KINSLEY (VIOLATION OF POLLUTION STATUTE).
W69-03475 05B

ACTION ON ILLEGAL DREDGING AND FILLING IN THE AREA OF
HEMPSTEAD, N.Y.
W69-03665 04A

LEAD RADIOISOTOPES
ISOTOPIC COMPOSITION OF LEAD IN NATURAL WATERS,
W69-03245 02K

LEAKAGE
FLOW OF GROUNDWATER IN RELATIVELY THICK LEAKY AQUIFERS,
W69-03220 02F

LEAMINGTON CANYON
GROUND-WATER RESOURCES OF THE SEVIER RIVER BASIN BETWEEN
YUBA DAM AND LEAMINGTON CANYON, UTAH,
W69-03529 02F

LEGAL ASPECTS
ACTION ON ILLEGAL DREDGING AND FILLING IN THE AREA OF
HEMPSTEAD, N.Y.
W69-03665 04A

LEGISLATION

DEPARTMENT OF NATURAL RESOURCES.
W69-03255 06E

W69-03256 06E

W69-03257 06E

DUTIES OF THE DEPARTMENT OF PUBLIC WORKS RELATIVE TO COMMONWEALTH LANDS, CERTAIN ISLANDS, AND PROPERTY IN PLYMOUTH.
W69-03258 04C

POWERS OF THE DEPARTMENT OF PUBLIC WORKS AS TO PR PORT OF BOSTON HARBOR.
W69-03259 04A

POWER OF THE DEPARTMENT OF PUBLIC WORKS TO TAKE AND HOLD REAL ESTATE AND BUILD THEREON.
W69-03260 06E

DEVELOPMENT OF WATERFRONT FACILITIES - IMPROVEMENT AND PRESERVATION OF RIVERS, HARBORS, ETC.
W69-03261 06E

STRUCTURES THE DEPARTMENT OF PUBLIC WORKS MAY LICENSE TO BE ERECTED IN RIVERS AND STREAMS.
W69-03262 06E

LICENSES TO BE REVOCABLE AND TO EXPIRE IN FIVE YEARS - BOSTON HARBOR LICENSES - FORM, HOW GRANTED AND CONSTRUED.
W69-03264 06E

STRUCTURES IN GREAT PONDS RESTRICTED - LOWERING WATERS REGULATED - SUPERVISION OF ERECTIONS - COMPENSATION FOR TIDE WATER DISPLACED.
W69-03266 04A

REMOVAL OF WRECKS ON SHORES OR IN TIDE WATERS.
W69-03271 06E

EMINENT DOMAIN -- RIGHT OF BY WHOM RIGHT MAY BE EXERCISED.
W69-03289 06E

EXISTING RIGHTS AND REMEDIES PRESERVED LIMITATIONS.
W69-03297 04A

WATER FRONT IMPROVEMENTS.
W69-03413 06E

MUNICIPALITIES GENERALLY - GENERAL POWERS.
W69-03415 06E

PUBLIC UTILITIES - ARTICLE 9 - BRIDGES, VIADUCTS AND TUNNELS.
W69-03416 06E

WATER POWER COMPANIES ALONG TRIBUTARIES TO BARNEGAT BAY.
W69-03417 06E

SEWERAGE COMPANIES.
W69-03418 06E

ECONOMIC DEVELOPMENT.
W69-03419 06E

DIVISION OF NAVIGATION
W69-03420 06E

BEACH FRONT REPAIR AND DREDGING OF STREAMS,
W69-03422 06E

NAVIGATION.
W69-03423 06E

LICENSE FOR TAKING OYSTERS OR CLAMS.
W69-03424 06E

JERUZAL V HERRICK (STATUTORY AUTHORITY OF DRAIN COMMISSIONER).
W69-03426 04A

DEMOSKI V STATE (CLAIMS AGAINST STATE ATTRIBUTED TO FLOOD PROTECTION PLAN).
W69-03430 04A

CITY OF EAST ORANGE V TOWNSHIP OF LIVINGSTON (TAX ASSESSMENT OF WATER RESERVE LANDS).
W69-03442 06C

MUNICIPAL AND PARISH BRIDGES.
W69-03445 04A

GENERAL DRAINAGE.
W69-03453 04A

USE AND PROTECTION OF WATERS.
W69-03457 04A

PUNISHMENT FOR VIOLATIONS.
W69-03458 04A

EFFECT AND ENFORCEMENT OF CONSERVATION LAWS.
W69-03464 06E

UNAPPROPRIATED STATE LANDS DEFINED.
W69-03465 06E

ACCELERATING OR IMPEDING FLOW OF MINERAL WATERS.
W69-03471 04A

WASTE OF MINERAL WATERS HOLDING SALTS AND EXCESS CARBONIC ACID GAS.
W69-03472 04A

STATE V KINSLEY (VIOLATION OF POLLUTION STATUTE).
W69-03475 05B

COMPREHENSIVE RIVER BASIN PLANNING THE ARKANSAS-WHITE-RED BASINS INTER-AGENCY COMMITTEE EXPERIENCE,
W69-03596 06B

SOME CRITICAL PROBLEMS OF THE SHELLFISH INDUSTRY,
W69-03621 06E

MARINE SHIPPING INDUSTRY - EFFECTS AND IMPACTS ON THE CHESAPEAKE BAY,
W69-03636 05G

'GEORGIA WATER QUALITY CONTROL BOARDS STATEMENT TO THE NATIONAL ESTUARINE STUDY REPORT',
W69-03679 05G

HOW TO STOP THE PILLAGE OF AMERICA,
W69-03694 06E

LEVEES
RICE V STODDARD (DIRECTING RUNOFF TO DRAINAGE DITCH).
W69-03280 04A

DRAINAGE DISTRICT NO 48 OF DUNLIN COUNTY V SMALL (NUISANCE ACTION BY DRAINAGE DISTRICT TO ABATE PRIVATE LEVEE).
W69-03437 04A

LINEAR RANDOM MODELS
LINEAR RANDOM MODELS OF ANNUAL STREAMFLOW SERIES,
W69-03379 04A

LINEARITY TEST
FLOOD HYDROLOGY OF SMALL WATERSHEDS--EVALUATION OF TIME PARAMETERS AND DETERMINATION OF PEAK DISCHARGE,
W69-03569 02E

LINKED SYSTEMS
OPTIMAL CONTROL OF LINKED RESERVOIRS,
W69-03571 06A

LIVESTOCK
RECOVERY OF BACTERIAL PATHOGENS FROM HIGH QUALITY SURFACE WATER,
W69-03311 05B

LOCAL GOVERNMENTS
TRI-COUNTY DRAINAGE DISTRICT V MORRISON (RIGHT OF A COUNTY TO WITHDRAW FROM ORIGINAL DRAINAGE DISTRICT).
W69-03436 06E

FERRIES, CANALS AND PUBLIC LANDINGS.
W69-03451 04A

ACTION ON ILLEGAL DREDGING AND FILLING IN THE AREA OF HEMPSTEAD, N.Y.
W69-03665 04A

LOCATING
FERRIES, CANALS AND PUBLIC LANDINGS.
W69-03451 04A

LOCKS
OPERATION OF HYDRO-ELECTRIC PLANTS AT CRESCENT AND VISHER FERRY CONTROL OF SARANAC LAKE LOCKS.
W69-03467 04A

LOESS
INFILTRATION AND SUBSIDENCE PROCESSES IN LOESS SOILS,
W69-03207 02G

LONG-TERM PLANNING
COMPREHENSIVE PLANNING IN RELATION TO THE RISE AND MANAGEMENT OF ESTUARIES,
W69-03624 06B

LOUISIANA
BURAS ICE FACTORY, INC V DEPARTMENT OF HIGHWAYS (EASEMENTS TO CANALS).
W69-03286 04A

MUNICIPAL AND PARISH BRIDGES.
W69-03445 04A

SERVITUDES WHICH ORIGINATE FROM THE NATURAL SITUATION OF THE PLACES.
W69-03446 04A

RIGHTS OF USUFRUCTUARY.
W69-03447 04A

RIGHT OF ACCESSION - IMMOVABLES.
W69-03448 04A

THINGS - DIVISION OF THINGS.
W69-03449 04A

LYSIMETERS
ACCURACY OF EVAPOTRANSPIRATION DETERMINATIONS BY THE BOWEN RATIO METHOD,
W69-03504 02D

MADISON(WIS)
COPPER IN LAKE MUDS FROM LAKES OF THE MADISON AREA,
W69-03366 05A

MAINTENANCE

LIBRATION AND MAINTENANCE OF VERTICAL-AXIS TYPE CURRENT
TERS,
9-03536 07B

GEMENT
MPREHENSIVE PLANNING IN RELATION TO THE RISE AND
NAGEMENT OF ESTUARIES,
9-03624 06B

HE ROLE OF MAN IN ESTUARINE PROCESSES',
9-03638 06G

INGS EQUATION
OOD-FLOW CHARACTERISTICS OF A RECTIFIED CHANNEL, JACKSON,
SSISSIPPI,
9-03566 02F

NAS
ATING FACILITIES.
9-03615 06B

NE PLANTS
VERNMENT, INDUSTRY AND SCIENCE STUDY POTENTIAL OF
AWEEDS.
9-03672 06B

ET VALUE
LIFORNIA SALMON LANDINGS, 1952 THROUGH 1965,
9-03686 06C

OV PROCESSES
FIRST-ORDER MARKOV MODEL FOR ASSESSING RAINFALL
SCONTINUITY IN CENTRAL AUSTRALIA,
9-03494 02B

LAND
NNEDY-CHAMBERLIN DEVELOPMENT CO V SNUBE (MUNICIPAL
AINAGE SYSTEMS).
9-03479 04A

ATEMENT BEFORE THE SUBCOMMITTEE ON AIR AND WATER
LLUTION,
9-03619 05B

ESAPEAKE BAY STUDY TASK GROUP ON FLOOD CONTROL,
IGATION, EROSION, FISHERIES--MINUTES OF THE FIRST
ETING.
9-03626 06B

RINE SHIPPING INDUSTRY - EFFECTS AND IMPACTS ON THE
ESAPEAKE BAY,
9-03636 05G

E CONDITION OF THE CHESAPEAKE BAY,
9-03637 06B

LANNING A WATER QUALITY MANAGEMENT SYSTEM THE CASE OF
E POTOMAC ESTUARY',
9-03643 05G

ATEMENT BEFORE THE SUBCOMMITTEE ON AIR AND WATER
LLUTION,
9-03670 05C

ACHUSETTS
PARTMENT OF NATURAL RESOURCES.
9-03255 06E

9-03256 06E

9-03257 06E

TIES OF THE DEPARTMENT OF PUBLIC WORKS RELATIVE TO
MONWEALTH LANDS, CERTAIN ISLANDS, AND PROPERTY IN
MOUTH.
9-03258 04C

WERS OF THE DEPARTMENT OF PUBLIC WORKS AS TO PR PORT OF
STON HARBOR.
9-03259 04A

WER OF THE DEPARTMENT OF PUBLIC WORKS TO TAKE AND HOLD
AL ESTATE AND BUILD THEREON.
9-03260 06E

VELOPMENT OF WATERFRONT FACILITIES - IMPROVEMENT AND
ESERVATION OF RIVERS, HARBORS, ETC.
9-03261 06E

RUCTURES THE DEPARTMENT OF PUBLIC WORKS MAY LICENSE TO BE
ECTED IN RIVERS AND STREAMS.
9-03262 06E

ENSES IN CONN RIVER, GREAT PONDS, AND TIDE WATERS AS TO
OMS, PIERS, WHARVES, PIPE LINE, ETC.
9-03263 06E

ENSES TO BE REVOCABLE AND TO EXPIRE IN FIVE YEARS -
STON HARBOR LICENSES - FORM, HOW GRANTED AND CONSTRUED.
9-03264 06E

BLIC ACCESS TO GREAT PONDS.
9-03265 04A

RUCTURES IN GREAT PONDS RESTRICTED - LOWERING WATERS
GULATED - SUPERVISION OF ERECTIONS - COMPENSATION FOR TIDE
TER DISPLACED.
9-03266 04A

DITIONAL COMPENSATION WHEN TITLE TO LAND IS IN THE
MONWEALTH - UNAUTHORIZED ERECTIONS IN TIDE WATER TO BE
PUBLIC NUISANCES.
W69-03267 04A

COUNTIES, CITIES, AND TOWNS MAY APPROPRIATE MONEY FOR
IMPROVEMENT OF WATERWAYS.
W69-03268 04A

PROHIBITION OF REMOVAL OF GRAVEL, ETC, FROM BEACHES REMOVAL
OF NATURAL BARRIERS FROM EROSION BY THE SEA PENALIZED.
W69-03269 04A

SURVEYS AND IMPROVEMENTS OF HARBORS - ESTABLISHMENT OF
HARBOR LINES - GREAT PONDS DEFINED.
W69-03270 06E

REMOVAL OF WRECKS ON SHORES OR IN TIDE WATERS.
W69-03271 06E

BREAKING UP, DISPOSAL, AND GROUNDING OF CERTAIN FLOATING
STRUCTURES - REMOVAL OF WHALES.
W69-03272 06E

LICENSING FOREIGN CORP ENGAGED IN WRECKING OR SALVAGING
SUPERVISION OF TRANSPORTATION AND DUMPING OR DREDGED
MATERIAL - ARREST WITHOUT WARRANT.
W69-03273 06E

DISCHARGE OF OIL ON SURFACE WATERS - DOUBLE TORT LIABILITY
FOR DAMAGES.
W69-03274 05B

PUBLIC BEACHES - CONTROL, SUPERVISION, AND PRESERVATION.
W69-03275 06E

THE OCCURRENCE AND CHARACTERISTICS OF GROUND-WATER
CONTAMINATION IN MASSACHUSETTS,
W69-03312 05B

WATER RESOURCES DATA FOR MASSACHUSETTS, NEW HAMPSHIRE, RHODE
ISLAND, VERMONT, 1967--PART 1. SURFACE WATER RECORDS, PART
2. WATER QUALITY RECORDS.
W69-03321 02E

MATHEMATICAL MODELS
THEORETICAL ANALYSIS OF REGIONAL GROUNDWATER FLOW. 2.
EFFECT OF WATER-TABLE CONFIGURATION AND SUBSURFACE
PERMEABILITY VARIATION,
W69-03243 02F

UNSTEADY, ONE-DIMENSIONAL FLOW OVER A PLANE-THE RISING
HYDROGRAPH,
W69-03332 02E

VERTICAL CURRENT STRUCTURE IN THE GREAT LAKES IV.
NUMERICAL EVALUATION OF STERN'S CALCULATION MODEL,
W69-03349 02H

VERTICAL CURRENT STRUCTURE IN THE GREAT LAKES V. THERMAL
CURRENT STRUCTURE IN LAKE MICHIGAN, ASSOCIATED WITH THE
SPRING WARM-UP SEASON--A THEORETICAL STUDY,
W69-03350 02H

ANALYSIS OF A WATER STORAGE RESERVOIR SYSTEM,
W69-03377 04A

ON RESERVOIR NETWORKS,
W69-03378 04A

LINEAR RANDOM MODELS OF ANNUAL STREAMFLOW SERIES,
W69-03379 04A

A PROCEDURE FOR COMPUTATION OF THE TOTAL RIVER SAND
DISCHARGE AND DETAILED DISTRIBUTION, BED TO SURFACE,
W69-03541 02J

HYDROLOGY OF SURFACE MINING-A CASE STUDY,
W69-03547 02A

A DERIVATION OF DUPUIT SOLUTION OF STEADY FLOW TOWARD WELLS
BY MATCHED ASYMPTOTIC EXPANSIONS,
W69-03550 02F

THE PERMEABILITY OF A POROUS MEDIUM DETERMINED FROM CERTAIN
PROBABILITY LAWS FOR PORE SIZE DISTRIBUTION,
W69-03553 02F

'NUMERICAL SOLUTION OF THE UNSTEADY, ESTUARY DISPERSION
EQUATION',
W69-03675 02L

'FINITE-DIFFERENCE MODELLING OF RIVER AND ESTUARY
POLLUTION',
W69-03690 05A

MATHEMATICAL STUDIES
EXPLANATION OF PARADOXES IN DUPUIT-FORCHHEIMER SEEPAGE
THEORY,
W69-03242 02F

ON THE MEANING OF THE DUPUIT AND PAVLOVSKII APPROXIMATIONS
IN AQUIFER FLOW,
W69-03252 02F

RESPONSE CHARACTERISTICS OF URBAN WATER RESOURCE DATA
SYSTEMS,
W69-03509 07A

MCHENRY(ILLINOIS)
FLOODS IN MCHENRY QUADRANGLE, NORTHEASTERN ILLINOIS,
W69-03328 02E

MEANDERS
AN ANALYSIS OF THE MEANDERING TENDENCY OF SERPENTINE CAVE, N.S.W.,
W69-03532 02F

METEOROLOGICAL DATA
CLIMATE AND SOIL MOISTURE EXTRACTION,
W69-03250 02G

MICHIGAN
JERUZAL V HERRICK (STATUTORY AUTHORITY OF DRAIN COMMISSIONER).
W69-03426 04A

HUDSON V VILLAGE OF HOMER (RIGHT TO REMOVE DAM).
W69-03427 04A

MICROCLIMATOLOGY
CLIMATE AND SOIL MOISTURE EXTRACTION,
W69-03250 02G

MICROENVIRONMENT
THE WATER OUTPUT OF THE DESERT VEGETATION IN THE DIFFERENT MICROHABITATS OF WADI HOFF,
W69-03501 02I

MICROMETEOROLOGY
METEOROLOGICAL STUDIES IN THE MARMOT CREEK WATERSHED, ALBERTA, CANADA, IN AUGUST 1965,
W69-03330 02D

MICROSESTON
MICROSESTON DYNAMICS IN A SIMPLE SIERRA NEVADA LAKE-STREAM SYSTEM,
W69-03359 02E

MILL DAMS
HUDSON V VILLAGE OF HOMER (RIGHT TO REMOVE DAM).
W69-03427 04A

MINE DRAINAGE
FENWICK V BLUEBIRD COAL COMPANY (MINE WASTES).
W69-03425 05C

MINERAL WATER
WASTE OF MINERAL WATERS HOLDING SALTS AND EXCESS CARBONIC ACID GAS.
W69-03472 04A

PRINCIPLES OF CHEMICAL COMPOSITION OF GROUNDWATERS (BASIC FACTORS), (IN RUSSIAN),
W69-03533 02K

MINERAL WATERS
ACCELERATING OR IMPEDING FLOW OF MINERAL WATERS.
W69-03471 04A

MINING
DICKEY V HONEYCUTT (MINE DAMAGE TO WELLS).
W69-03282 02F

MISSISSIPPI
SHOWS V CITY OF HATTIESBURG (NEGLIGENT MAINTENANCE OF DRAINAGE DITCH).
W69-03438 04A

MAGNOLIA PETROLEUM CO V STINSON (NEGLIGENT POLLUTION OF STREAMS).
W69-03439 05C

'STATEMENT', IN CLEAN WATER FOR THE NATION'S ESTUARIES,
W69-03605 05B

'STATEMENT',
W69-03649 05G

MISSISSIPPI RIVER
RECENT DELTAIC DEPOSITS OF THE MISSISSIPPI RIVER THEIR DEVELOPMENT AND CHRONOLOGY,
W69-03230 02J

MISSISSIPPI RIVER BASIN
PLANNING FOR MULTI-PURPOSE DEVELOPMENT OF WATER AND RELATED LAND RESOURCES IN THE UPPER MISSISSIPPI RIVER BASIN,
W69-03586 06B

MISSOURI
RICE V STODDARD (DIRECTING RUNOFF TO DRAINAGE DITCH).
W69-03280 04A

MCCORD V MISSOURI CROOKED RIVER BACKWATER LEVEE DISTRICT (MOTION TO ABATE CONDEMNATION PROCEEDINGS).
W69-03292 06E

DRAINAGE DISTRICT NO 48 OF DUNLIN COUNTY V SMALL (NUISANCE ACTION BY DRAINAGE DISTRICT TO ABATE PRIVATE LEVEE).
W69-03437 04A

MIXED FORESTS
THROUGHFALL AND STEMFLOW IN A PINE-HARDWOOD STAND IN THE OUACHITA MOUNTAINS OF ARKANSAS,
W69-03339 02I

MODEL STUDIES
USE OF THERMAL MODEL TO INVESTIGATE THE THEORY OF TRANSIENT FLOW TO A PARTIALLY PENETRATING WELL,
W69-03254 02F

A REVIEW OF RAINFALL-RUNOFF, PHYSICAL MODELS AS DEVELOPED BY DIMENSIONAL ANALYSIS AND OTHER METHODS,
W69-03309 02A

INVESTIGATION OF THE TECHNICAL FEASIBILITY OF STORING FRESH WATER IN SALINE AQUIFERS,
W69-03336 02F

DYNAMIC MODEL OF THE ECONOMY OF THE SUSQUEHANNA RIVER BASIN,
W69-03570 06B

'STATEMENT',
W69-03617 05G

MOISTURE CONTENT
MEASURING MOISTURE NEAR SOIL SURFACE...MINOR DIFFERENCES DUE TO NEUTRON SOURCE TYPE,
W69-03498 02G

ACCURACY OF SOIL MOISTURE READINGS WITH UNSEALED ACCESS TUBES,
W69-03500 02G

MOISTURE DEFICIT
EFFECT OF HIGH TEMPERATURES ON MOISTURE DEPLETION, IMBIBITION AND GERMINATION OF SEEDS OF MIMOSA HAMATA WILLD,
W69-03503 02I

MOISTURE STRESS
COMPARISON OF THE DYE METHOD WITH THE THERMOCOUPLE PSYCHROMETER FOR MEASURING LEAF WATER POTENTIALS,
W69-03390 02I

MEASUREMENT OF LEAF WATER POTENTIAL BY THE DYE METHOD,
W69-03392 02I

EFFECT OF LEAF AGING ON WATER DEFICIT-WATER POTENTIAL RELATIONSHIPS OF DOGWOOD LEAVES GROWING IN TWO ENVIRONMENTS,
W69-03393 02I

GERMINATION STUDIES ON ARID ZONE TREE SEEDS,
W69-03489 02I

DROUGHT-ASSOCIATED MORTALITY OF RANGE GRASSES IN SOUTH TEXAS,
W69-03495 02I

MONETARY BENEFITS
ESTUARIES A NEGLECTED RESOURCE COMPLEX,
W69-03620 06B

MONITORING
SURVEILLANCE OPERATIONS IN THE CONTROL OF WATER POLLUTION ON A NATIONAL SCALE,
W69-03584 05G

METROPOLITAN SEATTLE'S DUWAMISH ESTUARY WATER QUALITY PROGRAM,
W69-03667 05B

MONSOONS
FREQUENCY OF WET AND DRY SPELLS AT FIVE STATIONS IN RAJASTHAN,
W69-03490 02B

MONTANA
OCCURRENCE OF GROUND WATER IN THE JUDITH RIVER FORMATION, NORTH-CENTRAL MONTANA,
W69-03545 02F

MORTALITY
DROUGHT-ASSOCIATED MORTALITY OF RANGE GRASSES IN SOUTH TEXAS,
W69-03495 02I

MOUNTAINS
METEOROLOGICAL STUDIES IN THE MARMOT CREEK WATERSHED, ALBERTA, CANADA, IN AUGUST 1965,
W69-03330 02D

RELATIONS BETWEEN TOPOGRAPHY AND ANNUAL PRECIPITATION IN WESTERN OREGON AND WASHINGTON,
W69-03340 02B

MUD-WATER INTERFACE
PHOSPHORUS RELEASE FROM BOG LAKE MUDS,
W69-03363 02K

MULTIPLE PURPOSE
PLANNING FOR MULTI-PURPOSE DEVELOPMENT OF WATER AND RELATED LAND RESOURCES IN THE UPPER MISSISSIPPI RIVER BASIN,
W69-03586 06B

MULTIPLE PURPOSE PROJECTS
DISTRIBUTION OF COSTS OF MULTIPLE-PURPOSE HYDRAULIC PROJECTS,
W69-03577 06C

MULTIPLE-PURPOSE
PLANNING FOR MULTIPLE-PURPOSE DEVELOPMENT,
W69-03587 06B

MULTIPLE-PURPOSE PROJECTS
SAVE-THE-SALMON PROJECT ON THE ST. JOHN RIVER,
W69-03669 05C

MULTISTAGE STRUCTURE
OPTIMIZATION OF BRANCHING MULTISTAGE SYSTEMS A REPLY TO A COMMENT BY D P LOUCKS,
W69-03580 06A

MUNICIPAL WATER
MAIN I, A SYSTEM OF COMPUTERIZED MODELS FOR CALCULATING AND EVALUATING MUNICIPAL WATER REQUIREMENTS VOLUME I-

VELOPMENT OF THE MAIN SYSTEM VOLUME II-DESCRIPTION OF
E MAIN I SYSTEM AND LIBRARY OF WATER USAGE PARAMETERS.
9-03201 06D

IN I, A SYSTEM OF COMPUTERIZED MODELS FOR CALCULATING AND
ALUATING MUNICIPAL WATER REQUIREMENTS.
9-03202 06D

ITROLE CONCENTRATIONS IN CREEK WATERS DOWNSTREAM FROM AN
RIALLY SPRAYED WATERSHED SUBBASIN,
9-03226 05B

CIPAL WATER REQUIREMENT MODEL
IN I, A SYSTEM OF COMPUTERIZED MODELS FOR CALCULATING AND
ALUATING MUNICIPAL WATER REQUIREMENTS VOLUME I-
VELOPMENT OF THE MAIN SYSTEM VOLUME II-DESCRIPTION OF
E MAIN I SYSTEM AND LIBRARY OF WATER USAGE PARAMETERS.
9-03201 06D

IN I, A SYSTEM OF COMPUTERIZED MODELS FOR CALCULATING AND
ALUATING MUNICIPAL WATER REQUIREMENTS.
9-03202 06D

DEPT OF WATER RESOURCES
ANSFER OF CERTAIN POWERS, DUTIES, FUNCTIONS AND
SPONSIBILITIES OF THE DEPARTMENT OF CONSERVATION AND
VELOPMENT.
9-03429 06E

ONAL SEASHORES
NSERVATION AND MANAGEMENT OF SEASHORE AND UNDERWATER AREAS
R PUBLIC ENJOYMENT,
9-03676 06B

RAL FLOW DOCTRINE
NWICK V BLUEBIRD COAL COMPANY (MINE WASTES).
9-03425 05G

ULTON V BUNTING MCWILLIAMS POST NO 658 (DIVERSION OF NON-
VIGABLE STREAM).
9-03443 04A

RVITUDES WHICH ORIGINATE FROM THE NATURAL SITUATION OF THE
ACES.
9-03446 04A

RAL RESOURCES
ONOMIC DEVELOPMENT.
9-03419 06E

GABLE WATERS
OPLE V JOHNSON (TRESPASS ON PRIVATELY OWNED UNDERWATER
ND).
9-03277 06E

BLIC WORKS (ACQUISITION OF WATER RIGHTS FOR PUBLIC
RPOSES).
9-03412 06E

VIGATION.
9-03423 06E

VE LAKES OUTING CLUB V HORSESHOE LAKE PROTECTIVE ASS'N
WNERSHIP OF NON-NAVIGABLE LAKES).
9-03433 06E

GATION
MOVAL OF WRECKS ON SHORES OR IN TIDE WATERS.
9-03271 06E

EAKING UP, DISPOSAL, AND GROUNDING OF CERTAIN FLOATING
RUCTURES - REMOVAL OF WHALES.
9-03272 06E

HIGH VALLEY RR V THE RUSSELL NO 1 (LIABILITY FOR DAMAGE
USED BY SUBMERGED PILINGS).
9-03287 04A

ANTING REVOCABLE PERMITS.
9-03466 06C

TER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF
GINEERS IN ILLINOIS.
9-03591 06B

ESAPEAKE BAY STUDY TASK GROUP ON FLOOD CONTROL,
VIGATION, EROSION, FISHERIES--MINUTES OF THE FIRST
ETING.
9-03626 06B

GATION OBSTRUCTION
HIGH VALLEY RR V THE RUSSELL NO 1 (LIABILITY FOR DAMAGE
USED BY SUBMERGED PILINGS).
9-03287 04A

ORKS
RESERVOIR NETWORKS,
9-03378 04A

RON METERS
LUMETRIC CALIBRATION OF NEUTRON MOISTURE PROBES,
9-03394 02G

DA
QUFNTIAL STUDY OF DESERT FLOODING IN THE WHITE MOUNTAINS
CALIFORNIA AND NEVADA,
9-03222 02E

HAMPSHIRE
TER RESOURCES DATA FOR MASSACHUSETTS, NEW HAMPSHIRE, RHODE
LAND, VERMONT, 1967--PART 1. SURFACE WATER RECORDS, PART
2. WATER QUALITY RECORDS.
W69-03321 02E

STATE V 6.0 ACRES OF LAND (RIPARIAN OWNERS' RIGHT TO
ACCRETION LAND).
W69-03428 06E

NEW JERSEY
SCHULTZ V WILSON (TIDAL WATERS).
W69-03294 06E

PUBLIC WORKS (ACQUISITION OF WATER RIGHTS FOR PUBLIC
PURPOSES).
W69-03412 06E

WATER FRONT IMPLOVEMENTS.
W69-03413 06E

MUNICIPALITIES GENERALLY (PERMIT FOR BUILDING IN BED OF
MAPPED STREET OR DRAINAGE RIGHT OF WAY).
W69-03414 06E

MUNICIPALITIES GENERALLY - GENERAL POWERS.
W69-03415 06E

PUBLIC UTILITIES - ARTICLE 9 - BRIDGES, VIADUCTS AND
TUNNELS.
W69-03416 06E

WATER POWER COMPANIES ALONG TRIBUTARIES TO BARNEGAT BAY.
W69-03417 06E

SEWERAGE COMPANIES.
W69-03418 06E

ECONOMIC DEVELOPMENT.
W69-03419 06E

DIVISION OF NAVIGATION
W69-03420 06E

CONSERVATION AND DEVELOPMENT.
W69-03421 06E

BEACH FRONT REPAIR AND DREDGING OF STREAMS,
W69-03422 06E

NAVIGATION.
W69-03423 06E

LICENSE FOR TAKING OYSTERS OR CLAMS.
W69-03424 06E

CITY OF EAST ORANGE V TOWNSHIP OF LIVINGSTON (TAX ASSESSMENT
OF WATER RESERVE LANDS).
W69-03442 06C

LUMBER OR BOATS FOUND ADRIFT.
W69-03474 06E

STATE V KINSLEY (VIOLATION OF POLLUTION STATUTE).
W69-03475 05B

COMPUTATION OF REAERATION COEFFICIENTS FOR A RIVER SYSTEM IN
NORTHEASTERN NEW JERSEY,
W69-03561 05C

NEW SOUTH WALES
AN ANALYSIS OF THE MEANDERING TENDENCY OF SERPENTINE CAVE,
N.S.W.,
W69-03532 02F

NEW YORK
IN RE NEVERSINK RIPARIAN SECTION NO 1 SULLIVAN COUNTY
(CONDEMNATION PROCEEDINGS TO ACQUIRE ADDITIONAL WATER
SUPPLY).
W69-03276 06E

LEHIGH VALLEY RR V THE RUSSELL NO 1 (LIABILITY FOR DAMAGE
CAUSED BY SUBMERGED PILINGS).
W69-03287 04A

EXISTING RIGHTS AND REMEDIES PRESERVED LIMITATIONS.
W69-03297 04A

VIOLATIONS AND CIVIL LIABILITY.
W69-03298 06E

DELAWARE RIVER BASIN COMPACT.
W69-03299 06B

PURPOSE AND FINDINGS.
W69-03300 06E

REGULATION OF WITHDRAWALS AND DIVERSIONS.
W69-03303 06C

CONDEMNATION PROCEEDINGS, RIGHTS OF WAY AND EFFECT ON
RIPARIAN RIGHTS.
W69-03304 06E

WATER RESOURCES DATA FOR NEW YORK, 1967--PART 1. SURFACE
WATER RECORDS.
W69-03320 02E

DEMOSKI V STATE (CLAIMS AGAINST STATE ATTRIBUTED TO FLOOD
PROTECTION PLAN).
W69-03430 04A

CONSTRUCTION AND DEVELOPMENT OF EXCESS DRAINAGE FACILITIES -
CONTRACTS.

W69-03431 04A

REGULATION OF OPEN WELLS, CESSPOOLS, BASINS OR SUMPS.
W69-03432 04A

ANDREWS V STATE (CONDEMNATION VALUE OF REALTY).
W69-03450 06C

DECLARATION OF POLICY.
W69-03456 04A

USE AND PROTECTION OF WATERS.
W69-03457 04A

PUNISHMENT FOR VIOLATIONS.
W69-03458 04A

UNLAWFUL INTERFERENCE WITH IMPROVEMENT WORKS.
W69-03459 04A

WATER SUPPLY.
W69-03461 04A

WITHDRAWAL AND DIVERSION FROM PROTECTED AREAS.
W69-03462 04A

CONSERVATION AND WATER RESOURCES PLANS.
W69-03463 06B

EFFECT AND ENFORCEMENT OF CONSERVATION LAWS.
W69-03464 06E

UNAPPROPRIATED STATE LANDS DEFINED.
W69-03465 06E

GRANTING REVOCABLE PERMITS.
W69-03466 06C

OPERATION OF HYDRO-ELECTRIC PLANTS AT CRESCENT AND VISHER FERRY CONTROL OF SARANAC LAKE LOCKS.
W69-03467 04A

POLLUTING STREAMS PROHIBITED.
W69-03468 05B

PROHIBITED ACTS.
W69-03469 08I

PROTECTION OF WATERS CESSPOOLS AND DRAINS.
W69-03470 05B

ACCELERATING OR IMPEDING FLOW OF MINERAL WATERS.
W69-03471 04A

WASTE OF MINERAL WATERS HOLDING SALTS AND EXCESS CARBONIC ACID GAS.
W69-03472 04A

CENTRAL NEW YORK BROADCASTING CORP V STATE (STATE NOT LIABLE FOR DAMAGES FLOWING FROM FEDERALLY-CONTROLLED FLOOD CONTROL PROJECT).
W69-03473 04A

DRAINS AND PROTECTION OF PUBLIC WATER SUPPLIES.
W69-03476 05B

THROWING GAS TAR OR REFUSE INTO PUBLIC WATERS.
W69-03477 05B

SIRACO V VILLAGE OF WHITEHALL (NON-LIABILITY OF VILLAGE FOR FIRE DAMAGE RESULTING FROM VILLAGE'S FAULTY WATER SYSTEM).
W69-03478 06E

ACTION ON ILLEGAL DREDGING AND FILLING IN THE AREA OF HEMPSTEAD, N.Y.
W69-03665 04A

THE HUDSON RIVER ESTUARY, A PRELIMINARY INVESTIGATION OF FLOW AND WATER-QUALITY CHARACTERISTICS,
W69-03668 02L

POTENTIAL FRESHWATER RESERVOIR IN THE NEW YORK AREA,
W69-03700 04A

NITRATES
FATE OF DDT AND NITRATE IN GROUND WATER,
W69-03219 05B

NITROGEN COMPOUNDS
DETECTION OF LIMITING OR SURPLUS NITROGEN IN ALGAE AND AQUATIC WEEDS,
W69-03364 05C

GROWTH AND NUTRIENT UPTAKE OF IRRIGATED YOUNG PONDEROSA PINE AFTER FERTILIZER TREATMENTS,
W69-03398 05B

ASPECTS OF THE NITROGEN NUTRITION OF SOME NATURALLY OCCURRING POPULATIONS OF BLUE-GREEN ALGAE,
W69-03515 05C

NITROGEN FIXATION
ACETYLENE REDUCTION BY NITROGEN-FIXING BLUE-GREEN ALGAE,
W69-03368 02K

IN SITU STUDIES ON (NITROGEN) FIXATION USING THE ACETYLENE REDUCTION TECHNIQUE,
W69-03372 02K

NORTH AMERICA
THE CONTINENTAL USE OF ARCTIC-FLOWING RIVERS,
W69-03313 04A

NORTH CAROLINA
DRAINAGE OF HIGHWAY.
W69-03288 04A

EMINENT DOMAIN -- RIGHT OF BY WHOM RIGHT MAY BE EXERCISED.
W69-03289 06E

GROUNDWATER RESOURCES OF CHOWAN COUNTY, NORTH CAROLINA,
W69-03355 02F

TRANSFER OF CERTAIN POWERS, DUTIES, FUNCTIONS AND RESPONSIBILITIES OF THE DEPARTMENT OF CONSERVATION AND DEVELOPMENT.
W69-03429 06E

DISPOSITIONS OF STATE LAND.
W69-03440 04A

NUCLEAR MOISTURE METER
VOLUMETRIC CALIBRATION OF NEUTRON MOISTURE PROBES,
W69-03394 02G

NUCLEAR MOISTURE METERS
MEASURING MOISTURE NEAR SOIL SURFACE...MINOR DIFFERENCES DUE TO NEUTRON SOURCE TYPE,
W69-03498 02G

ACCURACY OF SOIL MOISTURE READINGS WITH UNSEALED ACCESS TUBES,
W69-03500 02G

NUCLEAR POWERPLANTS
DESALINATION AND ITS ROLE IN WATER SUPPLY.
W69-03351 03A

THE EFFECTS OF THERMAL POLLUTION ON RIVER ICE CONDITIONS,
W69-03546 05C

ENGINEERING AND ECONOMIC FEASIBILITY STUDY FOR A COMBINATION NUCLEAR POWER-DESALTING PLANT.
W69-03658 03A

NUMERICAL ANALYSIS
FINITE DIFFERENCING METHODS,
W69-03519 07C

STREAMFLOW ROUTING (WITH APPLICATIONS TO NORTH CAROLINA RIVERS),
W69-03564 02E

NUTRIENT REQUIREMENTS
EXTRACTIVE AND ENZYMATIC ANALYSES FOR LIMITING OR SURPLUS PHOSPHORUS IN ALGAE,
W69-03373 05A

STRIPPING EFFLUENTS OF NUTRIENTS BY BIOLOGICAL MEANS,
W69-03374 05F

ENVIRONMENTAL REQUIREMENTS OF BLUE-GREEN ALGAE.
W69-03512 05C

ASPECTS OF THE NITROGEN NUTRITION OF SOME NATURALLY OCCURRING POPULATIONS OF BLUE-GREEN ALGAE,
W69-03515 05C

NUTRIENTS
'MIXING OF COLUMBIA RIVER AND OCEAN WATERS, SUMMER',
W69-03632 05C

'NUTRIENT ASSIMILATION IN A VIRGINIA TIDAL SYSTEM',
W69-03695 05C

OBSTRUCTION TO FLOW
TOWN OF MIAMI SPRINGS V LAWRENCE (DAMAGES FROM FLOODING).
W69-03284 04A

PAYNE V HAZARD COCA COLA BOTTLING WORKS (ACTION TO ENJOIN OBSTRUCTION TO NATURAL FLOW OF WATER).
W69-03291 04A

NIMMONS V CITY OF LA GRANGE (ACTION BY LAND OWNER FOR FLOODING CAUSED BY CITY'S ROAD CONSTRUCTION).
W69-03293 04A

GRIFFITH V HURT (JOINDER OF PARTIES IN SUIT FOR DAMAGES CAUSED BY OBSTRUCTION TO FLOW).
W69-03434 04A

SERVITUDES WHICH ORIGINATE FROM THE NATURAL SITUATION OF THE PLACES.
W69-03446 04A

OFFSHORE PLATFORMS
HURRICANE DAMAGE TO STRUCTURES,
W69-03634 08A

OIL INDUSTRY
LIMITING FACTORS IN HARBOR DEVELOPMENT,
W69-03622 06F

GULF OF MEXICO IS STILL BOOMING.
W69-03673 06B

INDUSTRY OUTLOOK/DIRECTION 1968,
W69-03687 06D

OIL RESERVOIRS
GULF OF MEXICO IS STILL BOOMING.
W69-03673 06B

DUSTRY OUTLOOK/DIRECTION 1968,
9-03687 06D

WASTES
SCHARGE OF OIL ON SURFACE WATERS - DOUBLE TORT LIABILITY
R DAMAGES.
9-03274 05B

. S. COAST GUARD REPORT OF WAKE ISLAND OIL SPILL',
9-03685 05C

EPING OIL OUT OF THE SEA.
9-03688 05B

WELLS
LF OF MEXICO IS STILL BOOMING.
9-03673 06B

WATER
EPING OIL OUT OF THE SEA.
9-03688 05B

RIO
OUND WATER IN ONTARIO SOUTHWESTERN AREA, 1960-1963.
9-03354 02F

CHANNELS
FILTRATION AND SUBSIDENCE PROCESSES IN LOESS SOILS,
9-03207 02G

-CHANNEL HYDRAULICS
REAMS-THEIR DYNAMICS AND MORPHOLOGY,
9-03248 02E

ATING COSTS
ME ECONOMIC ASPECTS OF ADVANCED WASTE TREATMENT,
9-03644 05D

MAL CONTROL POLICIES
TIMAL CONTROL OF LINKED RESERVOIRS,
9-03571 06A

MIZATION
TIMIZATION TECHNIQUES FOR HYDROLOGIC ENGINEERING,
9-03329 06A

SPONSE CHARACTERISTICS OF URBAN WATER RESOURCE DATA
STEMS,
9-03509 07A

TIMIZATION OF BRANCHING MULTISTAGE SYSTEMS A REPLY TO A
MMENT BY D P LOUCKS,
9-03580 06A

NIC MATTER
CROSESTON DYNAMICS IN A SIMPLE SIERRA NEVADA LAKE-STREAM
STEM,
9-03359 02E

FECT OF ORGANIC MATTER CONTENT OF THE SOIL ON
FILTRATION,
9-03484 02G

TIC PRESSURE
MPARISON OF THE DYE METHOD WITH THE THERMOCOUPLE
YCHROMETER FOR MEASURING LEAF WATER POTENTIALS,
9-03390 02I

ASUREMENT OF LEAF WATER POTENTIAL BY THE DYE METHOD,
9-03392 02I

FECT OF EXTERNAL SALT CONCENTRATIONS ON WATER RELATIONS IN
ANTS II. EFFECT OF THE OSMOTIC DIFFERENTIAL BETWEEN
TERNAL MEDIUM AND XYLEM ON WATER RELATIONS IN THE ENTIRE
ANT,
9-03487 02I

DOR BASED RECREATION
PLICATION OF MARGINAL ECONOMIC ANALYSIS TO RESERVOIR
CREATION PLANNING,
9-03576 06B

FLOW
WN OF MIAMI SPRINGS V LAWRENCE (DAMAGES FROM FLOODING).
9-03284 04A

FLOWED LANDS
NERAL DRAINAGE.
9-03454 04A

LAND FLOW
STEADY, ONE-DIMENSIONAL FLOW OVER A PLANE-THE RISING
DROGRAPH,
9-03332 02E

CTORS AFFECTING THE RESPONSE OF SMALL WATERSHEDS TO
ECIPITATION IN HUMID AREAS,
9-03388 02E

RSHIP OF BEDS
AKE V RICHARDSON (TITLE TO PONDS BY ADVERSE POSSESSION AND
ESCRIPTION).
9-03279 04A

AMS V CREWS (TITLE TO SUBMERGED LAND).
9-03281 06E

EIN V BROWN PROPERTIES, INC (TITLE TO SUBMERGED LANDS).
9-03283 06E

HAYES V BOWMAN (RIPARIAN RIGHTS ON NAVIGABLE WATERS).
W69-03290 04A

SCHULTZ V WILSON (TIDAL WATERS).
W69-03294 06E

FIVE LAKES OUTING CLUB V HORSESHOE LAKE PROTECTIVE ASS'N
(OWNERSHIP OF NON-NAVIGABLE LAKES).
W69-03433 06E

THINGS - DIVISION OF THINGS.
W69-03449 04A

OXYGEN DEMAND
THE EFFECT OF TURBULENCE ON BACTERIAL SUBSTRATE UTILIZATION,
W69-03343 05G

OXYGEN ISOTOPES
THE OCCURRENCE OF TRITIUM IN PRECIPITATION AND ITS
SIGNIFICANCE IN HYDROLOGICAL INVESTIGATIONS,
W69-03555 02K

OXYGEN SAG
PROBABILISTIC ANALYSIS OF WASTE WATER TREATMENT AND DISPOSAL
SYSTEM,
W69-03699 05D

OXYGENATION
'ESTUARINE OXYGEN RESOURCES--PHOTOSYNTHESIS AND REAERATION',
W69-03610 05G

PROBABILISTIC ANALYSIS OF WASTE WATER TREATMENT AND DISPOSAL
SYSTEM,
W69-03699 05D

OYSTERS
THE OYSTER-BASED ECONOMY OF FRANKLIN COUNTY, FLORIDA,
W69-03631 06B

THE MOLLUSCAN SHELLFISH INDUSTRY, CURRENT STATUS AND TRENDS,
W69-03659 06B

THE OYSTER AND THE DREDGE OR 'BEAUTY AND THE BEAST',
W69-03680 06G

PALEOLIMNOLOGY
INTRODUCTION TO PALEOLIMNOLOGY,
W69-03342 02J

PALEOECOLOGICAL STUDIES OF POTATO LAKE AND ITS ENVIRONS,
W69-03361 02J

PARTIAL OPTIMIZATION
OPTIMIZATION OF BRANCHING MULTISTAGE SYSTEMS A REPLY TO A
COMMENT BY D P LOUCKS,
W69-03580 06A

PATH OF POLLUTANTS
CONVECTIVE SALT DIFFUSION IN A RADIAL SUBSURFACE STREAM IN
RELATION TO THE PROTECTION OF SUBSURFACE WATERS FROM
CONTAMINATED DISCHARGES,
W69-03212 05B

GEOPHYSICAL SURVEYS IN THE VICINITY OF SANITARY LANDFILLS IN
NORTHEASTERN ILLINOIS,
W69-03236 05B

HYDROLOGIC DATA COLLECTION IN TIDAL ESTUARIES,
W69-03239 02L

PATHOGENIC BACTERIA
RECOVERY OF BACTERIAL PATHOGENS FROM HIGH QUALITY SURFACE
WATER,
W69-03311 05B

PEAK DISCHARGE
MEASUREMENT OF PEAK DISCHARGE AT CULVERTS BY INDIRECT
METHODS,
W69-03345 07B

FLOOD HYDROLOGY OF SMALL WATERSHEDS--EVALUATION OF TIME
PARAMETERS AND DETERMINATION OF PEAK DISCHARGE,
W69-03569 02E

PEAK STREAMFLOW SYNTHESIS
THE USE OF PRECIPITATION RECORDS FOR PEAK STREAMFLOW
SYNTHESIS,
W69-03562 02A

PENNSYLVANIA
MESSINGER V TOWNSHIP OF WASHINGTON (DRAINAGE LICENSE).
W69-03295 04A

PAINTER V PENNSYLVANIA PUBLIC UTILITY COMMISSION (PREFERENCE
GIVEN EXISTING WATER COMPANIES IN GRANTING EXTENSIONS).
W69-03452 06E

AN APPRAISAL OF THE GROUND-WATER RESOURCES OF THE UPPER
SUSQUEHANNA RIVER BASIN IN PENNSYLVANIA,
W69-03528 02F

PERCHED WATER
ON THE MECHANISM OF SUSPENDED CAPILLARY WATER AND PERCHED
GROUNDWATER,
W69-03208 02F

PERCOLATING WATER
DICKEY V HONEYCUTT (MINE DAMAGE TO WELLS).
W69-03282 02F

C AND W COAL CORPORATION V SALYER (DESTRUCTION OF

UNDERGROUND STREAM).
W69-03444 04C

PERMEABILITY
THE PERMEABILITY OF A POROUS MEDIUM DETERMINED FROM CERTAIN PROBABILITY LAWS FOR PORE SIZE DISTRIBUTION,
W69-03553 02F

PERMITS
STRUCTURES THE DEPARTMENT OF PUBLIC WORKS MAY LICENSE TO BE ERECTED IN RIVERS AND STREAMS.
W69-03262 06E

LICENSES IN CONN RIVER, GREAT PONDS, AND TIDE WATERS AS TO BOOMS, PIERS, WHARVES, PIPE LINE, ETC.
W69-03263 06E

LICENSES TO BE REVOCABLE AND TO EXPIRE IN FIVE YEARS - BOSTON HARBOR LICENSES - FORM, HOW GRANTED AND CONSTRUED.
W69-03264 06E

ADDITIONAL COMPENSATION WHEN TITLE TO LAND IS IN THE COMMONWEALTH - UNAUTHORIZED ERECTIONS IN TIDE WATER TO BE PUBLIC NUISANCES.
W69-03267 04A

BREAKING UP, DISPOSAL, AND GROUNDING OF CERTAIN FLOATING STRUCTURES - REMOVAL OF WHALES.
W69-03272 06E

LICENSING FOREIGN CORP ENGAGED IN WRECKING OR SALVAGING - SUPERVISION OF TRANSPORTATION AND DUMPING OR DREDGED MATERIAL - ARREST WITHOUT WARRANT.
W69-03273 06E

MESSINGER V TOWNSHIP OF WASHINGTON (DRAINAGE LICENSE).
W69-03295 04A

MUNICIPALITIES GENERALLY (PERMIT FOR BUILDING IN BED OF MAPPED STREET OR DRAINAGE RIGHT OF WAY).
W69-03414 06E

PAINTER V PENNSYLVANIA PUBLIC UTILITY COMMISSION (PREFERENCE GIVEN EXISTING WATER COMPANIES IN GRANTING EXTENSIONS).
W69-03452 06E

PESTICIDE KINETICS
AMITROLE CONCENTRATIONS IN CREEK WATERS DOWNSTREAM FROM AN AERIALLY SPRAYED WATERSHED SUBBASIN,
W69-03226 05B

PESTICIDE RESIDUES
THE PERSISTENCE OF SILVEX IN WATER AND HYDROSOIL,
W69-03240 05A

PESTICIDE TOXICITY
THE PROBLEM OF PESTICIDES IN ESTUARIES,
W69-03618 05G

PESTICIDES
THE PERSISTENCE OF SILVEX IN WATER AND HYDROSOIL,
W69-03240 05A

THE DETERMINATION OF THE IONIZATION CONSTANT OF 2,4-D IN WATER,
W69-03241 05A

PESTICIDES IN FOREST WATERS--SYMPTOM OF A GROWING PROBLEM,
W69-03401 05C

PHOSPHATES
STUDIES OF THE ANALYSIS OF PHOSPHATES IN ALGAL CULTURES,
W69-03358 05A

PHOSPHATE EQUILIBRIUM BETWEEN REDUCED SEDIMENTS AND WATER,
W69-03365 02K

PHOSPHORUS
PHOSPHORUS RELEASE FROM BOG LAKE MUDS,
W69-03363 02K

PHOSPHORUS COMPOUNDS
EFFECT OF WATER SAMPLE PRESERVATION METHODS ON THE RELEASE OF PHOSPHORUS FROM ALGAE,
W69-03370 05B

EXTRACTIVE AND ENZYMATIC ANALYSES FOR LIMITING OR SURPLUS PHOSPHORUS IN ALGAE,
W69-03373 05A

GROWTH AND NUTRIENT UPTAKE OF IRRIGATED YOUNG PONDEROSA PINE AFTER FERTILIZER TREATMENTS,
W69-03398 05B

PHOTOSYNTHESIS
'ESTUARINE OXYGEN RESOURCES--PHOTOSYNTHESIS AND REAERATION',
W69-03610 05G

PHOTOSYNTHETIC OXYGEN
THE EFFECT OF ALGAE ON BOD MEASUREMENTS,
W69-03362 05A

THE EFFECT OF DILUTION MEDIA ON THE BOD OF ALGAE,
W69-03371 05A

PHREATOPHYTES
A SUGGESTED METHOD FOR ESTIMATING EVAPOTRANSPIRATION BY NATIVE PHREATOPHYTES,
W69-03557 02I

PHYSIOLOGICAL ECOLOGY
STUDIES OF THE ANALYSIS OF PHOSPHATES IN ALGAL CULTURES,
W69-03358 05A

WHY STUDY BLUE-GREEN ALGAE,
W69-03513 05C

PROBLEMS IN THE LABORATORY CULTURE OF PLANKTONIC BLUE-GREEN ALGAE,
W69-03514 05C

ASPECTS OF THE NITROGEN NUTRITION OF SOME NATURALLY OCCURRING POPULATIONS OF BLUE-GREEN ALGAE,
W69-03515 05C

ENVIRONMENTAL REQUIREMENTS OF THERMOPHILIC BLUE-GREEN ALGAE,
W69-03516 05C

GROWTH REQUIREMENTS OF BLUE-GREEN ALGAE AS DEDUCED FROM THEIR NATURAL DISTRIBUTION,
W69-03517 05C

RECENT ADVANCES IN THE PHYSIOLOGY OF BLUE-GREEN ALGAE,
W69-03518 05C

PHYTOPLANKTON
ACETYLENE REDUCTION BY NITROGEN-FIXING BLUE-GREEN ALGAE,
W69-03368 02K

IN SITU STUDIES ON (NITROGEN) FIXATION USING THE ACETYLENE REDUCTION TECHNIQUE,
W69-03372 02K

PROBLEMS IN THE LABORATORY CULTURE OF PLANKTONIC BLUE-GREEN ALGAE,
W69-03514 05C

'PREDICTING DIURNAL VARIATIONS IN DISSOLVED OXYGEN CAUSED BY ALGAE IN ESTUARINE WATERS, PART I',
W69-03611 05C

PIERS
PUBLIC UTILITIES - ARTICLE 9 - BRIDGES, VIADUCTS AND TUNNELS.
W69-03416 06E

PIPING
POTENTIAL FLOW AND SOIL STRUCTURE CHANGES,
W69-03203 02F

PLANKTON
ENVIRONMENTAL REQUIREMENTS OF BLUE-GREEN ALGAE.
W69-03512 05C

PLANNING
THE CONTINENTAL USE OF ARCTIC-FLOWING RIVERS,
W69-03313 04A

INTERAGENCY WATER RESOURCES RESEARCH AND DATA COLLECTION PROGRAM.
W69-03360 09D

CONSERVATION AND WATER RESOURCES PLANS.
W69-03463 06B

GROUND WATER RECHARGE, DEVELOPMENT AND MANAGEMENT,
W69-03540 04B

INTERGOVERNMENTAL RELATIONSHIPS IN THE ADMINISTRATION OF WATER RESOURCES,
W69-03589 06E

W69-03590 06E

ANNUAL REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY, ON CIVIL WORKS ACTIVITIES.
W69-03608 06B

COMPREHENSIVE PLANNING IN RELATION TO THE RISE AND MANAGEMENT OF ESTUARIES,
W69-03624 06B

'STATEMENT',
W69-03649 05G

PLANT GROWTH
EFFECT OF SODIUM SALTS ON THE GROWTH AND MINERAL COMPOSITION OF BAJRA (PENNISETUM TYPHOIDES),
W69-03483 03C

PLANT PHYSIOLOGY
EFFECTS OF SPECIES AND ARRANGEMENT OF FORESTS ON EVAPOTRANSPIRATION,
W69-03386 02D

COMPARISON OF THE DYE METHOD WITH THE THERMOCOUPLE PSYCHROMETER FOR MEASURING LEAF WATER POTENTIALS,
W69-03390 02I

MEASUREMENT OF LEAF WATER POTENTIAL BY THE DYE METHOD,
W69-03392 02I

EFFECT OF LEAF AGING ON WATER DEFICIT-WATER POTENTIAL RELATIONSHIPS OF DOGWOOD LEAVES GROWING IN TWO ENVIRONMENTS,
W69-03393 02I

THE HEAT RESISTANCE OF PLANTS, ITS DETERMINATION AND VARIABILITY,
W69-03485 02I

POISONS
MAGNOLIA PETROLEUM CO V STINSON (NEGLIGENT POLLUTION OF

EAMS).
9-03439 05C

ND
NDAMENTALS OF HYDROLOGIC FORECASTING,
9-03218 02E

EN
LEOECOLOGICAL STUDIES OF POTATO LAKE AND ITS ENVIRONS,
9-03361 02J

TANT IDENTIFICATION
NOLIA PETROLEUM CO V STINSON (NEGLIGENT POLLUTION OF
EAMS).
9-03439 05C

TION
TE OF MINERAL WATERS HOLDING SALTS AND EXCESS CARBONIC
D GAS.
9-03472 04A

TION ABATEMENT
LAP LAKE PROPERTY OWNERS ASS'N, INC V CITY OF
ARDSVILLE (ABATEMENT OF POLLUTION).
9-03278 05B

DUSTRIAL WASTE GUIDE ON THERMAL POLLUTION,
9-03537 05B

TIC RESPONSE TO POLLUTION REDUCTION IN A RIVER,
9-03602 05C

TEMENT BEFORE THE SUBCOMMITTEE ON AIR AND WATER
LUTION,
9-03619 05B

EORGIA WATER QUALITY CONTROL BOARDS STATEMENT TO THE
TIONAL ESTUARINE STUDY REPORT',
9-03679 05G

S MEDIA
DIFFUSION OF AIR THROUGH THE PORE WATER OF SOILS,
9-03205 02A

IVECTIVE SALT DIFFUSION IN A RADIAL SUBSURFACE STREAM IN
LATION TO THE PROTECTION OF SUBSURFACE WATERS FROM
TAMINATED DISCHARGES,
9-03212 05B

VESTIGATION OF WATER ABSORPTION BY THE SOIL ON THE BASIS
THE DIMENSIONAL THEORY,
9-03215 02G

MERICAL SOLUTIONS FOR DISPERSION IN POROUS MEDIUMS,
9-03237 05B

ALYZING SUBSURFACE FLOW SYSTEMS WITH ELECTRIC ANALOGS,
9-03310 02F

PERMEABILITY OF A POROUS MEDIUM DETERMINED FROM CERTAIN
OBABILITY LAWS FOR PORE SIZE DISTRIBUTION,
9-03553 02F

EPAGE FROM CHANNELS THROUGH LAYERED POROUS MEDIUMS,
9-03554 02G

TIAL FLOW
ENTIAL FLOW AND SOIL STRUCTURE CHANGES,
9-03203 02F

IPITATION(ATMOSPHERIC)
LATIONS BETWEEN TOPOGRAPHY AND ANNUAL PRECIPITATION IN
STERN OREGON AND WASHINGTON,
9-03340 02B

SPOSITION OF CONSTANT INTENSITY RAINFALL IN A KARST AREA,
9-03520 02A

ICTION
DROLOGIC DATA COLLECTION IN TIDAL ESTUARIES,
9-03239 02L

CRIPTIVE RIGHTS
AKE V RICHARDSON (TITLE TO PONDS BY ADVERSE POSSESSION AND
ESCRIPTION).
9-03279 04A

OSON V VILLAGE OF HOMER (RIGHT TO REMOVE DAM).
9-03427 04A

ES
ATING FACILITIES.
9-03615 06B

ABILITY
COMMENT ON HORTON'S LAW OF STREAM NUMBERS,
9-03338 02E

UCTIVITY
SH AND MAN, CONFLICT IN ATLANTIC ESTUARIES,
9-03627 05G

IT
ATING FACILITIES.
9-03615 06B

ECT PLANNING
ANNING FOR MULTIPLE-PURPOSE DEVELOPMENT,
9-03587 06B

TER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN ILLINOIS.
W69-03591 06B

SAN FRANCISCO BAY PLAN.
W69-03592 06B

WATERSHED, FLOOD PROTECTION, AND RECREATION DEVELOPMENT IN ATCHISON, KANSAS,
W69-03593 06B

THE TEXAS BASINS PROJECT,
W69-03625 06B

PROVENANCE
SEDIMENT TRANSPORT OF STREAMS IN THE WASHITA RIVER BASIN IN CADDO AND GRADY COUNTIES, OKLAHOMA,
W69-03326 02J

PUBLIC BENEFITS
PURPOSE AND FINDINGS.
W69-03300 06E

THINGS - DIVISION OF THINGS.
W69-03449 04A

SAN FRANCISCO BAY PLAN.
W69-03592 06B

PUBLIC HEALTH
DECLARATION OF POLICY.
W69-03456 04A

BENEFIT COST ANALYSIS A METHOD TO DEMONSTRATE THE IMPORTANCE OF WATER RESOURCES DEVELOPMENT,
W69-03574 06B

PUBLIC LANDS
DUTIES OF THE DEPARTMENT OF PUBLIC WORKS RELATIVE TO COMMONWEALTH LANDS, CERTAIN ISLANDS, AND PROPERTY IN PLYMOUTH.
W69-03258 04C

DEVELOPMENT OF WATERFRONT FACILITIES - IMPROVEMENT AND PRESERVATION OF RIVERS, HARBORS, ETC.
W69-03261 06E

LICENSES IN CONN RIVER, GREAT PONDS, AND TIDE WATERS AS TO BOOMS, PIERS, WHARVES, PIPE LINE, ETC.
W69-03263 06E

LICENSES TO BE REVOCABLE AND TO EXPIRE IN FIVE YEARS - BOSTON HARBOR LICENSES - FORM, HOW GRANTED AND CONSTRUED.
W69-03264 06E

PUBLIC RIGHTS
PUBLIC WORKS (ACQUISITION OF WATER RIGHTS FOR PUBLIC PURPOSES).
W69-03412 06E

THINGS - DIVISION OF THINGS.
W69-03449 04A

PUBLIC UTILITIES
SIRACO V VILLAGE OF WHITEHALL (NON-LIABILITY OF VILLAGE FOR FIRE DAMAGE RESULTING FROM VILLAGE'S FAULTY WATER SYSTEM).
W69-03478 06E

PUBLIC WATERS
THROWING GAS TAR OR REFUSE INTO PUBLIC WATERS.
W69-03477 05B

PUERTO RICO
CLEAN WATER FOR THE NATION'S ESTUARIES.
W69-03629 05G

PULP WASTES
PRELIMINARY ASSESSMENT OF THE ENGLISH SOLE IN PORT GARDNER, WASHINGTON,
W69-03660 05C

PUMPING
LAKE GIBSON LAND CO V LESTER (IRRIGATION BY PUMPING LOWERING LAKE LEVEL).
W69-03285 02H

ACCELERATING OR IMPEDING FLOW OF MINERAL WATERS.
W69-03471 04A

PUMPING TEST ANALYSIS
ELECTRIC ANALOG OF THREE-DIMENSIONAL FLOW TO WELLS AND ITS APPLICATION TO UNCONFINED AQUIFERS,
W69-03356 07C

RADIOISOTOPES
ISOTOPIC COMPOSITION OF LEAD IN NATURAL WATERS,
W69-03245 02K

CURRENT TRENDS IN THE USE OF RADIOACTIVE TRACERS IN HYDROLOGIC INVESTIGATIONS,
W69-03544 07B

RAIN WATER
LEEK V BRASFIELD (WRONGFUL FAILURE TO PERMIT DAM REPAIRS).
W69-03435 04A

RAINFALL
STREAMFLOW AND PRECIPITATION DATA INDEX,
W69-03380 04A

A FIRST-ORDER MARKOV MODEL FOR ASSESSING RAINFALL DISCONTINUITY IN CENTRAL AUSTRALIA,

RAI-RES
W69-03494 02B

OAKDALE GAGING INSTALLATION, CHICAGO-INSTRUMENTATION AND DATA,
W69-03508 02E

RAINFALL DISPOSITION
RELATIONS BETWEEN TOPOGRAPHY AND ANNUAL PRECIPITATION IN WESTERN OREGON AND WASHINGTON,
W69-03340 02B

A FIRST-ORDER MARKOV MODEL FOR ASSESSING RAINFALL DISCONTINUITY IN CENTRAL AUSTRALIA,
W69-03494 02B

DISPOSITION OF CONSTANT INTENSITY RAINFALL IN A KARST AREA,
W69-03520 02A

RAINFALL INTENSITY
THE SPATIAL DISTRIBUTION OF STORM RAINFALL,
W69-03534 02B

RAINFALL-RUNOFF RELATIONSHIP
URBAN WATER RESOURCES RESEARCH SYSTEMATIC STUDY AND DEVELOPMENT OF LONG-RANGE PLANS, FIRST YEAR REPORT, SEPTEMBER, 1968.
W69-03506 06B

DISPOSITION OF CONSTANT INTENSITY RAINFALL IN A KARST AREA,
W69-03520 02A

RAINFALL-RUNOFF RELATIONSHIPS
AN APPLICATION OF PRINCIPAL COMPONENT ANALYSIS AND FACTOR ANALYSIS IN THE STUDY OF WATER YIELD,
W69-03233 02A

THE NONLINEAR PREDICTION PROBLEM IN THE STUDY OF THE RUNOFF CYCLE,
W69-03308 02A

A REVIEW OF RAINFALL-RUNOFF, PHYSICAL MODELS AS DEVELOPED BY DIMENSIONAL ANALYSIS AND OTHER METHODS,
W69-03309 02A

LINEAR ANALYSIS OF HYDROGRAPHS,
W69-03331 07C

THROUGHFALL AND STEMFLOW IN A PINE-HARDWOOD STAND IN THE OUACHITA MOUNTAINS OF ARKANSAS,
W69-03339 02I

NORTHWOOD GAGING INSTALLATION, BALTIMORE-INSTRUMENTATION AND DATA,
W69-03507 02E

OAKDALE GAGING INSTALLATION, CHICAGO-INSTRUMENTATION AND DATA,
W69-03508 02E

RESPONSE CHARACTERISTICS OF URBAN WATER RESOURCE DATA SYSTEMS,
W69-03509 07A

THE USE OF PRECIPITATION RECORDS FOR PEAK STREAMFLOW SYNTHESIS,
W69-03562 02A

RAJASTHAN(INDIA)
FREQUENCY OF WET AND DRY SPELLS AT FIVE STATIONS IN RAJASTHAN,
W69-03490 02B

RANGE GRASSES
DROUGHT-ASSOCIATED MORTALITY OF RANGE GRASSES IN SOUTH TEXAS,
W69-03495 02I

RAVINES
EXPERIMENTAL INVESTIGATION AND COMPUTATION OF THE VOLUME OF MATERIAL DERIVED FROM DEEP RAVINES IN FORECASTING THE SILTING OF RESERVOIRS ON MOUNTAIN RIVERS,
W69-03216 02J

REAERATION
COMPUTATION OF REAERATION COEFFICIENTS FOR A RIVER SYSTEM IN NORTHEASTERN NEW JERSEY,
W69-03561 05C

'ESTUARINE OXYGEN RESOURCES--PHOTOSYNTHESIS AND REAERATION',
W69-03610 05G

REASONABLE USE
LAKE GIBSON LAND CO V LESTER (IRRIGATION BY PUMPING LOWERING LAKE LEVEL).
W69-03285 02H

RECHARGE
MOVEMENT OF MOISTURE IN THE UNSATURATED ZONE IN A DUNE AREA, SOUTHWESTERN KANSAS,
W69-03556 02G

RECREATION
THE CONDITION OF THE CHESAPEAKE BAY,
W69-03637 06B

RESEARCH PROBLEMS IN WATER QUALITY AND RECREATION,
W69-03643 05G

'STATEMENT',
W69-03671 02L

W69-03678 05C

INDEX OF SELECTED OUTDOOR RECREATION LITERATURE, VOLUME II.
W69-03681 06B

PROBABILISTIC ANALYSIS OF WASTE WATER TREATMENT AND DISPOSAL SYSTEM,
W69-03699 05D

RECREATION BENEFITS
ESTIMATION OF RECREATIONAL BENEFITS AT SOME SELECTED WATER DEVELOPMENT SITES IN CALIFORNIA,
W69-03578 06B

RECREATION DEMAND
ESTIMATION OF RECREATIONAL BENEFITS AT SOME SELECTED WATER DEVELOPMENT SITES IN CALIFORNIA,
W69-03578 06B

ECONOMICS OF OUTDOOR RECREATION,
W69-03628 06B

THE ECONOMICS OF RECREATION,
W69-03692 06D

RECREATION FACILITIES
BOATING FACILITIES.
W69-03615 06B

CONSERVATION AND MANAGEMENT OF SEASHORE AND UNDERWATER AREAS FOR PUBLIC ENJOYMENT,
W69-03676 06B

RECREATIONAL FACILITIES
PUBLIC BEACHES - CONTROL, SUPERVISION, AND PRESERVATION.
W69-03275 06E

REFLECTIVITY
REFLECTIVITY OF ELECTROMAGNETIC WAVES AT AN AIR-WATER INTERFACE FOR PURE AND SEA WATER,
W69-03598 01A

REGIONAL ANALYSIS
THEORETICAL ANALYSIS OF REGIONAL GROUNDWATER FLOW. 2. EFFECT OF WATER-TABLE CONFIGURATION AND SUBSURFACE PERMEABILITY VARIATION,
W69-03243 02F

REGIONAL WATER RESOURCE DEVELOPMENT IN THE FEDERAL SYSTEM,
W69-03411 06B

RESEARCH AND DEVELOPMENT
INTERAGENCY WATER RESOURCES RESEARCH AND DATA COLLECTION PROGRAM.
W69-03360 09D

RESERVOIR CONSTRUCTION
POTENTIAL FRESHWATER RESERVOIR IN THE NEW YORK AREA,
W69-03700 04A

RESERVOIR OPERATION
HYDROLOGY AND RESERVOIR CONTROL ON THE WISCONSIN RIVER BASIN,
W69-03375 04A

SELECTED BIBLIOGRAPHY ON HYDROLOGICAL CONTROL BY RESERVOIR OPERATION,
W69-03376 04A

ANALYSIS OF A WATER STORAGE RESERVOIR SYSTEM,
W69-03377 04A

ON RESERVOIR NETWORKS,
W69-03378 04A

RESERVOIR SILTING
EXPERIMENTAL INVESTIGATION AND COMPUTATION OF THE VOLUME OF MATERIAL DERIVED FROM DEEP RAVINES IN FORECASTING THE SILTING OF RESERVOIRS ON MOUNTAIN RIVERS,
W69-03216 02J

RESERVOIRS
NUMERICAL MODEL OF THE NONSTATIONARY TEMPERATURE FIELD OF FLOWING BODIES OF WATER,
W69-03213 02E

HYDROLOGIC SUBSTANTIATION AND COMPUTATION OF THE REDUCTION OF FORESTS AND THE EXPANSION OF NATURALLY WATERLOGGED AREAS AFTER UNDERFLOODING IN RIVER SYSTEMS,
W69-03214 02A

OPTIMAL CONTROL OF LINKED RESERVOIRS,
W69-03571 06A

EFFECTS OF STREAMFLOW REGULATION ON WATER QUALITY-THE TVA EXPERIENCE,
W69-03585 05B

RESISTANCE
A STUDY OF THE DRAINAGE OF IRRIGATED SAND DUNES USING AN ELECTRICAL RESISTANCE ANALOGUE,
W69-03526 04A

RESISTIVITY
USE OF THE ELECTRICAL RESISTIVITY METHOD FOR INVESTIGATING GEOLOGIC AND HYDROLOGIC CONDITIONS IN SANTA CLARA COUNTY, CALIFORNIA,
W69-03235 07B

RESOURCE ALLOCATION
PLANNING FOR MULTI-PURPOSE DEVELOPMENT OF WATER AND RELATED

AND RESOURCES IN THE UPPER MISSISSIPPI RIVER BASIN,
69-03586 06B

CONOMICS OF OUTDOOR RECREATION,
69-03628 06B

OURCE DEVELOPMENT
PPLICATION OF MARGINAL ECONOMIC ANALYSIS TO RESERVOIR
ECREATION PLANNING,
69-03576 06B

STATEMENT',
69-03696 02L

OURCES
EPARTMENT OF NATURAL RESOURCES.
69-03255 06E

DIRECTORY OF INFORMATION RESOURCES IN THE UNITED STATES
ATER.
69-03650 10

IEWS
STUARIES IRREPLACEABLE ENVIRONMENTS.
69-03662 06B

DE ISLAND
ATER RESOURCES DATA FOR MASSACHUSETTS, NEW HAMPSHIRE, RHODE
SLAND, VERMONT, 1967--PART 1. SURFACE WATER RECORDS, PART
. WATER QUALITY RECORDS.
69-03321 02E

ERBERIAN V DOWD (ACCESS RIGHTS AND EASEMENTS ACROSS PRIVATE
ROPERTY TO OCEAN).
69-03480 06E

ARRAGANSETT BAY A MARINE USE PROFILE,
69-03606 06B

DANCE(LEGAL ASPECTS)
ENNEDY-CHAMBERLIN DEVELOPMENT CO V SNURE (MUNICIPAL
RAINAGE SYSTEMS).
69-03479 04A

HT OF WAY
UBLIC ACCESS TO GREAT PONDS.
69-03265 04A

HT-OF-WAY
MINENT DOMAIN -- RIGHT OF BY WHOM RIGHT MAY BE EXERCISED.
69-03289 06E

ONDEMNATION PROCEEDINGS, RIGHTS OF WAY AND EFFECT ON
IPARIAN RIGHTS.
69-03304 06E

RIAN LAND
AYES V BOWMAN (RIPARIAN RIGHTS ON NAVIGABLE WATERS).
69-03290 04A

RIAN LANDS
UBLIC WORKS (ACQUISITION OF WATER RIGHTS FOR PUBLIC
URPOSES).
69-03412 06E

RIAN PLANTS
ERIODIC MOWINGS SUPPRESS TAMARISK GROWTH, INCREASE FORAGE
OR BROWSING,
69-03496 02I

RIAN RIGHTS
AYES V BOWMAN (RIPARIAN RIGHTS ON NAVIGABLE WATERS).
69-03290 04A

XISTING RIGHTS AND REMEDIES PRESERVED LIMITATIONS.
69-03297 04A

TATE V 6.0 ACRES OF LAND (RIPARIAN OWNERS' RIGHT TO
CCRETION LAND).
69-03428 06E

OULTON V BUNTING MCWILLIAMS POST NO 658 (DIVERSION OF NON-
AVIGABLE STREAM).
69-03443 04A

ER BASIN COMMISSIONS
ELAWARE RIVER BASIN COMPACT.
69-03299 06B

URPOSE AND FINDINGS.
69-03300 06E

ER BASIN DEVELOPMENT
ODERN HYDROLOGICAL RESEARCH METHODOLOGY ON RIVERS IN
MANIA (IN RUMANIAN),
69-03314 06B

ER BASINS
YDROLOGY AND RESERVOIR CONTROL ON THE WISCONSIN RIVER
ASIN,
69-03375 04A

ELECTED BIBLIOGRAPHY ON HYDROLOGICAL CONTROL BY RESERVOIR
PERATION,
69-03376 04A

NALYSIS OF A WATER STORAGE RESERVOIR SYSTEM,
69-03377 04A

ROUND-WATER RESOURCES OF THE SEVIER RIVER BASIN BETWEEN
IBA DAM AND LEAMINGTON CANYON, UTAH,
W69-03529 02F

PLANNING FOR MULTIPLE-PURPOSE DEVELOPMENT,
W69-03587 06B

RIVER BEDS
SCHULTZ V WILSON (TIDAL WATERS).
W69-03294 06E

PUNISHMENT FOR VIOLATIONS.
W69-03458 04A

RIVER FLOW
USE AND PROTECTION OF WATERS.
W69-03457 04A

PUNISHMENT FOR VIOLATIONS.
W69-03458 04A

RIVER REGULATION
EFFECTS OF STREAMFLOW REGULATION ON WATER QUALITY-THE TVA
EXPERIENCE,
W69-03585 05B

RIVER SYSTEMS
AN EXTENSION TO THE THOMAS-FIERING MODEL FOR THE SEQUENTIAL
GENERATION OF STREAMFLOW,
W69-03307 02A

RIVERBEDS
USE AND PROTECTION OF WATERS.
W69-03457 04A

RIVERS
THE EFFECTS OF THERMAL POLLUTION ON RIVER ICE CONDITIONS,
W69-03546 05C

COMPUTATION OF REAERATION COEFFICIENTS FOR A RIVER SYSTEM IN
NORTHEASTERN NEW JERSEY,
W69-03561 05C

ANNUAL REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY, ON
CIVIL WORKS ACTIVITIES.
W69-03608 06B

METROPOLITAN SEATTLE'S DUWAMISH ESTUARY WATER QUALITY
PROGRAM,
W69-03667 05B

ROAD CONSTRUCTION
NIMMONS V CITY OF LA GRANGE (ACTION BY LAND OWNER FOR
FLOODING CAUSED BY CITY'S ROAD CONSTRUCTION).
W69-03293 04A

ROCK MECHANICS
ROCK MECHANICS IN THE DISPOSAL OF RADIOACTIVE WASTES BY
HYDRAULIC FRACTURING,
W69-03522 08E

ROCKY MOUNTAINS
CONVERSION OF GULLIES TO VEGETATION-LINED WATERWAYS ON
MOUNTAIN SLOPES,
W69-03406 04A

ROOTING DEPTHS
EFFECTS OF SPECIES AND ARRANGEMENT OF FORESTS ON
EVAPOTRANSPIRATION,
W69-03386 02D

ROUTING
STREAMFLOW ROUTING (WITH APPLICATIONS TO NORTH CAROLINA
RIVERS),
W69-03564 02E

RUMANIA
MODERN HYDROLOGICAL RESEARCH METHODOLOGY ON RIVERS IN
RUMANIA (IN RUMANIAN),
W69-03314 06B

RUNNING WATERS
STREAMS-THEIR DYNAMICS AND MORPHOLOGY,
W69-03248 02E

RUNOFF
EFFECT OF ORGANIC MATTER CONTENT OF THE SOIL ON
INFILTRATION,
W69-03484 02G

'STATEMENT',
W69-03647 02L

RUNOFF FORECASTING
FUNDAMENTALS OF HYDROLOGIC FORECASTING,
W69-03218 02E

SALINAS RIVER LAGOON(CALIFORNIA)
SEA WATER INTRUSION INTO A FRESH WATER FOREBAY DUE TO WAVE
ACTION,
W69-03531 02L

SALINE SOILS
SAMPLING THE SOIL SOLUTION FOR SALINITY APPRAISAL,
W69-03488 02G

SALINE WATER
A STATISTICAL STUDY OF SOME INDICES OF SALINE WATER
IRRIGATED SOILS OF RAJASTHAN,
W69-03482 03C

ENVIRONMENTAL REQUIREMENTS OF THERMOPHILIC BLUE-GREEN ALGAE,
W69-03516 05C

SALINE WATER INTRUSION
INVESTIGATION OF THE TECHNICAL FEASIBILITY OF STORING FRESH WATER IN SALINE AQUIFERS,
W69-03336 02F

SEA WATER INTRUSION INTO A FRESH WATER FOREBAY DUE TO WAVE ACTION,
W69-03531 02L

THE DELTA PROJECT.
W69-03646 02L

SALINE WATER-FRESHWATER INTERFACES
DISPERSION AT THE INTERFACE OF MISCIBLE LIQUIDS IN A SOIL,
W69-03548 02F

SALINITY
EFFECT OF EXTERNAL SALT CONCENTRATIONS ON WATER RELATIONS IN PLANTS II. EFFECT OF THE OSMOTIC DIFFERENTIAL BETWEEN EXTERNAL MEDIUM AND XYLEM ON WATER RELATIONS IN THE ENTIRE PLANT,
W69-03487 02I

SALMON
SAVE-THE-SALMON PROJECT ON THE ST. JOHN RIVER,
W69-03669 05C

CALIFORNIA SALMON LANDINGS, 1952 THROUGH 1965,
W69-03686 06C

SALT MARSHES
TIDAL MARSH - CONFLICTS AND INTERACTIONS,
W69-03641 02L

SALTS
A STATISTICAL STUDY OF SOME INDICES OF SALINE WATER IRRIGATED SOILS OF RAJASTHAN,
W69-03482 03C

EFFECT OF SODIUM SALTS ON THE GROWTH AND MINERAL COMPOSITION OF BAJRA (PENNISETUM TYPHOIDES),
W69-03483 03C

SALVAGE VALUE
LICENSING FOREIGN CORP ENGAGED IN WRECKING OR SALVAGING - SUPERVISION OF TRANSPORTATION AND DUMPING OR DREDGED MATERIAL - ARREST WITHOUT WARRANT.
W69-03273 06E

SAMPLING
HYDROLOGIC DATA COLLECTION IN TIDAL ESTUARIES,
W69-03239 02L

SAMPLING THE SOIL SOLUTION FOR SALINITY APPRAISAL,
W69-03488 02G

SURVEILLANCE OPERATIONS IN THE CONTROL OF WATER POLLUTION ON A NATIONAL SCALE,
W69-03584 05G

SANDS
STABILIZING ERODING STREAMBANKS IN SAND DRIFT AREAS OF THE LAKE STATES.
W69-03405 02J

SANITARY ENGINEERING
THE CONDITION OF THE CHESAPEAKE BAY,
W69-03637 06B

SATURATED SOILS
HYDROLOGIC SUBSTANTIATION AND COMPUTATION OF THE REDUCTION OF FORESTS AND THE EXPANSION OF NATURALLY WATERLOGGED AREAS AFTER UNDERFLOODING IN RIVER SYSTEMS,
W69-03214 02A

SCENERY
PUBLIC BEACHES - CONTROL, SUPERVISION, AND PRESERVATION.
W69-03275 06E

SCENIC EASEMENTS
GEORGETOWN WATERFRONT.
W69-03595 06B

SEASHORES
CONSERVATION AND MANAGEMENT OF SEASHORE AND UNDERWATER AREAS FOR PUBLIC ENJOYMENT,
W69-03676 06B

SEDIMENT DISCHARGE
EXPERIMENTAL INVESTIGATION AND COMPUTATION OF THE VOLUME OF MATERIAL DERIVED FROM DEEP RAVINES IN FORECASTING THE SILTING OF RESERVOIRS ON MOUNTAIN RIVERS,
W69-03216 02J

SEDIMENT LOAD
EFFECT OF SEDIMENT LOAD ON THE RATING CURVES OF 0.6-FOOT HS FLUMES,
W69-03403 02E

SEDIMENT TRANSPORT
EXPERIMENTAL INVESTIGATION AND COMPUTATION OF THE VOLUME OF MATERIAL DERIVED FROM DEEP RAVINES IN FORECASTING THE SILTING OF RESERVOIRS ON MOUNTAIN RIVERS,
W69-03216 02J

AN ANALYSIS OF RELATIONSHIPS BETWEEN FLOW CONDITIONS AND STATISTICAL MEASURES OF BED CONFIGURATIONS IN STRAIGHT AND CURVED ALLUVIAL CHANNELS,
W69-03317 02J

SEDIMENT TRANSPORT OF STREAMS IN THE WASHITA RIVER BASIN IN CADDO AND GRADY COUNTIES, OKLAHOMA,
W69-03326 02J

A PROCEDURE FOR COMPUTATION OF THE TOTAL RIVER SAND DISCHARGE AND DETAILED DISTRIBUTION, BED TO SURFACE,
W69-03541 02J

SEDIMENT YIELD
EFFECTS OF CONSTRUCTION ON FLUVIAL SEDIMENT, URBAN AND SUBURBAN AREAS OF MARYLAND,
W69-03227 02J

SEDIMENT TRANSPORT OF STREAMS IN THE WASHITA RIVER BASIN IN CADDO AND GRADY COUNTIES, OKLAHOMA,
W69-03326 02J

SEDIMENTATION
SEDIMENTATION IN A MEANDERING ESTUARY,
W69-03228 02J

RECENT DELTAIC DEPOSITS OF THE MISSISSIPPI RIVER THEIR DEVELOPMENT AND CHRONOLOGY,
W69-03230 02J

CYCLIC SEDIMENTATION,
W69-03353 02J

A PROCEDURE FOR COMPUTATION OF THE TOTAL RIVER SAND DISCHARGE AND DETAILED DISTRIBUTION, BED TO SURFACE,
W69-03541 02J

DIFFUSION AND SETTLING OF SEDIMENTS AT RIVER MOUTHS A COMPUTER SIMULATION MODEL,
W69-03542 02J

'STATEMENT',
W69-03647 02L

BIOLOGICAL EFFECTS OF SPOIL DISPOSAL IN CHESAPEAKE BAY,
W69-03666 05C

SEDIMENTOLOGY
INTRODUCTION TO PALEOLIMNOLOGY,
W69-03342 02J

SEDIMENTS
PHOSPHATE EQUILIBRIUM BETWEEN REDUCED SEDIMENTS AND WATER,
W69-03365 02K

RECENT SEDIMENTS OF THREE WISCONSIN LAKES,
W69-03367 02J

INTERIM REPORT ON GROSS PHYSICAL AND BIOLOGICAL EFFECTS OF OVERBOARD SPOIL DISPOSAL.
W69-03682 05C

SEDIMENT-WATER INTERFACES
PHOSPHATE EQUILIBRIUM BETWEEN REDUCED SEDIMENTS AND WATER,
W69-03365 02K

SEED COATS
GERMINATION STUDIES ON ARID ZONE TREE SEEDS,
W69-03489 02I

SEEDS
GERMINATION STUDIES ON ARID ZONE TREE SEEDS,
W69-03489 02I

EFFECT OF HIGH TEMPERATURES ON MOISTURE DEPLETION, IMBIBITION AND GERMINATION OF SEEDS OF MIMOSA HAMATA WILLD,
W69-03503 02I

SEEPAGE
SEEPAGE FROM A CANAL INTO SOIL WITH SHALLOW WATER DEPTH,
W69-03204 02F

INFILTRATION AND SUBSIDENCE PROCESSES IN LOESS SOILS,
W69-03207 02G

PAYNE V HAZARD COCA COLA BOTTLING WORKS (ACTION TO ENJOIN OBSTRUCTION TO NATURAL FLOW OF WATER).
W69-03291 04A

SEEPAGE FROM CHANNELS THROUGH LAYERED POROUS MEDIUMS,
W69-03554 02G

SEEPAGE MODELS
SEEPAGE FROM A CANAL INTO SOIL WITH SHALLOW WATER DEPTH,
W69-03204 02F

SEICHES
COMPUTATION OF SEICHE VELOCITIES IN BODIES OF WATER WITH A COMPLEX BOTTOM RELIEF,
W69-03217 02H

SEQUENTIAL GENERATION
THE NONLINEAR PREDICTION PROBLEM IN THE STUDY OF THE RUNOFF CYCLE,
W69-03308 02A

SERPENTINE CAVE
AN ANALYSIS OF THE MEANDERING TENDENCY OF SERPENTINE CAVE, N.S.W.,
W69-03532 02F

SESTON
MICROSESTON DYNAMICS IN A SIMPLE SIERRA NEVADA LAKE-STREAM SYSTEM,
W69-03359 02E

AGE
GEORGIA WATER QUALITY CONTROL BOARDS STATEMENT TO THE
ATIONAL ESTUARINE STUDY REPORT',
69-03679 05G

AGE DISPOSAL
TEARNS V STATE (DIVERSION OF SEWAGE EFFLUENT INTO CLEAN
IVER BY ORDER OF ADMINISTRATIVE AGENCY).
69-03296 05B

ROTECTION OF WATERS CESSPOOLS AND DRAINS.
69-03470 05B

HROWING GAS TAR OR REFUSE INTO PUBLIC WATERS.
69-03477 05B

AGE EFFLUENTS
LEAN WATER FOR THE NATION'S ESTUARIES.
69-03629 05G

AGE SYSTEMS
EWERAGE COMPANIES.
69-03418 06E

AGE TREATMENT
GEORGIA WATER QUALITY CONTROL BOARDS STATEMENT TO THE
ATIONAL ESTUARINE STUDY REPORT',
69-03679 05G

EATTLE'S EFFORTS IN RESTORATION OF BAYS AND ESTUARIES,
69-03683 05G

ERS
UNLAP LAKE PROPERTY OWNERS ASS'N, INC V CITY OF
OWARDSVILLE (ABATEMENT OF POLLUTION).
69-03278 05B

AYNE V HAZARD COCA COLA BOTTLING WORKS (ACTION TO ENJOIN
BSTRUCTION TO NATURAL FLOW OF WATER).
69-03291 04A

ERUZAL V HERRICK (STATUTORY AUTHORITY OF DRAIN
OMMISSIONER).
69-03426 04A

CRITICAL REVIEW OF METHODS OF MEASURING DISCHARGE WITHIN A
EWER PIPE,
69-03510 07B

LLFISH
EOPLE V JOHNSON (TRESPASS ON PRIVATELY OWNED UNDERWATER
ND).
69-03277 06E

ICENSE FOR TAKING OYSTERS OR CLAMS.
69-03424 06E

ROTECTION OF WATERS CESSPOOLS AND DRAINS.
69-03470 05B

STATEMENT',
69-03678 05C

WRECKS
EMOVAL OF WRECKS ON SHORES OR IN TIDE WATERS.
69-03271 06E

PS
EMOVAL OF WRECKS ON SHORES OR IN TIDE WATERS.
69-03271 06E

REAKING UP, DISPOSAL, AND GROUNDING OF CERTAIN FLOATING
TRUCTURES - REMOVAL OF WHALES.
69-03272 06E

ONSEQUENCES OF MAJOR SPILLS ON INDUSTRIAL USES OF SEAWATER.
69-03633 05C

EEPING OIL OUT OF THE SEA.
69-03688 05B

RE PROTECTION
HE DELTA PROJECT.
69-03646 02L

RES
ROHIBITION OF REMOVAL OF GRAVEL, ETC, FROM BEACHES REMOVAL
NATURAL BARRIERS FROM EROSION BY THE SEA PENALIZED.
69-03269 04A

WALKS
OWS V CITY OF HATTIESBURG (NEGLIGENT MAINTENANCE OF
RAINAGE DITCH).
69-03438 04A

RRA NEVADA MOUNTAINS
OIL MOISTURE DEPLETION PATTERNS AROUND SCATTERED TREES,
69-03407 02I

RRA NEVADA(CALIF)
ICROSESTON DYNAMICS IN A SIMPLE SIERRA NEVADA LAKE-STREAM
YSTEM,
69-03359 02E

VEX
HE PERSISTENCE OF SILVEX IN WATER AND HYDROSOIL,
69-03240 05A

ULATION ANALYSIS
NALYSIS OF A WATER STORAGE RESERVOIR SYSTEM,
69-03377 04A

ON RESERVOIR NETWORKS,
W69-03378 04A

LINEAR RANDOM MODELS OF ANNUAL STREAMFLOW SERIES,
W69-03379 04A

SITES
FERRIES, CANALS AND PUBLIC LANDINGS.
W69-03451 04A

SLOPE DEGRADATION
RATES OF SLOPE DEGRADATION AS DETERMINED FROM BOTANICAL
EVIDENCE, WHITE MOUNTAINS, CALIFORNIA,
W69-03527 02I

SMALL WATERSHEDS
CITY OF EAST ORANGE V TOWNSHIP OF LIVINGSTON (TAX ASSESSMENT
OF WATER RESERVE LANDS).
W69-03442 06C

SNOW MANAGEMENT
OBSERVATIONS OF SNOW ACCUMULATION AND MELT IN DEMONSTRATION
CUTTINGS OF PONDEROSA PINE IN CENTRAL ARIZONA,
W69-03408 02C

SOCIAL ASPECTS
'THE ROLE OF MAN IN ESTUARINE PROCESSES',
W69-03638 06G

SOCIAL PARTICIPATION
THE ECONOMICS OF RECREATION,
W69-03692 06D

SODIUM
EFFECT OF SODIUM SALTS ON THE GROWTH AND MINERAL COMPOSITION
OF BAJRA (PENNISETUM TYPHOIDES),
W69-03483 03C

SOIL ALGAE
RELATIVE ABSORPTION OF STRONTIUM AND CALCIUM BY CERTAIN
ALGAE,
W69-03491 05B

SOIL AMENDMENTS
EVALUATION OF SOIL AMENDMENTS IN IMPERIAL VALLEY,
W69-03481 02G

SOIL ANALYSIS
SAMPLING THE SOIL SOLUTION FOR SALINITY APPRAISAL,
W69-03488 02G

SOIL CHEMICAL PROPERTIES
A STATISTICAL STUDY OF SOME INDICES OF SALINE WATER
IRRIGATED SOILS OF RAJASTHAN,
W69-03482 03C

SOIL CONSERVATION
'STATEMENT',
W69-03647 02L

SOIL EROSION
'STATEMENT',
W69-03647 02L

SOIL MECHANICS
THE ENCLOSURE OF THE ZUIDERZEE AND THE RECLAMATION OF
POLDERS IN THE YSSEL-LAKE.
W69-03656 08D

SOIL MOISTURE
SOIL MOISTURE.
W69-03223 02G

CLIMATE AND SOIL MOISTURE EXTRACTION,
W69-03250 02G

MEASURING MOISTURE NEAR SOIL SURFACE...MINOR DIFFERENCES DUE
TO NEUTRON SOURCE TYPE,
W69-03498 02G

SOIL MOISURE
THE WATER OUTPUT OF THE DESERT VEGETATION IN THE DIFFERENT
MICROHABITATS OF WADI HOFF,
W69-03501 02I

SOIL PROFILES
STEADY UNSATURATED VERTICAL FLOW THROUGH MULTILAYERED SOIL,
W69-03209 02G

SOIL PROPERTIES
EFFECT OF ORGANIC MATTER CONTENT OF THE SOIL ON
INFILTRATION,
W69-03484 02G

SOIL STRUCTURE
POTENTIAL FLOW AND SOIL STRUCTURE CHANGES,
W69-03203 02F

SOIL STRUCTURE CHANGE
POTENTIAL FLOW AND SOIL STRUCTURE CHANGES,
W69-03203 02F

SOIL SURFACES
MEASURING MOISTURE NEAR SOIL SURFACE...MINOR DIFFERENCES DUE
TO NEUTRON SOURCE TYPE,
W69-03498 02G

SOIL WATER MOVEMENT
POTENTIAL FLOW AND SOIL STRUCTURE CHANGES,
W69-03203 02F

THE DIFFUSION OF AIR THROUGH THE PORE WATER OF SOILS,
W69-03205 02A

STEADY UNSATURATED VERTICAL FLOW THROUGH MULTILAYERED SOIL,
W69-03209 02G

SOIL MOISTURE.
W69-03223 02G

DETERMINATION OF THE HYDRAULIC CONDUCTIVITY OF UNSATURATED SOILS FROM AN ANALYSIS OF TRANSIENT FLOW DATA,
W69-03337 02G

VOLUMETRIC CALIBRATION OF NEUTRON MOISTURE PROBES,
W69-03394 02G

THE EFFECTS OF ENTRAPPED AIR AND BAROMETRIC FLUCTUATIONS ON THE DRAINAGE OF POROUS MEDIUMS,
W69-03552 02G

SOILS
ERODIBILITY INDICES FOR WILDLAND SOILS OF OAHU, HAWAII, AS RELATED TO SOIL FORMING FACTORS,
W69-03316 02J

SOIL-PLANT-WATER RELATIONSHIPS
SOIL MOISTURE DEPLETION PATTERNS AROUND SCATTERED TREES,
W69-03407 02I

SOLUBILITY
THE DIFFUSION OF AIR THROUGH THE PORE WATER OF SOILS,
W69-03205 02A

SOLVENTS
RESIDUES OF HERBICIDES AND DIESEL OIL CARRIERS IN FOREST WATERS,
W69-03397 05B

SOUTH DAKOTA
TEMPERATURE VARIATIONS OF DEEP FLOWING WELLS IN SOUTH DAKOTA,
W69-03567 02F

SOUTHERN APPALACHIAN MOUNTAIN REGION
BLENDING FOREST USES,
W69-03404 04D

SPATIAL DISTRIBUTION
THE SPATIAL DISTRIBUTION OF STORM RAINFALL,
W69-03534 02B

SPECIFIC CAPACITY
CLASSIFICATION OF WATER-BEARING STRATA BASED ON CONDITIONS OF FLOW OF WATER INTO WELLS,
W69-03523 02F

SPORT FISHING
SUMMARY OF THE 1963 AND 1964 SOUTHERN CALIFORNIA INSHORE BAIT FISHERY,
W69-03604 06D

THE TEXAS BASINS PROJECT,
W69-03625 06B

SPRING FLOOD
CENTRAL NEW YORK BROADCASTING CORP V STATE (STATE NOT LIABLE FOR DAMAGES FLOWING FROM FEDERALLY-CONTROLLED FLOOD CONTROL PROJECT).
W69-03473 04A

STABLE ISOTOPES
ROLE OF STABLE HYDROGEN ISOTOPES IN THE STUDY OF GEOLOGICAL PROCESSES,
W69-03244 02F

STAGE-DISCHARGE RELATIONS
MEASUREMENT OF PEAK DISCHARGE AT CULVERTS BY INDIRECT METHODS,
W69-03345 07B

STAGE-DISCHARGE RELATIONSHIPS
FLOOD HEIGHT-FREQUENCY RELATIONS FOR THE PLAINS AREA IN MISSOURI,
W69-03563 02E

STANDARDS
WATER QUALITY MANAGEMENT IN THE DELAWARE RIVER BASIN,
W69-03583 06B

STATE GOVERNMENTS
CONSERVATION AND DEVELOPMENT.
W69-03421 06E

UNAPPROPRIATED STATE LANDS DEFINED.
W69-03465 06E

'STATEMENT',
W69-03649 05G

STATISTICAL METHODS
AN APPLICATION OF PRINCIPAL COMPONENT ANALYSIS AND FACTOR ANALYSIS IN THE STUDY OF WATER YIELD,
W69-03233 02A

APPLICATIONS OF FACTOR ANALYSIS IN STUDY OF CHEMISTRY OF GROUNDWATER QUALITY, MOJAVE RIVER VALLEY, CALIFORNIA,
W69-03253 02F

AN EXTENSION TO THE THOMAS-FIERING MODEL FOR THE SEQUENTIAL GENERATION OF STREAMFLOW,
W69-03307 02A

AN ANALYSIS OF RELATIONSHIPS BETWEEN FLOW CONDITIONS AND STATISTICAL MEASURES OF BED CONFIGURATIONS IN STRAIGHT AND CURVED ALLUVIAL CHANNELS,
W69-03317 02J

SOME STATISTICAL TOOLS IN HYDROLOGY,
W69-03344 07B

A FIRST-ORDER MARKOV MODEL FOR ASSESSING RAINFALL DISCONTINUITY IN CENTRAL AUSTRALIA,
W69-03494 02B

VARIANCE SPECTRUM ANALYSIS,
W69-03525 06A

AN ANALYSIS OF THE MEANDERING TENDENCY OF SERPENTINE CAVE, N.S.W.,
W69-03532 02F

STATISTICAL MODELS
A COMMENT ON HORTON'S LAW OF STREAM NUMBERS,
W69-03338 02E

PROBABILISTIC ANALYSIS OF WASTE WATER TREATMENT AND DISPOSAL SYSTEM,
W69-03699 05D

STATISTICS
A STATISTICAL STUDY OF SOME INDICES OF SALINE WATER IRRIGATED SOILS OF RAJASTHAN,
W69-03482 03C

THE POTOMAC ESTUARY - STATISTICS AND PROJECTIONS,
W69-03603 05B

SUMMARY OF THE 1963 AND 1964 SOUTHERN CALIFORNIA INSHORE BAIT FISHERY,
W69-03604 06D

THE BOATING BUSINESS (1966).
W69-03614 06C

THE CONDITION OF THE CHESAPEAKE BAY,
W69-03637 06B

THE ECONOMICS OF RECREATION,
W69-03692 06D

STEADY FLOW
THEORETICAL ANALYSIS OF REGIONAL GROUNDWATER FLOW. 2. EFFECT OF WATER-TABLE CONFIGURATION AND SUBSURFACE PERMEABILITY VARIATION,
W69-03243 02F

A DERIVATION OF DUPUIT SOLUTION OF STEADY FLOW TOWARD WELLS BY MATCHED ASYMPTOTIC EXPANSIONS,
W69-03550 02F

STEMFLOW
THROUGHFALL AND STEMFLOW IN A PINE-HARDWOOD STAND IN THE OUACHITA MOUNTAINS OF ARKANSAS,
W69-03339 02I

INTERCEPTION BY EASTERN WHITE PINE,
W69-03391 02I

DESIGN CRITERIA FOR INTERCEPTION STUDIES,
W69-03395 02I

NUTRIENT CYCLING BY THROUGHFALL AND STEMFLOW PRECIPITATION IN THREE COASTAL OREGON FOREST TYPES,
W69-03402 05B

STOMATA
TEST OF A TRANSPIRATION INHIBITOR OF A FORESTED WATERSHED,
W69-03396 02D

STORM RUNOFF
SEQUENTIAL STUDY OF DESERT FLOODING IN THE WHITE MOUNTAINS OF CALIFORNIA AND NEVADA,
W69-03222 02E

NORTHWOOD GAGING INSTALLATION, BALTIMORE-INSTRUMENTATION AND DATA,
W69-03507 02E

OAKDALE GAGING INSTALLATION, CHICAGO-INSTRUMENTATION AND DATA,
W69-03508 02E

THE SPATIAL DISTRIBUTION OF STORM RAINFALL,
W69-03534 02B

STREAM GAGES
GENERAL PROCEDURE FOR GAGING STREAMS,
W69-03346 07B

A CRITICAL REVIEW OF METHODS OF MEASURING DISCHARGE WITHIN A SEWER PIPE,
W69-03510 07B

STREAM HYDROGRAPHS
FACTORS AFFECTING THE RESPONSE OF SMALL WATERSHEDS TO PRECIPITATION IN HUMID AREAS,
W69-03388 02E

STREAM POLLUTION
BIOTIC RESPONSE TO POLLUTION REDUCTION IN A RIVER,
W69-03602 05C

AMFLOW
TER RESOURCES DATA FOR KENTUCKY, 1967--PART 1 SURFACE
TER RECORDS.
9-03318 02E

TER RESOURCES DATA FOR NEW YORK, 1967--PART 1. SURFACE
TER RECORDS.
9-03320 02E

TER RESOURCES DATA FOR MASSACHUSETTS, NEW HAMPSHIRE, RHODE
LAND, VERMONT, 1967--PART 1. SURFACE WATER RECORDS, PART
WATER QUALITY RECORDS.
9-03321 02E

NTHLY SURFACE-WATER INFLOW TO CHESAPEAKE BAY,
9-03325 02E

REAMFLOW AND PRECIPITATION DATA INDEX,
9-03380 04A

E INFLUENCE OF RAINFALL INTERCEPTION ON STREAMFLOW,
9-03384 02I

ST OF A TRANSPIRATION INHIBITOR OF A FORESTED WATERSHED,
9-03396 02D

OPE-DISCHARGE RELATIONS FOR EIGHT RIVERS IN THE UNITED
ATES,
9-03521 02E

OOD-FLOW CHARACTERISTICS OF A RECTIFIED CHANNEL, JACKSON,
SSISSIPPI,
9-03566 02F

AMFLOW FORECASTING
NDAMENTALS OF HYDROLOGIC FORECASTING,
9-03218 02E

EXTENSION TO THE THOMAS-FIERING MODEL FOR THE SEQUENTIAL
NERATION OF STREAMFLOW,
9-03307 02A

CTORS AFFECTING THE RESPONSE OF SMALL WATERSHEDS TO
ECIPITATION IN HUMID AREAS,
9-03388 02E

AMS
CROSESTON DYNAMICS IN A SIMPLE SIERRA NEVADA LAKE-STREAM
STEM,
9-03359 02E

REAM POLLUTION BY ALGAL NUTRIENTS,
9-03369 05C

P MINE LAKES
DROLOGY OF SURFACE MINING-A CASE STUDY,
9-03547 02A

P MINES
DROLOGY OF SURFACE MINING-A CASE STUDY,
9-03547 02A

NTIUM RADIOSOTOPES
LATIVE ABSORPTION OF STRONTIUM AND CALCIUM BY CERTAIN
GAE,
9-03491 05B

CTURES
RUCTURES IN GREAT PONDS RESTRICTED - LOWERING WATERS
GULATED - SUPERVISION OF ERECTIONS - COMPENSATION FOR TIDE
TER DISPLACED.
9-03266 04A

URFACE WASTE DISPOSAL
ASIBILITY CRITERIA FOR SUBSURFACE WASTE DISPOSAL IN
LINOIS,
9-03251 05E

R PINE TREES
IL MOISTURE DEPLETION PATTERNS AROUND SCATTERED TREES,
9-03407 02I

ACE DRAINAGE
SSINGER V TOWNSHIP OF WASHINGTON (DRAINAGE LICENSE).
9-03295 04A

ACE RUNOFF
VISION S-6-SOIL AND WATER MANAGEMENT AND CONSERVATION--
EL PAN SYSTEM FOR SPREADING AND STORING WATERSHED RUNOFF,
9-03499 02E

ACE WATER RECORDS
TER RESOURCES DATA FOR KENTUCKY, 1967--PART 1 SURFACE
TER RECORDS.
9-03318 02E

ACE WATERS
DROLOGY OF BROOKHAVEN NATIONAL LABORATORY AND VICINITY,
FFOLK COUNTY, NEW YORK,
9-03232 02E

E DETERMINATION OF THE IONIZATION CONSTANT OF 2,4-D IN
TER,
9-03241 05A

TER RESOURCES DATA FOR KENTUCKY, 1967--PART 1 SURFACE
TER RECORDS.
9-03318 02E

TER RESOURCES DATA FOR NEW YORK, 1967--PART 1. SURFACE
WATER RECORDS.
W69-03320 02E

WATER RESOURCES DATA FOR MASSACHUSETTS, NEW HAMPSHIRE, RHODE
ISLAND, VERMONT, 1967--PART 1. SURFACE WATER RECORDS, PART
2. WATER QUALITY RECORDS.
W69-03321 02E

EVALUATION OF ORGANIC COLOR AND IRON IN NATURAL SURFACE
WATERS,
W69-03558 03E

SURFACE-GROUNDWATER RELATIONSHIPS
SOIL MOISTURE.
W69-03223 02G

SURFACE-WATER RECORDS
WATER RESOURCES DATA FOR NEW YORK, 1967--PART 1. SURFACE
WATER RECORDS.
W69-03320 02E

SURFACE-WIND DIRECTION
THE SPATIAL DISTRIBUTION OF STORM RAINFALL,
W69-03534 02B

SURVEY
WATER POWER COMPANIES ALONG TRIBUTARIES TO BARNEGAT BAY.
W69-03417 06E

SUSQUEHANNA RIVER BASIN
AN APPRAISAL OF THE GROUND-WATER RESOURCES OF THE UPPER
SUSQUEHANNA RIVER BASIN IN PENNSYLVANIA,
W69-03528 02F

DYNAMIC MODEL OF THE ECONOMY OF THE SUSQUEHANNA RIVER BASIN,
W69-03570 06B

SWAMPS
DISPOSITIONS OF STATE LAND.
W69-03440 04A

SWIMMING POOLS
DRAINS AND PROTECTION OF PUBLIC WATER SUPPLIES.
W69-03476 05B

SYMPOSIA
SOIL MOISTURE.
W69-03223 02G

SYNTHETIC HYDROLOGY
AN EXTENSION TO THE THOMAS-FIERING MODEL FOR THE SEQUENTIAL
GENERATION OF STREAMFLOW,
W69-03307 02A

THE NONLINEAR PREDICTION PROBLEM IN THE STUDY OF THE RUNOFF
CYCLE,
W69-03308 02A

UNSTEADY, ONE-DIMENSIONAL FLOW OVER A PLANE-THE RISING
HYDROGRAPH,
W69-03332 02E

SYSTEMS ANALYSIS
A STUDY TO DETERMINE THE COSTS OF WATER IN INDUSTRIAL USES,
W69-03322 06C

OPTIMIZATION TECHNIQUES FOR HYDROLOGIC ENGINEERING,
W69-03329 06A

LINEAR RANDOM MODELS OF ANNUAL STREAMFLOW SERIES,
W69-03379 04A

URBAN WATER RESOURCES RESEARCH SYSTEMATIC STUDY AND
DEVELOPMENT OF LONG-RANGE PLANS, FIRST YEAR REPORT,
SEPTEMBER, 1968.
W69-03506 06B

TAMARISK
PERIODIC MOWINGS SUPPRESS TAMARISK GROWTH, INCREASE FORAGE
FOR BROWSING,
W69-03496 02I

TAXES
MUNICIPALITIES GENERALLY - GENERAL POWERS.
W69-03415 06E

TRI-COUNTY DRAINAGE DISTRICT V MORRISON (RIGHT OF A COUNTY
TO WITHDRAW FROM ORIGINAL DRAINAGE DISTRICT).
W69-03436 06E

GENERAL DRAINAGE.
W69-03453 04A

W69-03455 04A

TECHNOLOGY
SOME CRITICAL PROBLEMS OF THE SHELLFISH INDUSTRY,
W69-03621 06E

TEMPERATURE
VERTICAL CURRENT STRUCTURE IN THE GREAT LAKES V. THERMAL
CURRENT STRUCTURE IN LAKE MICHIGAN, ASSOCIATED WITH THE
SPRING WARM-UP SEASON--A THEORETICAL STUDY,
W69-03350 02H

EFFECT OF HIGH TEMPERATURES ON MOISTURE DEPLETION,
IMBIBITION AND GERMINATION OF SEEDS OF MIMOSA HAMATA WILLD,
W69-03503 02I

TEMPERATURE CONTROL
'ANALYZING STEAM ELECTRIC POWER PLANT DISCHARGES',

TEM-UND

W69-03655 05B

TENNESSEE
WATER USE IN TENNESSEE, PART A-AGRICULTURAL WATER USE,
W69-03323 06D

GRIFFITH V HURT (JOINDER OF PARTIES IN SUIT FOR DAMAGES CAUSED BY OBSTRUCTION TO FLOW).
W69-03434 04A

TENNESSEE VALLEY AUTHORITY PROJECT
EFFECTS OF STREAMFLOW REGULATION ON WATER QUALITY-THE TVA EXPERIENCE,
W69-03585 05B

TENNESSEE WATER-USE REGISTRATION LAW
WATER USE IN TENNESSEE, PART A-AGRICULTURAL WATER USE,
W69-03323 06D

TERTIARY TREATMENT
THE LAKE TAHOE WATER RECLAMATION PLANT,
W69-03640 05D

TEST PROCEDURES
SHORTCUTS AND SPECIAL PROBLEMS IN AQUIFER TESTS,
W69-03231 07B

TEXAS
URBAN HYDROLOGY OF THE HOUSTON, TEXAS METROPOLITAN AREA-COMPILATION OF BASIC DATA-1966,
W69-03538 04C

HURRICANE 'BEULAH', SEPT. 8-21, 1967.
W69-03543 02B

THE TEXAS BASINS PROJECT,
W69-03625 06B

TEXTBOOK
INTRODUCTION TO PALEOLIMNOLOGY,
W69-03342 02J

TEXTILES
TEXTILE WASTES - A BIBLIOGRAPHY,
W69-03597 05B

THEIS EQUATION
ANALYSIS OF SOME PUMPING TEST RESULTS,
W69-03206 02F

THERMAL POLLUTION
INDUSTRIAL WASTE GUIDE ON THERMAL POLLUTION,
W69-03537 05B

THE EFFECTS OF THERMAL POLLUTION ON RIVER ICE CONDITIONS,
W69-03546 05C

STATEMENT BEFORE THE SUBCOMMITTEE ON AIR AND WATER POLLUTION,
W69-03619 05B

EQUIPMENT FOR A DIRTY JOB.
W69-03661 05B

HOW TO STOP THE PILLAGE OF AMERICA,
W69-03694 06E

THERMAL POWERPLANTS
THE DISTRIBUTION OF EXCESS TEMPERATURE FROM A HEATED DISCHARGE IN AN ESTUARY,
W69-03341 02L

DESALINATION AND ITS ROLE IN WATER SUPPLY.
W69-03351 03A

THE EFFECTS OF THERMAL POLLUTION ON RIVER ICE CONDITIONS,
W69-03546 05C

STATEMENT BEFORE THE SUBCOMMITTEE ON AIR AND WATER POLLUTION,
W69-03619 05B

W69-03670 05C

THERMAL PROPERTIES
THERMAL PROSPECTING FOR GROUND WATER,
W69-03549 02F

THERMAL PROSPECTING
THERMAL PROSPECTING FOR GROUND WATER,
W69-03549 02F

THERMAL SPRINGS
THERMAL SPRINGS NEAR MIDWAY, UTAH,
W69-03568 02F

THERMAL STRESS
THE HEAT RESISTANCE OF PLANTS, ITS DETERMINATION AND VARIABILITY,
W69-03485 02I

EFFECT OF HIGH TEMPERATURES ON MOISTURE DEPLETION, IMBIBITION AND GERMINATION OF SEEDS OF MIMOSA HAMATA WILLD,
W69-03503 02I

THERMAL WATER
ENVIRONMENTAL REQUIREMENTS OF THERMOPHILIC BLUE-GREEN ALGAE,
W69-03516 05C

THERMAL SPRINGS NEAR MIDWAY, UTAH,
W69-03568 02F

THIEMS EQUATION
ANALYSIS OF SOME PUMPING TEST RESULTS,
W69-03206 02F

THROUGHFALL
THROUGHFALL AND STEMFLOW IN A PINE-HARDWOOD STAND IN THE OUACHITA MOUNTAINS OF ARKANSAS,
W69-03339 02I

INTERCEPTION BY EASTERN WHITE PINE,
W69-03391 02I

DESIGN CRITERIA FOR INTERCEPTION STUDIES,
W69-03395 02I

NUTRIENT CYCLING BY THROUGHFALL AND STEMFLOW PRECIPITATION IN THREE COASTAL OREGON FOREST TYPES,
W69-03402 05B

TIDAL EFFECTS
'NUMERICAL SOLUTION OF THE UNSTEADY, ESTUARY DISPERSION EQUATION',
W69-03675 02L

TIDAL WATERS
PROHIBITION OF REMOVAL OF GRAVEL, ETC, FROM BEACHES REMOVAL OF NATURAL BARRIERS FROM EROSION BY THE SEA PENALIZED.
W69-03269 04A

SCHULTZ V WILSON (TIDAL WATERS).
W69-03294 06E

FERRIES, CANALS AND PUBLIC LANDINGS.
W69-03451 04A

TIME SERIES ANALYSIS
TIME SERIES ANALYSIS,
W69-03524 06A

VARIANCE SPECTRUM ANALYSIS,
W69-03525 06A

TITLE TO RAISED LANDS
DISPOSITIONS OF STATE LAND.
W69-03440 04A

TOPOGRAPHY
RELATIONS BETWEEN TOPOGRAPHY AND ANNUAL PRECIPITATION IN WESTERN OREGON AND WASHINGTON,
W69-03340 02B

TRACERS
CURRENT TRENDS IN THE USE OF RADIOACTIVE TRACERS IN HYDROLOGIC INVESTIGATIONS,
W69-03544 07B

THE INVESTIGATION OF WATER FLOW THROUGH POROUS MEDIUMS BY MEANS OF RADIOTRACERS,
W69-03551 02F

SODIUM AS A CLUE TO DIRECTION OF GROUNDWATER MOVEMENT, NEVADA TEST SITE,
W69-03559 02F

AN EMPIRICAL FORMULA FOR DETERMINING THE AMOUNT OF DYE NEEDED FOR TIME-OF-TRAVEL MEASUREMENTS,
W69-03565 07C

TRANSLOCATION
EFFECT OF EXTERNAL SALT CONCENTRATIONS ON WATER RELATIONS IN PLANTS II. EFFECT OF THE OSMOTIC DIFFERENTIAL BETWEEN EXTERNAL MEDIUM AND XYLEM ON WATER RELATIONS IN THE ENTIRE PLANT,
W69-03487 02I

TRANSPIRATION
TEST OF A TRANSPIRATION INHIBITOR OF A FORESTED WATERSHED,
W69-03396 02D

THE WATER OUTPUT OF THE DESERT VEGETATION IN THE DIFFERENT MICROHABITATS OF WADI HOFF,
W69-03501 02I

TRANSPORTATION
THE CONDITION OF THE CHESAPEAKE BAY,
W69-03637 06B

THE ECONOMIC IMPACT OF UNITED STATES OCEAN PORTS.
W69-03654 06G

TREATMENT FACILITIES
THE LAKE TAHOE WATER RECLAMATION PLANT,
W69-03640 05D

TRIBUTARIES
A COMMENT ON HORTON'S LAW OF STREAM NUMBERS,
W69-03338 02E

TRITIUM
THE OCCURRENCE OF TRITIUM IN PRECIPITATION AND ITS SIGNIFICANCE IN HYDROLOGICAL INVESTIGATIONS,
W69-03555 02K

TURBULENCE
THE EFFECT OF TURBULENCE ON BACTERIAL SUBSTRATE UTILIZATION,
W69-03343 05G

UNDERGROUND STORAGE
INVESTIGATION OF THE TECHNICAL FEASIBILITY OF STORING FRESH WATER IN SALINE AQUIFERS,

W69-03336 02F

UNDERGROUND STREAMS
C AND W COAL CORPORATION V SALYER (DESTRUCTION OF UNDERGROUND STREAM).
W69-03444 04C

UNDERWATER
CONSERVATION AND MANAGEMENT OF SEASHORE AND UNDERWATER AREAS FOR PUBLIC ENJOYMENT,
W69-03676 06B

UNIT HYDROGRAPHS
LINEAR ANALYSIS OF HYDROGRAPHS,
W69-03331 07C

UNITED STATES
THE CONTINENTAL USE OF ARCTIC-FLOWING RIVERS,
W69-03313 04A

UNOBSTRUCTED VIEW
HAYES V BOWMAN (RIPARIAN RIGHTS ON NAVIGABLE WATERS).
W69-03290 04A

UNSATURATED FLOW
STEADY UNSATURATED VERTICAL FLOW THROUGH MULTILAYERED SOIL,
W69-03209 02G

SOIL MOISTURE.
W69-03223 02G

DETERMINATION OF THE HYDRAULIC CONDUCTIVITY OF UNSATURATED SOILS FROM AN ANALYSIS OF TRANSIENT FLOW DATA,
W69-03337 02G

MOVEMENT OF MOISTURE IN THE UNSATURATED ZONE IN A DUNE AREA, SOUTHWESTERN KANSAS,
W69-03556 02G

UNSATURATED SOILS
DETERMINATION OF THE HYDRAULIC CONDUCTIVITY OF UNSATURATED SOILS FROM AN ANALYSIS OF TRANSIENT FLOW DATA,
W69-03337 02G

UNSTEADY FLOW
USE OF THERMAL MODEL TO INVESTIGATE THE THEORY OF TRANSIENT FLOW TO A PARTIALLY PENETRATING WELL,
W69-03254 02F

UNSTEADY, ONE-DIMENSIONAL FLOW OVER A PLANE-THE RISING HYDROGRAPH,
W69-03332 02E

DETERMINATION OF THE HYDRAULIC CONDUCTIVITY OF UNSATURATED SOILS FROM AN ANALYSIS OF TRANSIENT FLOW DATA,
W69-03337 02G

STREAMFLOW ROUTING (WITH APPLICATIONS TO NORTH CAROLINA RIVERS),
W69-03564 02E

URBAN HYDROLOGY
URBAN WATER RESOURCES RESEARCH SYSTEMATIC STUDY AND DEVELOPMENT OF LONG-RANGE PLANS, FIRST YEAR REPORT, SEPTEMBER, 1968.
W69-03506 06B

NORTHWOOD GAGING INSTALLATION, BALTIMORE-INSTRUMENTATION AND DATA,
W69-03507 02E

OAKDALE GAGING INSTALLATION, CHICAGO-INSTRUMENTATION AND DATA,
W69-03508 02E

RESPONSE CHARACTERISTICS OF URBAN WATER RESOURCE DATA SYSTEMS,
W69-03509 07A

URBAN RENEWAL
THE POLITICS OF BEAUTY,
W69-03648 06E

URBAN SOCIOLOGY
THE NATURE OF CHANGES IN URBAN WATERSHEDS AND THEIR IMPORTANCE IN THE DECADES AHEAD,
W69-03511 04C

URBANIZATION
EFFECTS OF CONSTRUCTION ON FLUVIAL SEDIMENT, URBAN AND SUBURBAN AREAS OF MARYLAND,
W69-03227 02J

URBAN WATER RESOURCES RESEARCH SYSTEMATIC STUDY AND DEVELOPMENT OF LONG-RANGE PLANS, FIRST YEAR REPORT, SEPTEMBER, 1968.
W69-03506 06B

NORTHWOOD GAGING INSTALLATION, BALTIMORE-INSTRUMENTATION AND DATA,
W69-03507 02E

OAKDALE GAGING INSTALLATION, CHICAGO-INSTRUMENTATION AND DATA,
W69-03508 02E

THE NATURE OF CHANGES IN URBAN WATERSHEDS AND THEIR IMPORTANCE IN THE DECADES AHEAD,
W69-03511 04C

URBAN HYDROLOGY OF THE HOUSTON, TEXAS METROPOLITAN AREA-
COMPILATION OF BASIC DATA-1966,
W69-03538 04C

USSR
INFILTRATION AND SUBSIDENCE PROCESSES IN LOESS SOILS,
W69-03207 02G

DEUTERIUM CONTENT IN NATURAL WATERS,
W69-03229 02K

UTAH
GROUND-WATER RESOURCES OF THE SEVIER RIVER BASIN BETWEEN YUBA DAM AND LEAMINGTON CANYON, UTAH,
W69-03529 02F

THERMAL SPRINGS NEAR MIDWAY, UTAH,
W69-03568 02F

UTILITIES
UNLAWFUL INTERFERENCE WITH IMPROVEMENT WORKS.
W69-03459 04A

VALUE
ECONOMIC VALUE OF IRRIGATION WATER,
W69-03582 06B

GOVERNMENT, INDUSTRY AND SCIENCE STUDY POTENTIAL OF SEAWEEDS.
W69-03672 06B

THE ECONOMICS OF RECREATION,
W69-03692 06D

VAPOR PRESSURE
ACCURACY OF EVAPOTRANSPIRATION DETERMINATIONS BY THE BOWEN RATIO METHOD,
W69-03504 02D

VEGETATION EFFECTS
FOREST TREATMENT EFFECTS ON WATER YIELD,
W69-03387 03B

VELOCITY
AN EMPIRICAL FORMULA FOR DETERMINING THE AMOUNT OF DYE NEEDED FOR TIME-OF-TRAVEL MEASUREMENTS,
W69-03565 07C

VERMONT
WATER RESOURCES DATA FOR MASSACHUSETTS, NEW HAMPSHIRE, RHODE ISLAND, VERMONT, 1967--PART 1. SURFACE WATER RECORDS, PART 2. WATER QUALITY RECORDS.
W69-03321 02E

VIABILITY
GERMINATION STUDIES ON ARID ZONE TREE SEEDS,
W69-03489 02I

VIRGINIA
LEAKE V RICHARDSON (TITLE TO PONDS BY ADVERSE POSSESSION AND PRESCRIPTION).
W69-03279 04A

C AND W COAL CORPORATION V SALYER (DESTRUCTION OF UNDERGROUND STREAM).
W69-03444 04C

'PLANNING A WATER QUALITY MANAGEMENT SYSTEM THE CASE OF THE POTOMAC ESTUARY',
W69-03643 05G

STATEMENT BEFORE THE SUBCOMMITTEE ON AIR AND WATER POLLUTION,
W69-03670 05C

'NUTRIENT ASSIMILATION IN A VIRGINIA TIDAL SYSTEM',
W69-03695 05C

VISITATION RATES
APPLICATION OF MARGINAL ECONOMIC ANALYSIS TO RESERVOIR RECREATION PLANNING,
W69-03576 06B

WADI
THE WATER OUTPUT OF THE DESERT VEGETATION IN THE DIFFERENT MICROHABITATS OF WADI HOFF,
W69-03501 02I

WASHINGTON
GROUND-WATER RESOURCES OF ISLAND COUNTY, WASHINGTON,
W69-03224 02F

GROUND-WATER SURVEY, ODESSA-LIND AREA, WASHINGTON,
W69-03352 02F

ENVIRONMENTAL FACTORS IN COASTAL AND ESTUARINE WATERS BIBLIOGRAPHIC SERIES - VOLUME II. COAST OF WASHINGTON,
W69-03651 02L

PRELIMINARY ASSESSMENT OF THE ENGLISH SOLE IN PORT GARDNER, WASHINGTON,
W69-03660 05C

METROPOLITAN SEATTLE'S DUWAMISH ESTUARY WATER QUALITY PROGRAM,
W69-03667 05B

SEATTLE'S EFFORTS IN RESTORATION OF BAYS AND ESTUARIES,
W69-03683 05G

WASTE ASSIMILATION
'FINITE-DIFFERENCE MODELLING OF RIVER AND ESTUARY

POLLUTION',
W69-03690 05A

WASTE DISPOSAL
GEOPHYSICAL SURVEYS IN THE VICINITY OF SANITARY LANDFILLS IN NORTHEASTERN ILLINOIS,
W69-03236 05B

FEASIBILITY CRITERIA FOR SUBSURFACE WASTE DISPOSAL IN ILLINOIS,
W69-03251 05E

NAVIGATION.
W69-03423 06E

ROCK MECHANICS IN THE DISPOSAL OF RADIOACTIVE WASTES BY HYDRAULIC FRACTURING,
W69-03522 08E

'DISTRIBUTION OF POLLUTIONAL LOADINGS IN SUISUN BAY',
W69-03609 05B

THE CONDITION OF THE CHESAPEAKE BAY,
W69-03637 06B

BIOLOGICAL EFFECTS OF SPOIL DISPOSAL IN CHESAPEAKE BAY,
W69-03666 05C

WASTE WATER DISPOSAL
DRAINS AND PROTECTION OF PUBLIC WATER SUPPLIES.
W69-03476 05B

CLEAN WATER FOR THE NATION'S ESTUARIES.
W69-03629 05G

WASTE WATER TREATMENT
SOME ECONOMIC ASPECTS OF ADVANCED WASTE TREATMENT,
W69-03644 05D

REGIONAL CONSTRUCTION REQUIREMENTS FOR WATER AND WASTEWATER FACILITIES 1955-1967-1980,
W69-03698 05D

WASTES
THROWING GAS TAR OR REFUSE INTO PUBLIC WATERS.
W69-03477 05B

WATER ALLOCATION(POLICY)
IMPACT OF INSTITUTIONAL ARRANGEMENTS ON THE AVAILABLE ALTERNATIVE DEVELOPMENTAL PATHS FOR WATER ALLOCATION AND POLLUTION CONTROL IN THE COLORADO RIVER BASIN,
W69-03492 06A

WATER ANALYSIS
SAMPLING THE SOIL SOLUTION FOR SALINITY APPRAISAL,
W69-03488 02G

WATER BALANCE
INTERCEPTION BY EASTERN WHITE PINE,
W69-03315 02I

METEOROLOGICAL STUDIES IN THE MARMOT CREEK WATERSHED, ALBERTA, CANADA, IN AUGUST 1965,
W69-03330 02D

WATER CHEMISTRY
CHARACTERISTICS OF SUBSURFACE WATERS HAVING A TENDENCY TO PRECIPITATE IN THE FILTER ZONES OF WELLS,
W69-03210 02F

APPLICATIONS OF FACTOR ANALYSIS IN STUDY OF CHEMISTRY OF GROUNDWATER QUALITY, MOJAVE RIVER VALLEY, CALIFORNIA,
W69-03253 02F

PRINCIPLES OF CHEMICAL COMPOSITION OF GROUNDWATERS (BASIC FACTORS), (IN RUSSIAN),
W69-03533 02K

THE OCCURRENCE OF TRITIUM IN PRECIPITATION AND ITS SIGNIFICANCE IN HYDROLOGICAL INVESTIGATIONS,
W69-03555 02K

WATER CIRCULATION
COMPUTATION OF SEICHE VELOCITIES IN BODIES OF WATER WITH A COMPLEX BOTTOM RELIEF,
W69-03217 02H

'MIXING OF COLUMBIA RIVER AND OCEAN WATERS, SUMMER',
W69-03632 05C

WATER CONSERVATION
REGIONAL WATER RESOURCE DEVELOPMENT IN THE FEDERAL SYSTEM,
W69-03411 06B

WATER COOLING
'ANALYZING STEAM ELECTRIC POWER PLANT DISCHARGES',
W69-03655 05B

WATER COSTS
A STUDY TO DETERMINE THE COSTS OF WATER IN INDUSTRIAL USES,
W69-03322 06C

ENGINEERING AND ECONOMIC FEASIBILITY STUDY FOR A COMBINATION NUCLEAR POWER-DESALTING PLANT.
W69-03658 03A

WATER DEFICIT
EFFECT OF LEAF AGING ON WATER DEFICIT-WATER POTENTIAL RELATIONSHIPS OF DOGWOOD LEAVES GROWING IN TWO ENVIRONMENTS,
W69-03393 02I

WATER DESALINATION
INTERNATIONAL CONFERENCE ON WATER FOR PEACE 1967.
W69-03305 06B

WATER FOR PEACE
INTERNATIONAL CONFERENCE ON WATER FOR PEACE 1967.
W69-03305 06B

WATER FRONT IMPROVEMENT
WATER FRONT IMPROVEMENTS.
W69-03413 06E

WATER LAW
LICENSES IN CONN RIVER, GREAT PONDS, AND TIDE WATERS AS TO BOOMS, PIERS, WHARVES, PIPE LINE, ETC.
W69-03263 06E

ADAMS V CREWS (TITLE TO SUBMERGED LAND).
W69-03281 06E

C AND W COAL COMPORATION V SALYER (DESTRUCTION OF UNDERGROUND STREAM).
W69-03444 04C

LUMBER OR BOATS FOUND ADRIFT.
W69-03474 06E

WATER LEVEL FLUCTUATIONS
POTENTIAL FLOW AND SOIL STRUCTURE CHANGES,
W69-03203 02F

HYDROLOGIC SUBSTANTIATION AND COMPUTATION OF THE REDUCTION OF FORESTS AND THE EXPANSION OF NATUEALLY WATERLOGGED AREAS AFTER UNDERFLOODING IN RIVER SYSTEMS,
W69-03214 02A

GROUND-WATER SURVEY, ODESSA-LIND AREA, WASHINGTON,
W69-03352 02F

ELECTRIC ANALOG OF THREE-DIMENSIONAL FLOW TO WELLS AND ITS APPLICATION TO UNCONFINED AQUIFERS,
W69-03356 07C

WATER LEVELS
METHODS OF MEASURING WATER LEVELS IN DEEP WELLS,
W69-03535 07B

WATER MANAGEMENT
INTERNATIONAL CONFERENCE ON WATER FOR PEACE 1967.
W69-03305 06B

'PLANNING A WATER QUALITY MANAGEMENT SYSTEM THE CASE OF THE POTOMAC ESTUARY',
W69-03643 05G

WATER MANAGEMENT(APPLIED)
MAIN I, A SYSTEM OF COMPUTERIZED MODELS FOR CALCULATING AND EVALUATING MUNICIPAL WATER REQUIREMENTS. VOLUME I-DEVELOPMENT OF THE MAIN SYSTEM VOLUME II-DESCRIPTION OF THE MAIN I SYSTEM AND LIBRARY OF WATER USAGE PARAMETERS.
W69-03201 06D

MAIN I, A SYSTEM OF COMPUTERIZED MODELS FOR CALCULATING AND EVALUATING MUNICIPAL WATER REQUIREMENTS.
W69-03202 06D

WATER PERMITS
TRANSFER OF CERTAIN POWERS, DUTIES, FUNCTIONS AND RESPONSIBILITIES OF THE DEPARTMENT OF CONSERVATION AND DEVELOPMENT.
W69-03429 06E

WATER POLICY
DELAWARE RIVER BASIN COMPACT.
W69-03299 06B

REGULATION OF WITHDRAWALS AND DIVERSIONS.
W69-03303 06C

POLLUTION CONTROL - PLANNING A NATIONAL PROGRAM,
W69-03410 05G

DECLARATION OF POLICY.
W69-03456 04A

SOME CRITICAL PROBLEMS OF THE SHELLFISH INDUSTRY,
W69-03621 06E

WHAT ARE WE LEARNING FROM ECONOMIC STUDIES OF WATER QUALITY,
W69-03697 06B

WATER POLLUTION
NUMERICAL SOLUTIONS FOR DISPERSION IN POROUS MEDIUMS,
W69-03237 05B

HYDROLOGIC DATA COLLECTION IN TIDAL ESTUARIES,
W69-03239 02L

DISCHARGE OF OIL ON SURFACE WATERS - DOUBLE TORT LIABILITY FOR DAMAGES.
W69-03274 05B

STREAM CONTAMINATION BY HERBICIDES AFTER FALL RAINS ON FOREST LAND,
W69-03381 05B

RESIDUES OF HERBICIDES AND DIESEL OIL CARRIERS IN FOREST WATERS,
W69-03397 05B

MAGNOLIA PETROLEUM CO V STINSON (NEGLIGENT POLLUTION OF

STREAMS).
W69-03439 05C

POLLUTING STREAMS PROHIBITED.
W69-03468 05B

SURVEILLANCE OPERATIONS IN THE CONTROL OF WATER POLLUTION ON A NATIONAL SCALE,
W69-03584 05G

THE POTOMAC ESTUARY - STATISTICS AND PROJECTIONS,
W69-03603 05B

MARINE SHIPPING INDUSTRY - EFFECTS AND IMPACTS ON THE CHESAPEAKE BAY,
W69-03636 05G

THE POLITICS OF BEAUTY,
W69-03648 06E

BIOLOGICAL EFFECTS OF SPOIL DISPOSAL IN CHESAPEAKE BAY,
W69-03666 05C

'U. S. COAST GUARD REPORT OF WAKE ISLAND OIL SPILL',
W69-03685 05C

'ENVIRONMENTAL REACTION TO WATER POLLUTION',
W69-03693 05C

WATER POLLUTION CONTROL
EUTROPHICATION,
W69-03357 05C

STRIPPING EFFLUENTS OF NUTRIENTS BY BIOLOGICAL MEANS,
W69-03374 05F

PESTICIDES IN FOREST WATERS--SYMPTOM OF A GROWING PROBLEM,
W69-03401 05C

POLLUTION CONTROL - PLANNING A NATIONAL PROGRAM,
W69-03410 05G

POLLUTION CONTROL.
W69-03460 05G

PROTECTION OF WATERS CESSPOOLS AND DRAINS.
W69-03470 05B

IMPACT OF INSTITUTIONAL ARRANGEMENTS ON THE AVAILABLE ALTERNATIVE DEVELOPMENTAL PATHS FOR WATER ALLOCATION AND POLLUTION CONTROL IN THE COLORADO RIVER BASIN,
W69-03492 06A

ECONOMIC CONSIDERATIONS OF WATER POLLUTION CONTROL,
W69-03613 05G

'STATEMENT',
W69-03617 05G

ECONOMICS OF WATER POLLUTION CONTROL,
W69-03623 05G

CLEAN WATER FOR THE NATION'S ESTUARIES.
W69-03629 05G

SEATTLE'S EFFORTS IN RESTORATION OF BAYS AND ESTUARIES,
W69-03683 05G

BENEFIT-COST ANALYSIS FOR WATER RESOURCE PROJECTS A SELECTED ANNOTATED BIBLIOGRAPHY.
W69-03691 06B

WATER POLLUTION EFFECTS
STREAM POLLUTION BY ALGAL NUTRIENTS,
W69-03369 05C

WHY STUDY BLUE-GREEN ALGAE,
W69-03513 05C

THE PROBLEM OF PESTICIDES IN ESTUARIES,
W69-03618 05G

CONSEQUENCES OF MAJOR SPILLS ON INDUSTRIAL USES OF SEAWATER.
W69-03633 05C

CONDITION OF THE QUAHOG, MERCENARIA MERCENARIA, FROM POLLUTED AND UNPOLLUTED WATERS,
W69-03635 05C

'STATEMENT',
W69-03649 05G

PRELIMINARY ASSESSMENT OF THE ENGLISH SOLE IN PORT GARDNER, WASHINGTON,
W69-03660 05C

'STATEMENT',
W69-03678 05C

INTERIM REPORT ON GROSS PHYSICAL AND BIOLOGICAL EFFECTS OF OVERBOARD SPOIL DISPOSAL.
W69-03682 05C

'ENVIRONMENTAL REACTION TO WATER POLLUTION',
W69-03693 05C

WATER POLLUTION SOURCES
EFFECT OF WATER SAMPLE PRESERVATION METHODS ON THE RELEASE OF PHOSPHORUS FROM ALGAE,
W69-03370 05B

CHEMICAL BRUSH CONTROL AND HERBICIDE RESIDUES IN THE FOREST ENVIRONMENT,
W69-03399 05B

PESTICIDES IN FOREST WATERS--SYMPTOM OF A GROWING PROBLEM,
W69-03401 05C

STATE V KINSLEY (VIOLATION OF POLLUTION STATUTE).
W69-03475 05B

CONSEQUENCES OF MAJOR SPILLS ON INDUSTRIAL USES OF SEAWATER.
W69-03633 05C

KEEPING OIL OUT OF THE SEA.
W69-03688 05B

WATER POLLUTION TREATMENT
STRIPPING EFFLUENTS OF NUTRIENTS BY BIOLOGICAL MEANS,
W69-03374 05F

WATER POTENTIAL
COMPARISON OF THE DYE METHOD WITH THE THERMOCOUPLE PSYCHROMETER FOR MEASURING LEAF WATER POTENTIALS,
W69-03390 02I

MEASUREMENT OF LEAF WATER POTENTIAL BY THE DYE METHOD,
W69-03392 02I

EFFECT OF LEAF AGING ON WATER DEFICIT-WATER POTENTIAL RELATIONSHIPS OF DOGWOOD LEAVES GROWING IN TWO ENVIRONMENTS,
W69-03393 02I

WATER PROPERTIES
'NUTRIENT ASSIMILATION IN A VIRGINIA TIDAL SYSTEM',
W69-03695 05C

WATER QUALITY
RECOVERY OF BACTERIAL PATHOGENS FROM HIGH QUALITY SURFACE WATER,
W69-03311 05B

THE OCCURRENCE AND CHARACTERISTICS OF GROUND-WATER CONTAMINATION IN MASSACHUSETTS,
W69-03312 05B

WATER RESOURCES DATA FOR COLORADO, 1967--PART 2. WATER QUALITY RECORDS.
W69-03319 02E

WATER RESOURCES DATA FOR MASSACHUSETTS, NEW HAMPSHIRE, RHODE ISLAND, VERMONT, 1967--PART 1. SURFACE WATER RECORDS, PART 2. WATER QUALITY RECORDS.
W69-03321 02E

AN AQUIFER TEST USED TO INVESTIGATE A QUALITY OF WATER ANOMALY,
W69-03335 02F

POLLUTION CONTROL - PLANNING A NATIONAL PROGRAM,
W69-03410 05G

HYDROGEOLOGIC DATA FOR BACA AND SOUTHERN PROWERS COUNTIES, COLORADO,
W69-03530 02F

SODIUM AS A CLUE TO DIRECTION OF GROUNDWATER MOVEMENT, NEVADA TEST SITE,
W69-03559 02F

THERMAL SPRINGS NEAR MIDWAY, UTAH,
W69-03568 02F

EFFECTS OF STREAMFLOW REGULATION ON WATER QUALITY-THE TVA EXPERIENCE,
W69-03585 05B

SAN FRANCISCO BAY PLAN.
W69-03592 06B

THE POTOMAC ESTUARY - STATISTICS AND PROJECTIONS,
W69-03603 05B

'DISTRIBUTION OF POLLUTIONAL LOADINGS IN SUISUN BAY',
W69-03609 05B

'ESTUARINE OXYGEN RESOURCES--PHOTOSYNTHESIS AND REAERATION',
W69-03610 05G

'PLANNING A WATER QUALITY MANAGEMENT SYSTEM THE CASE OF THE POTOMAC ESTUARY',
W69-03643 05G

BIOLOGICAL EFFECTS OF SPOIL DISPOSAL IN CHESAPEAKE BAY,
W69-03666 05C

THE HUDSON RIVER ESTUARY, A PRELIMINARY INVESTIGATION OF FLOW AND WATER-QUALITY CHARACTERISTICS,
W69-03668 02L

WHAT ARE WE LEARNING FROM ECONOMIC STUDIES OF WATER QUALITY,
W69-03697 06B

WATER QUALITY CONTROL
WATER QUALITY MANAGEMENT IN THE DELAWARE RIVER BASIN,
W69-03583 06B

SURVEILLANCE OPERATIONS IN THE CONTROL OF WATER POLLUTION ON A NATIONAL SCALE,
W69-03584 05G

'STATEMENT',

W69-03617 05G

ECONOMICS OF WATER POLLUTION CONTROL,
W69-03623 05G

SOME ECONOMIC ASPECTS OF ADVANCED WASTE TREATMENT,
W69-03644 05D

DELAWARE ESTUARY COMPREHENSIVE STUDY--PRELIMINARY REPORT AND FINDINGS.
W69-03645 05G

RESEARCH PROBLEMS IN WATER QUALITY AND RECREATION,
W69-03653 05G

METROPOLITAN SEATTLE'S DUWAMISH ESTUARY WATER QUALITY PROGRAM,
W69-03667 05B

'GEORGIA WATER QUALITY CONTROL BOARDS STATEMENT TO THE NATIONAL ESTUARINE STUDY REPORT',
W69-03679 05G

WATER REQUIREMENTS
MAIN I, A SYSTEM OF COMPUTERIZED MODELS FOR CALCULATING AND EVALUATING MUNICIPAL WATER REQUIREMENTS VOLUME I-DEVELOPMENT OF THE MAIN SYSTEM VOLUME II-DESCRIPTION OF THE MAIN I SYSTEM AND LIBRARY OF WATER USAGE PARAMETERS.
W69-03201 06D

MAIN I, A SYSTEM OF COMPUTERIZED MODELS FOR CALCULATING AND EVALUATING MUNICIPAL WATER REQUIREMENTS.
W69-03202 06D

THE ROLE OF INDUSTRIAL PROCESS CHANGES IN AFFECTING WATER REQUIREMENTS,
W69-03599 06D

THE TEXAS BASINS PROJECT,
W69-03625 06B

WATER RESOURCES
GROUND-WATER RESOURCES OF ISLAND COUNTY, WASHINGTON,
W69-03224 02F

HYDROLOGY OF BROOKHAVEN NATIONAL LABORATORY AND VICINITY, SUFFOLK COUNTY, NEW YORK,
W69-03232 02E

DEPARTMENT OF NATURAL RESOURCES.
W69-03256 06E

W69-03257 06E

EXISTING RIGHTS AND REMEDIES PRESERVED LIMITATIONS.
W69-03297 04A

PURPOSE AND FINDINGS.
W69-03300 06E

OPTIMIZATION TECHNIQUES FOR HYDROLOGIC ENGINEERING,
W69-03329 06A

GROUNDWATER RESOURCES OF CHOWAN COUNTY, NORTH CAROLINA,
W69-03355 02F

CONSERVATION AND WATER RESOURCES PLANS.
W69-03463 06B

OCCURENCE OF GROUND WATER IN THE JUDITH RIVER FORMATION, NORTH-CENTRAL MONTANA,
W69-03545 02F

PLANNING FOR MULTI-PURPOSE DEVELOPMENT OF WATER AND RELATED LAND RESOURCES IN THE UPPER MISSISSIPPI RIVER BASIN,
W69-03586 06B

PLANNING FOR MULTIPLE-PURPOSE DEVELOPMENT,
W69-03587 06B

ECONOMICS OF OUTDOOR RECREATION,
W69-03628 06B

WATER RESOURCES DEVELOPMENT
DELAWARE RIVER BASIN COMPACT.
W69-03299 06B

THE CONTINENTAL USE OF ARCTIC-FLOWING RIVERS,
W69-03313 04A

REGIONAL WATER RESOURCE DEVELOPMENT IN THE FEDERAL SYSTEM,
W69-03411 06B

IMPACT OF INSTITUTIONAL ARRANGEMENTS ON THE AVAILABLE ALTERNATIVE DEVELOPMENTAL PATHS FOR WATER ALLOCATION AND POLLUTION CONTROL IN THE COLORADO RIVER BASIN,
W69-03492 06A

SOLVING THE ARID STATES' PROBLEMS,
W69-03493 06B

THE NATURE OF CHANGES IN URBAN WATERSHEDS AND THEIR IMPORTANCE IN THE DECADES AHEAD,
W69-03511 04C

GROUND WATER RECHARGE, DEVELOPMENT AND MANAGEMENT,
W69-03540 04B

PUBLIC OBJECTIVES IN WATER RESOURCES DEVELOPMENT,
W69-03575 06B

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN ILLINOIS.
W69-03591 06B

ANNUAL REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY, ON CIVIL WORKS ACTIVITIES.
W69-03608 06B

BENEFIT-COST ANALYSIS FOR WATER RESOURCE PROJECTS A SELECTED ANNOTATED BIBLIOGRAPHY.
W69-03691 06B

WATER REUSE
THE LAKE TAHOE WATER RECLAMATION PLANT,
W69-03640 05D

WATER RIGHTS
LAKE GIBSON LAND CO V LESTER (IRRIGATION BY PUMPING LOWERING LAKE LEVEL).
W69-03285 02H

WATER SHORTAGE
REGULATION OF WITHDRAWALS AND DIVERSIONS.
W69-03303 06C

WATER SOURCES
AMITROLE CONCENTRATIONS IN CREEK WATERS DOWNSTREAM FROM AN AERIALLY SPRAYED WATERSHED SUBBASIN,
W69-03226 05B

WATER SPREADING
DIVISION S-6-SOIL AND WATER MANAGEMENT AND CONSERVATION--LEVEL PAN SYSTEM FOR SPREADING AND STORING WATERSHED RUNOFF,
W69-03499 02E

WATER STORAGE
WATER SUPPLY.
W69-03461 04A

WATER SUPPLY
IN RE NEVERSINK RIPARIAN SECTION NO 1 SULLIVAN COUNTY (CONDEMNATION PROCEEDINGS TO ACQUIRE ADDITIONAL WATER SUPPLY).
W69-03276 06E

WATER SUPPLY (STORAGE AND RELEASE OF WATERS).
W69-03301 04A

WATER SUPPLY.
W69-03461 04A

SIRACO V VILLAGE OF WHITEHALL (NON-LIABILITY OF VILLAGE FOR FIRE DAMAGE RESULTING FROM VILLAGE'S FAULTY WATER SYSTEM).
W69-03478 06E

WATER TABLE
ACCURACY OF SOIL MOISTURE READINGS WITH UNSEALED ACCESS TUBES,
W69-03500 02G

WATER TEMPERATURE
NUMERICAL MODEL OF THE NONSTATIONARY TEMPERATURE FIELD OF FLOWING BODIES OF WATER,
W69-03213 02E

THE DISTRIBUTION OF EXCESS TEMPERATURE FROM A HEATED DISCHARGE IN AN ESTUARY,
W69-03341 02L

TEMPERATURE VARIATIONS OF DEEP FLOWING WELLS IN SOUTH DAKOTA,
W69-03567 02F

WATER TRANSFER
SOLVING THE ARID STATES' PROBLEMS,
W69-03493 06B

WATER TYPES
PRINCIPLES OF CHEMICAL COMPOSITION OF GROUNDWATERS (BASIC FACTORS), (IN RUSSIAN),
W69-03533 02K

WATER UTILIZATION
WATER USE IN TENNESSEE, PART A-AGRICULTURAL WATER USE,
W69-03323 06D

GROUND-WATER SURVEY, ODESSA-LIND AREA, WASHINGTON,
W69-03352 02F

SOIL MOISTURE DEPLETION PATTERNS AROUND SCATTERED TREES,
W69-03407 02I

WATER UTILIZATION IN GREENHOUSES ALTERNATIVES FOR AGRICULTURE IN ARID REGIONS,
W69-03486 03F

NATIONAL JURISDICTION AND THE USE OF THE SEA,
W69-03572 06B

WATER VALUES
THE CONDITION OF THE CHESAPEAKE BAY,
W69-03637 06B

WATER WELLS
CLASSIFICATION OF WATER-BEARING STRATA BASED ON CONDITIONS OF FLOW OF WATER INTO WELLS,
W69-03523 02F

HYDROGEOLOGIC DATA FOR BACA AND SOUTHERN PROWERS COUNTIES, COLORADO,
W69-03530 02F

ER YIELD IMPROVEMENT
HE INFLUENCE OF RAINFALL INTERCEPTION ON STREAMFLOW,
69-03384 02I

OREST TREATMENT EFFECTS ON WATER YIELD,
69-03387 03B

BSERVATIONS OF SNOW ACCUMULATION AND MELT IN DEMONSTRATION
UTTINGS OF PONDEROSA PINE IN CENTRAL ARIZONA,
69-03408 02C

ERFRONT DEVELOPMENT
EORGETOWN WATERFRONT.
69-03595 06B

ERSHED MANAGEMENT
OREST TREATMENT EFFECTS ON WATER YIELD,
69-03387 03B

LENDING FOREST USES,
69-03404 04D

RAINS AND PROTECTION OF PUBLIC WATER SUPPLIES.
69-03476 05B

ATERSHED, FLOOD PROTECTION, AND RECREATION DEVELOPMENT IN
TCHISON, KANSAS,
69-03593 06B

ERSHED PROTECTION AND FLOOD PREVENTION ACT
EPARTMENT OF NATURAL RESOURCES.
69-03255 06E

ERSHEDS(BASINS)
N APPLICATION OF PRINCIPAL COMPONENT ANALYSIS AND FACTOR
NALYSIS IN THE STUDY OF WATER YIELD,
69-03233 02A

ELENGTHS
N ANALYSIS OF THE MEANDERING TENDENCY OF SERPENTINE CAVE,
.S.W.,
69-03532 02F

ES(WATER)
EA WATER INTRUSION INTO A FRESH WATER FOREBAY DUE TO WAVE
CTION,
69-03531 02L

L FILTERS
HARACTERISTICS OF SUBSURFACE WATERS HAVING A TENDENCY TO
RECIPITATE IN THE FILTER ZONES OF WELLS,
69-03210 02F

L REGULATION
EGULATION OF OPEN WELLS, CESSPOOLS, BASINS OR SUMPS.
69-03432 04A

L REGULATIONS
RANSFER OF CERTAIN POWERS, DUTIES, FUNCTIONS AND
ESPONSIBILITIES OF THE DEPARTMENT OF CONSERVATION AND
EVELOPMENT.
69-03429 06E

L TESTING
NALYSIS OF SOME PUMPING TEST RESULTS,
69-03206 02F

LLS
ICKEY V HONEYCUTT (MINE DAMAGE TO WELLS).
69-03282 02F

T SEASONS
REQUENCY OF WET AND DRY SPELLS AT FIVE STATIONS IN
AJASTHAN,
69-03490 02B

TLANDS
OW TO STOP THE PILLAGE OF AMERICA,
69-03694 06E

TTING
INVESTIGATION OF WATER ABSORPTION BY THE SOIL ON THE BASIS
OF THE DIMENSIONAL THEORY,
69-03215 02G

ALES
BREAKING UP, DISPOSAL, AND GROUNDING OF CERTAIN FLOATING
STRUCTURES - REMOVAL OF WHALES.
69-03272 06E

EAT
DETERMINING EVAPO TRANSPIRATION BY THE GRAVIMETRIC METHOD
FOR THE WHEAT CROP IN THE IRRIGATION DISTRICT OF RIO YAQUI,
SONORA, MEXICO.
69-03497 02D

WHITE PINE TREES
INTERCEPTION BY EASTERN WHITE PINE,
69-03315 02I

WILDLIFE
RECOVERY OF BACTERIAL PATHOGENS FROM HIGH QUALITY SURFACE
WATER,
69-03311 05B

WILDLIFE HABITAT
POTENTIAL IMPACT OF FOREST FERTILIZATION ON RANGE, WILDLIFE,
AND WATERSHED MANAGEMENT,
69-03383 04C

WISCONSIN
STEARNS V STATE (DIVERSION OF SEWAGE EFFLUENT INTO CLEAN
RIVER BY ORDER OF ADMINISTRATIVE AGENCY).
69-03296 05B

INTERAGENCY WATER RESOURCES RESEARCH AND DATA COLLECTION
PROGRAM.
69-03360 09D

RECENT SEDIMENTS OF THREE WISCONSIN LAKES,
69-03367 02J

HYDROLOGY AND RESERVOIR CONTROL ON THE WISCONSIN RIVER
BASIN,
69-03375 04A

STREAMFLOW AND PRECIPITATION DATA INDEX,
69-03380 04A

WISCONSIN RIVER
HYDROLOGY AND RESERVOIR CONTROL ON THE WISCONSIN RIVER
BASIN,
69-03375 04A

SELECTED BIBLIOGRAPHY ON HYDROLOGICAL CONTROL BY RESERVOIR
OPERATION,
69-03376 04A

ANALYSIS OF A WATER STORAGE RESERVOIR SYSTEM,
69-03377 04A

STREAMFLOW AND PRECIPITATION DATA INDEX,
69-03380 04A

WITHDRAWAL
WITHDRAWAL AND DIVERSION FROM PROTECTED AREAS.
69-03462 04A

WITHDRAWALS
REGULATION OF WITHDRAWALS AND DIVERSIONS.
69-03303 06C

XYLEM
EFFECT OF EXTERNAL SALT CONCENTRATIONS ON WATER RELATIONS IN
PLANTS II. EFFECT OF THE OSMOTIC DIFFERENTIAL BETWEEN
EXTERNAL MEDIUM AND XYLEM ON WATER RELATIONS IN THE ENTIRE
PLANT,
69-03487 02I

YUBA DAM
GROUND-WATER RESOURCES OF THE SEVIER RIVER BASIN BETWEEN
YUBA DAM AND LEAMINGTON CANYON, UTAH,
69-03529 02F

ZONE OF SATURATION
ACCURACY OF SOIL MOISTURE READINGS WITH UNSEALED ACCESS
TUBES,
69-03500 02G

2-4 D
THE DETERMINATION OF THE IONIZATION CONSTANT OF 2,4-D IN
WATER,
69-03241 05A

STREAM CONTAMINATION BY HERBICIDES AFTER FALL RAINS ON
FOREST LAND,
69-03381 05B

CHEMICAL BRUSH CONTROL AND HERBICIDE RESIDUES IN THE FOREST
ENVIRONMENT,
69-03399 05B

2-4-5 T
STREAM CONTAMINATION BY HERBICIDES AFTER FALL RAINS ON
FOREST LAND,
69-03381 05B

AUTHOR INDEX

LTO, JOHAN A.
THE POTOMAC ESTUARY - STATISTICS AND PROJECTIONS,
W69-03603 05B

EN, K. D.
SUMMARY OF THE 1963 AND 1964 SOUTHERN CALIFORNIA INSHORE BAIT FISHERY,
W69-03604 06D

BOTT, WALTER
'STATEMENT', IN CLEAN WATER FOR THE NATION'S ESTUARIES,
W69-03605 05B

D EL RAHMAN, A. A.
THE WATER OUTPUT OF THE DESERT VEGETATION IN THE DIFFERENT MICROHABITATS OF WADI HOFF,
W69-03501 02I

AMS, WILLIAM M.
REFLECTIVITY OF ELECTROMAGNETIC WAVES AT AN AIR-WATER INTERFACE FOR PURE AND SEA WATER,
W69-03598 01A

INFRARED IMAGES OF THE KAU AND PUNA COASTLINES ON HAWAII,
W69-03600 07B

OLPHSON, D. G.
TEMPERATURE VARIATIONS OF DEEP FLOWING WELLS IN SOUTH DAKOTA,
W69-03567 02F

NEW, ALLEN F.
HYDROLOGY OF SURFACE MINING-A CASE STUDY,
W69-03547 02A

AI, K.
SEEPAGE FROM A CANAL INTO SOIL WITH SHALLOW WATER DEPTH,
W69-03204 02F

EKSEYEV, V. S.
CHARACTERISTICS OF SUBSURFACE WATERS HAVING A TENDENCY TO PRECIPITATE IN THE FILTER ZONES OF WELLS,
W69-03210 02F

EXANDER, LEWIS M.
NATIONAL JURISDICTION AND THE USE OF THE SEA,
W69-03572 06B

NARRAGANSETT BAY A MARINE USE PROFILE,
W69-03606 06B

LEN, G. W.
A BIOLOGIST'S VIEWPOINT OF MAN-MADE CHANGES IN ESTUARIES,
W69-03607 06G

LEN, HOWARD E.
FLOODS IN DYER QUADRANGLE, NORTHEASTERN ILLINOIS,
W69-03327 02E

LEN, MARY M.
THE EFFECT OF DILUTION MEDIA ON THE BOD OF ALGAE,
W69-03371 05A

LEN, P. B.
SEDIMENT TRANSPORT OF STREAMS IN THE WASHITA RIVER BASIN IN CADDO AND GRADY COUNTIES, OKLAHOMA,
W69-03326 02J

IEN, MICHAEL
STREAMFLOW ROUTING (WITH APPLICATIONS TO NORTH CAROLINA RIVERS),
W69-03564 02E

OROCHO, J.
THE NONLINEAR PREDICTION PROBLEM IN THE STUDY OF THE RUNOFF CYCLE,
W69-03308 02A

DERSON, HENRY W.
ERODIBILITY INDICES FOR WILDLAND SOILS OF OAHU, HAWAII, AS RELATED TO SOIL FORMING FACTORS,
W69-03316 02J

DERSON, HENRY W., JR.
GROUND-WATER RESOURCES OF ISLAND COUNTY, WASHINGTON,
W69-03224 02F

DREYEV, P. F.
ISOTOPIC COMPOSITION OF LEAD IN NATURAL WATERS,
W69-03245 02K

SANO, TAKASHI
'DISTRIBUTION OF POLLUTIONAL LOADINGS IN SUISUN BAY',
W69-03609 05B

AILEY, THOMAS E.
'ESTUARINE OXYGEN RESOURCES--PHOTOSYNTHESIS AND REAERATION',
W69-03610 05G

AIN, RICHARD C., JR.
'PREDICTING DIURNAL VARIATIONS IN DISSOLVED OXYGEN CAUSED BY ALGAE IN ESTUARINE WATERS, PART I',
W69-03611 05C

AKER, C. H., JR.
THERMAL SPRINGS NEAR MIDWAY, UTAH,
W69-03568 02F

BARDEN, L.
THE DIFFUSION OF AIR THROUGH THE PORE WATER OF SOILS,
W69-03205 02A

BARR, J. W.
THE HUDSON RIVER ESTUARY, A PRELIMINARY INVESTIGATION OF FLOW AND WATER-QUALITY CHARACTERISTICS,
W69-03668 02L

BASER, B. L.
EFFECT OF SODIUM SALTS ON THE GROWTH AND MINERAL COMPOSITION OF BAJRA (PENNISETUM TYPHOIDES),
W69-03483 03C

BATANOUNY, K. H.
THE WATER OUTPUT OF THE DESERT VEGETATION IN THE DIFFERENT MICROHABITATS OF WADI HOFF,
W69-03501 02I

BAVINA, L. G.
REFINEMENT OF PARAMETERS FOR CALCULATING EVAPORATION FROM BOGS ON THE BASIS OF OBSERVATIONS AT BOG STATIONS,
W69-03211 02D

BAXTER, SAMUEL S.
ECONOMIC CONSIDERATIONS OF WATER POLLUTION CONTROL,
W69-03613 05G

BEARD, LEO R.
OPTIMIZATION TECHNIQUES FOR HYDROLOGIC ENGINEERING,
W69-03329 06A

BEATY, CHESTER B.
SEQUENTIAL STUDY OF DESERT FLOODING IN THE WHITE MOUNTAINS OF CALIFORNIA AND NEVADA,
W69-03222 02E

BEHNKE, JEROLD J.
SEA WATER INTRUSION INTO A FRESH WATER FOREBAY DUE TO WAVE ACTION,
W69-03531 02L

BEIGHTLER, C. S.
OPTIMIZATION OF BRANCHING MULTISTAGE SYSTEMS A REPLY TO A COMMENT BY D P LOUCKS,
W69-03580 06A

BELLA, DAVID A.
'FINITE-DIFFERENCE MODELLING OF RIVER AND ESTUARY POLLUTION',
W69-03690 05A

BENTALL, RAY
SHORTCUTS AND SPECIAL PROBLEMS IN AQUIFER TESTS,
W69-03231 07B

BERGEN, JAMES D.
ATMOSPHERIC HUMIDITY MEASUREMENT NEAR THE SNOW SURFACE,
W69-03409 02C

BERGER, K. C.
PHOSPHORUS RELEASE FROM BOG LAKE MUDS,
W69-03363 02K

BERGSTROM, ROBERT E.
FEASIBILITY CRITERIA FOR SUBSURFACE WASTE DISPOSAL IN ILLINOIS,
W69-03251 05E

BERKELEY, NORBORNE, JR.
THE ECONOMICS OF RECREATION,
W69-03692 06D

BEVAN, DONALD E.
SIMULATION OF A WATER RESOURCES SYSTEM,
W69-03601 06A

BIGLANE, KENNETH E.
'ENVIRONMENTAL REACTION TO WATER POLLUTION',
W69-03693 05C

BINGHAM, J. W.
GROUND-WATER SURVEY, ODESSA-LIND AREA, WASHINGTON,
W69-03352 02F

BJORKLUND, L. J.
GROUND-WATER RESOURCES OF THE SEVIER RIVER BASIN BETWEEN YUBA DAM AND LEAMINGTON CANYON, UTAH,
W69-03529 02F

BOCHEVER, F. M.
CONVECTIVE SALT DIFFUSION IN A RADIAL SUBSURFACE STREAM IN RELATION TO THE PROTECTION OF SUBSURFACE WATERS FROM CONTAMINATED DISCHARGES,
W69-03212 05B

BODHAINE, G. L.
MEASUREMENT OF PEAK DISCHARGE AT CULVERTS BY INDIRECT METHODS,
W69-03345 07B

BODOVITZ, JOSEPH E.
PROBLEMS OF MAINTAINING BAYS AND ESTUARIES--A PANEL, SAN FRANCISCO BAY,
W69-03616 04A

BOLLEN, W. B.
NITROGEN CONTENT OF PRECIPITATION IN A COASTAL OREGON FOREST OPENING,
W69-03400 05B

NUTRIENT CYCLING BY THROUGHFALL AND STEMFLOW PRECIPITATION IN THREE COASTAL OREGON FOREST TYPES,
W69-03402 05B

BONHAM-CARTER, G. F.
DIFFUSION AND SETTLING OF SEDIMENTS AT RIVER MOUTHS A COMPUTER SIMULATION MODEL,
W69-03542 02J

BOUWER, HERMAN
ANALYZING SUBSURFACE FLOW SYSTEMS WITH ELECTRIC ANALOGS,
W69-03310 02F

BOX, THADIS W.
DROUGHT-ASSOCIATED MORTALITY OF RANGE GRASSES IN SOUTH TEXAS,
W69-03495 02I

BOYLE, ROBERT H.
HOW TO STOP THE PILLAGE OF AMERICA,
W69-03694 06E

BRAKENSIEK, D. L.
FINITE DIFFERENCING METHODS,
W69-03519 07C

BRAMER, HENRY C.
A STUDY TO DETERMINE THE COSTS OF WATER IN INDUSTRIAL USES,
W69-03322 06C

BRAND, E. W.
ANALYSIS OF SOME PUMPING TEST RESULTS,
W69-03206 02F

BREHMER, MORRIS L.
'NUTRIENT ASSIMILATION IN A VIRGINIA TIDAL SYSTEM',
W69-03695 05C

BREZGUNOV, V. S.
ROLE OF STABLE HYDROGEN ISOTOPES IN THE STUDY OF GEOLOGICAL PROCESSES,
W69-03244 02F

BRUTSAERT, WILFRIED
THE PERMEABILITY OF A POROUS MEDIUM DETERMINED FROM CERTAIN PROBABILITY LAWS FOR PORE SIZE DISTRIBUTION,
W69-03553 02F

BUCHANAN, THOMAS J.
COMPUTATION OF REAERATION COEFFICIENTS FOR A RIVER SYSTEM IN NORTHEASTERN NEW JERSEY,
W69-03561 05C

BUE, CONRAD D.
MONTHLY SURFACE-WATER INFLOW TO CHESAPEAKE BAY,
W69-03325 02E

BUGROV, N. M.
ISOTOPIC COMPOSITION OF LEAD IN NATURAL WATERS,
W69-03245 02K

BURBANCK, W. D.
'STATEMENT',
W69-03617 05G

BURRIS, R. H.
ACETYLENE REDUCTION BY NITROGEN-FIXING BLUE-GREEN ALGAE,
W69-03368 02K

IN SITU STUDIES ON (NITROGEN) FIXATION USING THE ACETYLENE REDUCTION TECHNIQUE,
W69-03372 02K

BURT, R. J.
GROUND-WATER SURVEY, ODESSA-LIND AREA, WASHINGTON,
W69-03352 02F

BUTLER, PHILIP A.
THE PROBLEM OF PESTICIDES IN ESTUARIES,
W69-03618 05G

CADWALLADER, LEWIS M.
STATEMENT BEFORE THE SUBCOMMITTEE ON AIR AND WATER POLLUTION,
W69-03619 05B

CAIN, S. A.
ESTUARIES A NEGLECTED RESOURCE COMPLEX,
W69-03620 06B

CAMPBELL, C. J.
PERIODIC MOWINGS SUPPRESS TAMARISK GROWTH, INCREASE FORAGE FOR BROWSING,
W69-03496 02I

CAMPBELL, THOMAS H.
AN EXTENSION TO THE THOMAS-FIERING MODEL FOR THE SEQUENTIAL GENERATION OF STREAMFLOW,
W69-03307 02A

CARLSON, ROBERT F.
HYDROLOGY AND RESERVOIR CONTROL ON THE WISCONSIN RIVER BASIN,
W69-03375 04A

SELECTED BIBLIOGRAPHY ON HYDROLOGICAL CONTROL BY RESERVOIR OPERATION,
W69-03376 04A

ON RESERVOIR NETWORKS,
W69-03378 04A

LINEAR RANDOM MODELS OF ANNUAL STREAMFLOW SERIES,
W69-03379 04A

CARLSTON, CHARLES W.
SLOPE-DISCHARGE RELATIONS FOR EIGHT RIVERS IN THE UNITED STATES,
W69-03521 02E

CARTER, H. H.
THE DISTRIBUTION OF EXCESS TEMPERATURE FROM A HEATED DISCHARGE IN AN ESTUARY,
W69-03341 02L

CARTER, R. W.
GENERAL PROCEDURE FOR GAGING STREAMS,
W69-03346 07B

CARTWRIGHT, KEROS
GEOPHYSICAL SURVEYS IN THE VICINITY OF SANITARY LANDFILLS IN NORTHEASTERN ILLINOIS,
W69-03236 05B

THERMAL PROSPECTING FOR GROUND WATER,
W69-03549 02F

CARVER, J. A., JR.
SOME CRITICAL PROBLEMS OF THE SHELLFISH INDUSTRY,
W69-03621 06E

CASSIDY, WILLIAM F.
LIMITING FACTORS IN HARBOR DEVELOPMENT,
W69-03622 06F

CASTENHOLZ, RICHARD W.
ENVIRONMENTAL REQUIREMENTS OF THERMOPHILIC BLUE-GREEN ALGAE,
W69-03516 05C

CASTLE, EMERY N.
ECONOMICS OF WATER POLLUTION CONTROL,
W69-03623 05G

CAULFIELD, HENRY P., JR.
COMPREHENSIVE PLANNING IN RELATION TO THE RISE AND MANAGEMENT OF ESTUARIES,
W69-03624 06B

CESARIO, F. J.
DYNAMIC MODEL OF THE ECONOMY OF THE SUSQUEHANNA RIVER BASIN,
W69-03570 06B

CHAMRAD, ALBERT D.
DROUGHT-ASSOCIATED MORTALITY OF RANGE GRASSES IN SOUTH TEXAS,
W69-03495 02I

CHAPMAN, CHARLES R.
THE TEXAS BASINS PROJECT,
W69-03625 06B

CHARNES, ABRAHAM
IMPACT OF INSTITUTIONAL ARRANGEMENTS ON THE AVAILABLE ALTERNATIVE DEVELOPMENTAL PATHS FOR WATER ALLOCATION AND POLLUTION CONTROL IN THE COLORADO RIVER BASIN,
W69-03492 06A

CHATTERJI, U. N.
EFFECT OF HIGH TEMPERATURES ON MOISTURE DEPLETION, IMBIBITION AND GERMINATION OF SEEDS OF MIMOSA HAMATA WILLD,
W69-03503 02I

CHENOWETH, S. B.
CONDITION OF THE QUAHOG, MERCENARIA MERCENARIA, FROM POLLUTED AND UNPOLLUTED WATERS,
W69-03635 05C

CHEN, C. S.
NITROGEN CONTENT OF PRECIPITATION IN A COASTAL OREGON FOREST OPENING,
W69-03400 05B

NUTRIENT CYCLING BY THROUGHFALL AND STEMFLOW PRECIPITATION IN THREE COASTAL OREGON FOREST TYPES,
W69-03402 05B

CHERY, D. L., JR.
A REVIEW OF RAINFALL-RUNOFF, PHYSICAL MODELS AS DEVELOPED BY DIMENSIONAL ANALYSIS AND OTHER METHODS,
W69-03309 02A

CHRISTIANSON, ALDEN G.
INDUSTRIAL WASTE GUIDE ON THERMAL POLLUTION,
W69-03537 05B

CHURCHILL, MILO A.
EFFECTS OF STREAMFLOW REGULATION ON WATER QUALITY-THE TVA EXPERIENCE,
W69-03585 05B

CLARK, J.
FISH AND MAN, CONFLICT IN ATLANTIC ESTUARIES,
W69-03627 05G

CLAWSON, MARION
ECONOMICS OF OUTDOOR RECREATION,
W69-03628 06B

CLESCERI, NICHOLAS L.
STUDIES OF THE ANALYSIS OF PHOSPHATES IN ALGAL CULTURES,
W69-03358 05A

COBB, ERNEST D.
THE USE OF PRECIPITATION RECORDS FOR PEAK STREAMFLOW SYNTHESIS,
W69-03562 02A

COCHRANE, D. R.
THE PERSISTENCE OF SILVEX IN WATER AND HYDROSOIL,
W69-03240 05A

COHEN, OBADIAH P.
CLIMATE AND SOIL MOISTURE EXTRACTION,
W69-03250 02G

COLBERG, M.
THE OYSTER-BASED ECONOMY OF FRANKLIN COUNTY, FLORIDA,
W69-03631 06B

COLE, J. A.
OPTIMAL CONTROL OF LINKED RESERVOIRS,
W69-03571 06A

COLE, LUCY W.
SOCIOLOGICAL FACTORS IN WATERSHED DEVELOPMENT,
W69-03594 06B

COLLINGE, V. K.
THE SPATIAL DISTRIBUTION OF STORM RAINFALL,
W69-03534 02B

CONOMOS, T. JOHN
'MIXING OF COLUMBIA RIVER AND OCEAN WATERS, SUMMER',
W69-03632 05C

COOPER, G. W.
HURRICANE DAMAGE TO STRUCTURES,
W69-03634 08A

COPPER, R. A.
CONDITION OF THE QUAHOG, MERCENARIA MERCENARIA, FROM POLLUTED AND UNPOLLUTED WATERS,
W69-03635 05C

COULTER, JAMES B.
MARINE SHIPPING INDUSTRY - EFFECTS AND IMPACTS ON THE CHESAPEAKE BAY,
W69-03636 05G

CRAIG, KENNETH R.
INSECTICIDES IN TILE DRAINAGE EFFLUENT,
W69-03221 05A

CRONIN, EUGENE
THE CONDITION OF THE CHESAPEAKE BAY,
W69-03637 06B

'THE ROLE OF MAN IN ESTUARINE PROCESSES',
W69-03638 06G

CUDNEY, D. W.
EVALUATION OF SOIL AMENDMENTS IN IMPERIAL VALLEY,
W69-03481 02G

CULP, RUSSELL L.
THE LAKE TAHOE WATER RECLAMATION PLANT,
W69-03640 05D

CUNNINGHAM, G. B.
STREAMFLOW DATA PROCESSING OPPORTUNITIES AND APPLICATION,
W69-03389 07C

DAGAN, G.
A DERIVATION OF DUPUIT SOLUTION OF STEADY FLOW TOWARD WELLS BY MATCHED ASYMPTOTIC EXPANSIONS,
W69-03550 02F

DAIBER, FRANKLIN C.
TIDAL MARSH - CONFLICTS AND INTERACTIONS,
W69-03641 02L

DAVIDIAN, JACOB
GENERAL PROCEDURE FOR GAGING STREAMS,
W69-03346 07B

DAVIS, ROBERT K.
'PLANNING A WATER QUALITY MANAGEMENT SYSTEM THE CASE OF THE POTOMAC ESTUARY',
W69-03643 05G

SOME ECONOMIC ASPECTS OF ADVANCED WASTE TREATMENT,
W69-03644 05D

DAWDY, D. R.
APPLICATIONS OF FACTOR ANALYSIS IN STUDY OF CHEMISTRY OF GROUNDWATER QUALITY, MOJAVE RIVER VALLEY, CALIFORNIA,
W69-03253 02F

DE LAGUNA, WALLACE
HYDROLOGY OF BROOKHAVEN NATIONAL LABORATORY AND VICINITY, SUFFOLK COUNTY, NEW YORK,
W69-03232 02E

DENISOV, YU. M.
NUMERICAL MODEL OF THE NONSTATIONARY TEMPERATURE FIELD OF FLOWING BODIES OF WATER,
W69-03213 02E

DEO, RAM
EFFECT OF SODIUM SALTS ON THE GROWTH AND MINERAL COMPOSITION OF BAJRA (PENNISETUM TYPHOIDES),
W69-03483 03C

DIAL, MILLER A.
'STATEMENT',
W69-03647 02L

DIAMOND, HENRY L.
THE POLITICS OF BEAUTY,
W69-03648 06E

DIAZ, GUILLERMO
AN APPLICATION OF PRINCIPAL COMPONENT ANALYSIS AND FACTOR ANALYSIS IN THE STUDY OF WATER YIELD,
W69-03233 02A

DIFFERENT, JACK
'STATEMENT',
W69-03649 05G

DINCER, T.
CURRENT TRENDS IN THE USE OF RADIOACTIVE TRACERS IN HYDROLOGIC INVESTIGATIONS,
W69-03544 07B

DINGMAN, S. L.
THE EFFECTS OF THERMAL POLLUTION ON RIVER ICE CONDITIONS,
W69-03546 05C

DITSWORTH, GEORGE R.
ENVIRONMENTAL FACTORS IN COASTAL AND ESTUARINE WATERS BIBLIOGRAPHIC SERIES - VOLUME II. COAST OF WASHINGTON,
W69-03651 02L

DOBBINS, WILLIAM E.
'FINITE-DIFFERENCE MODELLING OF RIVER AND ESTUARY POLLUTION',
W69-03690 05A

DOERING, E. J.
SAMPLING THE SOIL SOLUTION FOR SALINITY APPRAISAL,
W69-03488 02G

DOUGLASS, JAMES E.
BLENDING FOREST USES,
W69-03404 04D

DOUGLASS, J. E.
POTENTIAL IMPACT OF FOREST FERTILIZATION ON RANGE, WILDLIFE, AND WATERSHED MANAGEMENT,
W69-03383 04C

EFFECTS OF SPECIES AND ARRANGEMENT OF FORESTS ON EVAPOTRANSPIRATION,
W69-03386 02D

VOLUMETRIC CALIBRATION OF NEUTRON MOISTURE PROBES,
W69-03394 02G

DOVEL, W. L.
BIOLOGICAL EFFECTS OF SPOIL DISPOSAL IN CHESAPEAKE BAY,
W69-03666 05C

DROGUE, CLAUDE
DISPOSITION OF CONSTANT INTENSITY RAINFALL IN A KARST AREA,
W69-03520 02A

DUFF, P. M. D.
CYCLIC SEDIMENTATION,
W69-03353 02J

DYER, KENNETH L.
SEA WATER INTRUSION INTO A FRESH WATER FOREBAY DUE TO WAVE ACTION,
W69-03531 02L

EATON, E. D.
RESEARCH PROBLEMS IN WATER QUALITY AND RECREATION,
W69-03653 05G

EBERLY, WILLIAM R.
PROBLEMS IN THE LABORATORY CULTURE OF PLANKTONIC BLUE-GREEN ALGAE,
W69-03514 05C

EDINGER, JOHN ERIC
'ANALYZING STEAM ELECTRIC POWER PLANT DISCHARGES',
W69-03655 05B

EDMONSON, W. T.
WHY STUDY BLUE-GREEN ALGAE,
W69-03513 05C

ELLIS, W. R.
THE INVESTIGATION OF WATER FLOW THROUGH POROUS MEDIUMS BY MEANS OF RADIOTRACERS,
W69-03551 02F

ENGLE, J. B.
THE MOLLUSCAN SHELLFISH INDUSTRY, CURRENT STATUS AND TRENDS,
W69-03659 06B

ENGLISH, T. SAUNDERS
PRELIMINARY ASSESSMENT OF THE ENGLISH SOLE IN PORT GARDNER, WASHINGTON,
W69-03660 05C

ESMAIL, OMAR J.
INVESTIGATION OF THE TECHNICAL FEASIBILITY OF STORING FRESH

WATER IN SALINE AQUIFERS,
W69-03336 02F

FAIR, J. F.
RECOVERY OF BACTERIAL PATHOGENS FROM HIGH QUALITY SURFACE WATER,
W69-03311 05B

FANG, CHING SENG
STREAMFLOW ROUTING (WITH APPLICATIONS TO NORTH CAROLINA RIVERS),
W69-03564 02E

FAUST, S. L.
EFFECT OF WATER SAMPLE PRESERVATION METHODS ON THE RELEASE OF PHOSPHORUS FROM ALGAE,
W69-03370 05B

FETH, J. H.
APPLICATIONS OF FACTOR ANALYSIS IN STUDY OF CHEMISTRY OF GROUNDWATER QUALITY, MOJAVE RIVER VALLEY, CALIFORNIA,
W69-03253 02F

FFOLLIOTT, PETER F.
OBSERVATIONS OF SNOW ACCUMULATION AND MELT IN DEMONSTRATION CUTTINGS OF PONDEROSA PINE IN CENTRAL ARIZONA,
W69-03408 02C

FITT, R.
ACTION ON ILLEGAL DREDGING AND FILLING IN THE AREA OF HEMPSTEAD, N.Y.
W69-03665 04A

FITZGERALD, GEORGE P.
STUDIES OF THE ANALYSIS OF PHOSPHATES IN ALGAL CULTURES,
W69-03358 05A

DETECTION OF LIMITING OR SURPLUS NITROGEN IN ALGAE AND AQUATIC WEEDS,
W69-03364 05C

THE EFFECT OF DILUTION MEDIA ON THE BOD OF ALGAE,
W69-03371 05A

EXTRACTIVE AND ENZYMATIC ANALYSES FOR LIMITING OR SURPLUS PHOSPHORUS IN ALGAE,
W69-03373 05A

STRIPPING EFFLUENTS OF NUTRIENTS BY BIOLOGICAL MEANS,
W69-03374 05F

FITZGERALD, G. P.
ACETYLENE REDUCTION BY NITROGEN-FIXING BLUE-GREEN ALGAE,
W69-03368 02K

EFFECT OF WATER SAMPLE PRESERVATION METHODS ON THE RELEASE OF PHOSPHORUS FROM ALGAE,
W69-03370 05B

IN SITU STUDIES ON (NITROGEN) FIXATION USING THE ACETYLENE REDUCTION TECHNIQUE,
W69-03372 02K

FITZPATRICK, E. A.
A FIRST-ORDER MARKOV MODEL FOR ASSESSING RAINFALL DISCONTINUITY IN CENTRAL AUSTRALIA,
W69-03494 02B

FLEMER, DAVID A.
BIOLOGICAL EFFECTS OF SPOIL DISPOSAL IN CHESAPEAKE BAY,
W69-03666 05C

FLORKOWSKI, T.
CURRENT TRENDS IN THE USE OF RADIOACTIVE TRACERS IN HYDROLOGIC INVESTIGATIONS,
W69-03544 07B

FRAZIER, DAVID E.
RECENT DELTAIC DEPOSITS OF THE MISSISSIPPI RIVER THEIR DEVELOPMENT AND CHRONOLOGY,
W69-03230 02J

FREEZE, R. ALLAN
THEORETICAL ANALYSIS OF REGIONAL GROUNDWATER FLOW. 2. EFFECT OF WATER-TABLE CONFIGURATION AND SUBSURFACE PERMEABILITY VARIATION,
W69-03243 02F

FRITSCHEN, LEO J.
ACCURACY OF EVAPOTRANSPIRATION DETERMINATIONS BY THE BOWEN RATIO METHOD,
W69-03504 02D

FULLER, WALLACE H.
RELATIVE ABSORPTION OF STRONTIUM AND CALCIUM BY CERTAIN ALGAE,
W69-03491 05B

GANN, E. EUGENE
FLOOD HEIGHT-FREQUENCY RELATIONS FOR THE PLAINS AREA IN MISSOURI,
W69-03563 02E

GARBER, M. S.
METHODS OF MEASURING WATER LEVELS IN DEEP WELLS,
W69-03535 07B

GEMMELL, ROBERT S.
IMPACT OF INSTITUTIONAL ARRANGEMENTS ON THE AVAILABLE ALTERNATIVE DEVELOPMENTAL PATHS FOR WATER ALLOCATION AND POLLUTION CONTROL IN THE COLORADO RIVER BASIN,
W69-03492 06A

GERARD, ROBERT D.
POTENTIAL FRESHWATER RESERVOIR IN THE NEW YORK AREA,
W69-03700 04A

GEYER, JOHN C.
'ANALYZING STEAM ELECTRIC POWER PLANT DISCHARGES',
W69-03655 05B

GIANELLI, WILLIAM R.
SOLVING THE ARID STATES' PROBLEMS,
W69-03493 06B

GIBBS, C. V.
METROPOLITAN SEATTLE'S DUWAMISH ESTUARY WATER QUALITY PROGRAM,
W69-03667 05B

GIESE, G. L.
THE HUDSON RIVER ESTUARY, A PRELIMINARY INVESTIGATION OF FLOW AND WATER-QUALITY CHARACTERISTICS,
W69-03668 02L

GILLESPIE, G. J.
SAVE-THE-SALMON PROJECT ON THE ST. JOHN RIVER,
W69-03669 05C

GITZGERALD, GEORGE P.
THE EFFECT OF ALGAE ON BOD MEASUREMENTS,
W69-03362 05A

GLANZMAN, RICHARD K.
HYDROGEOLOGIC DATA FOR BACA AND SOUTHERN PROWERS COUNTIES, COLORADO,
W69-03530 02F

GLEBOVSKAYA, V. S.
ISOTOPIC COMPOSITION OF LEAD IN NATURAL WATERS,
W69-03245 02K

GOLDBERG, IRVING
MEASURING MOISTURE NEAR SOIL SURFACE...MINOR DIFFERENCES DUE TO NEUTRON SOURCE TYPE,
W69-03498 02G

GOLDBERG, M. C.
THE DETERMINATION OF THE IONIZATION CONSTANT OF 2,4-D IN WATER,
W69-03241 05A

GOLDSTONE, S. E.
DYNAMIC MODEL OF THE ECONOMY OF THE SUSQUEHANNA RIVER BASIN,
W69-03570 06B

GOREV, A. V.
DEUTERIUM CONTENT IN NATURAL WATERS,
W69-03229 02K

GORE, JOHN W.
STATEMENT BEFORE THE SUBCOMMITTEE ON AIR AND WATER POLLUTION,
W69-03670 05C

GOTAAS, HAROLD B.
IMPACT OF INSTITUTIONAL ARRANGEMENTS ON THE AVAILABLE ALTERNATIVE DEVELOPMENTAL PATHS FOR WATER ALLOCATION AND POLLUTION CONTROL IN THE COLORADO RIVER BASIN,
W69-03492 06A

GOULD, DAVID H. G.
'STATEMENT',
W69-03671 02L

GRANDI, ALBERTO LUIS
DISTRIBUTION OF COSTS OF MULTIPLE-PURPOSE HYDRAULIC PROJECTS,
W69-03577 06C

GROSS, M. GRANT
'MIXING OF COLUMBIA RIVER AND OCEAN WATERS, SUMMER',
W69-03632 05C

GUNNERSON, CHARLES G.
HYDROLOGIC DATA COLLECTION IN TIDAL ESTUARIES,
W69-03239 02L

GUPTA, B. R. D.
FREQUENCY OF WET AND DRY SPELLS AT FIVE STATIONS IN RAJASTHAN,
W69-03490 02B

HALEVY, E.
CURRENT TRENDS IN THE USE OF RADIOACTIVE TRACERS IN HYDROLOGIC INVESTIGATIONS,
W69-03544 07B

HALLADAY, WILLIAM B.
ECONOMIC ASPECTS OF THE DELAWARE RIVER ESTUARY PROGRAM,
W69-03674 06B

HALLAM, A.
CYCLIC SEDIMENTATION,
W69-03353 02J

HALL, LAWRENCE C.
'NUMERICAL SOLUTION OF THE UNSTEADY, ESTUARY DISPERSION EQUATION',
W69-03675 02L

HAMILTON, H. R.

AMIC MODEL OF THE ECONOMY OF THE SUSQUEHANNA RIVER BASIN,
-03570 06B

, JOE E.
ER UTILIZATION IN GREENHOUSES ALTERNATIVES FOR
ICULTURE IN ARID REGIONS,
-03486 03F

N, EDWARD A.
BILIZING ERODING STREAMBANKS IN SAND DRIFT AREAS OF THE
E STATES.
-03405 02J

ERVATIONS OF SNOW ACCUMULATION AND MELT IN DEMONSTRATION
TINGS OF PONDEROSA PINE IN CENTRAL ARIZONA,
-03408 02C

ISH, MAHDI S.
W OF GROUNDWATER IN RELATIVELY THICK LEAKY AQUIFERS,
-03220 02F

ASTLE, JAMES E.
ATIVE ABSORPTION OF STRONTIUM AND CALCIUM BY CERTAIN
AE,
-03491 05B

MAN, DONALD R. F.
ERICAL SOLUTIONS FOR DISPERSION IN POROUS MEDIUMS,
-03237 05B

MERICAL SOLUTION OF THE UNSTEADY, ESTUARY DISPERSION
ATION',
-03675 02L

, ARCHIE A.
EXTENSION TO THE THOMAS-FIERING MODEL FOR THE SEQUENTIAL
ERATION OF STREAMFLOW,
-03307 02A

OG, GEORGE B., JR.
NSERVATION AND MANAGEMENT OF SEASHORE AND UNDERWATER AREAS
R PUBLIC ENJOYMENT,
-03676 06B

ER, ARTHUR D.
TROPHICATION,
-03357 05C

ER, A. D.
OSPHORUS RELEASE FROM BOG LAKE MUDS,
-03363 02K

ER, VICTOR L.
TE OF DDT AND NITRATE IN GROUND WATER,
-03219 05B

EY, JMES P.
PACT OF INSTITUTIONAL ARRANGEMENTS ON THE AVAILABLE
TERNATIVE DEVELOPMENTAL PATHS FOR WATER ALLOCATION AND
LLUTION CONTROL IN THE COLOPADO RIVER BASIN,
-03492 06A

PPTH, JOEL W.
SPECTS OF THE ESTUARINE ECOSYSTEM',
-03677 06G

E, BURCHARD H.
NVERSION OF GULLIES TO VEGETATION-LINED WATERWAYS ON
UNTAIN SLOPES,
-03406 04A

EY, EDWARD J.
CEMBER 1964, A 400-YEAR FLOOD IN NORTHERN CALIFORNIA,
-03560 02E

EY, J. D.
TERCEPTION BY EASTERN WHITE PINE,
-03315 02I

-03391 02I

SIGN CRITERIA FOR INTERCEPTION STUDIES,
-03395 02I

ERSON, JOHN M.
TATEMENT',
-03678 05C

EL, THERESA
PPER IN LAKE MUDS FROM LAKES OF THE MADISON AREA,
-03366 05A

SMEIER, L. F.
FFECT OF SEDIMENT LOAD ON THE RATING CURVES OF 0.6-FOOT HS
UMES,
-03403 02E

SHEY, LLOYD A.
YDROGEOLOGIC DATA FOR BACA AND SOUTHERN PROWERS COUNTIES,
OLORADO,
-03530 02F

LETT, JOHN D.
LENDING FOREST USES,
-03404 04D

LETT, J. D.
ACTORS AFFECTING THE RESPONSE OF SMALL WATERSHEDS TO
RECIPITATION IN HUMID AREAS,
-03388 02E

TEST OF A TRANSPIRATION INHIBITOR OF A FORESTED WATERSHED,
W69-03396 02D

HIBBERT, A. R.
FOREST TREATMENT EFFECTS ON WATER YIELD,
W69-03387 03B

FACTORS AFFECTING THE RESPONSE OF SMALL WATERSHEDS TO
PRECIPITATION IN HUMID AREAS,
W69-03388 02E

STREAMFLOW DATA PROCESSING OPPORTUNITIES AND APPLICATION,
W69-03389 07C

HILMON, J. B.
POTENTIAL IMPACT OF FOREST FERTILIZATION ON RANGE, WILDLIFE,
AND WATERSHED MANAGEMENT,
W69-03383 04C

HIRSCH, ALLAN
POLLUTION CONTROL - PLANNING A NATIONAL PROGRAM,
W69-03410 05G

HOLM-HANSON, OSMUND
RECENT ADVANCES IN THE PHYSIOLOGY OF BLUE-GREEN ALGAE,
W69-03518 05C

HOWARD, R. S.
'GEORGIA WATER QUALITY CONTROL BOARDS STATEMENT TO THE
NATIONAL ESTUARINE STUDY REPORT',
W69-03679 05G

HOYT, JOHN H.
SEDIMENTATION IN A MEANDERING ESTUARY,
W69-03228 02J

HUANG, JOSEPH C.
VERTICAL CURRENT STRUCTURE IN THE GREAT LAKES III.
DETERMINATION OF EDDY VISCOSITY AND EDDY DIFFUSIVITY IN LAKE
MICHIGAN,
W69-03348 02H

VERTICAL CURRENT STRUCTURE IN THE GREAT LAKES V. THERMAL
CURRENT STRUCTURE IN LAKE MICHIGAN, ASSOCIATED WITH THE
SPRING WARM-UP SEASON--A THEORETICAL STUDY,
W69-03350 02H

HULLA, J.
POTENTIAL FLOW AND SOIL STRUCTURE CHANGES,
W69-03203 02F

HUSTON, JOHN W.
THE OYSTER AND THE DREDGE OR 'BEAUTY AND THE BEAST',
W69-03680 06G

IGNAZIO, JOSEPH L.
PLANNING FOR MULTIPLE-PURPOSE DEVELOPMENT,
W69-03587 06B

IRMAY, S.
ON THE MEANING OF THE DUPUIT AND PAVLOVSKII APPROXIMATIONS
IN AQUIFER FLOW,
W69-03252 02F

ISAAC, GARY J.
SEATTLE'S EFFORTS IN RESTORATION OF BAYS AND ESTUARIES,
W69-03683 05G

ISAAC, G. W.
METROPOLITAN SEATTLE'S DUWAMISH ESTUARY WATER QUALITY
PROGRAM,
W69-03667 05B

ITTIHADIEH, F. T.
INSECTICIDES IN TILE DRAINAGE EFFLUENT,
W69-03221 05A

IULO, WILLIAM
THE ROLE OF INDUSTRIAL PROCESS CHANGES IN AFFECTING WATER
REQUIREMENTS,
W69-03599 06D

IVANOV, K. YE
HYDROLOGIC SUBSTANTIATION AND COMPUTATION OF THE REDUCTION
OF FORESTS AND THE EXPANSION OF NATURALLY WATERLOGGED AREAS
AFTER UNDERFLOODING IN RIVER SYSTEMS,
W69-03214 02A

JAMIESON, D. G.
THE SPATIAL DISTRIBUTION OF STORM RAINFALL,
W69-03534 02B

JAVANDEL, I.
USE OF THERMAL MODEL TO INVESTIGATE THE THEORY OF TRANSIENT
FLOW TO A PARTIALLY PENETRATING WELL,
W69-03254 02F

JENKINS, ALLSTON
TESTIMONY - PHILADELPHIA CONSERVATIONISTS, INC.,
W69-03684 05B

JENKINS, WILLIAM A.
'U. S. COAST GUARD REPORT OF WAKE ISLAND OIL SPILL',
W69-03685 05C

JENSEN, P. T.
CALIFORNIA SALMON LANDINGS, 1952 THROUGH 1965,
W69-03686 06C

JEPPSON, ROLAND W.
SEEPAGE FROM CHANNELS THROUGH LAYERED POROUS MEDIUMS,

JEP-LU,

W69-03554 02G

JOHNSON, ALFRED M. F.
WATER USE IN TENNESSEE, PART A-AGRICULTURAL WATER USE,
W69-03323 06D

JOHNSON, S. L.
URBAN HYDROLOGY OF THE HOUSTON, TEXAS METROPOLITAN AREA-COMPILATION OF BASIC DATA-1966,
W69-03538 04C

JOHNSTON, WILLIAM R.
INSECTICIDES IN TILE DRAINAGE EFFLUENT,
W69-03221 05A

JONES, J. P.
EVALUATION OF SOIL AMENDMENTS IN IMPERIAL VALLEY,
W69-03481 02G

JORGENSEN, DONALD G.
AN AQUIFER TEST USED TO INVESTIGATE A QUALITY OF WATER ANOMALY,
W69-03335 02F

JULIAN, PAUL R.
VARIANCE SPECTRUM ANALYSIS,
W69-03525 06A

KASTROP, J. E.
INDUSTRY OUTLOOK/DIRECTION 1968,
W69-03687 06D

KAUL, R. N.
GERMINATION STUDIES ON ARID ZONE TREE SEEDS,
W69-03489 02I

KEPINSKI, ALFRED
CLASSIFICATION OF WATER-BEARING STRATA BASED ON CONDITIONS OF FLOW OF WATER INTO WELLS,
W69-03523 02F

KEVI, L.
THE INVESTIGATION OF WATER FLOW THROUGH POROUS MEDIUMS BY MEANS OF RADIOTRACERS,
W69-03551 02F

KIECHEL, W.
REGIONAL WATER RESOURCE DEVELOPMENT IN THE FEDERAL SYSTEM,
W69-03411 06B

KIMBLER, OSCAR K.
INVESTIGATION OF THE TECHNICAL FEASIBILITY OF STORING FRESH WATER IN SALINE AQUIFERS,
W69-03336 02F

KINDSVATER, C. E.
'STATEMENT',
W69-03696 02L

KING, JAMES S.
PLANNING FOR MULTI-PURPOSE DEVELOPMENT OF WATER AND RELATED LAND RESOURCES IN THE UPPER MISSISSIPPI RIVER BASIN,
W69-03586 06B

KIRKHAM, DON
EXPLANATION OF PARADOXES IN DUPUIT-FORCHHEIMER SEEPAGE THEORY,
W69-03242 02F

KNEESE, ALLEN V.
WHAT ARE WE LEARNING FROM ECONOMIC STUDIES OF WATER QUALITY,
W69-03697 06B

KNETSCH, JACK L.
ECONOMICS OF OUTDOOR RECREATION,
W69-03628 06B

KNIGHT, ALLEN W.
BIOTIC RESPONSE TO POLLUTION REDUCTION IN A RIVER,
W69-03602 05C

KNIPLING, E. B.
COMPARISON OF THE DYE METHOD WITH THE THERMOCOUPLE PSYCHROMETER FOR MEASURING LEAF WATER POTENTIALS,
W69-03390 02I

MEASUREMENT OF LEAF WATER POTENTIAL BY THE DYE METHOD,
W69-03392 02I

EFFECT OF LEAF AGING ON WATER DEFICIT-WATER POTENTIAL RELATIONSHIPS OF DOGWOOD LEAVES GROWING IN TWO ENVIRONMENTS,
W69-03393 02I

KOLLAR, K. L.
REGIONAL CONSTRUCTION REQUIREMENTS FOR WATER AND WASTEWATER FACILITIES 1955-1967-1980,
W69-03698 05D

KOOPMAN, F. C.
METHODS OF MEASURING WATER LEVELS IN DEEP WELLS,
W69-03535 07B

KOTHANDARMAN, VEERASAMY
PROBABILISTIC ANALYSIS OF WASTE WATER TREATMENT AND DISPOSAL SYSTEM,
W69-03699 05D

KRAMER, P. J.
COMPARISON OF THE DYE METHOD WITH THE THERMOCOUPLE PSYCHROMETER FOR MEASURING LEAF WATER POTENTIALS,
W69-03390 02I

KRAUSZ, NORMAN G. P.
INTERGOVERNMENTAL RELATIONSHIPS IN THE ADMINISTRATION OF WATER RESOURCES,
W69-03589 06E

W69-03590 06E

KRISHNAN, A.
A FIRST-ORDER MARKOV MODEL FOR ASSESSING RAINFALL DISCONTINUITY IN CENTRAL AUSTRALIA,
W69-03494 02B

KULIK, V. YA.
INVESTIGATION OF WATER ABSORPTION BY THE SOIL ON THE BASIS OF THE DIMENSIONAL THEORY,
W69-03215 02G

KUTNER, LOUIS
HABEAS MANINUS DUE PROCESS OF INNERSPACE - A PROPOSAL,
W69-03588 06E

LAMARCHE, VALMORE C., JR.
RATES OF SLOPE DEGRADATION AS DETERMINED FROM BOTANICAL EVIDENCE, WHITE MOUNTAINS, CALIFORNIA,
W69-03527 02I

DECEMBER 1964, A 400-YEAR FLOOD IN NORTHERN CALIFORNIA,
W69-03560 02E

LAMAR, WILLIAM L.
EVALUATION OF ORGANIC COLOR AND IRON IN NATURAL SURFACE WATERS,
W69-03558 03E

LAND, LYNTON S.
SEDIMENTATION IN A MEANDERING ESTUARY,
W69-03228 02J

LANGE, O. L.
THE HEAT RESISTANCE OF PLANTS, ITS DETERMINATION AND VARIABILITY,
W69-03485 02I

LAUFF, GEORGE H.
BIOTIC RESPONSE TO POLLUTION REDUCTION IN A RIVER,
W69-03602 05C

LAWSON, EDWIN R.
THROUGHFALL AND STEMFLOW IN A PINE-HARDWOOD STAND IN THE OUACHITA MOUNTAINS OF ARKANSAS,
W69-03339 02I

LEE, CHOK-HUNG
'NUMERICAL SOLUTION OF THE UNSTEADY, ESTUARY DISPERSION EQUATION',
W69-03675 02L

LEE, G. FRED
STUDIES OF THE ANALYSIS OF PHOSPHATES IN ALGAL CULTURES,
W69-03358 05A

LEISER, CURTIS P.
SEATTLE'S EFFORTS IN RESTORATION OF BAYS AND ESTUARIES,
W69-03683 05G

LEPLEY, LARRY K.
REFLECTIVITY OF ELECTROMAGNETIC WAVES AT AN AIR-WATER INTERFACE FOR PURE AND SEA WATER,
W69-03598 01A

INFRARED IMAGES OF THE KAU AND PUNA COASTLINES ON HAWAII,
W69-03600 07B

LEROUX, E. F.
TEMPERATURE VARIATIONS OF DEEP FLOWING WELLS IN SOUTH DAKOTA,
W69-03567 02F

LIGGETT, J. A.
UNSTEADY, ONE-DIMENSIONAL FLOW OVER A PLANE-THE RISING HYDROGRAPH,
W69-03332 02E

LIVENGOOD, CHARLES D.
TEXTILE WASTES - A BIBLIOGRAPHY,
W69-03597 05B

LI, WEN-HSIUNG
DISPERSION AT THE INTERFACE OF MISCIBLE LIQUIDS IN A SOIL,
W69-03548 02F

LLOYD, O. BRUCE, JR.
GROUNDWATER RESOURCES OF CHOWAN COUNTY, NORTH CAROLINA,
W69-03355 02F

LUSCZYNSKI, N. J.
HYDROLOGY OF BROOKHAVEN NATIONAL LABORATORY AND VICINITY, SUFFOLK COUNTY, NEW YORK,
W69-03232 02E

LUTHIN, J. N.
THE EFFECTS OF ENTRAPPED AIR AND BAROMETRIC FLUCTUATIONS ON THE DRAINAGE OF POROUS MEDIUMS,
W69-03552 02G

LUZIER, J. E.
GROUND-WATER SURVEY, ODESSA-LIND AREA, WASHINGTON,
W69-03352 02F

LU, K. C.

THOGEN CONTENT OF PRECIPITATION IN A COASTAL OREGON FOREST
ENING,
9-03400 05B

TRIENT CYCLING BY THROUGHFALL AND STEMFLOW PRECIPITATION
THREE COASTAL OREGON FOREST TYPES,
9-03402 05B

OPMICK, A. J.
DROLOGY AND RESERVOIR CONTROL ON THE WISCONSIN RIVER
SIN,
9-03375 04A

LECTED BIBLIOGRAPHY ON HYDROLOGICAL CONTROL BY RESERVOIR
ERATION,
9-03376 04A

NEAR RANDOM MODELS OF ANNUAL STREAMFLOW SERIES,
9-03379 04A

, ARNETT C., JR.
CURACY OF SOIL MOISTURE READINGS WITH UNSEALED ACCESS
BES,
9-03500 02G

ILLIVRAY, NORMAN A.
ASURING MOISTURE NEAR SOIL SURFACE...MINOR DIFFERENCES DUE
NEUTRON SOURCE TYPE,
9-03498 02G

OLEK, J. A.
CROSESTON DYNAMICS IN A SIMPLE SIERRA NEVADA LAKE-STREAM
STEM,
9-03359 02E

WAL, G. L.
STATISTICAL STUDY OF SOME INDICES OF SALINE WATER
RRIGATED SOILS OF RAJASTHAN,
9-03482 03C

TSEV, A. YE
XPERIMENTAL INVESTIGATION AND COMPUTATION OF THE VOLUME OF
ATERIAL DERIVED FROM DEEP RAVINES IN FORECASTING THE
ILTING OF RESERVOIRS ON MOUNTAIN RIVERS,
9-03216 02J

GELSDORF, A. J.
ATERSHED, FLOOD PROTECTION, AND RECREATION DEVELOPMENT IN
TCHISON, KANSAS,
9-03593 06B

NERING, J. V.
FFECT OF ORGANIC MATTER CONTENT OF THE SOIL ON
NFILTRATION,
9-03484 02G

OHAR, MAN SINGH
ERMINATION STUDIES ON ABID ZONE TREE SEEDS,
9-03489 02I

UEDA, ANGEL M.
CONOMIC VALUE OF IRRIGATION WATER,
9-03582 06B

LAR, JOHN T.
HE EFFECT OF TURBULENCE ON BACTERIAL SUBSTRATE UTILIZATION,
9-03343 05G

SHALL, N.
ONDITION OF THE QUAHOG, MERCENARIA MERCENARIA, FROM
OLLUTED AND UNPOLLUTED WATERS,
9-03635 05C

STON, RICHARD B.
MITROLE CONCENTRATIONS IN CREEK WATERS DOWNSTREAM FROM AN
ERIALLY SPRAYED WATERSHED SUBBASIN,
9-03226 05B

ALAS, N. C.
IME SERIES ANALYSIS,
9-03524 06A

THAI, H. P.
AGNITUDE AND FREQUENCY OF FLOODS IN THE UNITED STATES,
9-03225 02E

USEWICZ, JOSEF
UNDAMENTALS OF HYDROLOGIC FORECASTING,
69-03218 02E

EY, GEORGE B.
YDROGEOLOGY OF DESERT BASINS,
69-03238 02F

LAIN, W. C.
OCK MECHANICS IN THE DISPOSAL OF RADIOACTIVE WASTES BY
YDRAULIC FRACTURING,
69-03522 08E

OMAS, MURRY R.
EOPHYSICAL SURVEYS IN THE VICINITY OF SANITARY LANDFILLS IN
ORTHEASTERN ILLINOIS,
69-03236 05B

DERMOTT, JAMES H.
SURVEILLANCE OPERATIONS IN THE CONTROL OF WATER POLLUTION ON
A NATIONAL SCALE,
69-03584 05G

MILLION, LESLIE G.
FATE OF DDT AND NITRATE IN GROUND WATER,
W69-03219 05B

MCNALL, DOROTHY
COPPER IN LAKE MUDS FROM LAKES OF THE MADISON AREA,
W69-03366 05A

MCPHERSON, M. B.
THE NATURE OF CHANGES IN URBAN WATERSHEDS AND THEIR
IMPORTANCE IN THE DECADES AHEAD,
W69-03511 04C

MEIER JR, W. L.
OPTIMIZATION OF BRANCHING MULTISTAGE SYSTEMS A REPLY TO A
COMMENT BY D P LOUCKS,
W69-03580 06A

MEIN, R. G.
A STUDY OF THE DRAINAGE OF IRRIGATED SAND DUNES USING AN
ELECTRICAL RESISTANCE ANALOGUE,
W69-03526 04A

MEREWITZ, LEONARD
ESTIMATION OF RECREATIONAL BENEFITS AT SOME SELECTED WATER
DEVELOPMENT SITES IN CALIFORNIA,
W69-03578 06B

MICKELSON, ROME H.
DIVISION S-6-SOIL AND WATER MANAGEMENT AND CONSERVATION--
LEVEL PAN SYSTEM FOR SPREADING AND STORING WATERSHED RUNOFF,
W69-03499 02E

MITCHELL, WILLIAM D.
LINEAR ANALYSIS OF HYDROGRAPHS,
W69-03331 07C

MOLOCHNOVA, V. A.
DEUTERIUM CONTENT IN NATURAL WATERS,
W69-03229 02K

MOORE, JOHN E.
SODIUM AS A CLUE TO DIRECTION OF GROUNDWATER MOVEMENT,
NEVADA TEST SITE,
W69-03559 02F

MORGAN, JAMES J.
STREAM POLLUTION BY ALGAL NUTRIENTS,
W69-03369 05C

MORISAWA, MARIE
STREAMS-THEIR DYNAMICS AND MORPHOLOGY,
W69-03248 02E

MORRISON, S. M.
RECOVERY OF BACTERIAL PATHOGENS FROM HIGH QUALITY SURFACE
WATER,
W69-03311 05B

MOTTS, WARD S.
THE OCCURRENCE AND CHARACTERISTICS OF GROUND-WATER
CONTAMINATION IN MASSACHUSETTS,
W69-03312 05B

MOTZ, DONALD J.
A STUDY TO DETERMINE THE COSTS OF WATER IN INDUSTRIAL USES,
W69-03322 06C

MUNN, R. E.
METEOROLOGICAL STUDIES IN THE MARMOT CREEK WATERSHED,
ALBERTA, CANADA, IN AUGUST 1965,
W69-03330 02D

MURRAY, RAYMOND C.
RECENT SEDIMENTS OF THREE WISCONSIN LAKES,
W69-03367 02J

MUSTAFAEV, A. A.
INFILTRATION AND SUBSIDENCE PROCESSES IN LOESS SOILS,
W69-03207 02G

MYCYK, ROMAN T.
FLOODS IN MCHENRY QUADRANGLE, NORTHEASTERN ILLINOIS,
W69-03328 02E

NELSON, THOMAS C.
EXTRACTIVE AND ENZYMATIC ANALYSES FOR LIMITING OR SURPLUS
PHOSPHORUS IN ALGAE,
W69-03373 05A

NICHOLSON, H. P.
THE PERSISTENCE OF SILVEX IN WATER AND HYDROSOIL,
W69-03240 05A

NICHOLS, HARRY B.
WATER USE IN TENNESSEE, PART A-AGRICULTURAL WATER USE,
W69-03323 06D

NICHOLS, M. STARR
COPPER IN LAKE MUDS FROM LAKES OF THE MADISON AREA,
W69-03366 05A

NOBLE, VINCENT E.
VERTICAL CURRENT STRUCTURE IN THE GREAT LAKES II. CURRENT
METER STUDIES OFF SHEBOYGAN, WISCONSIN, AUGUST 1967,
W69-03334 02H

VERTICAL CURRENT STRUCTURE IN THE GREAT LAKES 1.
CHARACTERIZATION OF THE CIRCULATION DYNAMICS OF LAKE
MICHIGAN,
W69-03347 02H

NORRIS, LOGAN A.

STREAM CONTAMINATION BY HERBICIDES AFTER FALL RAINS ON FOREST LAND,
W69-03381 05B

RESIDUES OF HERBICIDES AND DIESEL OIL CARRIERS IN FOREST WATERS,
W69-03397 05B

NORRIS, L. A.
CHEMICAL BRUSH CONTROL AND HERBICIDE RESIDUES IN THE FOREST ENVIRONMENT,
W69-03399 05B

NORUM, D. I.
THE EFFECTS OF ENTRAPPED AIR AND BAROMETRIC FLUCTUATIONS ON THE DRAINAGE OF POROUS MEDIUMS,
W69-03552 02G

NORWOOD, GUS
PUBLIC OBJECTIVES IN WATER RESOURCES DEVELOPMENT,
W69-03575 06B

NOVAK, CHARLES E.
CALIBRATION AND MAINTENANCE OF VERTICAL-AXIS TYPE CURRENT METERS,
W69-03536 07B

OERTLI, J. J.
EFFECT OF EXTERNAL SALT CONCENTRATIONS ON WATER RELATIONS IN PLANTS II. EFFECT OF THE OSMOTIC DIFFERENTIAL BETWEEN EXTERNAL MEDIUM AND XYLEM ON WATER RELATIONS IN THE ENTIRE PLANT,
W69-03487 02I

OLSEN, SIGURD
PHOSPHATE EQUILIBRIUM BETWEEN REDUCED SEDIMENTS AND WATER,
W69-03365 02K

ONGLEY, E. D.
AN ANALYSIS OF THE MEANDERING TENDENCY OF SERPENTINE CAVE, N.S.W.,
W69-03532 02F

ORADOVSKAYA, A. YE.
CONVECTIVE SALT DIFFUSION IN A RADIAL SUBSURFACE STREAM IN RELATION TO THE PROTECTION OF SUBSURFACE WATERS FROM CONTAMINATED DISCHARGES,
W69-03212 05B

ORESHINA, L. M.
NUMERICAL MODEL OF THE NONSTATIONARY TEMPERATURE FIELD OF FLOWING BODIES OF WATER,
W69-03213 02E

OSTERKAMP, W. R.
OCCURENCE OF GROUND WATER IN THE JUDITH RIVER FORMATION, NORTH-CENTRAL MONTANA,
W69-03545 02F

PAGE, LEO M.
USE OF THE ELECTRICAL RESISTIVITY METHOD FOR INVESTIGATING GEOLOGIC AND HYDROLOGIC CONDITIONS IN SANTA CLARA COUNTY, CALIFORNIA,
W69-03235 07B

PALIWAL, K. V.
A STATISTICAL STUDY OF SOME INDICES OF SALINE WATER IRRIGATED SOILS OF RAJASTHAN,
W69-03482 03C

PARTOM, I.
STEADY UNSATURATED VERTICAL FLOW THROUGH MULTILAYERED SOIL,
W69-03209 02G

PATRIC, J. H.
DESIGN CRITERIA FOR INTERCEPTION STUDIES,
W69-03395 02I

PAULIK, GERALD J.
SIMULATION OF A WATER RESOURCES SYSTEM,
W69-03601 06A

PAYNE, B. R.
THE OCCURRENCE OF TRITIUM IN PRECIPITATION AND ITS SIGNIFICANCE IN HYDROLOGICAL INVESTIGATIONS,
W69-03555 02K

PEALY, ROBERT H.
COMPREHENSIVE RIVER BASIN PLANNING THE ARKANSAS-WHITE-RED BASINS INTER-AGENCY COMMITTEE EXPERIENCE,
W69-03596 06B

PETER, P.
POTENTIAL FLOW AND SOIL STRUCTURE CHANGES,
W69-03203 02F

PFITZENMEYER, H. T.
BIOLOGICAL EFFECTS OF SPOIL DISPOSAL IN CHESAPEAKE BAY,
W69-03666 05C

PINCKNEY, D. J.
THE DETERMINATION OF THE IONIZATION CONSTANT OF 2,4-D IN WATER,
W69-03241 05A

PLATAGEA, GHEORGHE
MODERN HYDROLOGICAL RESEARCH METHODOLOGY ON RIVERS IN ROMANIA (IN RUMANIAN),
W69-03314 06B

POPE, J. D., JR.
THE PERSISTENCE OF SILVEX IN WATER AND HYDROSOIL,
W69-03240 05A

POWERS, RALPH
WATER QUALITY MANAGEMENT IN THE DELAWARE RIVER BASIN,
W69-03583 06B

POSOKHOV, YE V.
PRINCIPLES OF CHEMICAL COMPOSITION OF GROUNDWATERS (BASIC FACTORS), (IN RUSSIAN),
W69-03533 02K

PRILL, ROBERT C.
MOVEMENT OF MOISTURE IN THE UNSATURATED ZONE IN A DUNE AREA, SOUTHWESTERN KANSAS,
W69-03556 02G

RANTZ, S. E.
A SUGGESTED METHOD FOR ESTIMATING EVAPOTRANSPIRATION BY NATIVE PHREATOPHYTES,
W69-03557 02I

REEVES, C. C., JR.
INTRODUCTION TO PALEOLIMNOLOGY,
W69-03342 02J

REEVE, R. C.
SAMPLING THE SOIL SOLUTION FOR SALINITY APPRAISAL,
W69-03488 02G

RICHARDS, DAVID B.
HYDROGEOLOGIC DATA FOR BACA AND SOUTHERN PROWERS COUNTIES, COLORADO,
W69-03530 02F

RIGGS, H. C.
SOME STATISTICAL TOOLS IN HYDROLOGY,
W69-03344 07B

RITCHIE, D. E., JR.
BIOLOGICAL EFFECTS OF SPOIL DISPOSAL IN CHESAPEAKE BAY,
W69-03666 05C

ROBINSON, F. E.
EVALUATION OF SOIL AMENDMENTS IN IMPERIAL VALLEY,
W69-03481 02G

ROBINSON, G. B., JR.
GROUND-WATER RESOURCES OF THE SEVIER RIVER BASIN BETWEEN YUBA DAM AND LEAMINGTON CANYON, UTAH,
W69-03529 02F

RODERICK, RALPH E.
THE LAKE TAHOE WATER RECLAMATION PLANT,
W69-03640 05D

ROHLICH, GERARD A.
THE EFFECT OF DILUTION MEDIA ON THE BOD OF ALGAE,
W69-03371 05A

RUHAL, D. V. S.
EFFECT OF SODIUM SALTS ON THE GROWTH AND MINERAL COMPOSITION OF BAJRA (PENNISETUM TYPHOIDES),
W69-03483 03C

SAINES, MARVIN
THE OCCURRENCE AND CHARACTERISTICS OF GROUND-WATER CONTAMINATION IN MASSACHUSETTS,
W69-03312 05B

SAYLOR, JAMES H.
VERTICAL CURRENT STRUCTURE IN THE GREAT LAKES IV. NUMERICAL EVALUATION OF STERN'S CALCULATION MODEL,
W69-03349 02H

SCALF, MARION R.
FATE OF DDT AND NITRATE IN GROUND WATER,
W69-03219 05B

SCHAAKE, J. C., JR.
RESPONSE CHARACTERISTICS OF URBAN WATER RESOURCE DATA SYSTEMS,
W69-03509 07A

SCHERMERHORN, VAIL P.
RELATIONS BETWEEN TOPOGRAPHY AND ANNUAL PRECIPITATION IN WESTERN OREGON AND WASHINGTON,
W69-03340 02B

SCHICK, ASHER P.
EFFECTS OF CONSTRUCTION ON FLUVIAL SEDIMENT, URBAN AND SUBURBAN AREAS OF MARYLAND,
W69-03227 02J

SCHOFF, STUART L.
SODIUM AS A CLUE TO DIRECTION OF GROUNDWATER MOVEMENT, NEVADA TEST SITE,
W69-03559 02F

SCHULTS, DONALD W.
AMITROLE CONCENTRATIONS IN CREEK WATERS DOWNSTREAM FROM AN AERIALLY SPRAYED WATERSHED SUBBASIN,
W69-03226 05B

SCHWEIG, Z.
OPTIMAL CONTROL OF LINKED RESERVOIRS,
W69-03571 06A

SCOTT, J.
INDUSTRY OUTLOOK/DIRECTION 1968,
W69-03687 06D

RTZELL, P. G.
LIFORNIA SALMON LANDINGS, 1952 THROUGH 1965,
9-03686 06C

ER, PAUL R.
APPRAISAL OF THE GROUND-WATER RESOURCES OF THE UPPER
SQUEHANNA RIVER BASIN IN PENNSYLVANIA,
9-03528 02F

LL, J. I.
APPLICATION OF PRINCIPAL COMPONENT ANALYSIS AND FACTOR
ALYSIS IN THE STUDY OF WATER YIELD,
9-03233 02A

IR, URI Y.
MERICAL SOLUTIONS FOR DISPERSION IN POROUS MEDIUMS,
9-03237 05B

LTON, C. H.
APPLICATION OF PRINCIPAL COMPONENT ANALYSIS AND FACTOR
NALYSIS IN THE STUDY OF WATER YIELD,
9-03233 02A

ROYAMA, TAMOTSU
ITROLE CONCENTRATIONS IN CREEK WATERS DOWNSTREAM FROM AN
RIALLY SPRAYED WATERSHED SUBBASIN,
9-03226 05B

CFAN, N. D.
OMPUTATION OF SEICHE VELOCITIES IN BODIES OF WATER WITH A
OMPLEX BOTTOM RELIEF,
9-03217 02H

AKOVA, YE. L.
YDROLOGIC SUBSTANTIATION AND COMPUTATION OF THE REDUCTION
F FORESTS AND THE EXPANSION OF NATURALLY WATERLOGGED AREAS
FTER UNDERFLOODING IN RIVER SYSTEMS,
9-03214 02A

ES, G. R.
HE DIFFUSION OF AIR THROUGH THE PORE WATER OF SOILS,
9-03205 02A

EN, ROY R.
ROWTH AND NUTRIENT UPTAKE OF IRRIGATED YOUNG PONDEROSA PINE
FTER FERTILIZER TREATMENTS,
9-03398 05B

LES, JOHN ELLIS, III.
PPLICATION OF MARGINAL ECONOMIC ANALYSIS TO RESERVOIR
ECREATION PLANNING,
9-03576 06B

RT, SAMUEL J.
COMMENT ON HORTON'S LAW OF STREAM NUMBERS,
9-03338 02E

OT, GEORGE F.
ALIBRATION AND MAINTENANCE OF VERTICAL-AXIS TYPE CURRENT
ETERS,
9-03536 07B

OLOV, M. M.
EUTERIUM CONTENT IN NATURAL WATERS,
9-03229 02K

FER, V. N.
OLE OF STABLE HYDROGEN ISOTOPES IN THE STUDY OF GEOLOGICAL
ROCESSES,
9-03244 02F

ARER, DAVID
N ANALYSIS OF RELATIONSHIPS BETWEEN FLOW CONDITIONS AND
TATISTICAL MEASURES OF BED CONFIGURATIONS IN STRAIGHT AND
URVED ALLUVIAL CHANNELS,
9-03317 02J

DLER, GERALD J.
YDROLOGY AND RESERVOIR CONTROL ON THE WISCONSIN RIVER
ASIN,
9-03375 04A

ELECTED BIBLIOGRAPHY ON HYDROLOGICAL CONTROL BY RESERVOIR
PERATION,
9-03376 04A

NALYSIS OF A WATER STORAGE RESERVOIR SYSTEM,
9-03377 04A

TREAMFLOW AND PRECIPITATION DATA INDEX,
9-03380 04A

LLMAN, ROBERT W.
LECTRIC ANALOG OF THREE-DIMENSIONAL FLOW TO WELLS AND ITS
PPLICATION TO UNCONFINED AQUIFERS,
9-03356 07C

RNBERG, YARON M.
HYDROLOGY OF SURFACE MINING-A CASE STUDY,
9-03547 02A

EWART, W. D. P.
ACETYLENE REDUCTION BY NITROGEN-FIXING BLUE-GREEN ALGAE,
9-03368 02K

IN SITU STUDIES ON (NITROGEN) FIXATION USING THE ACETYLENE
REDUCTION TECHNIQUE,
9-03372 02K

ORR, D.

METEOROLOGICAL STUDIES IN THE MARMOT CREEK WATERSHED,
ALBERTA, CANADA, IN AUGUST 1965,
W69-03330 02D

STUMM, WERNER
STREAM POLLUTION BY ALGAL NUTRIENTS,
W69-03369 05C

SUTHERLAND, ALEX J.
DIFFUSION AND SETTLING OF SEDIMENTS AT RIVER MOUTHS A
COMPUTER SIMULATION MODEL,
W69-03542 02J

SWANK, W. T.
THE INFLUENCE OF RAINFALL INTERCEPTION ON STREAMFLOW,
W69-03384 02I

SWENSON, MARLETTE E.
EUTROPHICATION,
W69-03357 05C

TARRANT, ROBERT F.
RESIDUES OF HERBICIDES AND DIESEL OIL CARRIERS IN FOREST
WATERS,
W69-03397 05B

GROWTH AND NUTRIENT UPTAKE OF IRRIGATED YOUNG PONDEROSA PINE
AFTER FERTILIZER TREATMENTS,
W69-03398 05B

NITROGEN CONTENT OF PRECIPITATION IN A COASTAL OREGON FOREST
OPENING,
W69-03400 05B

PESTICIDES IN FOREST WATERS--SYMPTOM OF A GROWING PROBLEM,
W69-03401 05C

NUTRIENT CYCLING BY THROUGHFALL AND STEMFLOW PRECIPITATION
IN THREE COASTAL OREGON FOREST TYPES,
W69-03402 05B

TER-STEPANIAN, G.
ON THE MECHANISM OF SUSPENDED CAPILLARY WATER AND PERCHED
GROUNDWATER,
W69-03208 02F

THATCHER, L. L.
THE OCCURRENCE OF TRITIUM IN PRECIPITATION AND ITS
SIGNIFICANCE IN HYDROLOGICAL INVESTIGATIONS,
W69-03555 02K

TICHENOR, BRUCE A.
INDUSTRIAL WASTE GUIDE ON THERMAL POLLUTION,
W69-03537 05B

TINNEY, E. R.
THE CONTINENTAL USE OF ARCTIC-FLOWING RIVERS,
W69-03313 04A

TOFFALETI, F. B.
A PROCEDURE FOR COMPUTATION OF THE TOTAL RIVER SAND
DISCHARGE AND DETAILED DISTRIBUTION, BED TO SURFACE,
W69-03541 02J

TUCKER, L. S.
NORTHWOOD GAGING INSTALLATION, BALTIMORE-INSTRUMENTATION AND
DATA,
W69-03507 02E

OAKDALE GAGING INSTALLATION, CHICAGO-INSTRUMENTATION AND
DATA,
W69-03508 02E

TUNZI, M. G.
MICROSESTON DYNAMICS IN A SIMPLE SIERRA NEVADA LAKE-STREAM
SYSTEM,
W69-03359 02E

TURNER, A. K.
A STUDY OF THE DRAINAGE OF IRRIGATED SAND DUNES USING AN
ELECTRICAL RESISTANCE ANALOGUE,
W69-03526 04A

UNO, T.
SEEPAGE FROM A CANAL INTO SOIL WITH SHALLOW WATER DEPTH,
W69-03204 02F

VACHAUD, GEORGES
DETERMINATION OF THE HYDRAULIC CONDUCTIVITY OF UNSATURATED
SOILS FROM AN ANALYSIS OF TRANSIENT FLOW DATA,
W69-03337 02G

VINYARD, WILLIAM C.
GROWTH REQUIREMENTS OF BLUE-GREEN ALGAE AS DEDUCED FROM
THEIR NATURAL DISTRIBUTION,
W69-03517 05C

VLASOVA, L. S.
ROLE OF STABLE HYDROGEN ISOTOPES IN THE STUDY OF GEOLOGICAL
PROCESSES,
W69-03244 02F

VOLONTE, AUGUST F.
REGIONAL CONSTRUCTION REQUIREMENTS FOR WATER AND WASTEWATER
FACILITIES 1955-1967-1980,
W69-03698 05D

WAGGONER, P. E.
TEST OF A TRANSPIRATION INHIBITOR OF A FORESTED WATERSHED,
W69-03396 02D

WAGNER, CARROTH J.
BENEFIT COST ANALYSIS A METHOD TO DEMONSTRATE THE IMPORTANCE OF WATER RESOURCES DEVELOPMENT,
W69-03574 06B

WALTER, GERALD L.
FLOODS IN MCHENRY QUADRANGLE, NORTHEASTERN ILLINOIS,
W69-03328 02E

WALTON, E. K.
CYCLIC SEDIMENTATION,
W69-03353 02J

WARREN, M. A.
HYDROLOGY OF BROOKHAVEN NATIONAL LABORATORY AND VICINITY, SUFFOLK COUNTY, NEW YORK,
W69-03232 02E

WATTS, DONALD G.
HYDROLOGY AND RESERVOIR CONTROL ON THE WISCONSIN RIVER BASIN,
W69-03375 04A

SELECTED BIBLIOGRAPHY ON HYDROLOGICAL CONTROL BY RESERVOIR OPERATION,
W69-03376 04A

LINEAR RANDOM MODELS OF ANNUAL STREAMFLOW SERIES,
W69-03379 04A

WEEKS, W. F.
THE EFFECTS OF THERMAL POLLUTION ON RIVER ICE CONDITIONS,
W69-03546 05C

WELCH, N. H.
SEDIMENT TRANSPORT OF STREAMS IN THE WASHITA RIVER BASIN IN CADDO AND GRADY COUNTIES, OKLAHOMA,
W69-03326 02J

WENZEL, H. G., JR.
A CRITICAL REVIEW OF METHODS OF MEASURING DISCHARGE WITHIN A SEWER PIPE,
W69-03510 07B

WERSHAW, R. L.
THE DETERMINATION OF THE IONIZATION CONSTANT OF 2,4-D IN WATER,
W69-03241 05A

WHITESIDE, MELBOURNE C.
PALEOECOLOGICAL STUDIES OF POTATO LAKE AND ITS ENVIRONS,
W69-03361 02J

WIEBENGA, W. A.
THE INVESTIGATION OF WATER FLOW THROUGH POROUS MEDIUMS BY MEANS OF RADIOTRACERS,
W69-03551 02F

WILKINSON, KENNETH
SOCIOLOGICAL FACTORS IN WATERSHED DEVELOPMENT,
W69-03594 06B

WILSON, JAMES P., JR.
AN EMPIRICAL FORMULA FOR DETERMINING THE AMOUNT OF DYE NEEDED FOR TIME-OF-TRAVEL MEASUREMENTS,
W69-03565 07C

WILSON, JOHN M.
WATER USE IN TENNESSEE, PART A-AGRICULTURAL WATER USE,
W69-03323 06D

WILSON, K. V.
FLOOD-FLOW CHARACTERISTICS OF A RECTIFIED CHANNEL, JACKSON, MISSISSIPPI,
W69-03566 02F

WINDHAM, D. M.
THE OYSTER-BASED ECONOMY OF FRANKLIN COUNTY, FLORIDA,
W69-03631 06B

WISCHMEIER, W. H.
EFFECT OF ORGANIC MATTER CONTENT OF THE SOIL ON INFILTRATION,
W69-03484 02G

WITHERSPOON, P. A.
THEORETICAL ANALYSIS OF REGIONAL GROUNDWATER FLOW. 2. EFFECT OF WATER-TABLE CONFIGURATION AND SUBSURFACE PERMEABILITY VARIATION,
W69-03243 02F

USE OF THERMAL MODEL TO INVESTIGATE THE THEORY OF TRANSIENT FLOW TO A PARTIALLY PENETRATING WELL,
W69-03254 02F

WOLMAN, M. GORDON
EFFECTS OF CONSTRUCTION ON FLUVIAL SEDIMENT, URBAN AND SUBURBAN AREAS OF MARYLAND,
W69-03227 02J

WOOLHISER, D. A.
UNSTEADY, ONE-DIMENSIONAL FLOW OVER A PLANE-THE RISING HYDROGRAPH,
W69-03332 02E

WU, I-PAI
FLOOD HYDROLOGY OF SMALL WATERSHEDS--EVALUATION OF TIME PARAMETERS AND DETERMINATION OF PEAK DISCHARGE,
W69-03569 02E

YAMAMOTO, TERUO
ERODIBILITY INDICES FOR WILDLAND SOILS OF OAHU, HAWAII, AS RELATED TO SOIL FORMING FACTORS,
W69-03316 02J

YEH, GOUR-TSYH
DISPERSION AT THE INTERFACE OF MISCIBLE LIQUIDS IN A SOIL,
W69-03548 02F

YEN, Y. C.
THE EFFECTS OF THERMAL POLLUTION ON RIVER ICE CONDITIONS,
W69-03546 05C

YOUNG, R. A.
EFFECT OF SEDIMENT LOAD ON THE RATING CURVES OF 0.6-FOOT HS FLUMES,
W69-03403 02E

ZICKER, E. L.
PHOSPHORUS RELEASE FROM BOG LAKE MUDS,
W69-03363 02K

ZIEMER, ROBERT
MEASURING MOISTURE NEAR SOIL SURFACE...MINOR DIFFERENCES DUE TO NEUTRON SOURCE TYPE,
W69-03498 02G

ZIEMER, ROBERT R.
SOIL MOISTURE DEPLETION PATTERNS AROUND SCATTERED TREES,
W69-03407 02I

ORGANIZATIONAL INDEX

ULTURAL RESEARCH SERVICE, BELTSVILLE, MD. HYDROGRAPH

TE DIFFERENCING METHODS,
-03519 07C

ULTURAL RESEARCH SERVICE, BELTSVILLE, MD. SOIL AND
CONSERVATION DIV. AND MINNESOTA AGRICULTURAL
MENT STATION, ST. PAUL.
CT OF SEDIMENT LOAD ON THE RATING CURVES OF 0.6-FOOT HS
ES,
-03403 02E

ULTURAL RESEARCH SERVICE, CHICKASHA, OKLA. SOIL AND
CONSERVATION RESEARCH DIV.
MENT TRANSPORT OF STREAMS IN THE WASHITA RIVER BASIN IN
DO AND GRADY COUNTIES, OKLAHOMA,
-03326 02J

ULTURAL RESEARCH SERVICE, FRESNO, CALIF. SOIL AND
CONSERVATION RESEARCH DIV.
WATER INTRUSION INTO A FRESH WATER FOREBAY DUE TO WAVE
ION,
-03531 02L

ULTURAL RESEARCH SERVICE, LAFAYETTE, IND.
CT OF ORGANIC MATTER CONTENT OF THE SOIL ON
ILTRATION,
-03484 02G

ULTURAL RESEARCH SERVICE, PHOENIX, ARIZ. WATER
RVATION LAB.
LYZING SUBSURFACE FLOW SYSTEMS WITH ELECTRIC ANALOGS,
-03310 02F

ULTURAL RESEARCH SERVICE, RIVERSIDE, CALIF. SALINITY

PLING THE SOIL SOLUTION FOR SALINITY APPRAISAL,
-03488 02G

ULTURAL RESEARCH SERVICE, TEMPE, ARIZ. WATER
RVATION LAB.
URACY OF EVAPOTRANSPIRATION DETERMINATIONS BY THE BOWEN
IO METHOD,
-03504 02D

ULTURAL RESEARCH SERVICE, TUCSON, ARIZ. SOUTHWEST
SHED RESEARCH CENTER.
EVIEW OF RAINFALL-RUNOFF, PHYSICAL MODELS AS DEVELOPED BY
ENSIONAL ANALYSIS AND OTHER METHODS,
-03309 02A

MIYA NAUK ARMYANSKOI SSR, EREVAN. INSTITUT
GICHESKIKH NAUK.
THE MECHANISM OF SUSPENDED CAPILLARY WATER AND PERCHED
UNDWATER,
-03208 02F

A UNIV., COLLEGE. INST. OF MARINE SCIENCE.
ECTS OF THE NITROGEN NUTRITION OF SOME NATURALLY
URRING POPULATIONS OF BLUE-GREEN ALGAE,
-03515 05C

CAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE,
NGTON, D. C.
E ROLE OF MAN IN ESTUARINE PROCESSES',
-03638 06G

CAN SOCIETY OF CIVIL ENGINEERS PROGRAM OFFICE,
IDGE, MASS.
THWOOD GAGING INSTALLATION, BALTIMORE-INSTRUMENTATION AND
A,
-03507 02E

DALE GAGING INSTALLATION, CHICAGO-INSTRUMENTATION AND
A,
-03508 02E

NATURE OF CHANGES IN URBAN WATERSHEDS AND THEIR
ORTANCE IN THE DECADES AHEAD,
-03511 04C

CAN SOCIETY OF CIVIL ENGINEERS, NEW YORK. URBAN
LOGY RESEARCH COUNCIL.
AN WATER RESOURCES RESEARCH SYSTEMATIC STUDY AND
ELOPMENT OF LONG-RANGE PLANS, FIRST YEAR REPORT,
TEMBER, 1968.
-03506 06B

CH COLL., YELLOW SPRINGS, OHIO.
EAMS-THEIR DYNAMICS AND MORPHOLOGY,
-03248 02E

NA UNIV., TUCSON. DEPT. OF AGRICULTURAL CHEMISTRY AND
.
ATIVE ABSORPTION OF STRONTIUM AND CALCIUM BY CERTAIN
AE,
-03491 05B

ALIAN ATOMIC ENERGY COMMISSION RESEARCH ESTABLISHMENT,
HEIGHTS AND BUREAU OF MINERAL RESOURCES, GEOLOGY, AND
YSICS, CANBERRA (AUSTRALIA).
INVESTIGATION OF WATER FLOW THROUGH POROUS MEDIUMS BY
NS OF RADIOTRACERS,
-03551 02F

AIJAN POLYTECHNIC INST., BAKU (USSR).
ILTRATION AND SUBSIDENCE PROCESSES IN LOESS SOILS,
W69-03207 02G

BATTELLE MEMORIAL INST., COLUMBUS, OHIO.
DYNAMIC MODEL OF THE ECONOMY OF THE SUSQUEHANNA RIVER BASIN,
W69-03570 06B

BATTELLE-NORTHWEST, RICHLAND, WASH. AND NORTHWESTERN UNIV.,
EVANSTON, ILL.
IMPACT OF INSTITUTIONAL ARRANGEMENTS ON THE AVAILABLE
ALTERNATIVE DEVELOPMENTAL PATHS FOR WATER ALLOCATION AND
POLLUTION CONTROL IN THE COLORADO RIVER BASIN,
W69-03492 06A

BRITISH INFORMATION SERVICE, LONDON (ENGLAND).
DESALINATION AND ITS ROLE IN WATER SUPPLY.
W69-03351 03A

BUREAU OF OUTDOOR RECREATION, WASHINGTON, D. C.
INDEX OF SELECTED OUTDOOR RECREATION LITERATURE, VOLUME II.
W69-03681 06B

BUREAU OF SPORT FISHERIES AND WILDLIFE, BISHOP, CALIF., AND
CALIFORNIA UNIV., DAVIS. DEPT. OF ZOOLOGY.
MICROSESTON DYNAMICS IN A SIMPLE SIERRA NEVADA LAKE-STREAM
SYSTEM,
W69-03359 02E

CAIRO UNIV. (EGYPT). DEPT. OF BOTANY.
THE WATER OUTPUT OF THE DESERT VEGETATION IN THE DIFFERENT
MICROHABITATS OF WADI HOFF,
W69-03501 02I

CALIFORNIA STATE DEPT. OF WATER RESOURCES, SACRAMENTO.
SOLVING THE ARID STATES' PROBLEMS,
W69-03493 06B

CALIFORNIA UNIV., BERKELEY AND CALIFORNIA STATE DEPT. OF
WATER RESOURCES, SACRAMENTO.
GROUND WATER RECHARGE, DEVELOPMENT AND MANAGEMENT,
W69-03540 04B

CALIFORNIA UNIV., BERKELEY. DEPT. OF CIVIL ENGINEERING.
USE OF THERMAL MODEL TO INVESTIGATE THE THEORY OF TRANSIENT
FLOW TO A PARTIALLY PENETRATING WELL,
W69-03254 02F

CALIFORNIA UNIV., DAVIS.
THE NONLINEAR PREDICTION PROBLEM IN THE STUDY OF THE RUNOFF
CYCLE,
W69-03308 02A

CALIFORNIA UNIV., LOS ANGELES. DEPT. OF ENGINEERING
CALIFORNIA UNIV., LOS ANGELES. WATER RESOURCES CENTER AND
CALIFORNIA STATE DEPT. OF WATER RESOURCES, FRESNO.
INSECTICIDES IN TILE DRAINAGE EFFLUENT,
W69-03221 05A

CALIFORNIA UNIV., RIVERSIDE. CITRUS RESEARCH CENTER AND
AGRICULTURAL RESEARCH STATION.
EFFECT OF EXTERNAL SALT CONCENTRATIONS ON WATER RELATIONS IN
PLANTS II. EFFECT OF THE OSMOTIC DIFFERENTIAL BETWEEN
EXTERNAL MEDIUM AND XYLEM ON WATER RELATIONS IN THE ENTIRE
PLANT,
W69-03487 02I

CANADIAN METEOROLOGICAL SERVICE, TORONTO (ONTARIO) AND EAST
SLOPES WATERSHED RESEARCH PROGRAM, CALGARY (ALBERTA).
METEOROLOGICAL STUDIES IN THE MARMOT CREEK WATERSHED,
ALBERTA, CANADA, IN AUGUST 1965,
W69-03330 02D

CENTRAL ARID ZONE RSEARCH INSTITUTE, JODHPUR (INDIA).
GERMINATION STUDIES ON ARID ZONE TREE SEEDS,
W69-03489 02I

CENTRAL GREAT PLAINS FIELD STATION, AKRON, COLO.
DIVISION S-6-SOIL AND WATER MANAGEMENT AND CONSERVATION--
LEVEL PAN SYSTEM FOR SPREADING AND STORING WATERSHED RUNOFF,
W69-03499 02E

COLABA OBSERVATORY, BOMBAY (INDIA).
FREQUENCY OF WET AND DRY SPELLS AT FIVE STATIONS IN
RAJASTHAN,
W69-03490 02B

COLD REGIONS RESEARCH AND ENGINEERING LAB., HANOVER, N. H.
THE EFFECTS OJ THERMAL POLLUTION ON RIVER ICE CONDITIONS,
W69-03546 05C

COLORADO STATE UNIV., FORT COLLINS, DEPT. OF HORTICULTURE.
WATER UTILIZATION IN GREENHOUSES ALTERNATIVES FOR
AGRICULTURE IN ARID REGIONS,
W69-03486 03F

COLORADO STATE UNIV., FORT COLLINS.
RECOVERY OF BACTERIAL PATHOGENS FROM HIGH QUALITY SURFACE
WATER,
W69-03311 05B

COMMISSION ON MARINE SCIENCE, ENGINEERING AND RESOURCES,
WASHINGTON, D. C.
NATIONAL JURISDICTION AND THE USE OF THE SEA,
W69-03572 06B

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH
ORGANIZATION, CANBERRA (AUSTRALIA) AND CENTRAL ARID ZONE
RESEARCH INST., JODHPUR (INDIA).

A FIRST-ORDER MARKOV MODEL FOR ASSESSING RAINFALL DISCONTINUITY IN CENTRAL AUSTRALIA,
W69-03494 02B

COPENHAGEN UNIV., (DENMARK). DEPT. OF PLANT PHYSIOLOGY.
PHOSPHATE EQUILIBRIUM BETWEEN REDUCED SEDIMENTS AND WATER,
W69-03365 02K

CORNELL UNIV., ITHACA, N. Y. DEPT. OF WATER RESOURCES ENGINEERING.
UNSTEADY, ONE-DIMENSIONAL FLOW OVER A PLANE-THE RISING HYDROGRAPH,
W69-03332 02E

CORNELL UNIV., ITHACA, N. Y. SCHOOL OF CIVIL ENGINEERING.
THE PERMEABILITY OF A POROUS MEDIUM DETERMINED FROM CERTAIN PROBABILITY LAWS FOR PORE SIZE DISTRIBUTION,
W69-03553 02F

CORPS OF ENGINEERS, CHICAGO, ILL.
WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN ILLINOIS.
W69-03591 06B

CORPS OF ENGINEERS, GALVESTON, TEX.
HURRICANE 'BEULAH', SEPT. 8-21, 1967.
W69-03543 02B

CORPS OF ENGINEERS, PORTLAND, OREG.
FLOOD PLAIN INFORMATION, WILLAMETTE RIVER AND TRIBUTARIES IN MARION AND POLK COUNTIES, OREGON,
W69-03539 02E

CORPS OF ENGINEERS, SACRAMENTO, CALIF. HYDROLOGIC ENGINEERING CENTER.
OPTIMIZATION TECHNIQUES FOR HYDROLOGIC ENGINEERING,
W69-03329 06A

CORPS OF ENGINEERS, VICKSBURG, MISS.
A PROCEDURE FOR COMPUTATION OF THE TOTAL RIVER SAND DISCHARGE AND DETAILED DISTRIBUTION, BED TO SURFACE,
W69-03541 02J

COWEETA HYDROLOGIC LAB., ASHEVILLE, N. C.
INTERCEPTION BY EASTERN WHITE PINE,
W69-03315 02I

DEPARTMENT OF MINES AND TECHNICAL SURVEYS, CALGARY (ALBERTA). WATER RESEARCH BRANCH AND CALIFORNIA UNIV., BERKELEY. DEPT. OF CIVIL ENGINEERING.
THEORETICAL ANALYSIS OF REGIONAL GROUNDWATER FLOW. 2. EFFECT OF WATER-TABLE CONFIGURATION AND SUBSURFACE PERMEABILITY VARIATION,
W69-03243 02F

EDINBURGH UNIV. (SCOTLAND). GRANT INST. OF GEOLOGY.
CYCLIC SEDIMENTATION,
W69-03353 02J

ESSO PRODUCTION RESEARCH CO., HOUSTON, TEX.
RECENT DELTAIC DEPOSITS OF THE MISSISSIPPI RIVER THEIR DEVELOPMENT AND CHRONOLOGY,
W69-03230 02J

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, ATLANTA, GA.
'STATEMENT', IN CLEAN WATER FOR THE NATION'S ESTUARIES,
W69-03605 05B

'STATEMENT',
W69-03617 05G

CLEAN WATER FOR THE NATION'S ESTUARIES.
W69-03629 05G

'STATEMENT',
W69-03647 02L

W69-03649 05G

W69-03671 02L

W69-03678 05C

'GEORGIA WATER QUALITY CONTROL BOARDS STATEMENT TO THE NATIONAL ESTUARINE STUDY REPORT',
W69-03679 05G

'STATEMENT',
W69-03696 02L

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, CINCINNATI, OHIO.
HYDROLOGIC DATA COLLECTION IN TIDAL ESTUARIES,
W69-03239 02L

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, CORVALLIS, OREG., AND ASTORIA DEPARTMENT OF PUBLIC WORKS, OREG.
AMITROLE CONCENTRATIONS IN CREEK WATERS DOWNSTREAM FROM AN AERIALLY SPRAYED WATERSHED SUBBASIN,
W69-03226 05B

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, CORVALLIS, ORE. PACIFIC NORTHWEST WATER LAB, AND WASHINGTON UNIV., SEATTLE.
ENVIRONMENTAL REQUIREMENTS OF BLUE-GREEN ALGAE.
W69-03512 05C

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, CORVALLIS, OREG. PACIFIC NORTHWEST WATER LAB.
INDUSTRIAL WASTE GUIDE ON THERMAL POLLUTION,
W69-03537 05B

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, WASHINGTON, D. C.
POLLUTION CONTROL - PLANNING A NATIONAL PROGRAM,
W69-03410 05G

FLORIDA UNIV., GAINESVILLE. DEPT. OF ENVIRONMENTAL ENGINEERING.
RESPONSE CHARACTERISTICS OF URBAN WATER RESOURCE DATA SYSTEMS,
W69-03509 07A

FOREST SERVICE, FORT COLLINS, COLO.
PERIODIC MOWINGS SUPPRESS TAMARISK GROWTH, INCREASE FORAGE FOR BROWSING,
W69-03496 02I

ACCURACY OF SOIL MOISTURE READINGS WITH UNSEALED ACCESS TUBES,
W69-03500 02G

GEOLOGICAL SURVEY, ALBANY, N.Y.
WATER RESOURCES DATA FOR NEW YORK, 1967--PART 1. SURFACE WATER RECORDS.
W69-03320 02E

GEOLOGICAL SURVEY, ARLINGTON, VA.
TIME SERIES ANALYSIS,
W69-03524 06A

GEOLOGICAL SURVEY, AUSTIN, TEX.
URBAN HYDROLOGY OF THE HOUSTON, TEXAS METROPOLITAN AREA-COMPILATION OF BASIC DATA-1966,
W69-03538 04C

GEOLOGICAL SURVEY, BOSTON, MASS.
WATER RESOURCES DATA FOR MASSACHUSETTS, NEW HAMPSHIRE, RHODE ISLAND, VERMONT, 1967--PART 1. SURFACE WATER RECORDS, PART 2. WATER QUALITY RECORDS.
W69-03321 02E

GEOLOGICAL SURVEY, CHAMPAIGN, ILL.
LINEAR ANALYSIS OF HYDROGRAPHS,
W69-03331 07C

GEOLOGICAL SURVEY, CHEYENNE, WYO.
AN EMPIRICAL FORMULA FOR DETERMINING THE AMOUNT OF DYE NEEDED FOR TIME-OF-TRAVEL MEASUREMENTS,
W69-03565 07C

GEOLOGICAL SURVEY, DENVER, COLO.
THE DETERMINATION OF THE IONIZATION CONSTANT OF 2,4-D IN WATER,
W69-03241 05A

WATER RESOURCES DATA FOR COLORADO, 1967--PART 2. WATER QUALITY RECORDS.
W69-03319 02E

HYDROGEOLOGIC DATA FOR BACA AND SOUTHERN PROWERS COUNTIES, COLORADO,
W69-03530 02F

GEOLOGICAL SURVEY, GARDEN CITY, KANS.
MOVEMENT OF MOISTURE IN THE UNSATURATED ZONE IN A DUNE AREA, SOUTHWESTERN KANSAS,
W69-03556 02G

GEOLOGICAL SURVEY, HURON, S. DAK. WATER RESOURCES DIV.
AN AQUIFER TEST USED TO INVESTIGATE A QUALITY OF WATER ANOMALY,
W69-03335 02F

GEOLOGICAL SURVEY, JACKSON, MISS.
FLOOD-FLOW CHARACTERISTICS OF A RECTIFIED CHANNEL, JACKSON, MISSISSIPPI,
W69-03566 02F

GEOLOGICAL SURVEY, LOUISVILLE, KY.
WATER RESOURCES DATA FOR KENTUCKY, 1967--PART 1 SURFACE WATER RECORDS.
W69-03318 02E

GEOLOGICAL SURVEY, MENLO PARK, CALIF.
APPLICATIONS OF FACTOR ANALYSIS IN STUDY OF CHEMISTRY OF GROUNDWATER QUALITY, MOJAVE RIVER VALLEY, CALIFORNIA,
W69-03253 02F

A SUGGESTED METHOD FOR ESTIMATING EVAPOTRANSPIRATION BY NATIVE PHREATOPHYTES,
W69-03557 02I

EVALUATION OF ORGANIC COLOR AND IRON IN NATURAL SURFACE WATERS,
W69-03558 03E

DECEMBER 1964, A 400-YEAR FLOOD IN NORTHERN CALIFORNIA,
W69-03560 02E

GEOLOGICAL SURVEY, RAPID CITY, S. DAK. AND GEOLOGICAL SURVEY, HURON, S. DAK.
TEMPERATURE VARIATIONS OF DEEP FLOWING WELLS IN SOUTH DAKOTA,
W69-03567 02F

GEOLOGICAL SURVEY, ROLLA, MO.
FLOOD HEIGHT-FREQUENCY RELATIONS FOR THE PLAINS AREA IN MISSOURI,
W69-03563 02E

GEOLOGICAL SURVEY, SALT LAKE CITY, UTAH.

MAL SPRINGS NEAR MIDWAY, UTAH,
03568 02F

ICAL SURVEY, TACOMA, WASH.
ND-WATER SURVEY, ODESSA-LIND AREA, WASHINGTON,
03352 02F

ICAL SURVEY, TRENTON, N. J.
UTATION OF REAERATION COEFFICIENTS FOR A RIVER SYSTEM IN
HEASTERN NEW JERSEY,
03561 05C

ICAL SURVEY, WASHINGTON, D. C.
ND-WATER RESOURCES OF ISLAND COUNTY, WASHINGTON,
03224 02F

ITUDE AND FREQUENCY OF FLOODS IN THE UNITED STATES,
03225 02E

TCUTS AND SPECIAL PROBLEMS IN AQUIFER TESTS,
03231 07B

OLOGY OF BROOKHAVEN NATIONAL LABORATORY AND VICINITY,
OLK COUNTY, NEW YORK,
03232 02E

HLY SURFACE-WATER INFLOW TO CHESAPEAKE BAY,
03325 02E

DS IN DYER QUADRANGLE, NORTHEASTERN ILLINOIS,
03327 02E

DS IN MCHENRY QUADRANGLE, NORTHEASTERN ILLINOIS,
03328 02E

STATISTICAL TOOLS IN HYDROLOGY,
03344 07B

UREMENT OF PEAK DISCHARGE AT CULVERTS BY INDIRECT
ODS,
03345 07B

RAL PROCEDURE FOR GAGING STREAMS,
03346 07B

NDWATER RESOURCES OF CHOWAN COUNTY, NORTH CAROLINA,
03355 02F

TRIC ANALOG OF THREE-DIMENSIONAL FLOW TO WELLS AND ITS
ICATION TO UNCONFINED AQUIFERS,
03356 07C

E-DISCHARGE RELATIONS FOR EIGHT RIVERS IN THE UNITED
ES,
03521 02E

S OF SLOPE DEGRADATION AS DETERMINED FROM BOTANICAL
ENCE, WHITE MOUNTAINS, CALIFORNIA,
03527 02I

PPRAISAL OF THE GROUND-WATER RESOURCES OF THE UPPER
UEHANNA RIVER BASIN IN PENNSYLVANIA,
-03528 02F

ND-WATER RESOURCES OF THE SEVIER RIVER BASIN BETWEEN
DAM AND LEAMINGTON CANYON, UTAH,
-03529 02F

IODS OF MEASURING WATER LEVELS IN DEEP WELLS,
-03535 07B

IBRATION AND MAINTENANCE OF VERTICAL-AXIS TYPE CURRENT
ERS,
-03536 07B

URENCE OF GROUND WATER IN THE JUDITH RIVER FORMATION,
CH-CENTRAL MONTANA,
-03545 02F

USE OF PRECIPITATION RECORDS FOR PEAK STREAMFLOW
THESIS,
-03562 02A

GICAL SURVEY, WASHINGTON, D. C., AND GEOLOGICAL SURVEY,
, COLO.
IUM AS A CLUE TO DIRECTION OF GROUNDWATER MOVEMENT,
ADA TEST SITE,
-03559 02F

ETOWN PLANNING COUNCIL, WASHINGTON, D. C.
RGETOWN WATERFRONT.
-03595 06B

IA INST. OF TECH., ATLANTA. SCHOOL OF ENGINEERING AND
IA INST. OF TECH., ATLANTA. WATER RESOURCES CENTER.
EFFECT OF TURBULENCE ON BACTERIAL SUBSTRATE UTILIZATION,
-03343 05G

BLE UNIV., (FRANCE). LABORATOIRES DE MECANIQUE DES
ES.
ERMINATION OF THE HYDRAULIC CONDUCTIVITY OF UNSATURATED
LS FROM AN ANALYSIS OF TRANSIENT FLOW DATA,
-03337 02G

RD UNIV., CAMBRIDGE, MASS. DIV. OF ENGINEERING AND
ED PHYSICS.
EAM POLLUTION BY ALGAL NUTRIENTS,
-03369 05C

I UNIV., HONOLULU.
OD HYDROLOGY OF SMALL WATERSHEDS--EVALUATION OF TIME
PARAMETERS AND DETERMINATION OF PEAK DISCHARGE,
W69-03569 02E

REFLECTIVITY OF ELECTROMAGNETIC WAVES AT AN AIR-WATER
INTERFACE FOR PURE AND SEA WATER,
W69-03598 01A

HAWII UNIV., HONOLULU.
INFRARED IMAGES OF THE KAU AND PUNA COASTLINES ON HAWAII,
W69-03600 07B

HITTMAN ASSOCIATES, INC., COLUMBIA, MARYLAND.
MAIN I, A SYSTEM OF COMPUTERIZED MODELS FOR CALCULATING AND
EVALUATING MUNICIPAL WATER REQUIREMENTS VOLUME I-
DEVELOPMENT OF THE MAIN SYSTEM VOLUME II-DESCRIPTION OF
THE MAIN I SYSTEM AND LIBRARY OF WATER USAGE PARAMETERS.
W69-03201 06D

MAIN I, A SYSTEM OF COMPUTERIZED MODELS FOR CALCULATING AND
EVALUATING MUNICIPAL WATER REQUIREMENTS.
W69-03202 06D

HUMBOLDT STATE COLL., ARCATA, CALIF.
GROWTH REQUIREMENTS OF BLUE-GREEN ALGAE AS DEDUCED FROM
THEIR NATURAL DISTRIBUTION,
W69-03517 05C

HYDRO-CHEMICAL INST., NOVOCHERKASSK(USSR).
PRINCIPLES OF CHEMICAL COMPOSITION OF GROUNDWATERS (BASIC
FACTORS), (IN RUSSIAN),
W69-03533 02K

IBM WATSON RESEARCH CENTER, YORKTOWN HEIGHTS, N. Y.
A COMMENT ON HORTON'S LAW OF STREAM NUMBERS,
W69-03338 02E

ILLINOIS STATE GEOLOGICAL SURVEY, URBANA.
GEOPHYSICAL SURVEYS IN THE VICINITY OF SANITARY LANDFILLS IN
NORTHEASTERN ILLINOIS,
W69-03236 05B

FEASIBILITY CRITERIA FOR SUBSURFACE WASTE DISPOSAL IN
ILLINOIS,
W69-03251 05E

THERMAL PROSPECTING FOR GROUND WATER,
W69-03549 02F

ILLINOIS UNIV., URBANA.
A CRITICAL REVIEW OF METHODS OF MEASURING DISCHARGE WITHIN A
SEWER PIPE,
W69-03510 07B

ILLINOIS UNIV., URBANA. DEPT. OF AGRICULTURAL ECONOMICS.
INTERGOVERNMENTAL RELATIONSHIPS IN THE ADMINISTRATION OF
WATER RESOURCES,
W69-03589 06E

W69-03590 06E

INDIANA UNIV., BLOOMINGTON.
PALEOECOLOGICAL STUDIES OF POTATO LAKE AND ITS ENVIRONS,
W69-03361 02J

HYDROLOGY OF SURFACE MINING-A CASE STUDY,
W69-03547 02A

INSTITUT PRIKLADNOI GEOFIZIKI, LENINGRAD. TRUDY (USSR).
DEUTERIUM CONTENT IN NATURAL WATERS,
W69-03229 02K

ISOTOPIC COMPOSITION OF LEAD IN NATURAL WATERS,
W69-03245 02K

INTERNATIONAL ATOMIC ENERGY AGENCY, VIENNA (AUSTRIA).
CURRENT TRENDS IN THE USE OF RADIOACTIVE TRACERS IN
HYDROLOGIC INVESTIGATIONS,
W69-03544 07B

THE OCCURRENCE OF TRITIUM IN PRECIPITATION AND ITS
SIGNIFICANCE IN HYDROLOGICAL INVESTIGATIONS,
W69-03555 02K

INTERNATIONAL COMMISSION ON IRRIGATION AND DRAINAGE.
DETERMINING EVAPO TRANSPIRATION BY THE GRAVIMETRIC METHOD
FOR THE WHEAT CROP IN THE IRRIGATION DISTRICT OF RIO YAQUI,
SONORA, MEXICO.
W69-03497 02D

IOWA STATE UNIV., AMES. WATER RESOURCES RESEARCH INST.
EXPLANATION OF PARADOXES IN DUPUIT-FORCHHEIMER SEEPAGE
THEORY,
W69-03242 02F

IOWA UNIV., IOWA CITY. WATER RESOURCES RESEARCH INST.
AN ANALYSIS OF RELATIONSHIPS BETWEEN FLOW CONDITIONS AND
STATISTICAL MEASURES OF BED CONFIGURATIONS IN STRAIGHT AND
CURVED ALLUVIAL CHANNELS,
W69-03317 02J

ISCONSIN UNIV., MADISON. LAB. OF LIMNOLOGY AND WISCONSIN
UNIV., MADISON. UNIVERSITY-INDUSTRY RESEARCH PROGRAM.
EUTROPHICATION,
W69-03357 05C

JODHPUR UNIV. (INDIA). DEPT. OF BOTANY.
EFFECT OF HIGH TEMPERATURES ON MOISTURE DEPLETION,
IMBIBITION AND GERMINATION OF SEEDS OF MIMOSA HAMATA WILLD,
W69-03503 02I

JOHN HOPKINS UNIV., BALTIMORE, MD. CHESAPEAKE BAY INST.

THE DISTRIBUTION OF EXCESS TEMPERATURE FROM A HEATED DISCHARGE IN AN ESTUARY,
W69-03341 02L

JOHNS HOPKINS UNIV., BALTIMORE, MD.
EFFECTS OF CONSTRUCTION ON FLUVIAL SEDIMENT, URBAN AND SUBURBAN AREAS OF MARYLAND,
W69-03227 02J

KENTUCKY UNIV., LEXINGTON. WATER RESOURCES INST.
APPLICATION OF MARGINAL ECONOMIC ANALYSIS TO RESERVOIR RECREATION PLANNING,
W69-03576 06B

KYOTO UNIV. (JAPAN).
SEEPAGE FROM A CANAL INTO SOIL WITH SHALLOW WATER DEPTH,
W69-03204 02F

LEAGUE OF WOMEN VOTERS EDUCATION FUND, OMAHA, NEBR.
WATERSHED, FLOOD PROTECTION, AND RECREATION DEVELOPMENT IN ATCHISON, KANSAS,
W69-03593 06B

LEHIGH UNIV., BETHELEM, PA. MARINE SCIENCE CENTER GEORGIA UNIV., SAPELO ISLAND, GA., MARINE INST. AND GEORGIA UNIV., ATHENS. DEPT. OF GEOLOGY.
SEDIMENTATION IN A MEANDERING ESTUARY,
W69-03228 02J

LOUISIANA STATE UNIV., BATON ROUGE. WATER RESOURCES RESEARCH INST.
INVESTIGATION OF THE TECHNICAL FEASIBILITY OF STORING FRESH WATER IN SALINE AQUIFERS,
W69-03336 02F

MANCHESTER COLLEGE, NORTH MANCHESTER, IND.
PROBLEMS IN THE LABORATORY CULTURE OF PLANKTONIC BLUE-GREEN ALGAE,
W69-03514 05C

MANCHESTER UNIV. (ENGLAND) AND SALFORD UNIV. (ENGLAND).
THE DIFFUSION OF AIR THROUGH THE PORE WATER OF SOILS,
W69-03205 02A

MASSACHUSETTS INST. OF TECH., CAMBRIDGE. HYDRODYNAMICS LAB.
NUMERICAL SOLUTIONS FOR DISPERSION IN POROUS MEDIUMS,
W69-03237 05B

MASSACHUSETTS UNIV., AMHERST.
THE OCCURRENCE AND CHARACTERISTICS OF GROUND-WATER CONTAMINATION IN MASSACHUSETTS,
W69-03312 05B

MIAMI UNIV., CORAL GABLES, FLA. SCHOOL OF LAW.
HABEAS MARINUS DUE PROCESS OF INNERSPACE - A PROPOSAL,
W69-03588 06E

MICHIGAN STATE UNIV., HICKORY CORNERS. W. K. KELLOGG BIOLOGICAL STATION.
BIOTIC RESPONSE TO POLLUTION REDUCTION IN A RIVER,
W69-03602 05C

MICHIGAN UNIV., ANN ARBOR. GREAT LAKES RESEARCH DIV.
VERTICAL CURRENT STRUCTURE IN THE GREAT LAKES II. CURRENT METER STUDIES OFF SHEBOYGAN, WISCONSIN, AUGUST 1967,
W69-03334 02H

VERTICAL CURRENT STRUCTURE IN THE GREAT LAKES I. CHARACTERIZATION OF THE CIRCULATION DYNAMICS OF LAKE MICHIGAN,
W69-03347 02H

VERTICAL CURRENT STRUCTURE IN THE GREAT LAKES III. DETERMINATION OF EDDY VISCOSITY AND EDDY DIFFUSIVITY IN LAKE MICHIGAN,
W69-03348 02H

VERTICAL CURRENT STRUCTURE IN THE GREAT LAKES IV. NUMERICAL EVALUATION OF STERN'S CALCULATION MODEL,
W69-03349 02H

VERTICAL CURRENT STRUCTURE IN THE GREAT LAKES V. THERMAL CURRENT STRUCTURE IN LAKE MICHIGAN, ASSOCIATED WITH THE SPRING WARM-UP SEASON--A THEORETICAL STUDY,
W69-03350 02H

MICHIGAN UNIV., ANN ARBOR. INST. OF PUBLIC ADMINISTRATION.
COMPREHENSIVE RIVER BASIN PLANNING THE ARKANSAS-WHITE-RED BASINS INTER-AGENCY COMMITTEE EXPERIENCE,
W69-03596 06B

MISSISSIPPI STATE UNIV., STATE COLLEGE. WATER RESOURCES RESEARCH INST.
SOCIOLOGICAL FACTORS IN WATERSHED DEVELOPMENT,
W69-03594 06B

MONTANA UNIV., MISSOULA. DEPT. OF GEOGRAPHY.
SEQUENTIAL STUDY OF DESERT FLOODING IN THE WHITE MOUNTAINS OF CALIFORNIA AND NEVADA,
W69-03222 02E

MONTPELLIER UNIV. (FRANCE). GEOLOGIC LAB.
DISPOSITION OF CONSTANT INTENSITY RAINFALL IN A KARST AREA,
W69-03520 02A

NATIONAL CENTER FOR ATMOSPHERIC RESEARCH, BOULDER, COLO.
VARIANCE SPECTRUM ANALYSIS,
W69-03525 06A

NATIONAL COUNCIL OF ENGINEERS AND TECHNICAL SCIENTISTS, BUCHAREST (RUMANIA).
MODERN HYDROLOGICAL RESEARCH METHODOLOGY ON RIVERS IN RUMANIA (IN RUMANIAN),
W69-03314 06B

NATIONAL RESEARCH COUNCIL OF CANADA, OTTAWA (ONTARIO). SUBCOMMITTEE ON HYDROLOGY.
SOIL MOISTURE.
W69-03223 02G

NATIONAL SECURITY INDUSTRIAL ASSOCIATION, WASHINGTON, D. C.
CONSEQUENCES OF MAJOR SPILLS ON INDUSTRIAL USES OF SEAWATER.
W69-03633 05C

'ASPECTS OF THE ESTUARINE ECOSYSTEM',
W69-03677 06G

'U. S. COAST GUARD REPORT OF WAKE ISLAND OIL SPILL',
W69-03685 05C

'ENVIRONMENTAL REACTION TO WATER POLLUTION',
W69-03693 05C

NEVADA BUREAU OF MINES, RENO. DESERT RESEARCH INST.
HYDROGEOLOGY OF DESERT BASINS,
W69-03238 02F

NEW MEXICO INST. OF MINING AND TECHNOLOGY, SOCORRO.
FLOW OF GROUNDWATER IN RELATIVELY THICK LEAKY AQUIFERS,
W69-03220 02F

NORTH CAROLINA STATE UNIV., RALEIGH. DEPT. OF CIVIL ENGINEERING AND NORTH CAROLINA UNIV., CHAPEL HILL.
STREAMFLOW ROUTING (WITH APPLICATIONS TO NORTH CAROLINA RIVERS),
W69-03564 02E

NORTH CAROLINA STATE UNIV., RALEIGH. DEPT. OF TEXTILE CHEMISTRY.
TEXTILE WASTES - A BIBLIOGRAPHY,
W69-03597 05B

NORTH CENTRAL FOREST EXPERIMENT STATION, ST. PAUL, MINN.
STABILIZING ERODING STREAMBANKS IN SAND DRIFT AREAS OF THE LAKE STATES.
W69-03405 02J

NOTTINGHAM UNIV. (ENGLAND). DEPT. OF CIVIL ENGINEERING.
ANALYSIS OF SOME PUMPING TEST RESULTS,
W69-03206 02F

OAK RIDGE NATIONAL LAB., OAK RIDGE, TENN. HEALTH PHYSICS DIV.
ROCK MECHANICS IN THE DISPOSAL OF RADIOACTIVE WASTES BY HYDRAULIC FRACTURING,
W69-03522 08E

ONTARIO WATER RESOURCES COMMISSION, TORONTO.
GROUND WATER IN ONTARIO SOUTHWESTERN AREA, 1960-1963.
W69-03354 02F

OREGON UNIV., EUGENE, DEPT. OF BIOLOGY.
ENVIRONMENTAL REQUIREMENTS OF THERMOPHILIC BLUE-GREEN ALGAE,
W69-03516 05C

PACIFIC NORTHWEST AND RANGE EXPERIMENT STATION, CORVALLIS, OREG.
PESTICIDES IN FOREST WATERS--SYMPTOM OF A GROWING PROBLEM,
W69-03401 05C

PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION, CORVALLIS, OREG.
STREAM CONTAMINATION BY HERBICIDES AFTER FALL RAINS ON FOREST LAND,
W69-03381 05B

RESIDUES OF HERBICIDES AND DIESEL OIL CARRIERS IN FOREST WATERS,
W69-03397 05B

GROWTH AND NUTRIENT UPTAKE OF IRRIGATED YOUNG PONDEROSA PINE AFTER FERTILIZER TREATMENTS,
W69-03398 05B

CHEMICAL BRUSH CONTROL AND HERBICIDE RESIDUES IN THE FOREST ENVIRONMENT,
W69-03399 05B

NITROGEN CONTENT OF PRECIPITATION IN A COASTAL OREGON FOREST OPENING,
W69-03400 05B

NUTRIENT CYCLING BY THROUGHFALL AND STEMFLOW PRECIPITATION IN THREE COASTAL OREGON FOREST TYPES,
W69-03402 05B

PACIFIC SOUTHWEST FOREST AND RANGE EXPERIMENT STATION, BERKELEY, CALIF.
ERODIBILITY INDICES FOR WILDLAND SOILS OF OAHU, HAWAII, AS RELATED TO SOIL FORMING FACTORS,
W69-03316 02J

SOIL MOISTURE DEPLETION PATTERNS AROUND SCATTERED TREES,
W69-03407 02I

PACIFIC SOUTHWEST FOREST AND RANGE EXPERIMENT STATION, BERKELEY, CALIF. AND CALIFORNIA STATE DEPT. OF WATER RESOURCES, SACRAMENTO AND CALIFORNIA STATE DEPT. OF WATER RESOURCES, BAKERSFIELD.
MEASURING MOISTURE NEAR SOIL SURFACE...MINOR DIFFERENCES DUE TO NEUTRON SOURCE TYPE,
W69-03498 02G

TRICS, BERKELEY, CALIF.
MATION OF RECREATIONAL BENEFITS AT SOME SELECTED WATER
LOPMENT SITES IN CALIFORNIA,
03578 06B

CYRUS W.) AND CO., PITTSBURGH, PA.
UDY TO DETERMINE THE COSTS OF WATER IN INDUSTRIAL USES,
03322 06C

S. KERR WATER RESEARCH CENTER, ADA, OKLA. AND
ESTERN GREAT PLAINS RESEARCH CENTER, BUSHLAND, TEX.
OF DDT AND NITRATE IN GROUND WATER,
03219 05B

MOUNTAIN FOREST AND RANGE EXPERIMENT STATION, FORT
S, COLO.
ERSION OF GULLIES TO VEGETATION-LINED WATERWAYS ON
TAIN SLOPES,
03406 04A

MOUNTAIN FOREST AND RANGE EXPERIMENT STATION, FORT
S, COLO. AND NORTHERN ARIZONA UNIV., FLAGSTAFF.
RVATIONS OF SNOW ACCUMULATION AND MELT IN DEMONSTRATION
LNGS OF PONDEROSA PINE IN CENTRAL ARIZONA,
03408 02C

MOUNTAIN FOREST AND RANGE EXPERIMENT STATION, FORT
S, COLO.
SPHERIC HUMIDITY MEASUREMENT NEAR THE SNOW SURFACE,
03409 02C

ANCISCO BAY CONSERVATION AND DEVELOPMENT COMMISSION,
FRANCISCO BAY PLAN.
03592 06B

CHEWAN UNIV., SASKATOON AND CALIFORNIA UNIV., DAVIS.
EFFECTS OF ENTRAPPED AIR AND BAROMETRIC FLUCTUATIONS ON
DRAINAGE OF POROUS MEDIUMS,
03552 02G

S INSTITUTION OF OCEANOGRAPHY, LA JOLLA, CALIF.
NT ADVANCES IN THE PHYSIOLOGY OF BLUE-GREEN ALGAE,
03518 05C

OIL CO., HOUSTON, TEX.
NT SEDIMENTS OF THREE WISCONSIN LAKES,
03367 02J

TECHNICAL UNIV., BRATISLAVA (CZECHOSLOVAKIA).
NTIAL FLOW AND SOIL STRUCTURE CHANGES,
03203 02F

AST WATER LAB., ATHENS, GA.
PERSISTENCE OF SILVEX IN WATER AND HYDROSOIL,
03240 05A

ASTERN FOREST EXPERIMENT STATION, ASHEVILLE, N. C.
ORGIA UNIV., ATHENS. SCHOOL OF FORESTRY.
DING FOREST USES,
03404 04D

ASTERN FOREST EXPERIMENT STATION, FRANKLIN, N. C.
NTIAL IMPACT OF FOREST FERTILIZATION ON RANGE, WILDLIFE,
WATERSHED MANAGEMENT,
03383 04C

INFLUENCE OF RAINFALL INTERCEPTION ON STREAMFLOW,
03384 02I

CTS OF SPECIES AND ARRANGEMENT OF FORESTS ON
OTRANSPIRATION,
03386 02D

ST TREATMENT EFFECTS ON WATER YIELD,
03387 03B

ORS AFFECTING THE RESPONSE OF SMALL WATERSHEDS TO
IPITATION IN HUMID AREAS,
03388 02E

AMFLOW DATA PROCESSING OPPORTUNITIES AND APPLICATION,
03389 07C

RCEPTION BY EASTERN WHITE PINE,
03391 02I

METRIC CALIBRATION OF NEUTRON MOISTURE PROBES,
03394 02G

GN CRITERIA FOR INTERCEPTION STUDIES,
03395 02I

ASTERN FOREST EXPERIMENT STATION, FRANKLIN, N. C. AND
NIV., DURHAM, N. C.
ARISON OF THE DYE METHOD WITH THE THERMOCOUPLE
HROMETER FOR MEASURING LEAF WATER POTENTIALS,
03390 02I

UREMENT OF LEAF WATER POTENTIAL BY THE DYE METHOD,
03392 02I

CT OF LEAF AGING ON WATER DEFICIT-WATER POTENTIAL
TIONSHIPS OF DOGWOOD LEAVES GROWING IN TWO ENVIRONMENTS,
03393 02I

ASTERN FOREST EXPERIMENT STATION, FRANKLIN, N. C. AND
TICUT AGRICULTURAL EXPERIMENT STATION, NEW HAVEN.
OF A TRANSPIRATION INHIBITOR OF A FORESTED WATERSHED,
03396 02D

SOUTHERN FOREST EXPERIMENT STATION, HARRISON, ARK.
THROUGHFALL AND STEMFLOW IN A PINE-HARDWOOD STAND IN THE
OUACHITA MOUNTAINS OF ARKANSAS,
W69-03339 02I

SREDNEAZIATSKII NAUCHNO-ISSLEDOVATELSKII INSTITUT
IRRIGATSII, TASHKENT (USSR).
NUMERICAL MODEL OF THE NONSTATIONARY TEMPERATURE FIELD OF
FLOWING BODIES OF WATER,
W69-03213 02E

EXPERIMENTAL INVESTIGATION AND COMPUTATION OF THE VOLUME OF
MATERIAL DERIVED FROM DEEP RAVINES IN FORECASTING THE
SILTING OF RESERVOIRS ON MOUNTAIN RIVERS,
W69-03216 02J

STANFORD UNIV., CALIF.
'DISTRIBUTION OF POLLUTIONAL LOADINGS IN SUISUN BAY',
W69-03609 05B

'MIXING OF COLUMBIA RIVER AND OCEAN WATERS, SUMMER',
W69-03632 05C

'ANALYZING STEAM ELECTRIC POWER PLANT DISCHARGES',
W69-03655 05B

'NUMERICAL SOLUTION OF THE UNSTEADY, ESTUARY DISPERSION
EQUATION',
W69-03675 02L

'FINITE-DIFFERENCE MODELLING OF RIVER AND ESTUARY
POLLUTION',
W69-03690 05A

'NUTRIENT ASSIMILATION IN A VIRGINIA TIDAL SYSTEM',
W69-03695 05C

STANFORD UNIV., CALIF. DEPT. OF GEOLOGY AND STANFORD
UNIV., CALIF. DEPT. OF CIVIL ENGINEERING.
DIFFUSION AND SETTLING OF SEDIMENTS AT RIVER MOUTHS A
COMPUTER SIMULATION MODEL,
W69-03542 02J

STANFORD UNIV., STANFORD, CALIFORNIA.
'ESTUARINE OXYGEN RESOURCES--PHOTOSYNTHESIS AND REAERATION',
W69-03610 05G

'PREDICTING DIURNAL VARIATIONS IN DISSOLVED OXYGEN CAUSED BY
ALGAE IN ESTUARINE WATERS, PART I',
W69-03611 05C

SYDNEY UNIV. (AUSTRALIA). DEPT. OF GEOGRAPHY.
AN ANALYSIS OF THE MEANDERING TENDENCY OF SERPENTINE CAVE,
N.S.W.,
W69-03532 02F

SYRACUSE UNIV., N. Y.
DISPERSION AT THE INTERFACE OF MISCIBLE LIQUIDS IN A SOIL,
W69-03548 02F

TECHNION - ISRAEL INST. OF TECH., HAIFA.
A DERIVATION OF DUPUIT SOLUTION OF STEADY FLOW TOWARD WELLS
BY MATCHED ASYMPTOTIC EXPANSIONS,
W69-03550 02F

TECHNION-ISRAEL INST. OF TECH., HAIFA.
ON THE MEANING OF THE DUPUIT AND PAVLOVSKII APPROXIMATIONS
IN AQUIFER FLOW,
W69-03252 02F

TECHNISCHE HOCHSCHULE, DARMSTADT (WEST GERMANY).
BOTANISCHES INSTITUT.
THE HEAT RESISTANCE OF PLANTS, ITS DETERMINATION AND
VARIABILITY,
W69-03485 02I

TENNESSEE DEPT. OF CONSERVATION, NASHVILLE. DIV. OF WATER
RESOURCES.
WATER USE IN TENNESSEE, PART A-AGRICULTURAL WATER USE,
W69-03323 06D

TENNESSEE UNIV., KNOXVILLE. DEPT. OF AGRICULTURAL
ENGINEERING.
AN APPLICATION OF PRINCIPAL COMPONENT ANALYSIS AND FACTOR
ANALYSIS IN THE STUDY OF WATER YIELD,
W69-03233 02A

TEXAS A AND M UNIV., COLLEGE STATION AND TEXAS UNIV.,
AUSTIN.
OPTIMIZATION OF BRANCHING MULTISTAGE SYSTEMS A REPLY TO A
COMMENT BY D P LOUCKS,
W69-03580 06A

TEXAS TECHNOLOGICAL COLL., LUBBOCK. DEPT. OF GEOSCIENCES.
INTRODUCTION TO PALEOLIMNOLOGY,
W69-03342 02J

UDAIPUR UNIV. (INDIA). AGRICULTURAL EXPERIMENT STATION.
A STATISTICAL STUDY OF SOME INDICES OF SALINE WATER
IRRIGATED SOILS OF RAJASTHAN,
W69-03482 03C

EFFECT OF SODIUM SALTS ON THE GROWTH AND MINERAL COMPOSITION
OF BAJRA (PENNISETUM TYPHOIDES),
W69-03483 03C

UTAH STATE UNIV., LOGAN.
SEEPAGE FROM CHANNELS THROUGH LAYERED POROUS MEDIUMS,
W69-03554 02G

VOLCANI INST. OF AGRICULTURAL RESEARCH, BET-DAGAN (ISRAEL) AND ISRAEL METEOROLOGICAL SERVICE, BET-DAGAN.
CLIMATE AND SOIL MOISTURE EXTRACTION,
W69-03250 02G

VSESOYUZNYI NAUCHNO-ISSLEDOVATELSKII INSTITUT YADERNOI GEOFIZIKI I GEOKHIMII, MOSCOW (USSR).
ROLE OF STABLE HYDROGEN ISOTOPES IN THE STUDY OF GEOLOGICAL PROCESSES,
W69-03244 02F

WASHINGTON STATE UNIV., PULLMAN WASHINGTON WATER RESEARCH CENTER, PULLMAN AND WASHINGTON UNIV., SEATTLE.
THE CONTINENTAL USE OF ARCTIC-FLOWING RIVERS,
W69-03313 04A

WASHINGTON UNIV., SEATTLE AND WASHINGTON WATER RESEARCH CENTER, PULLMAN.
AN EXTENSION TO THE THOMAS-FIERING MODEL FOR THE SEQUENTIAL GENERATION OF STREAMFLOW,
W69-03307 02A

WASHINGTON UNIV., SEATTLE. DEPT. OF ZOOLOGY.
WHY STUDY BLUE-GREEN ALGAE,
W69-03513 05C

WASHINGTON UNIV., SEATTLE. FISHERIES RESEARCH INST.
SIMULATION OF A WATER RESOURCES SYSTEM,
W69-03601 06A

WASHINGTON, STATE UNIV., PULLMAN. BUREAU OF ECONOMIC AND BUSINESS RESEARCH.
THE ROLE OF INDUSTRIAL PROCESS CHANGES IN AFFECTING WATER REQUIREMENTS,
W69-03599 06D

WATER CONSERVATION AND IRRIGATION COMMISSION, (AUSTRALIA) AND MELBOURNE UNIV., PARKVILLE (AUSTRALIA). DEPT OF AGRICULTURAL ENGINEERING.
A STUDY OF THE DRAINAGE OF IRRIGATED SAND DUNES USING AN ELECTRICAL RESISTANCE ANALOGUE,
W69-03526 04A

WATER PLANNING FOR ISRAEL LTD. TEL AVIV AND WATER RESEARCH ASSOCIATION, MEDMENHAM (ENGLAND).
OPTIMAL CONTROL OF LINKED RESERVOIRS,
W69-03571 06A

WATER PLANNING FOR ISRAEL LTD., HAIFA.
STEADY UNSATURATED VERTICAL FLOW THROUGH MULTILAYERED SOIL,
W69-03209 02G

WATER RESOURCE BOARD, READING (ENGLAND). RESEARCH DIV. AND NEWCASTLE-UPON-TYNE UNIV., (ENGLAND).
THE SPATIAL DISTRIBUTION OF STORM RAINFALL,
W69-03534 02B

WEATHER BUREAU, PORTLAND, OREG. RIVER FORECAST CENTER.
RELATIONS BETWEEN TOPOGRAPHY AND ANNUAL PRECIPITATION IN WESTERN OREGON AND WASHINGTON,
W69-03340 02B

WELDER WILDLIFE FOUNDATION, SINTON, TEX. AND TEXAS TECHNOLOGICAL COLL., LUBBOCK.
DROUGHT-ASSOCIATED MORTALITY OF RANGE GRASSES IN SOUTH TEXAS,
W69-03495 02I

WISCONSIN DEPT. OF NATURAL RESOURCES, MADISON AND WISCONSIN UNIV., MADISON.
INTERAGENCY WATER RESOURCES RESEARCH AND DATA COLLECTION PROGRAM.
W69-03360 09D

WISCONSIN UNIV., MADISON. DEPT. OF BIOCHEMISTRY AND WISCONSIN UNIV., MADISON. WATER CHEMISTRY LAB.
ACETYLENE REDUCTION BY NITROGEN-FIXING BLUE-GREEN ALGAE,
W69-03368 02K

WISCONSIN UNIV., MADISON. DEPT. OF BIOCHEMISTRY AND WISCONSIN UNIV., MADISON. WATER CHEMISTRY LAB.
IN SITU STUDIES ON (NITROGEN) FIXATION USING THE ACETYLENE REDUCTION TECHNIQUE,
W69-03372 02K

WISCONSIN UNIV., MADISON. DEPT. OF SOIL SCIENCE AND WISCONSIN UNIV., MADISON. DEPT. OF ZOOLOGY.
PHOSPHORUS RELEASE FROM BOG LAKE MUDS,
W69-03363 02K

WISCONSIN UNIV., MADISON. HYDRAULIC LAB AND WISCONSIN UNIV., MADISON. SANITARY LAB.
THE EFFECT OF DILUTION MEDIA ON THE BOD OF ALGAE,
W69-03371 05A

WISCONSIN UNIV., MADISON. HYDRAULIC LAB., AND WISCONSIN UNIV, MADISON. SANITARY LAB.
THE EFFECT OF ALGAE ON BOD MEASUREMENTS,
W69-03362 05A

WISCONSIN UNIV., MADISON. SANITARY LAB.
STRIPPING EFFLUENTS OF NUTRIENTS BY BIOLOGICAL MEANS,
W69-03374 05F

WISCONSIN UNIV., MADISON. STATE LAB. OF HYGIENE.
COPPER IN LAKE MUDS FROM LAKES OF THE MADISON AREA,
W69-03366 05A

WISCONSIN UNIV., MADISON. WATER CHEMISTRY LAB AND WISCONSIN UNIV., MADISON. MCARDLE MEMORIAL LAB.
EXTRACTIVE AND ENZYMATIC ANALYSES FOR LIMITING OR SURPLUS PHOSPHORUS IN ALGAE,
W69-03373 05A

WISCONSIN UNIV., MADISON. WATER CHEMISTRY LAB.
STUDIES OF THE ANALYSIS OF PHOSPHATES IN ALGAL CULTURES,
W69-03358 05A

DETECTION OF LIMITING OR SURPLUS NITROGEN IN ALGAE AND AQUATIC WEEDS,
W69-03364 05C

EFFECT OF WATER SAMPLE PRESERVATION METHODS ON THE RELEASE OF PHOSPHORUS FROM ALGAE,
W69-03370 05B

ACCESSION NUMBER INDEX

06D	W69-03201	04A	W69-03280	05A	W69-03358	04A	W69-03435
06D	W69-03202	06E	W69-03281	02E	W69-03359	06E	W69-03436
02F	W69-03203	02F	W69-03282	09D	W69-03360	04A	W69-03437
02F	W69-03204	06E	W69-03283	02J	W69-03361	04A	W69-03438
02A	W69-03205	04A	W69-03284	05A	W69-03362	05C	W69-03439
02F	W69-03206	02H	W69-03285	02K	W69-03363	04A	W69-03440
02G	W69-03207	04A	W69-03286	05C	W69-03364	04A	W69-03441
02F	W69-03208	04A	W69-03287	02K	W69-03365	06C	W69-03442
02G	W69-03209	04A	W69-03288	05A	W69-03366	04A	W69-03443
02F	W69-03210	06E	W69-03289	02J	W69-03367	04C	W69-03444
02D	W69-03211	04A	W69-03290	02K	W69-03368	04A	W69-03445
05B	W69-03212	04A	W69-03291	05C	W69-03369	04A	W69-03446
02E	W69-03213	06E	W69-03292	05B	W69-03370	04A	W69-03447
02A	W69-03214	04A	W69-03293	05A	W69-03371	04A	W69-03448
02G	W69-03215	06E	W69-03294	02K	W69-03372	04A	W69-03449
02J	W69-03216	04A	W69-03295	05A	W69-03373	06C	W69-03450
02H	W69-03217	05B	W69-03296	05F	W69-03374	04A	W69-03451
02E	W69-03218	04A	W69-03297	04A	W69-03375	06E	W69-03452
05B	W69-03219	06E	W69-03298	04A	W69-03376	04A	W69-03453
02F	W69-03220	06B	W69-03299	04A	W69-03377	04A	W69-03454
05A	W69-03221	06E	W69-03300	04A	W69-03378	04A	W69-03455
02E	W69-03222	04A	W69-03301	04A	W69-03379	04A	W69-03456
02G	W69-03223	04A	W69-03302	04A	W69-03380	04A	W69-03457
02F	W69-03224	06C	W69-03303	05B	W69-03381	04A	W69-03458
02E	W69-03225	06E	W69-03304	04C	W69-03383	04A	W69-03459
05B	W69-03226	06B	W69-03305	02I	W69-03384	05G	W69-03460
02J	W69-03227	02A	W69-03307	02D	W69-03386	04A	W69-03461
02J	W69-03228	02A	W69-03308	03B	W69-03387	04A	W69-03462
02K	W69-03229	02A	W69-03309	02E	W69-03388	06B	W69-03463
02J	W69-03230	02F	W69-03310	07C	W69-03389	06E	W69-03464
07B	W69-03231	05B	W69-03311	02I	W69-03390	06E	W69-03465
02E	W69-03232	05B	W69-03312	02I	W69-03391	06C	W69-03466
02A	W69-03233	04A	W69-03313	02I	W69-03392	04A	W69-03467
07B	W69-03235	06B	W69-03314	02I	W69-03393	05B	W69-03468
05B	W69-03236	02I	W69-03315	02G	W69-03394	08I	W69-03469
05B	W69-03237	02J	W69-03316	02I	W69-03395	05B	W69-03470
02F	W69-03238	02J	W69-03317	02D	W69-03396	04A	W69-03471
02L	W69-03239	02E	W69-03318	05B	W69-03397	04A	W69-03472
05A	W69-03240	02E	W69-03319	05B	W69-03398	04A	W69-03473
05A	W69-03241	02E	W69-03320	05B	W69-03399	06E	W69-03474
02F	W69-03242	02E	W69-03321	05B	W69-03400	05B	W69-03475
02F	W69-03243	06C	W69-03322	05C	W69-03401	05B	W69-03476
02F	W69-03244	06D	W69-03323	05B	W69-03402	05B	W69-03477
02K	W69-03245	02E	W69-03325	02E	W69-03403	06E	W69-03478
02E	W69-03248	02J	W69-03326	04D	W69-03404	04A	W69-03479
02G	W69-03250	02E	W69-03327	02J	W69-03405	06E	W69-03480
05E	W69-03251	02E	W69-03328	04A	W69-03406	02G	W69-03481
02F	W69-03252	06A	W69-03329	02I	W69-03407	03C	W69-03482
02F	W69-03253	02D	W69-03330	02C	W69-03408	03C	W69-03483
02F	W69-03254	07C	W69-03331	02C	W69-03409	02G	W69-03484
06E	W69-03255	02E	W69-03332	05G	W69-03410	02I	W69-03485
06E	W69-03256	02H	W69-03334	06B	W69-03411	03F	W69-03486
06E	W69-03257	02F	W69-03335	06E	W69-03412	02I	W69-03487
04C	W69-03258	02F	W69-03336	06E	W69-03413	02G	W69-03488
04A	W69-03259	02G	W69-03337	06E	W69-03414	02I	W69-03489
06E	W69-03260	02E	W69-03338	06E	W69-03415	02B	W69-03490
06E	W69-03261	02I	W69-03339	06E	W69-03416	05B	W69-03491
06E	W69-03262	02B	W69-03340	06E	W69-03417	06A	W69-03492
06E	W69-03263	02L	W69-03341	06E	W69-03418	06B	W69-03493
06E	W69-03264	02J	W69-03342	06E	W69-03419	02B	W69-03494
04A	W69-03265	05G	W69-03343	06E	W69-03420	02I	W69-03495
04A	W69-03266	07B	W69-03344	06E	W69-03421	02I	W69-03496
04A	W69-03267	07B	W69-03345	06E	W69-03422	02D	W69-03497
04A	W69-03268	07B	W69-03346	06E	W69-03423	02G	W69-03498
04A	W69-03269	02H	W69-03347	06E	W69-03424	02E	W69-03499
06F	W69-03270	02H	W69-03348	05G	W69-03425	02G	W69-03500
06E	W69-03271	02H	W69-03349	04A	W69-03426	02I	W69-03501
06E	W69-03272	02H	W69-03350	04A	W69-03427	02I	W69-03503
06E	W69-03273	03A	W69-03351	06E	W69-03428	02D	W69-03504
05B	W69-03274	02F	W69-03352	06E	W69-03429	06B	W69-03506
06E	W69-03275	02J	W69-03353	04A	W69-03430	02E	W69-03507
06E	W69-03276	02F	W69-03354	04A	W69-03431	02E	W69-03508
06E	W69-03277	02F	W69-03355	04A	W69-03432	07A	W69-03509
05B	W69-03278	07C	W69-03356	06E	W69-03433	07B	W69-03510
04A	W69-03279	05C	W69-03357	04A	W69-03434	04C	W69-03511

05C	W69-03512	03E	W69-03558	06G	W69-03607	05B	W69-03655
05C	W69-03513	02F	W69-03559	06B	W69-03608	08D	W69-03656
05C	W69-03514	02E	W69-03560	05B	W69-03609	06B	W69-03657
05C	W69-03515	05C	W69-03561	05G	W69-03610	03A	W69-03658
05C	W69-03516	02A	W69-03562	05C	W69-03611	06B	W69-03659
05C	W69-03517	02E	W69-03563	05G	W69-03613	05C	W69-03660
05C	W69-03518	02E	W69-03564	06C	W69-03614	05B	W69-03661
07C	W69-03519	07C	W69-03565	06B	W69-03615	06B	W69-03662
02A	W69-03520	02F	W69-03566	04A	W69-03616	02L	W69-03663
02E	W69-03521	02F	W69-03567	05G	W69-03617	06C	W69-03664
08E	W69-03522	02F	W69-03568	05G	W69-03618	04A	W69-03665
02F	W69-03523	02E	W69-03569	05B	W69-03619	05C	W69-03666
06A	W69-03524	06B	W69-03570	06B	W69-03620	05B	W69-03667
06A	W69-03525	06A	W69-03571	06E	W69-03621	02L	W69-03668
04A	W69-03526	06B	W69-03572	06F	W69-03622	05C	W69-03669
02I	W69-03527	06B	W69-03574	05G	W69-03623	05C	W69-03670
02F	W69-03528	06B	W69-03575	06B	W69-03624	02L	W69-03671
02F	W69-03529	06B	W69-03576	06B	W69-03625	06B	W69-03672
02F	W69-03530	06C	W69-03577	06B	W69-03626	06B	W69-03673
02L	W69-03531	06B	W69-03578	05G	W69-03627	06B	W69-03674
02F	W69-03532	06A	W69-03580	06B	W69-03628	02L	W69-03675
02K	W69-03533	06B	W69-03582	05G	W69-03629	06B	W69-03676
02B	W69-03534	06B	W69-03583	04A	W69-03630	06G	W69-03677
07B	W69-03535	05G	W69-03584	06B	W69-03631	05C	W69-03678
07B	W69-03536	05B	W69-03585	05C	W69-03632	05G	W69-03679
05B	W69-03537	06B	W69-03586	05C	W69-03633	06G	W69-03680
04C	W69-03538	06B	W69-03587	08A	W69-03634	06B	W69-03681
02E	W69-03539	06E	W69-03588	05C	W69-03635	05C	W69-03682
04B	W69-03540	06E	W69-03589	05G	W69-03636	05G	W69-03683
02J	W69-03541	06E	W69-03590	06B	W69-03637	05B	W69-03684
02J	W69-03542	06B	W69-03591	06G	W69-03638	05C	W69-03685
02B	W69-03543	06B	W69-03592	05D	W69-03640	06C	W69-03686
07B	W69-03544	06B	W69-03593	02L	W69-03641	06D	W69-03687
02F	W69-03545	06B	W69-03594	05G	W69-03643	05B	W69-03688
05C	W69-03546	06B	W69-03595	05D	W69-03644	05A	W69-03690
02A	W69-03547	06B	W69-03596	05G	W69-03645	06B	W69-03691
02F	W69-03548	05B	W69-03597	02L	W69-03646	06D	W69-03692
02F	W69-03549	01A	W69-03598	02L	W69-03647	05C	W69-03693
02F	W69-03550	06D	W69-03599	06E	W69-03648	06E	W69-03694
02F	W69-03551	07B	W69-03600	05G	W69-03649	05C	W69-03695
02G	W69-03552	06A	W69-03601	10	W69-03650	02L	W69-03696
02F	W69-03553	05C	W69-03602	02L	W69-03651	06B	W69-03697
02G	W69-03554	05B	W69-03603	04A	W69-03652	05D	W69-03698
02K	W69-03555	06D	W69-03604	05G	W69-03653	05D	W69-03699
02G	W69-03556	05B	W69-03605	06G	W69-03654	04A	W69-03700
02I	W69-03557	06B	W69-03606				

Digitized by the Internet Archive in 2011

Subject Fields

1 NATURE OF WATER

2 WATER CYCLE

3 WATER SUPPLY AUGMENTATION AND CONSERVATION

4 WATER QUANTITY MANAGEMENT AND CONTROL

5 WATER QUALITY MANAGEMENT AND PROTECTION

6 WATER RESOURCES PLANNING

7 RESOURCES DATA

8 ENGINEERING WORKS

9 MANPOWER, GRANTS, AND FACILITIES

10 SCIENTIFIC AND TECHNICAL INFORMATION

INDEXES

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF COMMERCE

LIBRARY RATE
PRINTED MATTER

U.S. DEPARTMENT OF COMMERCE
CLEARINGHOUSE FOR FEDERAL
SCIENTIFIC AND TECHNICAL INFORMATION
SPRINGFIELD, VA. 22151

OFFICIAL BUSINESS

6.33391
.48

UNIVERSITY OF ILLINOIS
AUG 29 1969
LIBRARY

SELECTED WATER RESOURCES ABSTRACTS

VOLUME 2, NUMBER 10
MAY 15, 1969

WR 69-03702 -- WR 69-04200

Selected Water Resources Abstracts is published semimonthly for the Water Resources Scientific Information Center (WRSIC) by the Clearinghouse for Federal Scientific and Technical Information (CFSTI) of the Bureau of Standards, U. S. Department of Commerce. It is available to Federal agencies, contractors, or grantees in water resources upon request to: Manager, Water Resources Scientific Information Center, Office of Water Resources Research, U. S. Department of the Interior, Washington, D. C. 20240. Annual subscription is $22.00 (domestic), $27.50 (foreign), single copy price is $3.00. Certain documents abstracted in this journal can be purchased from the Clearinghouse at the prices indicated in the entry. Prepayment is required.

CLEARINGHOUSE
FOR FEDERAL SCIENTIFIC AND TECHNICAL INFORMATION
U.S. Department of Commerce, Springfield, Va., 22151

SELECTED
WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

VOLUME 2, NUMBER 10
MAY 15, 1969

WR 69-03702 -- WR 69-04200

of funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources. WRSIC is not presently prepared to furnish loan or retention copies of the publications announced.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas. Centers, and their subject coverage, now in operation are:

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

CONTENTS

FOREWORD_____iii

SUBJECT FIELDS AND GROUPS

(Use Edge Index on back cover to Locate Subject Fields and Indexes in the journal.)

01 NATURE OF WATER
Includes the following Groups: Properties; Aqueous Solutions and Suspensions

02 WATER CYCLE
Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION
Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL
Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Non-Water Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION
Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING
Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA
Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS
Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS, AND FACILITIES
Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.

10 SCIENTIFIC AND TECHNICAL INFORMATION
Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

SELECTED WATER RESOURCES ABSTRACTS

01. NATURE OF WATER

1B. Aqueous Solutions AND Suspensions

MINERAL-WATER INTERACTION DURING THE CHEMICAL WEATHERING OF SILICATES,
Johns Hopkins Univ., Baltimore, Md. Dept. of Geography; Johns Hopkins Univ., Baltimore, Md. Dept. of Geology; and Maryland Geological Survey, Baltimore.
For primary bibliographic entry see Field 02K.
For abstract, see .
W69-03724

BIOLOGICAL STUDIES OF MANGANESE SOLUTION FROM ITS DIOXIDE,
Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
For primary bibliographic entry see Field 02H.
For abstract, see .
W69-03725

02. WATER CYCLE

2A. General

PROCEEDINGS: INTERNATIONAL SYMPOSIUM ON FOREST HYDROLOGY.
National Science Foundation, Washington, D. C.
William E. Sopper, and Howard W. Lull.
Pergamon Press, Oxford, England. 813 pages. 1967. $45.

Descriptors: *Hydrologic aspects, *Watershed management, *Forest management, *Stream flow, Precipitation (Atmospheric), Interception, Snow management, Soil water, Ground water, Bogs, Evapotranspiration, Energy budget, Runoff, Water Yield Improvement, Erosion, Soil stability, Mathematical modeling, Water measurement, Revegetation.
Identifiers: *Forest hydrology, *Experimental watersheds, Watershed calibration, Rehabilitation (Watershed).

The beginning of the International Hydrological Decade on January 1, 1965 stimulated activity in hydrologic research and provided an appropriate occasion for the Symposium. It was sponsored by the School of Forest Resources of the Pennsylvania State University; the Northeastern Forest Experiment Station, Forest Service, USDA; the International Association of Scientific Hydrology; and Section II: Forest Influences and Watershed Management of the International Union of Forestry Research Organizations. More than eighty papers, forming a wealth of expert scientific knowledge, were presented under the following Session headings: Resumes of Forest Hydrology Research; Forests and Precipitation; Forests and Soil Water; Forests and Evapotranspiration; Forests and Runoff; Forests and Soil Stabilization; Research Techniques and Instrumentation; Panel Discussion of New Instruments. (Reigner-Forest Service)
W69-03806

THE RELATION BETWEEN RAINFALL AND RUNOFF,
Stanford Univ., Calif. Dept. of Civil Engineering.
Ray K. Linsley.
Journal of Hydrology, Amsterdam, Vol 5, No 4, pp 297-311, 1967. 15 p.

Descriptors: *Rainfall-runoff relationships, Rainfall simulators, *Runoff forecasting, Runoff coefficient, *Computers, Storm runoff, *Correlation analysis, Data collections, Model studies, Measurement, *Hydrologic data, Hydrographs, Flood forecasting, Depth-area curves, Infiltration, Precipitation (Atmospheric).
Identifiers: Empiricism.

Three hundred years of research in rainfall and runoff were reviewed. In the late 1660's Perrault's crude experimentation confirmed the casual relationship between rainfall and runoff. Following that time a lengthy period of empiricism caused by inadequate data existed until the correlation era when a descriptive picture of the runoff process and correlations between precipitation and runoff were developed. The computer era has demonstrated the possibility of simulating the runoff process on a computer. If proper kinds of hydrologic data are obtained a general simulation model which can reproduce the streamflow hydrograph on any stream gauged or ungauged with accuracy equaling the computer is a possibility. (Affleck-Arizona)
W69-03890

SURFACE IRRIGATION HYDRAULICS-KINEMATICS,
California Univ., Davis. Dept. of Water Science and Engineering; and Washington State Univ., Pullman. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 03F.
For abstract, see .
W69-03936

AUGMENTING COLORADO RIVER BY WEATHER MODIFICATION,
Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 03B.
For abstract, see .
W69-03950

OPTIMAL IDENTIFICATION OF NONLINEAR HYDROLOGIC SYSTEM RESPONSE MODELS BY QUASILINEARIZATION,
California Univ., Los Angeles.
John Woodson Labadie.
MS Thesis, Calif Univ Dep Eng, 1968. 72 p, 9 fig, 3 tab, 23 ref, 2 append. WRC No. WI34-4B-68, OWRR Project B-028-CAL.

Descriptors: *Rainfall-runoff relationships, *Mathematical models, Approximation method, Digital computers, Computer programs, Model studies.
Identifiers: Quasilinearization, Prasad models.

Through quasilinearization, implicit solutions to a large class of nonlinear models can be obtained in terms of a maximizing operation on linear equations. This algorithm also provides for systematic determination of the optimal values of model parameters in the identification problem. Furthermore, a complete set of initial conditions need not be supplied. Application of quasilinearization to a recent nonlinear conceptual model of hydrologic system response confirms rapid convergence and accuracy of the algorithm, as long as initial approximations are adequate. If accurate modeling has been hampered by computational difficulties of the system identification problem, it is believed that knowledge of computational tools such as quasilinearization will do much to encourage more realistic modeling of hydrologic systems. A computer programming flow chart and a sample computation are included.
W69-03958

TREE-RING ANALYSIS: A TOOL FOR WATER RESOURCES RESEARCH,
Arizona Univ., Tucson. Lab. of Tree-Ring Research.
Harold C. Fritts.
EOS, Trans Amer Geophys Union, Vol 50, No 1, pp 22-29, Jan 1969. 8 p, 3 fig, 18 ref.

Descriptors: *Dendrochronology, *Climatology, Trees, Paleoclimatology, Weather, Hydrology.
Identifiers: Dendroclimatology.

The uses of tree-ring analysis in hydrological studies are reviewed and new applications are suggested. A conceptual model relating tree ring width to climatic factors is proposed. It is hypothesized that climate of the period preceding ring formation is important because growth is controlled by stored rather than currently available food and soil moisture. A tree-ring analysis for climatic history of a site starts with selection of trees in the most climatically sensitive part of the site, usually a dry area near a forest fringe. Then trees are cored until the best samples are found, selected for good correlation, and the rings are first used to date the cores. Ring widths are then entered into computer programs for statistical analysis. Several types of data treatment are suggested. By computing a lag time, ring widths may be correlated with dry or wetperiods. A bibliography is included. (Knapp-USGS)
W69-03963

WINTER THAWS CAN RAISE GROUND WATER LEVELS IN DRIFTLESS AREA,
Forest Service (USDA), St. Paul, Minn. North Central Forest Experiment Station.
For primary bibliographic entry see Field 02F.
For abstract, see .
W69-04015

RESPONSE OF SPRINGFLOW TO SOME CLIMATIC VARIABLES IN SOUTHWESTERN WISCONSIN,
Forest Service (USDA) St. Paul, Minn. North Central Forest Experiment Station.
Willie R. Curtis.
Water Resources Res. 1966, 2 (2): 311-314, illus.

Descriptors: *Springs, *Distribution patterns, *Precipitation (Atmospheric), *Hydrologic cycle, *Groundwater, Aquifers, Fluctuation, Groundwater recharge, Soil water, Frozen ground, Infiltration, Barometric efficiency.

Field investigations show the relationships of springflow to some climatic variables in southwestern Wisconsin. These observations indicate that springflow fluctuates in much the same manner as recharge to groundwater. In addition, short-period fluctuations in springflow are caused by changes in barometric pressure. This influence is more pronounced during the dormant season. A good correlation was found between springflow and the base flow of a nearby stream.
W69-04016

ADSORPTION OF POLY (VINYL ALCOHOL) BY NATURAL SOIL AGGREGATES,
Adelaide Univ. (Australia). Waite Inst.
B. G. Williams, D. J. Greenland, and J. P. Quirk.
Australia J of Soil Research, No 4, pp 131-143, 1966. 6 fig, 2 tab, 20 ref.

Descriptors: *Adsorption, *Alcohols, *Soil aggregates, Pores, Molecular structure, Organic matter, Porous media, Soil properties, Sampling, Penetration, Cores.
Identifiers: *Polymers, *Polyvinyl alcohol, Soil cores.

A study was made on adsorption of poly (vinyl alcohol-PVA) by relatively undisturbed soil aggregates and soil cores. The principal factor controlling penetration of soil aggregates by PVA molecules was probably the size of soil pores in relation to size of the polymer molecules. Presence of naturally occurring organic matter could greatly reduce the extent of PVA adsorption by occupying adsorption sites and creating steric interference to polymer movement. Depth of penetration of PVA into a soil core from a free solution was aided by a water potential gradient. PVA represented a class of linear uncharged polymers and as such it was representative of the simplest type of synthetic organic polymers that could be effective in inducing soil aggregate stability to many soils in arid climates of the world. (Blecker-Ariz)
W69-04108

ELECTROKINETIC MEASUREMENTS OF COLLOIDAL-LADEN FLOW THROUGH A SAND COLUMN,
Purdue Univ., Lafayette, Ind.
E. J. Monke, and D. M. Edwards.
Indiana Acad. Sci. Proc., Vol 76, pp 377-385, 1966. 3 fig, 12 ref.

Descriptors: *Colloids, *Sands, *Zeta potential, *Porous media, *Flow measurement, Clays, Silica, Bacteria, Pores, Hydrogen ion concentration, Measurement, Soil physical properties, Columns, Seepage, Infiltration, Kinetics, Reservoir leakage.
Identifiers: Clogging.

This study investigated the effect of pH, period of operation and depth within a column on the electrokinetic properties of clay colloids and total colloidal clay-silica sand system. The pH control of the porous media system depended on whether the system was used to promote or inhibit rapid clogging of pores. The dominant reaction of the system was that of the silica sand column and accumulated bacteria on the clay colloids. Electrokinetic forces augmented by the charge orientation of bacteria could be the principal mechanism by which colloidal particles are retained in porous media. Information gained in the study could be used in arid lands with respect to sealing of reservoir bottoms or irrigation canals and stopping seepage of water through deep aquifers. (Blecker-Ariz)
W69-04112

STUDIES ON DEW FORMATION UNDER SEMI-ARID CONDITIONS,
Directorate of Agricultural Research, Potchefstroom (South Africa). Dept. of Agricultural Technical Services.
W. Baier.
Agricultural Meteorology, Vol 3, pp 103-112, February 1966. 3 fig, 2 tab, 19 ref.

Descriptors: *Dew, *Condensation, *Logging (Recording), Dew point, Semiarid climates, Soil surfaces, Rainfall disposition, Transpiration, Temperature, Soil moisture, Fluctuation, Water balance, Climatic data.
Identifiers: *Kessler dew recorder, *South Africa.

Reported here are results of dew recordings by means of the Kessler dew recorder above various soil surfaces under semi-arid climatic conditions in the interior of South Africa. Monthly amounts of dew varied from approximately 0.5 mm in late winter and spring to above 2 mm in autumn. The dew deposition on a lawn amounted to approximately 2% of the annual rainfall. Dew formation commenced on the average of 2-3 hours after sunset, but in extreme cases, particularly in winter, it commenced before sunset. Dewfall usually continued until sunrise or even one hour thereafter. Preceding rains seemed to be a condition for heavy dew formation. Dew formation was most frequent and intensive in autumn, when the soil was still adequately supplied with moisture and wide daily temperature fluctuations occurred. Dew may benefit the internal water balance of plants grown in arid climates because transpiration is reduced during morning hours when dew is still present on the leaves. (Blecker-Ariz)
W69-04115

GEOPHYSICAL, ISOTOPE AND TRACER TECHNIQUES IN WATERSHED RESEARCH,
California Univ., Davis. Dept. of Water Science and Engineering.
David C. Lewis.
Transactions of the ASAE, Vol 11, No 5, pp 601-607, Sept-Oct 1968. 1 fig, 1 tab.

Descriptors: *Watersheds (Basins), *Tracking techniques, *Tracers, *Radioisotopes, *Geophysics, Runoff, Measurement, Precipitation (Atmospheric), Water storage, Rainfall-runoff relationships.

A review was given of each process that occurs in the runoff cycle with a discussion of the applicable geophysical, isotope, and tracer techniques, their limitations, and current or potential uses in watershed research. Those processes included were precipitation, interception, and depression storage, infiltration and soil moisture, interflow, percolation, groundwater storage and movement, evaporation, transpiration, snowmelt, erosion, sediment transport, baseflow, surface runoff, overland flow, and channel flow. In reviewing the watershed system process by process, it was found that geophysical, isotope and tracer techniques were very important in the measurement of process variables and media characteristics. Definitions of the various geophysical, isotope and tracer techniques discussed in the paper were given. (Affleck-Ariz)
W69-04119

HYDROLOGICAL STUDIES IN MASSACHUSETTS,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
George R. Higgins.
Publication No 6, termination report, Water Resources Research Center, June 30, 1968. 36 p, 17 ref, 1 append. OWRR Project A-003-Mass.

Descriptors: *Storage-yield relations, *Evaporation, Hydrologic response, Stream flow synthesis, Mathematical modelling.

The progress to date for Project WR - 3 is described in this report. Results of yield studies on Massachusetts streams, initiation of evaporation studies on Quabbin Reservoir and applications of hydrologic techniques to existing data are presented along with recommendations for future studies. Computer applications to the Rippl diagram for storage-yield relations have been conducted and include manipulations of the periods of analysis, variations in the time of beginning of the water year, and storage-yield plots that emphasize the impact of the 1961-67 drought. An evaporation station has been established on Quabbin Reservoir and useful data concerning radiation, relative humidity, and winds speeds for applications in the mass transfer and energy budget methods have been collected since June 1967. Hydrologic response functions and applications of statistical methods to hydrologic data are currently being studied for analysis and refinement of design methodology in water resource planning. It is anticipated that data collected on project WR - 3 will be applicable to a full assessment of the drought, for mathematical modelling techniques to thermal stratification, and other related projects.
W69-04131

2B. Precipitation

SODIUM-TO-CHLORINE RATIO IN HAWAIIAN RAINS AS A FUNCTION OF DISTANCE INLAND AND OF ELEVATION,
Hawaii Univ., Honolulu. Dept. of Chemistry; and Hawaii Institute of Geophysics, Honolulu.
Yuk-Bon Seto, Robert A. Duce, and Alfred H. Woodcock.
Office Naval Res 3748 (04). Work supported in major part by Office of Naval Research. J Geophys Res, Vol 74, No 4, pp 1101-1103, Feb 1969. 3 p, 1 fig, 8 ref.

Descriptors: *Chemistry of precipitation, *Precipitation (Atmospheric), Sodium compounds, Salts, Chlorides, Rainfall, Hawaii, Altitude.
Identifiers: Bromine, Iodine, Particles, Chloride ratios, Altitude-chloride ratio relations.

Sodium and chloride analyses were performed on approximately 400 rain samples collected on the windward slopes of the island of Hawaii at altitudes from 535 to 1560 m above sea level. These altitudes correspond to distances of approximately 11 to 27 km from the eastern coastline of the island. Very little variation in the Na/Cl ratio with collection altitude was observed. It was previously shown that the I/Cl and Br/Cl ratios increase with increasing collection altitude in Hawaiian rains. The present results indicate that the I/Cl and Br/Cl increases are not due to loss of chlorine from the rain or the particles incorporated into the rain but must be due to addition of iodine and bromine.
W69-03735

FOG,
Joel N. Myers.
Sci Amer, Vol 219, No 6, pp 75-82, Dec 1968. 9 p, 15 fig.

Descriptors: *Fog, *Fog dispersion, Air pollution, *Smog, Smoke, *Air pollution effects, *Meteorology, *Cloud seeding, Cloud physics, Hazards, Drops (Fluids), Atmospheric pollution, Artificial precipitation, Haze, *Weather modification, Air pollution, Clouds, Atmospherics, Mist.
Identifiers: Air pollution control, Atmospheric research.

Fog is simply a cloud on the ground, composed of tiny water droplets, or more rarely, ice crystals. Fog is a growing problem to man, presenting hazards to travel, increasing air pollution, and in combination with air pollution, may modify the climate and upset the delicate balance of man's ecosystem. The incidence, duration, and probably the intensity of fogs vary directly with the amount of air pollution and industrial activity in the area involved. The smogs of urban areas and the lethal fogs in London and Pennsylvania are described. The formation and meteorological classification of fog, and effects on air pollution are discussed. Methods for dissipating fogs are reviewed; no universally practicable method has been found. The most promising method appears to be seeding the fog with a catalyst or agent, causing the droplets to grow large enough to fall. Artificial fog dissipation is costly and much might be done to prevent the formation of fog. Developing fog prevention and dispersal methods may lead to eventual solution of the fog problem, but success will depend on achieving an effective control over pollution of air and water. (USBR)
W69-03786

AUGMENTING COLORADO RIVER BY WEATHER MODIFICATION,
Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 03B.
For abstract, see .
W69-03950

RAINFALL DISTRIBUTION OVER DISSECTED TERRAIN IN SOUTHWESTERN WISCONSIN,
Forest Service (USDA), St. Paul, Minn. North Central Forest Experiment Station.
Richard S. Sartz.
Water Resources Res. 1966, 2 (4): 803-809, illus.

Descriptors: *Precipitation (Atmospheric), *Micrometeorology, *Storms, *Topography, *Wind velocity, Distribution patterns, Climatic data, Valleys, Slopes, Small watersheds, Weather patterns.

Rainfall studies on the Coulee Experimental Forest in southwestern Wisconsin have shown that the dissected terrain of the area has only a small effect on annual point rainfall. On a steep ridge, rain gages on the windward side caught 3% less rain than gages on the leeward side. The difference for the storms of 0.5-inch precipitation or more was only 2%. A comparison of rainfall caught by ridge and valley gages indicated that ridge gages tended to catch more, but these differences were also small. Thus, rainfall on the experimental forest varies from place to place, but the differences probably result more from normal storm variation than from topographic effects per se.
W69-04014

SONAL PRECIPITATION AND SCALED
IL IN EASTERN NEW MEXICO,
Mexico Dept. of Game and Fish, Al-
erque.
ard Campbell.
of Wildlife Mgt, Vol 32, No 3, pp 641-644,
968. 2 tab.

riptors: *Precipitation (Atmospheric),
sonal, *New Mexico, *Game birds, *Density,
all disposition, Animal populations, Hunting,
lation analysis, Data collections, Dry seasons,
easons.
ifiers: *Scaled quail, *Quail, Correlation coef-
t.

urpose of this paper was to document a posi-
elationship between spring-summer rainfall in
n New Mexico and scaled quail population
y as indicated by hunting success during
66. It was assumed that for any large area,
r success bore a direct but not necessarily
rtional, relationship to quail density. Using
ssumption it appeared that the quail popula-
of eastern New Mexico was significantly in-
ced and perhaps controlled by spring-summer
ll. The correlation between fall-winter
pitation and hunter success was not statisti-
significant. Therefore, it seems that unlike the
ion in Arizona with respect to Gambel's quail,
inter precipitation had no important in-
ce on the scaled quail population studied. (Af-
Ariz)
04120

CARCH ON THE MORPHOLOGY OF
CIPITATION AND RUNOFF IN TEXAS,
A and M Univ., College Station. Water
rces Inst.
rt A. Clark.
nical Report No. 15, Feb 1969. 96 p, 16 tab,
g, 48 ref, 1 append. OWRR Project A-002-

riptors: *River forecasting, *Rainfall-runoff
onships, Radar meteorology, Hydrograph
sis, Forecasting, *Stochastic processes,
e Carlo method, *Hurricanes.

project has consisted of two distinct phases:
quipment modification and installation with
iated collection and (2) analyses of data plus
opment of hydrologic techniques. Errors in-
t in the utilization of radar as a hydrologic
r are discussed. It is shown that errors in the
urement of in-cloud liquid water content can
much as 100 per cent. Similar results will be
ned in the measurement of rainfall rates by
ier radar. It is demonstrated that radar can be
quite effectively in the synthesis of hydro-
s. In particular, the feasibility of using radar
eamflow forecasting has been tested for the
Washita River in Oklahoma. The results were
encouraging. Techniques for hydrograph
esis are discussed. These have been combined
a stochastic model (which incorporates a
order Markov chain) for rainfall-runoff simu-
. The proposed model has been tested
ughly and appears to hold promise as a
asting tool. A study was made of Hurrican
h which produced extremely heavy precipita-
n south Texas and fostered an unprecedented
er of tornadoes. The injection of dry air into
rea northeast of the parent cyclone was ap-
tly responsible for the extreme instability and
opment of a large number of tornadoes in that
n.
04135

Snow, Ice, ND Frost

CIER OUTBURST FLOODS IN THE
FIC NORTHWEST,
gical Survey, Tacoma, Wash.
ld Richardson.
Geol Surv Res 1968, Prof Pap 600-D, pp D79-D86, 1968. 8 p, 3 fig, 6 ref.

Descriptors: *Floods, *Glaciers, *Melt water, Mudflows, Disasters, Debris avalanches, Landslides.
Identifiers: Glacier outburst floods.

Glacier outburst floods, not uncommon in the Pacific Northwest in late summer or fall, are sometimes triggered by heavy rain but may occur even during a rainless period. Associated mudflows often compound the destruction downstream. Outburst floods are particularly hazardous at Mount Rainier, Washington, where debris flows are reported to occur at a rate of 1 in 3-10 yr. Several floods witnessed at Mount Rainier were much larger, than expected from direct storm runoff or release of water temporarily impounded by landslides. The principal source of those floods is believed to have been the large volumes of water that are stored at times within and beneath glacier. At present there is no known way of predicting glacier outburst floods. Conceivably, their imminence might be indicated by measurements of englacial water pressure, and their potential size would be indicated by determinations of the volume of water stored in glaciers. (Knapp-USGS)
W69-03741

RIME AND HOARFROST IN UPPER-SLOPE FORESTS OF EASTERN WASHINGTON,
Forest Service (USDA) Wenatchee, Wash. Pacific Northwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 02I.
For abstract, see .
W69-03807

2D. Evaporation and Transpiration

EVAPORATION STUDY AT SHARP STATION POND NEAR BATON ROUGE, LOUISIANA,
Geological Survey, Baton Rouge, La.
Fred N. Lee.
La Dep Public Works Tech Rep No 4, 1969. 13 p, 4 fig, 3 tab, 4 ref.

Descriptors: *Evaporation, *Evapotranspiration, *Mass transfer, Water balance, Seepage, Regression analysis, Louisiana.
Identifiers: Mass transfer coefficient.

The mass-transfer coefficient, n, for the evaporation equation used by the U. S. Geological Survey was determined by regression analysis of data from a 2 1/2 acre pond near Baton Rouge, Louisiana. The value of N = 0.00041, obtained from analysis of data from 5 years of study, 1962-7, compares well with values from 2 other humid sites in Florida and North Carolina, but is slightly greater than would be expected in similar size ponds in a more arid climate. Seasonal variation of the combined effects of inseepage, outseepage, and evapotranspiration was determined to be as much as +0.003 ft per day in summer and -0.005 ft per day in winter, applied to a base loss of 0.0048 ft per day. (Knapp-USGS)
W69-03731

MEASUREMENT OF NATURAL EVAPORATION: COMPARISON OF GRAVIMETRIC AND AERODYNAMIC METHODS,
British Meteorological Office, Cambridge (England). Research Unit.
M. J. Blackwell, and J. B. Tyldesley.
UNESCO, Arid Zone Research, Vol 25, pp 141-148, 1968. 8 p, 3 fig.

Descriptors: *Evaporation, Energy budget, Meteorological data, Heat transfer, Lysimeters, Arid lands, Fluctuation, Instrumentation, Water loss, *Measurement, *Gravimetry, Data processing, Water vapor, Temperature, Equations, Stability, Latent heat.
Identifiers: *Aerodynamics, Sensible heat.

Aerodynamic and energy balance methods of measuring natural evaporation from land surfaces were compared. The modern weighing lysimeter was used in the experiment to determine relative merits of the two methods for evaluating water losses. Suggestions were made for extending their use in arid regions. The aerodynamic method can be modified for more general application by including an empirical correction for stability, and this was recommended particularly for arid zone studies. The energy balance approach could also be modified by allowing for variation of eddy diffusivities for heat and water vapor at large negative Richardson numbers. Both methods were exacting in instrumental techniques, and it may be necessary to combine some aspects of both when horizontal gradients of temperature and humidity are no longer small. This is likely to be the case in normally arid areas, near the boundary of irrigated crops. when the influence of small scale advection is like.y to be significant. (Affleck-Arizona)
W69-03891

ANOTHER EVAPORATION FORMULA,
Texas A and M Univ., College Station. Dept. of Meteorology.
J. F. Griffiths.
Agricultural Meteorology, Vol 3, No 3, 4, pp 257-261, 1966. 2 fig, 1 tab.

Descriptors: *Evaporation, *Evaporation pans, *Equations, Climatology, Meteorology, Southwest U.S., Texas, Temperature, Air circulation, Data collections, Regression analysis.
Identifiers: *Formulae, Parameters, Evaporation equation.

The object of the investigation was to derive some simple equation for evaporation using standard meteorological parameters that could be applied in areas of the southwestern United States and would have an accuracy within the requirements of practical demands. The study considered the logic of the evaporation equation and stressed need for a realization of the accuracy required and the practical aspects of the problem. Mean monthly pan evaporation figures for a number of stations in Texas disclosed an apparently close relationship between evaporation, mean temperature and air flow. The study showed that over certain large areas of the Southwest, a very simple evaporation equation is of adequate accuracy for practical purposes. (Blecker-Ariz)
W69-04107

A SYSTEM FOR SHORT INTERVAL MEASUREMENT OF EVAPOTRANSPIRATION,
New York State Agricultural Experiment Station, Geneva.
N. H. Peck, L. N. Mielke, and M. T. Vittum.
Agronomy J., Vol 59, No 6, pp 607-609, Nov-Dec 1967. 4 fig.

Descriptors: *Evapotranspiration, *Beans, *Measurement, *Sands, *Nutrients, Instrumentation, Logging (Recording), Cycling nutrients.
Identifiers: Snap beans, Peak rates, Culture beads, Sand-nutrient culture.

A sand-nutrient culture system was designed to measure evapotranspiration of snap beans under field conditions. One advantage of the system was that evapotranspiration could be measured for periods as short as 2 hours, thus permitting an accurate determination of peak rates and correlation of these peak rates with simultaneous weather. The system could be used in arid climates to measure the effect of transpiration suppression agents on vegetated areas. (Blecker-Ariz)
W69-04110

STOMATA IN RELATION TO DROUGHT RESISTANCE OF WHEAT VARIETIES,
West Pakistan Agricultural Univ., Lyallpur. Dept. of Plant Breeding and Genetics.
For primary bibliographic entry see Field 03F.
For abstract, see .
W69-04117

ECO-PHYSIOLOGICAL STUDIES ON PLANTS IN ARID AND SEMI-ARID REGIONS IN WESTERN AUSTRALIA. I. AUTECOLOGY OF RHAGODIA BACCATA (LABILL.) MOQ,
Western Australia Univ., Nedlands. Dept. of Botany.
For primary bibliographic entry see Field 03F.
For abstract, see .
W69-04118

HYDROLOGICAL STUDIES IN MASSACHUSETTS,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02A.
For abstract, see .
W69-04131

2E. Streamflow and Runoff

VELOCITY-DISTRIBUTIONS IN STRAIGHT RECTANGULAR CHANNELS,
Hydronautics, Inc., Laurel, Md.
Chin-lien Yen.
Tech Completion Rep 801-3, No 3 of 3 vol, July 1968. 17 p, 8 fig, 9 ref. OWRR 14-01-0001-1572. C-1008.

Descriptors: *Dispersion, *Open channel flow, Dimensional analysis, Turbulent flow, Laminar flow, Diffusion, Mixing, Path of pollutants, Streamflow, Viscosity, Reynolds number, Convection, Roughness (Hydraulic).
Identifiers: Longitudinal dispersion, Straight channels.

Experimental data for velocity-distributions in turbulent flow in straight rectangular channels with varying width-depth ratios and boundary roughnesses were collected from various sources and analyzed in an attempt to produce a generalized velocity-distribution for this type of channel flow. From the available data for smooth channels, it is clearly seen that when the width-depth ratio exceeds a value of about 5 a central portion of the channel, called the wall-free zone, has a velocity-distribution of 2-dimensional nature. Based on this fact, dimensional analysis is applied in search for the possible parameters to generalize the velocity-distributions in the outer-law region where viscosity plays no role in determining the flow pattern. Analysis of the available data shows that velocity-distributions correlate reasonably well for different width-depth ratios in the regions not too close to the boundaries. A dimensional analysis is also carried out for the inner-law region. It is pointed out that a unique inner-law relationship will definitely lead to the consequence that the viscous sublayer becomes thicker around the corners of a rectangular channel. Based on measured boundary shear stress, 2 examples are calculated to demonstrate the actual thickening. Some velocity-distribution data for rough rectangular channels are also presented to show a general trend of variations, but no effort was made to generalize these data because not enough data could be collected.
W69-03703

A DISCUSSION OF THE DISPERSIVITY TENSOR FOR A TURBULENT UNIFORM CHANNEL FLOW,
Hydronautics, Inc., Laurel, Md.
G. Dagan.
Tech Completion Rep 801-2, No 2 of 3 vol, June 1968. 28 p, 3 fig, 20 ref. OWRR 14-01-0001-1572. C-1008.

Descriptors: *Dispersion, *Open channel flow, Turbulent flow, Laminar flow, Diffusion, Mixing, Path of pollutants, Streamflow, Viscosity, Reynolds number, Convection.
Identifiers: *Dispersivity tensors, Mixing length, Eddy viscosity.

The turbulent mixing of a pollutant in a stream flow is described with the aid of the dispersivity tensor. In a 2-dimensional (pipe or wide channel) flow only the radial (or vertical) dispersivity coefficient is significant and is usually determined through the Reynolds analogy. The analogy is extended to a 3-dimensional (i.e. channel of arbitrary section) uniform flow. It is shown that the mixing length theory leads to the representation of the dispersivity tensor in the terms of only 2 distinct coefficients: + REPRESENTING MIXING NORMAL TO ISOVELS WHICH MAY BE FOUND THROUGH Reynolds analogy and a lateral dispersivity coefficient which has to be determined from dispersivity measurements.
W69-03704

CALCULATION OF THE DISPERSION COEFFICIENT IN STRAIGHT PRISMATIC STREAMS,
Hydronautics, Inc., Laurel, Md.
C. L. Yen, and C. Elata.
Tech Completion Rep 801-1, No 1 of 3 vol, June 1968. 25 p, 5 fig, 10 ref. OWRR 14-01-0001-1572. C-1008.

Descriptors: *Dispersion, *Open channel flow, Turbulent flow, Laminar flow, Diffusion, Mixing, Path of pollutants, Streamflow, Viscosity, Reynolds number.
Identifiers: Longitudinal dispersion, Straight channels.

A general approximate expression for the dispersion coefficient of flow in a straight prismatic conduit is developed. Dispersion coefficients are calculated for flow in a straight pipe as a function of velocity distribution and friction coefficient--neglecting the laminar sublayer. The results show that the effect of friction coefficient on the dimensionless dispersion coefficient is very slight. Calculations are also carried out for turbulent flow in a straight smooth pipe with a logarithmic velocity distribution outside and a linear distribtuion within the laminar sublayer. The effect of the laminar sublayer on the dispersion coefficient appears to be very large, with the dispersion coefficient increasing rapidly when the relative thickness of the laminar sublayer increases, i.e., when Reynolds number decreases. Actual measurements of the dispersion coefficient are usually made when the average concentration of the dispersing pollutant outside the laminar sublayer reaches a Gaussian distribution in the longitudinal direction, but the occurrence of a Gaussian distribution for the entire pollutant requires a much longer distance downstream. Calculations for the first case show remarkably good agreement with measurements assembled from several sources. To determine the effect of the geometrical configuration of conduits, dispersion coefficients are calculated in elliptical open channels with various assumed velocity distributions and width to depth ratios. It is shown that the dispersion coefficient depends heavily on velocity distribution, increasing with the average velocity defect.
W69-03705

EFFECTS OF URBAN DEVELOPMENT ON FLOODS IN NORTHERN VIRGINIA,
Geological Survey, Richmond, Va.
For primary bibliographic entry see Field 04C.
For abstract, see .
W69-03706

FLOODS IN BEECHER WEST QUADRANGLE, NORTHEASTERN ILLINOIS,
Geological Survey, Washington, D. C.
Howard E. Allen.
U S Geol Surv Hydrol Invest Atlas HA-257, 1 sheet, 1968. Text, 10 fig, 2 ref.

Descriptors: *Floods, Hydrologic data, *Flood forecasting, Frequency analysis, Discharge measurements, River flow, Streamflow forecasting, Gages, Flood plains.
Identifiers: *Northeastern Illinois, Flood profiles, Hydrologic characteristics.

Hydrologic data are presented that can be used to forecast and evaluate floods and water supply possibilities of the Beecher West Quadrangle, Illinois. On the basis of observations collected by several hydrologic stations for several years, the frequencies of flood discharges and flood stages were evaluated. The drainage areas and flood profiles of several creeks in the area were evaluated and given in conjunction with a topographic map of 1:24000 scale. The author briefly discusses the following hydrological properties of the several flood plains: flood heights; flood discharge; flood frequency; recurrence intervals; flood profiles; and additional data sources. (Gabriel-USGS)
W69-03720

STAGE MEASUREMENT AT GAGING STATIONS,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 07B.
For abstract, see .
W69-03721

WATER AVAILABILITY OF GENEVA COUNTY, ALABAMA,
Geological Survey, University, Ala.
J. C. Scott, H. G. Golden, and J. R. Avrett.
Ala Geol Surv Water Availability Map No 55, 1968. 1 sheet, text, 3 fig, 4 tab.

Descriptors: *Water resources, Groundwater, Surface waters, Water quality, Water yield, Alabama, Aquifers, Streamflow.
Identifiers: Geneva County (Alabama).

The water resources of Geneva County, Alabama are discussed in a 1-sheet water availability map and text. The 2 major aquifers in the county are artesian. The shallow aquifer, consisting of sand and limestone, yields 0.3 to 1.0 mgd per well. The deep aquifer, of gravel, sand, and limestone, yields 1.5 to 3.0 mgd per well. The water is suitable for most purposes but may in some areas be too hard or contain too much Fe and Cl for some uses. Average annual runoff is about 22 inches or 1.04 mgd per sq mi. Average streamflow is about 3,000 mgd. Surface water is soft and slightly acid. Water availability in streams and wells, depth to water, hardness of groundwater, low flow, and surface water quality are shown on maps and cross sections. Geologic units and their water-bearing characteristics are shown on a stratigraphic chart. Records of wells and springs and chemical analyses are tabulated. (Knapp-USGS)
W69-03733

WATER AVAILABILITY OF BUTLER COUNTY, ALABAMA,
Geological Survey, University, Ala.
P. C. Reed, J. C. Scott, H. G. Golden, and J. R. Avrett.
Ala Geol Surv Water Availability Map No 57, 1968. 1 sheet, text, 7 fig, 1 map, 5 tab, 1 ref.

Descriptors: *Water resources, Groundwater, Surface waters, Water quality, Water yield, Alabama, Aquifers, Streamflow.
Identifiers: Butler County (Alabama).

The water resources of Butler County, Alabama, are discussed in a 1-sheet water availability map and text. The principal aquifers in the county are sand beds in Gulf Coastal Plain Tertiary and Cretaceous sediments. The groundwater in the county is satisfactory for most uses, but some wells yield water too hard or too high in Fe for some industrial uses. The average annual runoff is about 19 inches or 0.9 mgd per sq mi. Surfaces waters of the county are generally soft and slightly acid. Water availability in streams and wells, depth to water, hardness of groundwater, low flow, iron content of groundwater, and surface water quality are shown on maps and cross sections. Geologic units and

r water-bearing characteristics are shown on a
igraphic chart. Records of wells and springs
chemical analyses are tabulated. (Knapp-
S)
-03734

WATER-BALANCE EQUATION FOR THE THDRUM PRAIRIE GROUND-WATER ERVOIR, NEAR SPOKANE, WASHING-
,
logical Survey, Washington, D. C.; and Geolog-
Survey, Boise, Idaho.
Pluhowski, and C. A. Thomas.
l Surv Res 1968, Prof Pap 600-D, pp D75-D78,
3. 4 p, 2 fig, 1 tab, 2 ref.

criptors: *Water balance, *Aquifers, *Glacial
, *Underflow, washington, Groundwater
ement, Recharge, Discharge (Water), Water
l.
tifiers: Rathdrum Prairie aquifer (Wash),
kane.

highly permeable sand and gravel deposits
h form the Rathdrum Prairie aquifer effective-
ore and transmit large quantities of ground-
r. From a water-balance equation for the
ndwater reservoir, it is estimated that un-
low from the aquifer to the Spokane Valley
ages about 1,000 cubic ft per second, or about
mgd. This water enters the Spokane River in
reach between Otis Orchards and Long Lake,
h. (Knapp-USGS)
-03740

ACIER OUTBURST FLOODS IN THE IFIC NORTHWEST,
logical Survey, Tacoma, Wash.
primary bibliographic entry see Field 02C.
abstract, see .
-03741

NERAL FIELD AND OFFICE PROCEDURES R INDIRECT DISCHARGE MEASURE-NTS,
logical Survey, Washington, D. C.
primary bibliographic entry see Field 07B.
abstract, see .
-03748

ASUREMENT OF PEAK DISCHARGE AT TH CONTRACTIONS BY INDIRECT THODS,
logical Survey, Washington, D. C.
primary bibliographic entry see Field 07B.
abstract, see .
-03753

IMATING DESIGN FLOODS FROM EX-ME RAINFALL,
rado State Univ., Fort Collins; and New South
es Univ., Kensington (Australia).
lerick C. Bell.
rado State Univ, Hydrol Pap, No 29, Ft Col-
July 1968. 21 p, 20 fig, 5 tab, 39 ref.

criptors: *Design flood, *Rainfall, *Precipita-
(Atmospheric), Watersheds (Basins),
nage basins, *Forecasting, Bibliographies,
rology, Floods, Small watersheds, Hydrologic
, Time, Time lag, Flood forecasting, Flood
rographs, Flood peaks, Design storm, Rainfall-
ff relationships, Rational formula, *Storm ru-
.
tifiers: Flood hydrology.

inct differences exist between estimating
ific floods from data on specific rainfall events
estimating design or representative floods from
fall statistics. The latter should be regarded as a
e generalized procedure in which high accura-
cannot be expected. Many physical details of
ific events are irrelevant for estimating
esentative events. A single parameter is suffi-
cient to express the time-distributing characteristics of a watershed for design purposes. The suggested parameter is the representative lag, closely related to the volume/peak ratio. For small watersheds in the western U. S., the same return period may be assigned to the design flood and the corresponding extreme rainfall. This finding is not expected to apply to all climatic situations, but may be a reasonable assumption in the absence of any other information. The rational-loss rate method is suggested for estimating extreme floods from extreme rainfall because of its simplicity, flexibility, and consistency with the requirements and limitations of the problem. This method does not give satisfactory reproductions of the 10-yr floods on the test watersheds and cannot be strongly supported by this performance. (USBR)
W69-03783

FLOOD PLAIN INFORMATION OF LEFT-HAND CREEK, VOLUME 1, BOULDER COUNTY, COLORADO.
Corps of Engineers, Omaha, Nebr.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03926

FLOOD PLAIN INFORMATION, MOJAVE RIVER (VICINITY OF BARSTOW), SAN BERNARDINO COUNTY, CALIFORNIA.
Corps of Engineers, Los Angeles, Calif.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03927

FLOOD PLAIN INFORMATION, AUGLAIZE RIVER, WAPAKONETA, OHIO.
Corps of Engineers, Detroit, Mich.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03928

FLOOD PLAIN INFORMATION, ALLEGHENY RIVER, LITTLE VALLEY AND GREAT VALLEY CREEKS, SALAMANCA, NEW YORK.
Corps of Engineers, Pittsburgh, Pa.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03929

FLOOD PLAIN INFORMATION, OUACHITA RIVER, WEST MONROE, LOUISIANA.
Corps of Engineers, Vicksburg, Miss.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03930

FLOOD PLAIN INFORMATION, CONCORD AND SHAWSHEEN RIVERS, BEDFORD, MASSACHUSETTS.
Corps of Engineers, Waltham, Mass.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03931

FLOOD PLAIN INFORMATION-SOUTH FORK EEL RIVER, WEOTT TO MYERS FLAT, HUMBOLDT COUNTY, CALIFORNIA.
Corps of Engineers, San Francisco, Calif.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03932

FUTURE IRRIGATION DEMAND IN THE SUSQUEHANNA BASIN,
Chesapeake Bay-Susquehanna Rivers Basins Project, Susquehanna Field Station.
For primary bibliographic entry see Field 03F.
For abstract, see .
W69-03934

SURFACE IRRIGATION HYDRAULICS-KINEMATICS,
California Univ., Davis. Dept. of Water Science and Engineering; and Washington State Univ., Pullman. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 03F.
For abstract, see .
W69-03936

WATER RESOURCES OF WISCONSIN, FOX-WOLF RIVER BASIN,
Geological Survey, Washington, D. C.
Perry G. Olcott.
Geol Surv Hydrol Invest Atlas HA-321, 4 sheet, 1968. 13 map, 4 tab, 21 ref, text.

Descriptors: *Water resources, *Surface waters, *Groundwater, *Wisconsin, Water wells, Hydrologic data, Aquifers, Water quality, Streamflow, Hydrographs, Flow characteristics, Water utilization.
Identifiers: Fox River (Wis), Wolf River (Wis).

The water resources of the Fox-Wolf River basin, Wisconsin are described in a 4-sheet reconnaissance hydrological atlas. A generalized hydrologic budget of the basin is shown graphically. Groundwater availability, movement, and quality are shown on maps. Surface water discharge, high-flow recurrence, low-flow recurrence, and quality-discharge relations are shown graphically and by maps. Chemical analyses are tabulated. In general, both ground- and surface water are more available and at higher quality in outwash areas and less in lake-bed and ground moraine areas. Industry and commerce use about 65% of the water withdrawn in the area, municipalities about 20%, and stock rural domestic, and irrigation about 15%. Use is summarized by a map and a table. Recreational use is also summarized by a map and a table. Pollution is a problem in the lower Fox River. Saline water intrusion from aquifers in the SE part of the basin is possible if local areas are over pumped. Groundwater is generally hard. Geology, lithology of aquifers, water-bearing properties of aquifers, streamflow characteristics, and quality of ground- and surface water are summarized in a table. (Knapp-USGS)
W69-03939

ROLE OF IRRIGATION IN THE WEST'S EXPANDING ECONOMY,
Bureau of Reclamation, Washington, D. C.
For primary bibliographic entry see Field 03F.
For abstract, see .
W69-03940

INDEX OF SURFACE-WATER RECORDS TO SEPTEMBER 30, 1967. PART 8- WESTERN GULF OF MEXICO BASINS,
Geological Survey, Washington, D. C.
H. P. Eisenhuth.
Geol Surv Circ No 578, 1968. 51 p, 1 fig.

Descriptors: *Data collections, Gaging stations, Flow measurement, Stream gages, Gulf Coastal Plain, Discharge measurement, Streamflow.
Identifiers: Index of gaging stations, Western Gulf of Mexico basin.

The streamflow and reservoir stations in th Western Gulf of Mexico basins for which records have been or are to be published in reports of the Geological Survey are listed for periods through September 30, 1967. In addition to the continuous-record gaging stations, crest-stage and low-flow partial-record stations are included. A continuous-record station is a gaging station on a stream of reservoir for which the discharge, stage, or contents is published on a daily, weekly or monthly basis for a continuous period of time. A crest-stage partial-record station is a streamflow station for which only the annual maximum discharge is published over a period of years for use in flood-flow analyses. A low-flow partial-record station is a streamflow station for which only discharge measurements made at base flow, when streamflow is

primarily from ground-water storage, are published. Measurements are generally collected over a period of 5 yr or more for use in low-flow analyses. Discharge measurements have been made at many sites and published as miscellaneous measurements. Such measurements are not included except those made in earlier years at sites now classified as low-flow partial-record stations. (Knapp-USGS)
W69-03942

FLUOROMETRIC PROCEDURES FOR DYE TRACING,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 07B.
For abstract, see .
W69-03944

MEASUREMENT OF PEAK DISCHARGE AT DAMS BY INDIRECT METHODS,
Geological Survey, Washington, D. C.
Harry Hulsing.
Geol Surv Tech Water-Resources Invest, Book 3, Chapter A5, 1968. 29 p, 25 fig, 4 tab, 12 ref.

Descriptors: *Stream gages, *Discharge measurement, *Weirs, *Stage-discharge relations, Control, Spillway crests, Dams, Embankments, Submergence.
Identifiers: Technical manuals, Stream gaging, Submergence effects, Sharp-crested weirs, Broad-crested weirs, Round-crested weirs.

Procedures used by the U. S. Geological Survey for measuring peak stream discharges using dams, weirs, and embankments are described. Field and office procedures limited to this method are discussed. Discharge coefficients and formulas are given for 3 general classes of weirs - sharp-crested, broad-crested, and round-crested - and for highway embankments and weirs of unusual shape. The effects of submergence are defined for most forms. (USGS)
W69-03945

HYDROLOGIC DATA: 1967 - VOLUME 1: NORTH COASTAL AREA.
California State Dept. of Water Resources, Sacramento.
For primary bibliographic entry see Field 02F.
For abstract, see .
W69-03951

MINERAL AND WATER RESOURCES OF BARBOUR COUNTY, ALABAMA,
Alabama Geological Survey, University; and Geological Survey, Washington, D. C.
P. E. LaMoreaux, R. M. Alverson, J. G. Newton, W. E. Smith, and W. J. Powell.
Geol Surv of Ala Inform. Ser 37, 1968. 41 p, 11 fig, 5 tab, 17 ref.

Descriptors: *Water resources, Groundwater, Surface waters, Water quality, Alabama, Streamflow, Runoff, Water wells, Aquifers.
Identifiers: Barbour County (Ala), Water availability.

The water resources of Barbour County, Alabama, are surveyed as part of a report of the county's total resources. Annual precipitation in the county averages over 40 inches. Groundwater availability is shown on maps and cross sections. Generally the south-dipping coastal plains sediments yield large amounts of water, which may in some wells be very hard or have a high iron content. Average annual surface runoff is about 18 in. or 0.85 mgd per sq mi. The average flow of the Chattahoochee River at Eufaula is about 6,600 mgd. Stream water is soft, low in chloride content, and slightly acid. It should be satisfactory for most industrial uses. Low flow, average flow, and chemical character are shown on maps. Geologic units and their water-bearing characteristics are shown in a stratigraphic chart. Records of wells and springs, chemical analyses, and streamflow data are tabulated. (Knapp-USGS)
W69-03952

RIVER ADJUSTMENT TO ALTERED HYDROLOGIC REGIMEN-MURRUMBIDGEE RIVER AND PALEOCHANNELS, AUSTRALIA,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02J.
For abstract, see .
W69-03957

MEASUREMENT OF PEAK DISCHARGE BY THE SLOPE-AREA METHOD,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 07B.
For abstract, see .
W69-03967

QUALITY OF SURFACE WATERS FOR IRRIGATION, WESTERN STATES, 1963,
Geological Survey, Washington, D. C.
S. K. Love.
Geol Surv Water-Supply Pap 1952, 1967. 148 p, 2 fig, 1 plate, 18 ref.

Descriptors: *Water quality, *Irrigation, *Surface waters, Drainage, Chemical analysis, Salinity, Sodium, Rivers, River basins, Hydrogeology.
Identifiers: *Hudson Bay, *Mississippi River basin, *Colorado River basin, Snake River basin, Missouri River basin, Yellowstone River basin.

This thirteenth annual compilation of data for 73 irrigation network stations on streams west of the Mississippi River contains records of chemical analyses, other physical measurements, and discharge. Together with Geological Survey Water-Supply Papers 1264 and 1361, for the years 1951 and 1952 respectively, it provides comprehensive information about the chemical quality of surface waters used for irrigation and the changes resulting from the drainage of irrigated lands. Tabular data are presented on periods of operation and water samples analyzed with particular reference to the use of water from these streams for irrigation. To complement the graphic data, the criteria of water quality used here is briefly outlined. The salinity and sodium classifications are also described. (Llaverias-USGS)
W69-03968

ROUGHNESS CHARACTERISTICS OF NATURAL CHANNELS,
Geological Survey, Washington, D. C.
Harry H. Barnes, Jr.
Geol Surv Water-Supply Pap 1849, 1967. 213 p, 100 photo, 50 tab, 50 sketch, 13 ref, index.

Descriptors: *Roughness (Hydraulic), *Roughness coefficient, *Photography, Remote sensing, Data collections, Channels, Open channel flow.
Identifiers: *Natural channels, *Photohydrology, Channel conditions.

Color photographs and descriptive data are presented for 50 stream channels for which roughness coefficients have been determined. Computations of open channel flow require an evaluation of channel roughness characteristics. This evaluation remains chiefly an art when a satisfactory quantitative procedure is lacking. Typical channels with known roughness coefficients are described, sketched, and shown in cross sections. The 100 photographs and data represent a wide range of channel conditions. Familiarity with the appearance, geometry, and roughness characteristics of these channels will improve the engineer's ability to select roughness coefficients for other channels. (Llaverias-USGS)
W69-03978

COMPILATION OF THE MAXIMUM STREAMFLOWS OF SNOWMELT WATERS IN USSR RIVERS (RUSSIAN),
A. A. Sokolov.
Leningrad, USSR, Gidrometeorologicheskoye Izdatel'stvo, 1967. 195 p.

Descriptors: *Hydrology, *Snowmelt, *River systems, *Hydrological characteristics, *Maximum probable flood, Parametric hydrology, River flow, River forecasting, Runoff coefficient, Mathematical models, Frequency analysis.
Identifiers: USSR Rivers.

Runoff of snowmelt waters was investigated by using data compilation from a network of hydrological stations that represent conditions for both mountain and plain types of river basins. Statistical and graphical methods were used to evaluate the volume of maximum runoff and various parameters and coefficients. The report is mostly a tabulation of information including drainage area, maximum and mean flow, and other hydrological parameters. It is based on the use of data recorded by 2370 hydrologic stations located in European Russia and Siberia. (Gabriel-USGS)
W69-03981

HYDROLOGIC CHARACTERISTICS OF SOIL TYPES,
Agricultural Research Service, Beltsville, Md. Soil and Water Conservation Research Div.
H. N. Holtan, Charles B. England, and D. E. Whelan.
J Amer Soc Civil Engin, Irrigation and Drainage Div, Vol 93, No IR3, pp 33-41, 1967. 9 p, 3 tab, 1 fig, 4 ref.

Descriptors: *Infiltration, Physical properties, Soil texture, *Soil types.
Identifiers: Northeast U S soils.

Physical properties of soil types are used to establish soil moisture volumes of gravitational and plant-available water above an impeding layer or horizon of the soil profile. Examples of soil moisture volumes are presented in tabular form for soil types representative of the Northeastern States. Volume of watershed retentions for specific conditions can be predicted by subtracting antecedent soil moisture from the total potential soil moisture storage above the impeding horizon and adding the volume of water percolating through the control horizon. (England-USDA Hydro Lab)
W69-04011

CONCEPTS IN HYDROLOGIC SOIL GROUPING,
Agricultural Research Service, Beltsville, Md. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 02G.
For abstract, see .
W69-04013

ABUNDANCE AND CHARACTER OF MICROSESTON IN A CALIFORNIA MOUNTAIN STREAM,
Bureau of Sport Fisheries and Wildlife, Bishop, Calif.
J. A. Maciolek.
Verh Int Ver Limnol, Vol 16, pp 639-645, Dec 1966.

Descriptors: *California, *Streams, *Seston, Detritus, Diatoms, Grazing, Invertebrates, Lakes, Oligotrophy, Organic matter, Periphyton, Phytoplankton, Primary productivity, Secondary productivity, Streamflow, Trophic level, Trout.
Identifiers: *Microseston, Sierra Nevada (Calif), Convict Creek (Calif), Convict Lake (Calif), Mono County (Calif), Lake-stream systems, Trophodynamics, Simuliidae, Potamoplankton, Synedra, Asterionella, Fragillaria, Autochthonous sources, Allochthonous sources.

Secondary production in mountain streams largely depends upon microseston abundance. Author studied microsestonic changes over 13-month interval, beginning September 1962, in a Sierra Nevada, Calif, lake-stream system (Convict Creek drainage). Samples (125), collected at one principal and several reference stations several times per day at weekly intervals, were analyzed by wet dichromate oxidation for microseston (milli-

ıs/liter). Microsestonic characteristics were ntified from area-weighted counts of micro-ic preparations. Total microseston varied from in autumn to 2.1 mg/liter just prior to peak mflow (about 3-1/4 cubic meters/second) in spring. Organic detritus dominated the oseston (annual mean - 60%), while miscel-ous microorganisms remained at 20% rather tantly, and lacustrine diatoms varied 0-50% an - 20%). Author estimates about 20% of oseston was autochthonous, 30-40% nated from lake, and 40-50% derived from mside or more distant sources. Cyclic fluctua-in microseston during cold winter days corre-d with diel flow patterns induced by ice forma-. Filter-feeding invertebrates had rather con-t food supplies, populations being partially ted by minimal 0.5 mg/liter and not exploiting sses above 1 mg/liter because of high stream-. Exploitation may also be limited by size and ity of populations. Food quality may govern duction.
9-04031

DROLOGICAL STUDIES IN MAS-CHUSETTS,
sachusetts Univ., Amherst. Dept. of Civil En-ering.
primary bibliographic entry see Field 02A.
abstract, see .
9-04131

SEARCH ON THE MORPHOLOGY OF ECIPITATION AND RUNOFF IN TEXAS,
as A and M Univ., College Station. Water ources Inst.
primary bibliographic entry see Field 02B.
abstract, see .
9-04135

. Groundwater

AILABILITY OF GROUND WATERS IN THE RTHERN PART, TENMILE AND TAUNTON VER BASINS, SOUTHEASTERN MAS-CHUSETTS,
ological Survey, Washington, D. C.
n R. Williams.
ol Surv Hydrol Invest Atlas HA-300, 1 sheet, 68. 1 map, 1 tab, 6 ref, text.

scriptors: *Aquifers, *Groundwater, *Hydrolog-properties, *Aquifer characteristics, Water rces, Water supply, Water chemistry, Water ta-, Water properties, Water resources, Pumped rage, Swamps.
ntifiers: *Southeastern Massachusetts, Taunton sin, Tenmile Basin.

oundwater resources of the northern part of the nmile and Taunton River basins were in-tigated and plotted on a map of 1:24000 scale ing the availability of groundwater in the area by ng various shades of blue color indicating a gree of availability of groundwater. The aquifers sent in the area are subdivided into the principal l lesser ones. In their turn the principal and ser aquifers are subdivided into sources of large, derate, and favorable to the development of ge or moderate supplies of water. The map con-ns a comprehensive description of geological perties of water-bearing formations and a brief emical analysis of the aquifer waters. Estimated nual sustained yields and pumpage of principal uifers are also given. (Gabriel-USGS)
69-03723

ATER AVAILABILITY OF GENEVA COUN-Y, ALABAMA,
ological Survey, University, Ala.
r primary bibliographic entry see Field 02E.
r abstract, see .
69-03733

WATER AVAILABILITY OF BUTLER COUNTY, ALABAMA,
Geological Survey, University, Ala.
For primary bibliographic entry see Field 02E.
For abstract, see .
W69-03734

THEORETICAL ANALYSIS OF TWO-DIMENSIONAL, TRANSIENT FLOW OF WATER IN UNSATURATED AND PARTLY UNSATURATED SOILS,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 02G.
For abstract, see .
W69-03736

THERMAL AND SEISMIC INDICATIONS OF OLD FAITHFUL GEYSER'S INNER WORKINGS,
Environmental Science Services Administration, Boulder, Colo. Research Labs.
John S. Rinehart.
J Geophys Res, Vol 74, No 2, pp 566-573, Jan 1969. 8 p, 12 fig, 5 ref.

Descriptors: *Geysers, Thermal water, Seismic studies, Geothermal studies, Heat flow, Temperature, Groundwater movement, Boiling.
Identifiers: Old Faithful Geyser, Yellowstone National Park, Eruption mechanism, Thermal profile.

Recent temperature measurements within Old Faithful combined with earlier seismic data provide a fairly broad knowledge of the mechanics of the geyser's action. The geyser tube which is surprisingly deep, probably deeper than 175 m fills suddenly shortly after an eruption. Initially the water in the whole tube superheats, but the upper 60 m soon cools as the boiling works its way downward. Finally, the hotter water below the 60m level rises to the top fairly rapidly, again superheating the water in the upper regions, causing the eruption to start. The boiling rapidly cascades downward, thrusting water from the reservoir to continue the eruption.
W69-03737

GROUNDWATER DISCHARGE TOWARD GREAT SALT LAKE THROUGH VALLEY FILL IN THE JORDAN VALLEY, UTAH,
Geological Survey, Salt Lake City, Utah.
R. W. Mower.
Geol Surv Res 1968, Prof Pap 600-D, pp D71-D74, 1968. 4 p, 2 fig, 1 tab, 4 ref.

Descriptors: *Groundwater movement, *Discharge (Water), Aquifers, Artesian wells, Utah, Great Salt Lake, Seismic studies, Darcys law.
Identifiers: Jordan Valley (Utah), Valley fill aquifer.

Groundwater in the northern part of the Jordan Valley is principally under artesian conditions in valley fill of Quaternary age consisting of clay, silt, and sand. The water is moving generally toward the southeast shore of Great Salt Lake. The computed quantity of water discharging into Great Salt Lake from the valley fill in the northern part of the Jordan Valley is estimated to be a maximum of 7,000 acre-ft per year. (Knapp-USGS)
W69-03739

GROUNDWATER CONDITIONS AND GEOLOGIC RECONNAISSANCE IN THE UPPER SEVIER RIVER BASIN, UTAH,
Geological Survey, Washington, D. C.
C. H. Carpenter, G. B. Robinson, Jr., and L. J. Bjorklund.
Geol Surv Water-Supply Pap 1836, 1967. 91 p, 6 fig, 3 plate, 19 tab, 46 ref, index.

Descriptors: *Surface-groundwater relationships, *Pumping, *Permeability, Water table, Utah, Confined water, River Basins.
Identifiers: *Sevier River basin, Valley fill.

The four main valleys comprising the Upper Sevier River basin, Utah, were investigated to determine general groundwater conditions, the interrelation of groundwater and surface water, the effects of increasing the pumping of groundwater, and the amount of groundwater in storage. The valley fill, which is predominantly alluvium of sand, silt, and clay, has a maximum thickness of more than 800 ft. An average of about 25% of the valley fill is permeable sand and gravel which yields water readily to wells and springs. Groundwater occurs under both artesian and water-table conditions in all basins and subbasins. Along the sides and upstream ends of these basins, water is usually under water-table conditions. Additional water, although not readily available to wells, is stored in beds of silt and clay. Some groundwater also is available in the bedrock underlying and surrounding the basins, although the bedrock formations generally are poor aquifers. (Llaverias-USGS)
W69-03750

LAND SUBSIDENCE IN PLEASANT VALLEY AREA, FRESNO COUNTY, CALIF.,
Bureau of Reclamation, Sacramento, Calif.
Nikola P. Prokopovich, and David C. Magleby.
J Amer Water Works Ass, Vol 60, No 4, pp 413-424, Apr 1968. 12 p, 9 fig, 4 tab, 5 ref.

Descriptors: *Land subsidence, Central Valley Project, Groundwater, *Groundwater mining, Engineering geology, Alluvium, *Subsidence, Oil fields, Oil wells, Irrigation wells, Irrigation, Irrigation effects, Agriculture, *Overdraft, Settlement.
Identifiers: Central Valley (Calif), Gas production, *Overpumping, Irrigated agriculture.

Pleasant Valley is a young structural depression in the eastern foothills of California Coastal Ranges, with an alluvium blanket covering about 60 sq m. The regional geology and stratigraphy have been studied extensively, but little data are available on the stratigraphy and occurrence of the valley fill. The unconsolidated recent alluvium is several hundred feet thick and composed of interbedded sand, silt, and clay. Main causes of subsidence include: overdraft of ground water, withdrawal of crude oil and gas, oxidation and alteration of peat, and hydrocompaction. The first 2 causes are major contributors to the subsidence. Irrigation overdraft of ground water cannot explain subsidence in dry range lands surrounding the valley. Several oil and gas fields scattered around the valley are probably responsible for the minor subsidence in hills. Some subsidence in the valley in areas of oil fields could be partially related to the pumpage of oil and gas. Recent acceleration of subsidence in Coalinga, Calif., indicates that most subsidence is related to the overdraft of ground water. Comparisons of 1887 railroad elevations with 1955 elevations indicate about 4.5 ft subsidence at Coalinga and 7 ft subsidence in the Pasajero Gap during that interval. (USBR)
W69-03797

CITY OF FOND DU LAC V TOWN OF EMPIRE (VALIDITY OF MUNICIPAL ORDINANCE REGULATING THE DRILLING OF WELLS).

273 Wisc 333, 77 N W 2d 699-703 (1956).

Descriptors: *Wisconsin, *Municipal water, *Legislation, *Well regulations, Judicial decisions, Water law, Cities, Wells, Water sources, Water supply, Well casings, Drilling, Groundwater, Water wells, Overdraft, Legal aspects, Casings, Subsurface waters, Water utilization.
Identifiers: Ordinances.

This action was brought for a declaratory judgment as to the validity of a town ordinance which prohibited the drilling of a water well in the town with casings in excess of six inches in diameter except by permission of the town board. Such permission would only be granted upon a showing that the well would not adversely affect the availability of water for private wells in the town. The City of Fond Du Lac was trying to drill wells in the Town

of Empire for a new water source. The trial court held that the ordinance was invalid and the Supreme Court of Wisconsin affirmed because it conflicted with state statutes which indicated that the use of subterranean waters is a matter of statewide concern and which authorize a municipality to acquire necessary water supplies. (Watson-Fla)
W69-03902

GROVE LABORATORIES V FLOWOOD CORP (WELL WATER RIGHTS CONTRACT INTERPRETATION).
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-03911

MINERAL SPRINGS OF THE DAYLESFORD DISTRICT,
Melbourne Univ., Parkville (Australia). Dept. of Geology.
For primary bibliographic entry see Field 02K.
For abstract, see .
W69-03933

COMPUTATIONAL SCHEMES FOR THE BOUSSINESQ EQUATION,
California Univ., Davis. Dept. of Water Science and Engineering.
For primary bibliographic entry see Field 07C.
For abstract, see .
W69-03937

MODEL STUDY OF BOUNDARY EFFECTS ON DITCH DRAINAGE,
North Carolina State Univ., Raleigh. Dept. of Biological and Agricultural Engineering.
For primary bibliographic entry see Field 02G.
For abstract, see .
W69-03938

WATER RESOURCES OF WISCONSIN, FOX-WOLF RIVER BASIN,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02E.
For abstract, see .
W69-03939

SUBSURFACE DRAINAGE BY TRANSIENT-FLOW THEORY,
Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 02G.
For abstract, see .
W69-03941

FLUOROMETRIC PROCEDURES FOR DYE TRACING,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 07B.
For abstract, see .
W69-03944

SP LOG INTERPRETATION IN SHALY SANDS,
Koninklijke/Shell Exploratie en Produktie Laboratorium, Rijswijk (Netherlands).
For primary bibliographic entry see Field 07B.
For abstract, see .
W69-03946

HYDROLOGIC DATA: 1967 - VOLUME 1: NORTH COASTAL AREA.
California State Dept. of Water Resources, Sacramento.

Calif Water Resources Bull No 130-67, Nov 1968. 79 p, 3 fig, 16 tab.

Descriptors: *Data collections, *Groundwater, *Surface waters, *Water quality, Water levels, Discharge (Water), California, Climatic data.
Identifiers: North Coastal Area (Cal).

Data on climate, surface water flow, groundwater levels, and surface-and groundwater quality are compiled for the North Coastal Area of California, 1967. Climate data include precipitation, temperature, and evaporation. Surface water data include daily stream discharges, gaging station locations, and summary tables of monthly and annual unimpaired runoff from major streams. Groundwater data consist of water level measurements from 50 wells and a table which summarizes the measurements. Water quality data include dissolved oxygen, pH, and temperature at the time of collection, as well as laboratory chemical analysis reports. (Knapp-USGS)
W69-03951

MINERAL AND WATER RESOURCES OF BARBOUR COUNTY, ALABAMA,
Alabama Geological Survey, University; and Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02E.
For abstract, see .
W69-03952

ON THE MAINTENANCE OF ANOMALOUS FLUID PRESSURES: 1. THICK SEDIMENTARY SEQUENCES,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02J.
For abstract, see .
W69-03954

GEOLOGY AND GROUND-WATER RESOURCES OF THE MURPHY AREA, NORTH CAROLINA,
Geological Survey, Raleigh, N. C.
Chester L. Dodson, and R. L. Laney.
Groundwater Bull No 13, N C Dep Water and Air Resources, Aug 1968. 113 p, 17 fig, 18 tab, 16 ref.

Descriptors: *Water resources, *Groundwater, *North Carolina, *Hydrologic data, Water quality, Aquifers, Water level fluctuations, Water utilization.
Identifiers: *Murphy area (N C), Cherokee County (N C), Clay County (N C), Swain County (N C), Graham County (N C).

The groundwater resources of Cherokee, Clay, Graham, and Swain Counties, N. C., are described. The area is in the Blue Ridge physiographic province and is underlain by metamorphic rocks. The groundwater is in unconsolidated alluvium, fractures in metamorphic silicate rocks, and in solution cavities in marble. The rural population uses water from springs and wells. Recharge greatly exceeds the present water use of less than 1 1/2 mgd. Groundwater is soft and slightly acid, total dissolved solids concentration is less than 100 ppm, and iron concentration is less than 0.3 ppm. Maps show geology, the distribution of 5 quality-types of groundwater, and locations of wells and springs. Water level fluctuations are shown in observation well hydrographs. (Knapp-USGS)
W69-03959

GEOLOGY AS A GUIDE TO REGIONAL ESTIMATES OF THE WATER RESOURCE,
New Jersey Geological Survey, Trenton. Dept. of Conservation and Economic Development.
Kemble Widmer.
N J Bur Geol and Topogr, Geol Rep Ser No 8, 1968. 15 p, 2 fig, 1 tab, 11 ref. Published also in Proc of Int Conf on Water for Peace, Wash., D. C. May 23-31, 1967. (Vol 4, pp 915-925).

Descriptors: *Water resources, *Groundwater, *New Jersey, Aquifers, Geology, Water resources development, Water wells, Delaware River, Hudson River, Atlantic Ocean.
Identifiers: Groundwater provinces, Water resource peninsula.

Recent studies of groundwater geology published by the New Jersey Geological Survey were designed to provide information by which municipalities, counties, or regional planning groups can estimate the upper limits of groundwater resource in the area of interest. New Jersey is a water resource peninsula between the Delaware River and Bay on the west and the Hudson River and Atlantic Ocean on the east. Water development plans for New Jersey are limited to its own area and its share of any Delaware River development. The geologic conditions within the State establish 5 groundwater provinces with widely divergent potentials and problems. Three-fifths of New Jersey is a coastal plain whose low relief severely limits surface water development, while groundwater is abundant and easily utilized. Estimates of the groundwater potential should not only be based on the outcropping of a formation and the usual geologic and hydrologic factors, but also upon the area within which wells may be constructed to utilize the various sand formations. The northern 2/5 of the State are underlain by rock formations in 3 groundwater provinces where fissure water conditions prevail. The glaciated part of northeastern New Jersey forms a fifth groundwater province. The presence or absence and the character of the Pleistocene cover noticeably changes the groundwater potential of every underlying formation. Careful examination of large numbers of well records from any geologic formation indicates the safe sustained yield. From these estimates of safe sustained yield the minimum lot size for suburban development or the maximum population densities or industrial water need per sq mi can be determined from many areas of the state. (Knapp-USGS)
W69-03961

GEOHYDROLOGY OF THE SOURIS RIVER VALLEY IN THE VICINITY OF MINOT, NORTH DAKOTA,
Geological Survey, Washington, D. C.
Wayne A. Pettyjohn.
Geol Surv Water-Supply Pap 1844, 1967. 53 p, 16 fig, 3 plate, 5 tab, 14 ref.

Descriptors: *Hydrogeology, *Groundwater, *Aquifers, Confined water, North Dakota, Artificial recharge, Natural recharge, Transmissivity.
Identifiers: *Minot Aquifer, Souris River.

Detailed geohydrologic data are presented on the Minot aquifer, a deeply buried glaciofluvial deposit of sand and gravel containing large amounts of clay. Water occurs in this aquifer under both artesian (confined) and water-table (unconfined) conditions. The maximum coefficient of transmissibility was determined as 250,000 gpd per ft. Recharge is by lateral movement in the aquifers from adjacent buried glaciofluvial channels and from Souris River seepage. Natural recharge probably averages about 3 mgd. In 1963, 13 municipal wells pumped an average of nearly 4 mgd from the Minot aquifer, but since the first municipal well began pumping in 1916, the water level has declined more than 70 ft. This rapid decline is indicative of a future serious water shortage, which may be overcome by artificial recharge from the western part of Minot. (Llaverias-USGS)
W69-03969

GEOLOGY AND GROUNDWATER OF THE SAVANNAH RIVER PLANT AND VICINITY, SOUTH CAROLINA,
Geological Survey, Washington, D. C.
George E. Siple.
Geol Surv Water-Supply Pap 1841, 1967. 113 p, 37 fig, 6 plate, 15 tab.

Descriptors: *Hydrogeology, *Aquifers, *Storage coefficient, *Water quality, Water level fluctuations, Water supply, Transmissivity, Recharge, South Carolina.
Identifiers: *Savannah River nuclear processing plant.

To provide the Atomic Energy Commission with geohydrologic data relating to the construction and operation of the Savannah River nuclear

essing plant, an evaluation is presented on the
ogy, hydrology, groundwater chemistry, and
r-level fluctuations of the area. The principal
fer is recharged by leakage, and can supply
00 gpm for operating the plant without exceed-
the allowable drawdown in existing (1960)
uction wells. Pumping of wells screened in the
aloosa Formation indicate values for the coef-
nt of transmissibility from 34,000 to 400,000
per ft; for the coefficient of storage, from
02 to 0.0008; and for the coefficient of
ieability, from 360 to 1,500 gpd per sq ft.
er from the Tuscaloosa Formation has a low
unt of mineralization, is quite soft, but slightly
ic. The disposal of radioactive waste has not
ously affected the quality of groundwater. (L-
rias-USGS)
9-03970

ESTIGATION OF THE KARSTIC WATER ERVES BURIED UNDER MIOCENE, OCENE, AND QUATERNARY SEDIMENTS THE MEDITERRANEAN BASIN (FRENCH),
ntpellier Univ. (France).
ques Avias.
p of Dubrovnik, Int Ass Sci Hydrol, 1965. 10 p,
, 4 ref.

criptors: *Water resources, *Groundwater
ns, *Hydrogeology, *Karst, *Water resources
elopment, Aquifers, Artesian wells, Water
ity, Water supply.
ntifiers: Mediterranean basins, Languedoc-
ssillon (France).

calcareous and dolomitic massifs of the
diterranean basin are described as unusually fis-
d and karstified. This phenomena depends to a
e extent on the tectonic alpine movements af-
ing the levels of the ancient seas and on the
diterranean climate characterized by the con-
tration of rainfall, the conditions usually adding
ne formation of water traps. The use of geologi-
geophysical (seismic, electric) and various
ehole methods in the Languedoc-Roussillon
resulted in the discovery of excellent aquifers
er a sedimentary cover. It is concluded that im-
tant reserves for future water supplies may be
nd eventually in the karstic formations of the
diterranean basin provided the geologic forma-
s have never been associated with the seas and
not subject to saline water encroachment.
abriel-USGS)
9-03972

OLOGY AND GROUNDWATER SOURCES OF THE BIG SANDY CREEK LLEY, LINCOLN, CHEYENNE, AND KIOWA UNTIES, COLORADO,
ological Survey, Washington, D. C.
nald L. Coffin, and Albert C. Horr.
ol Surv Water-Supply Pap 1843, 1967. 49 p, 10
1 plate, 5 tab, 20 ref.

scriptors: *Water management (Applied),
olorado, Water quality, Groundwater move-
nt, Hydrogeology, Aquifer characteristics,
ter storage.
ntifiers: *Big Sandy Creek Valley, Lincoln,
eyenne and Kiowa Counties (Colo).

order to determine the availability of ground-
ter, the extent of groundwater development, the
emical quality of water as related to use, and the
sent and possible future groundwater problems,
tudy was undertaken of the Big Sandy Creek val-
, Colorado. The valley-fill deposits constitute
major aquifer and yield as much as 800 gpm to
lls; maximum well yields in the tributary valleys
about 200 gpm and average 5 to 10 gpm. The
ne sand and upland deposits yield little water
cause of drainage. Direct precipitation and infil-
tion of floodwater are chief sources of the
undwater reservoir, and floods are a major
rce of recharge. Surface-water irrigation has
en unsuccessful because of the failure of diver-
n dams and because of excessive seepage from
reservoirs. Groundwater is suitable for most pur-
poses, but the water yield from wells is slight. (L-
laverias-USGS)
W69-03974

ANALYSIS OF AQUIFER TESTS IN THE PUNJAB REGION OF WEST PAKISTAN,
Geological Survey, Washington, D. C.
Gordon D. Bennett, Ata-ur- Rehman, Ijaz Ahmed Sheikh, and Sabir Ali.
Geol Surv Water-Supply Pap 1608-G, p Gl-G56, 1967. 56 p, 23 fig, 1 plate, 3 tab, 5 ref.

Descriptors: *Aquifer characteristics, *Pumping, *Flow characteristics, Permeability, Drawdown, Water yield.
Identifiers: *West Pakistan, Punjab Plain, Unconfined flow.

Analytical results are presented of 141 aquifer pumping tests in the Punjab Plain of West Pakistan. The assumptions underlying the methods used are detailed, and the general theory of unconfined flow to wells is outlined. Data on the lateral permeability of the screened interval, the specific yield of the material at water-table depth for 106 tests, and the vertical permeability of the material between the water table and the top of the screen for 14 tests are reported. (Llaverias-USGS)
W69-03975

WATER RESOURCES OF JACKSON AND INDEPENDENCE COUNTIES, ARKANSAS,
Geological Survey, Washington, D. C.
Donald R. Albin, Marion S. Hines, and J. W. Stephens.
Geol Surv Water-Supply Pap 1839-G, pp Gl-G29, 1967. 29 p, 7 fig, 3 plate, 9 tab, 19 ref.

Descriptors: *Water resources development, *Water utilization, Wells, Flow characteristics, Water quality, Surface-groundwater relationships, Water yield.
Identifiers: *Jackson and Independence Counties (Ark).

Technical details are provided on a water resources investigation in Arkansas to determine the availability of water for municipal, industrial, irrigation, and domestic uses. It was found that supplies for these large-scale uses can be obtained from wells in the Coastal Plain and from streams in the highlands. When screened at depths from 100 to 150 ft in alluvial sand and gravel of Quaternary age, wells will yield 1,000-2,000 gpm of water, requiring treatment to remove iron and eliminate hardness. Small tributary streams of the White River, and the flow of Polk Bayou may be utilized and require only slight storage facilities. Dependable supplies can be obtained from streams in the Boston Mountains and in the Arkansas Valley by constructing storage facilities. Although hard, water from all highland streams is of excellent chemical quality. (Llaverias-USGS)
W69-03976

WINTER THAWS CAN RAISE GROUND WATER LEVELS IN DRIFTLESS AREA,
Forest Service (USDA), St. Paul, Minn. North Central Forest Experiment Station.
Richard S. Sartz.
U.S.D.A. Forest Serv. Res. Note NC-35, 1967. 2 pp.

Descriptors: *Springs, *Groundwater, *Frozen ground, *Infiltration, *Groundwater recharge, Precipitation (Atmospheric), Aquifers, Hydrologic cycle, Fluctuation, Soil water, Distribution patterns, Snow cover.

Springflow and ground water levels both rose with winter thaws, even when the ground was frozen. A high soil water content suggests that water moved to the water table through a continuous column of soil water rather than as a wetting front.
W69-04015

DISPERSION OF RADIOACTIVE TRACERS IN A MODEL BASIN SANDY AQUIFER,
Middle Eastern Regional Radioisotope Centre for the Arab Countries, Cairo (Egypt).
I. B. Hazzaa, R. K. Girgis, and S. M. Refaei.
Bulletin of the International Assoc of Scientific Hydrology, pp 75-81, December 1967. 4 fig, 2 tab.

Descriptors: *Tracers, *Sands, *Aquifers, *Iodine radioisotopes, *Dispersion, Radioisotopes, Wells, Groundwater movement, Model studies, Pumping, Porosity, Watersheds (Basins), Tracking techniques, Piezometers.

Controlled conditions for a model basin sandy aquifer were described. Experiments were carried out on three observation wells. Four different rates of pumping were tried on the central well. Radioactive iodine was used as the tracer. Effective porosity determinations showed that the time of the first arrival of radioactive tracers injected in an observation well to a pumped well should be considered in porosity calculations. The tests showed an increase of the dispersion of tracers with the increasing of the distance of their path and lowering of the discharge rate. The methods and procedures that were used in the study could be used to determine properties of sandy aquifers which are found in arid climates. (Blecker-Ariz)
W69-04111

GROUND WATER AND COMPUTER SIMULATIONS,
TRW Systems Group, Redondo Beach, Calif.
M. L. Frankel.
J Amer Water Works Ass, Vol 59, No 11, pp 1360-1369, Nov 1967. 10 p, 2 fig.

Descriptors: *Simulation analysis, *Water supply, *Groundwater basins, Hydraulic properties, Hydrologic budget, Networks, Mathematical models, Surface waters, Analytical techniques, Water management (Applied).

The role of computer simulation of groundwater systems in the planning of water resources development was discussed. The use of groundwater as a supply source in the past, present and future was described. The characteristics of groundwater flow and the basis for simulation models were outlined. Models were of the network-node flow type, with the equations for flow between nodes based on Darcy's Law and the law of conservation. Surface water simulation was briefly described. Solution methods such as iterative relaxation techniques, the Hardy-Cross and Newton-Raphson techniques, were outlined. Water demand models based on a Cobb-Douglas-type demand function, and the importance of fitting of coefficients for this type of model, were discussed. It was concluded that simulation was a valuable tool for water management. (Gysi-Cornell)
W69-04149

2G. Water in Soils

THEORETICAL ANALYSIS OF TWO-DIMENSIONAL, TRANSIENT FLOW OF WATER IN UNSATURATED AND PARTLY UNSATURATED SOILS,
Geological Survey, Menlo Park, Calif.
J. Rubin.
Soil Sci Soc Amer Proc, Vol 32, No 5, pp 607-615, Sept-Oct 1968. 9 p, 10 fig, 18 ref, 1 append.

Descriptors: *Unsaturated flow, *Infiltration, *Soils, Drainage, Darcys law, Hydraulic conductivity, Mathematical models, Digital computers, Approximation method.
Identifiers: Implicit difference methods.

The Darcian flow-equation for two-dimensional, transient transfer of water in rectangular, unsaturated or partly unsaturated soil slabs was solved numerically with the aid of alternating-directions, implicit difference methods. Two alternative processes were considered: predominantly horizontal infiltration and ditch-drainage. The results ob-

tained for the horizontal infiltration process indicate that it involves upward flow-components which are due, primarily, to a gravity-induced variation in hydraulic conductivity along the inflow face. These components may materially affect the course of infiltration, especially during its earlier stages. The drainage case results demonstrate that transient water flow within the unsaturated zone and the outflow from the seepage zone may significantly affect the progress of water-table descent and the total outflow rates.
W69-03736

WATER TRANSPORT IN SOIL WITH A DAILY TEMPERATURE WAVE I THEORY AND EXPERIMENT,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Land Research.
C. W. Rose.
Aust J of Soil Research, Vol 6, No 1, pp 31-44, July 1968. 14 p, 10 fig, 28 ref, append.

Descriptors: *Water transfer, *Soil water movement, *Soil temperature, *Moisture content, Soil profiles, Radiation, Diurnal, Fluctuation, Equations, Volumetric analysis, Diffusivity, Vapor pressure, Hydraulic conductivity, Thermal conductivity, *Thermocline.
Identifiers: Water transport.

Temperature gradients can result in moisture movement in soil. An experiment was described in which profiles of water content and temperature were measured in the top 15 cm. of bare loamy sand for a period of 6 days following saturation. The theory of water transport in soil was summarized for situations where flux can arise from gradients in temperature as well as in soil water suction and gravitational potential. Soil data was examined with respect to moisture characteristics, bulk density, vapor diffusion characteristics, hydraulic conductivity and diffusivity. For all but the lowest sampling depths there was, superimposed on a regular decline in a water content, an approximately sinusoidal fluctuation of daily period. As moisture characteristics were practically constant over the depth of measurement, water content profiles indicated an upward liquid movement of water both by day and by night. Temperature flux plays a part in water movement in arid soils. See also Part II, W69-03870. (Blecker-Arizona)
W69-03869

WATER TRANSPORT IN SOIL WITH A DAILY TEMPERATURE WAVE II: ANALYSIS,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Land Research.
C. W. Rose.
Aust J of Soil Research, Vol 6, No 1, pp 45-57, July 1968. 13 p, 2 fig, 2 tab, 26 ref.

Descriptors: *Water transfer, Vapor pressure, *Soil temperature, *Soil profiles, *Fluctuation, Diurnal, *Thermocline, Equations, On-site investigations, Soil water movement, Analytical techniques, Hydraulic conductivity, Moisture content.
Identifiers: Vapor flux, Liquid flux, Error analysis.

The results of a field experiment investigating water transport in soil with a strong daily temperature wave were analysed. Net vapor flux densities in different soil profile layers were of comparable magnitude that enabled them to be transferred into the liquid phase. The hypothesis of the existence of a vapor flux in the soil of a magnitude comparable with the liquid flux was examined quantitatively. Two possible vapor flux enhancement mechanisms with daily periodicity were discussed with respect to their making a significant contribution to vapor flux under the conditions of the experiment that was conducted. In a hot, arid climate, a discontinuous liquid phase can enhance vapor phase transport over the rate expected if both solid and liquid phases are regarded as a barrier to such movement. See also Part I, W69-03869. (Blecker-Arizona)
W69-03870

MOISTURE STORAGE AND SPRING WHEAT YIELDS ON LEVEL-BENCH TERRACES AS INFLUENCED BY CONTRIBUTING AREA COVER AND EVAPORATION CONTROL,
Agricultural Research Service, Mandan, N. Dak.
For primary bibliographic entry see Field 03F.
For abstract, see .
W69-03871

INFLUENCE OF VARIOUS RANGELAND CULTURAL TREATMENTS ON RUNOFF AND SEDIMENT PRODUCTION FROM THE BIG SAGE TYPE, EASTGATE BASIN, NEVADA,
Nevada Univ., Reno. Renewable Resource Center.
Gerald F. Gifford, and C. M. Skau.
Proc Third Annul Amer Water Resources Conf, pp 137-148, 1967. 12 p, 2 fig, 3 tab.

Descriptors: *Cultural control, *Runoff, *Sediment discharge, Crop response, *Sagebrush, *Nevada, Range management, Treatment, Peak discharge, Infiltration, Infiltrometers, Rainfall simulators, Soil profiles, Regression analysis, Variability, Mathematical studies.
Identifiers: Macroplots, Paramenters, Eastgate Basin (Nev), Replications.

The influence of various cultural practices on runoff and sediment production in the big sagebrush (Artemisia Tridentata) was studied in the first year of treatment response in Eastgate Basin, Nevada. Two sites with varying elevation, average slope and soil characteristics were utilized. Influence of site and condition of plot (dry or wet) were significant during all aspects of infiltrometer runs. Treatment influenced certain aspects of the infiltrometer run: time from start of infiltrometer run to when runoff exceeded 0.1 in./hr and infiltration rates after 10, 15, and 20 min. Sediment yield and peak sediment discharge rates were variable. Multiple regression analysis of plot factors influencing hydrologic behavior during infiltrometer runs revealed importance of cover, soil texture, condition of plot and rock in 0-1 in. or 1-4 in. of soil. Indications were made that cultural activity in plant communities should be undertaken where site potential suggests improvements. (Affleck-Arizona)
W69-03873

EVAPORATION FROM AN EPHEMERAL STREAMBED,
Geological Survey, Denver, Colo. Water Resources Div.; and Arizona Univ., Tucson. Dept. of Agricultural Engineering.
Michael L. Sorey, and William G. Matlock.
J of Hydraulics Div, ASCE, Vol 95, No HY1, Proc Paper 6368, pp 423-438, Jan 1969. 16 p, 10 fig, 6 tab.

Descriptors: *Evaporation, *Ephemeral streams, Arizona, *Water loss, *Streambeds, *Sands, Evaporation pans, Diurnal, Water table, Wetting, Semiarid climates, Sampling, Moisture content, Drying, Channels, Sediments, Particle size, Seasonal.
Identifiers: *Tucson (Arizona).

In Tucson, Arizona daily evaporation was measured for sands that dry without contact with a water table. Selected sands from an ephemeral streambed were packed in cylinders, wetted, and weighed to determine evaporation loss under field climatic conditions. In summer and early fall tests, first day evaporation from the sands was less than half the loss from an adjacent Class A Weather Bureau Pan. During the first week, evaporation rates for the sands were lower than those reported for irrigated soil. The maximum depth of drying during the three-week tests was less than 1 foot. The results of these tests were used to estimate the volume of water lost annually by streambed evaporation in the Tucson area. (Affleck-Arizona)
W69-03874

THE EFFECTS OF EVAPORATION, POTENTIAL TRANSPIRATION AND RAINFALL ON DEPLETION OF SOIL MOISTURE BY IRRIGATED PERENNIAL PASTURE,
State Research Farm, Werribee (Australia).
For primary bibliographic entry see Field 03F.
For abstract, see .
W69-03875

ISOLATION AND CHARACTERIZATION OF HYDROLOGIC RESPONSE UNITS WITHIN AGRICULTURAL WATERSHEDS,
Agricultural Research Service, Beltsville, Md. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 03F.
For abstract, see .
W69-03879

CONSERVATION BENCH TERRACES IN EASTERN COLORADO,
Agricultural Research Service, Akron, Colo. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 03F.
For abstract, see .
W69-03880

LEVEL PAN CONSTRUCTION FOR DIVERTING AND SPREADING RUNOFF,
Agricultural Research Service, Akron, Colo. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 03F.
For abstract, see .
W69-03881

WATER FLUX IN MOIST SOIL: THERMAL VERSUS SUCTION GRADIENTS,
Department of Agriculture, Washington, D. C.
J. W. Cary.
Soil Science, Vol 100, No 3, pp 168-175, Sept 1965. 8 p, 2 fig, 2 tab, 18 ref.

Descriptors: *Soil moisture, *Thermal properties, *Heat flow, Water properties, Latent heat, *Water circulation, Soil temperature, Water transfer, *Unsaturated flow, Fluctuation, Thermocline, Conductivity, Heat transfer, Thermal conductivity, Vapor pressure, Equations, Liquids.
Identifiers: Moisture transport.

This experiment was designed to yield data defining the relative importance of thermal gradients in transporting soil moisture and to probe mechanisms of transfer. An apparatus was built to measure simultaneous fluxes of heat and moisture across an unsaturated soil sample. Net moisture flux was the sum of two components: flowing due to pressure difference and that due to thermal difference. Most of the rise in heat flux at higher average temperatures was due to transfer of latent heat of vaporization as the vapor flow increased. A temperature gradient of 0.5 degrees C. per cm. at a soil moisture suction of 5 cm. of mercury moved as much water through the soil as a pressure gradient of 2 cm. of water per cm. A linear thermodynamic moisture flux equation was developed in terms of commonly used flow coefficients and variables. A mechanism for unsaturated flow in the liquid phase through soil was proposed. Water flux in moist soil in arid climates could be measured using methods and procedures outlined in the study. (Blecker-Arizona)
W69-03883

SOME STUDIES OF SENSIBLE AND LATENT HEAT FLUXES AT WALTAIR, SOUTHEASTERN COAST OF INDIA,
Meteorological Service of Canada, Toronto (Ontario).
R. J. Polavarapu.
Agric Meterol, Vol 5, No 4, pp 255-268, July, 1968. 14 p, 10 fig.

Descriptors: Energy budget, Soil moisture, *Latent heat, Heat transfer, *Heat balance, *Fluctuation, Moisture content, Diurnal, Annual, Seasonal, *Variability, *Radiation, Monsoons.

ntifiers: *Bowen ratio, *Sensible heat, India, urly, Halstead's model, *Heat fluxes.

nsible and latent heat fluxes were estimated over 22-month period at Waltair, India using three thods: Halstead's model of non-equivalence of bulent transfer coefficients, the classical con- pt of equivalence of turbulent transfer coeffi- nts, and by use of the Bowen ratio. Halstead's thod gave the best evaluation of sensible and ent heat fluxes. Agreement of fluxes obtained by Bowen ratio method and Halstead's method s best during daytime and poor during night e. The diurnal, seasonal, and annual variation of sensible and latent heat fluxes were discussed. relation between the Bowen ratio and the mean isture content of the top 30-cm soil layer was ablished. The Bowen reached a limiting value as moisture content in the soil increased to field pacity. (Affleck-Arizona)
69-03887

LT PENETRATION TECHNIQUE FOR EPAGE MEASUREMENT,
ricultural Research Service, Phoenix, Ariz. ater Conservation Lab.
r primary bibliographic entry see Field 04A.
r abstract, see .
69-03935

ODEL STUDY OF BOUNDARY EFFECTS ON TCH DRAINAGE,
rth Carolina State Univ., Raleigh. Dept. of ological and Agricultural Engineering.
gene W. Rochester, and George J. Kriz.
CE Proc, J Irrig and Drainage Div, Vol 94, No 4, Pap 6313, pp 493-504, Dec 1968. 12 p, 8 fig, ref, append.

scriptors: *Furrow drainage, *Hydraulic odels, *Impervious soils, *Subsurface drainage, isotropy, Seepage, Water table, Dimensional alysis.
ntifiers: *Hele-Shaw models, Ditch drainage.

Hele-Shaw model was used to evaluate the in- ence of the depth to an impermeable layer on nsient subsurface drainage into equally spaced en drains. The results indicate that a horizontal permeable layer affects drainage significantly ly if the layer is closer to the ditch bottom than e-twelfth the ditch spacing. The initial depth of ter above the ditch bottom does not affect this teria. The midpoint recession of the free surface exponential if the flow is not affected by the im- rmeable layer. Some dimensionless groupings e valid only if the ditch bottom extends to the im- rmeable layer.
69-03938

BSURFACE DRAINAGE BY TRANSIENT- OW THEORY,
reau of Reclamation, Denver, Colo.
e D. Dumm.
CE Proc, J Irrig and Drainage Div, Vol 94, No 4, Pap 6315, pp 505-519, Dec 1968. 15p, 12 fig, ab, 13 ref.

scriptors: *Subsurface drainage, *Mathematical dies, *Unsteady flow, *Drawdown, Ground- ter, Seepage, Discharge (Water), Irrigation, ater balance, Hydrologic budget, Evapotrans- ation.
ntifiers: Drain spacing, Transient flow theory.

e transient-flow theory is used as a basis for termining spacing relationships of subsurface ains. Steady-state flow theory does not adequate- describe the changing conditions of subsurface ainage. Research work from Australia and nada and data from a Bureau of Reclamation oject were used for checking the validity of the athematical developments of the transient-flow eory under many varying field conditions. An ac- al field problem is given as an example of how ld investigational data and other available data e used in developing drain-spacing requirements under various specified conditions. Discharge formulas are given and their validity is verified by the Australian and Canadian research work.
W69-03941

FLUID FLOW AND PORE-WALL ADSORPTION RELATIONSHIP: THE EFFECT OF TENSION AGENTS (FRENCH),
Montpellier Univ. (France. Inst. of Geology.
Jacques Avias, and Christian Armangau.
Genie Chimique, Vol 95, No 5, pp 1033-1040, May 1966. 8 p, 4 fig, 15 ref.

Descriptors: *Fluid flow, *Capillary action, *Detergents, *Adsorption, *Surface tension, *Pourous media, Infiltration, Pores, Wettability, Percolation, Water treatment, Hydrologic properties, Solubility, Flow resistance, Surfactants.
Identifiers: *Tension agents effect.

Laboratory and field experiments were conducted to evaluate the effects of tension agents on water permeability of natural porous media such as sand, calcareous tufa, etc, and on the water-permeability of artificial material (sintered glass). The study shows that the addition of tension agents (detergents) modifies the permeability of porous media by increasing this permeability in rocks of high permeability and decreasing it in rocks characterized by low water-adsorption. No inverstion permeability was observed as a function of the medium type. The study of the speeds of sedimentation of various size of particles by adding various tension agents has served to better elucidate the adsorption phenomenon. (Gabriel-USGS)
W69-03973

LEACHING REQUIREMENT FOR EXCHANGEABLE-SODIUM CONTROL,
Agricultural Research Service, Riverside, Calif. Salinity Lab.
J. D. Rhoades.
Soil Sci Soc Amer Proc Vol 32, No 5, pp 652-656, Sept-Oct 1968. 4 fig, 2 tab, 16 ref.

Descriptors: *Irrigation water, *Sodium, *Leaching, *Cation exchange, *Equations, Drainage water, Water quality, Saline water, Salts, Root zone, Permeability, Adsorption, Soil water, Salinity, Arid lands, Lime, Salt tolerance.
Identifiers: *Leaching requirement, Sodium adsorption ratio, Sodium hazard.

Estimation of the leaching fraction required to maintain the SAR (Sodium-Adsorption Ratio) in irrigation water at the lower limit of the plant-rooting zone below some limiting value was described. Plant tolerances to sodium and soil permeability regulate the limiting SAR. Prediction of SAR values for a calcareous soil was accomplished by use of a formula equating the leaching requirement for salinity control from irrigation and soil waters. (Affleck-Ariz)
W69-04012

CONCEPTS IN HYDROLOGIC SOIL GROUPING,
Agricultural Research Service, Beltsville, Md. Soil and Water Conservation Research Div.
H. N. Holtan, Charles B. England, and Vernon O. Shanholtz.
Trans Amer Soc Agr Engin, Vol 10, No 3, pp 407-410, 1967. 2 tab, 4 fig, 8 ref, 4 p.

Descriptors: *Infiltration, Physical properties, Porosity, *Soil groups.
Identifiers: *Infiltration model, Storage depletion.

Infiltration is derived as a function of physical characteristics of soils readily available from soil survey data. Volumes of gravitational water and plant-available water provide upper limits of infiltration recovery by drainage and evapotranspiration, respectively, in computations of the hydrologic performance of a soil over an extended period of time. (England-USDA Hydro Lab)
W69-04013

GEOLOGY OF CLEMSON RESEARCH WATERSHED,
Clemson Univ., S. C.
J. R. Lambert, P. K. Birkhead, and T. V. Wilson.
Clemson University Water Resources Research Institute, Report No. 9. 21 p, 5 tab, 6 fig. OWRR Project A-003-SC.

Descriptors: *Geologic mapping, Soil investigations, Seismographs.

The geology of the 561-acre watershed near the Clemson University campus was investigated using a portable seismograph and a power auger. Topographic and lithologic and soils maps indicate rock types and water table elevations, and the various soils by slope, erosion, type and capability. Valley cross-sections indicate the general relationships among overburden, bedrock, and water tables.
W69-04018

A METHOD OF DETERMINING HYDRAULIC CONDUCTIVITY CHARACTERISTICS FOR NON-SWELLING SOILS IN SITU, AND OF CALCULATING EVAPORATION FROM BARE SOIL,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Land Research; and Central Arid Zone Research Inst., Jodhpur (India).
C. W. Rose, and A. Krishnan.
Soil Science, Vol 103, No 6, pp 369-373, June 1967. 3 fig, 1 tab, 9 ref.

Descriptors: *Measurements, *Hydraulic conductivity, *Evaporation, *Soil water, *Moisture content, Arid lands, Depth, Pores, Sands, Profiles.
Identifiers: Soil matrix, Non-swelling soils, Bare soil, In situ, India, Iterative method.

This paper described a method of determining hydraulic conductivity of arid soil in situ as a function of depth and water content for non-swelling soils in which moisture characteristics reflected distribution of pore sizes within the soil matrix. The method was illustrated for data obtained on a sandy soil at the Central Arid Zone Research Institute, India. The method required a series of consecutive measurements of water-content profiles. Soil-water suction could be measured in situ or inferred from water content and moisture characteristics determined in the laboratory. Calculation of hydraulic conductivity required the knowledge of evaporation from bare soil during the measurement period. A rapidly convergent iterative method was described for estimating that evaporation and therefore of calculating conductivities. (Blecker-Ariz)
W69-04114

SOIL WATER TRANSLOCATION IN A HIGH WATER TABLE AREA,
Agricultural Research Service, Mandan, N. Dak.
L. C. Benz, W. O. Willis, F. M. Sandoval, and R. H. Mickelson.
Water Resources Research, Vol 4, No 1, pp 95-101, June 1968. 6 fig, 2 tab, 18 ref.

Descriptors: *Soil water, *Water table, *Soil temperature, *Confined water, *Translocation, Soil water movement, Specific yield, Saline soils, Mulching, Soil surfaces, Thermocline, Winter, Freezing, Soil profiles, Climatic data.
Identifiers: *Straw.

This paper reports results of a field experiment conducted to evaluate soil water, water table and soil temperature relationships in an area having a high water table, saline soil and artesian water. Soil surface treatments were straw cover and no cover--both without cropping. Soil water content increased during winter, depending on the surface treatment. Average water content of the soil profile increased more than the amount of water theoretically available on the basis of the specific yield and the corresponding water table drop. The additional water was apparently obtained from artesian ground water. Changes in soil water content and

water table depth were associated with soil temperature. Soil moisture conditions studied in this report are characteristic of arid lands. (Blecker-Ariz)
W69-04124

DETERMINATION OF THE SOLUBILITY PRODUCT OF SOIL CONSTITUENTS SUCH AS GYPSUM,
Sydney Univ. (Australia). Dept. of Soil Science.
Joan M. Rance, and B. G. Davey.
Soil Sci Amer Proc Vol 32, No 5, pp 670-672, Sept-Oct 1968. 2 tab.

Descriptors: *Solubility, *Gypsum, Calcium sulfate, Saline soils, Arid lands, Soil chemistry, Ions, Equations, Absorption, Spectroscopy.
Identifiers: *Solubility product.

A converging cyclic procedure involving use of a published value for the dissociation constant for gypsum, an experimentally derived value for total Ca concentration and the second approximation of the Debye-Huckel equation was utilized to calculate the solubility product of gypsum at 20 deg C. Atomic absorption spectroscopy was used to determine total Ca concentration. The solubility product of CaSO sub 4 using this method was 2.4 times 10 to the minus 5th power. Ion pairs comprised 32.1% of total soluble Ca. Gypsum is a common constituent of soils of arid regions, and is used in the reclamation of saline soils and as a fertilizer. (Affleck-Ariz)
W69-04127

MEASURING THE RELATIVE HUMIDITY OF SOILS AT DIFFERENT MOISTURE CONTENTS BY THE GRAY HYDROCAL HYDROMETER,
Michigan State Univ., East Lansing.
George J. Bouyoucos, and Ray L. Cook.
Soil Science, Vol 104, No 4, pp 297-305, July 1968. 6 fig, 6 tab, 9 ref.

Descriptors: *Moisture content, *Hygrometry, *Humidity, *Soil moisture, *Instrumentation, Soil physics, Moisture tension, Saline soils, Silts, Loam, Clays, Calibrations, Measurements.
Identifiers: Gray hydrocal hygrometer, Relative humidity, Sensors, Non-saline soils.

A gray hydrocal hygrometer was used to measure relative humidity of soils at different moisture contents. Data were obtained for a silty clay, silt loam, lateritic clay, clay loam and sandy loam soils. The hygrometer had a range of 10-100%. Tremendous soil moisture tension forces were shown at the various moisture contents. A high degree of sensitivity and consistency was revealed by the hydrocal sensor. The hydrocal hygrometer was capable of measuring both the relative humidity and the soil-moisture tension of saline and non-saline soils. (Blecker-Ariz)
W69-04130

2H. Lakes

BIOLOGICAL STUDIES OF MANGANESE SOLUTION FROM ITS DIOXIDE,
Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
Robert S. Ingols, and Mine E. Enginun.
Cosponsor: Water Res Center, Georgia Inst of Technology. Symp on Trace Inorg in Water, Advance in Chem Ser, No 73, pp 143-148, 1968. 6 p, 3 fig, 5 ref.

Descriptors: *Aqueous solutions, *Biochemistry, *Manganese, *Bacteria, *Lakes, Leaching, Soils, Coliforms.
Identifiers: Bacterial manganese reduction, Book.

Studies of the solution of manganese from manganese dioxide by reaction with sterile and inoculated bacterial media indicate that the inoculation is unnecessary for the solution. Actually, the growing organisms compete for the reactive capacity of the food in the medium; the more rapidly that the organisms develop the greater is the competitive interference. Under natural conditions, the organisms contribute to the manganese solution by developing an oxygen free environment for the maintenance of a manganous solution at the neutral pH values typical of natural lakes.
W69-03725

EVAPORATION STUDY AT SHARP STATION POND NEAR BATON ROUGE, LOUISIANA,
Geological Survey, Baton Rouge, La.
For primary bibliographic entry see Field 02D.
For abstract, see .
W69-03731

EVAPORATION OF WATER: ITS RETARDATION BY MONOLAYERS,
Columbia Univ., New York. Dept. of Mineral Technology; and Calif. Univ., Berkeley. Dept. of Mineral Technology.
For primary bibliographic entry see Field 03B.
For abstract, see .
W69-03884

HEITSCH V CLARK (INJUNCTION TO ENJOIN CHANGE IN LAKE LEVEL).
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03901

THE GREAT LAKES WATER LEVELS PROBLEM,
United States Lake Survey, Detroit, Mich. Engineering Div.
Ben G. DeCooke.
Limnos, Vol 1, No 1, pp 22-26, Spring 1968. 5 p, 1 map, 1 tab.

Descriptors: *Great Lakes, *Water level fluctuations, *Hydrologic budget, Legal aspects, Economic justification, Regulation, International Joint Commission.
Identifiers: *Water level regulation.

Because of public concern over water level fluctuation in the Great Lakes, a study is being made of the water budget of the system so that lake-level regulation may be planned. The outflow of Lake Superior has been regulated since 1921 and Lake Ontario since 1960. Riparian interests desire reduction of duration and height of high stages. High water in 1951 caused damages of about $61 million, about 80% of which was caused by wave action. No costs are available for low-water damages, but riparian interests also desire low-water control. Navigation interests need relatively high minimum levels to allow greater draft for vessels. The Corps of Engineers estimates that raising minimum levels 1-1 1/2 ft in Lake Michigan-Huron would benefit navigation by about $1 million per yr. Power interests desire generally high stages to provide greater head and storage and to insure proper ice cover and flow in winter. Because of large natural variation in input, regulation for absolutely constant level is impractical. Some degree of regulation of the system is feasible from an engineering point of view, but the economic justification has not been determined. A cost-benefit study is being made. (Knapp-USGS)
W69-03947

CHERT AND ITS SODIUM-SILICATE PRECURSORS IN SODIUM-CARBONATE LAKES OF EAST AFRICA,
California Univ., Berkeley. Dept. of Geology and Geophysics.
Richard L. Hay.
Contrib Mineral and Petrol, Vol 17, No 4, pp 255-274, 1968. 20 p, 8 fig, 2 tab, 13 ref.

Descriptors: *Chemical precipitation, *Chert, *Lakes, Carbonates, *Silicates, Colloids, Leaching, Igneous rocks, Zeolites.
Identifiers: *Africa, Kenya, Tanzania, Lake Magadi, Lake Natron, Magadiite, Kenyaite

Chert has formed from two sodium-silicate minerals, magadiite and kenyaite, in uppermost Pleistocene deposits of lakes Magadi and Natron in Kenya and Tanzania. The chert consists of finely crystalline quartz and characteristically forms nodules of irregular shape with white coatings having reticulate surface patterns. Similar nodules are widespread in lower and middle Pleistocene lacustrine deposits in the vicinity of Lake Magadi, Lake Natron, and Olduvai Gorge. Although magadiite and kenyaite are absent in the lower and middle Pleistocene deposits, the chert in these beds probably formed from a sodium-silicate precursor. All of the chert-bearing sediments were deposited in saline, alkaline lakes rich in dissolved sodium carbonate-bicarbonate. Magadiite (and chert) may form either thin, widespread deposits or localized masses which may be cross-cutting. Thin, widespread layers of magadiite have been precipitated by mixing of silica-rich brine with fresh water in a chemically stratified lake; localized masses may have been formed by interaction of brine with fresher water entering the floor or margin of the lake. Magadiite and kenyaite can alter to chert in contact with sodium-carbonate brine and possible by leaching with relatively fresh water over a period of 20,000 years or less. The siliceous zeolites clinoptilolite and erionite predominate in trachyte tuffs associated with magadiite and chert; less-siliceous phillipsite predominates in trachyte tuffs of chert-free sequences.
W69-03955

PILOT STUDY OF DYNAMICS OF RESERVOIR DESTRATIFICATION,
Robert S. Kerr Water Research Center, Ada, Okla.
For primary bibliographic entry see Field 05G.
For abstract, see .
W69-03960

RELATION BETWEEN DEPTH FOR MAXIMUM AMOUNT OF EXCESS OXYGEN DURING THE SUMMER STAGNATION PERIOD AND THE TRANSPARENCY OF FRESHWATER LAKES OF JAPAN,
College of Science and Literature, Tokyo (Japan). Geographical Inst.
Shinkichi Yoshimura.
Proc Imperial Acad Japan, Vol 11, No 9, pp 356-358, 1939. 2 fig, 1 tab, 2 ref.

Descriptors: *Limnology, *Light penetration, *Photosynthetic oxygen, *Stratification, Lakes, Oligotrophy, Oxygen, Phytoplankton, Estimating equations.
Identifiers: *Transparency, *Japan, Metalimnetic maxima, Trophic layer, Tropholytic layer, Compensation depth, Lake Wakuike, Lake Masyuko, Lake Tazawako.

Author reports data on maximum depth, transparency (depth of disappearance of white disc), and depth of occurrence of maximum photosynthetically produced oxygen concentrations during stratification for 37 Japanese lakes. Maximum depths range from 7 (Lake Wakuike) to 425 meters (Lake Tazawako); transparencies, 0.8 (Lake Wakuike) to 41.6 meters (Lake Masyuko); and depths of maximum oxygen concentrations, 1.5 (Lake Wakuike) to approximately 50 meters (Lake Masyuko). Transparencies reported correspond with depth to which 16% of surface light penetrates. Analysis of the data led to the conclusion that compensation depth between trophic and tropholytic layers is close to the depth of oxygen maximum. Plot of transparency versus depth of maximum oxygen concentration results in a reasonably linear relationship in which compensation depth equals 1.5 times the transparency. (Eichhorn-Wis)
W69-04019

LIGHT PENETRATION INTO FRESH WATER,
W. H. Pearsall, and Philip Ullyott.

xp Biol, Vol 11, pp 89-93, 1934. 3 fig, 1 tab, 8

scriptors: *Lakes, *Limnology, *Light penetra-
n, *Vegetation, *Phytoplankton, Aquatic plants,
tical properties, Seasonal, Light penetration,
anophyta, Diatoms, Light.
ntifiers: *Lake Windermere (England), English
e district, Photoelectric cells, Transparency,
ht measurements.

om March 1932 to March 1933, authors took
re than 70 series of readings of light penetration
Lake Windermere, England, using a vacuum
assium-on-copper photoelectric cell and poten-
meter. The sensing element had a spectral
ponse with maximal sensitivity at 4000-4900
gstrom units. Discussed in some detail are data,
thirteen dates, on light penetration at depths of
.3 meters, the lowest limit of rooted vegetation.
es were chosen for their biological significance,
example, dates of maximum clarity, diatom
xima, and cyanophyte maxima. Analysis of the
a led to conclusion that penetration of light in
ndermere depends chiefly on the number of
toplankters in the epilimnion. Greatest depth at
ch rooted hydrophytes can grow must therefore
affected by phytoplankton abundance.
drophytes grow fastest in July and August, when
sence of cyanophytes allows penetration to 4.3
ters of only 1.5-2.5% surface intensities, as com-
ed with 6.7% at maximum clarity and 4-5% at
rage clarity. On 12 June, a typical date at which
diatom pulse is uniformly mixed throughout the
limnion, penetration to 4.3 meters was 1.5% of
face illumination. (Eichhorn-Wis)
9-04020

**CULAR CHANGES IN THE TRANS-
RENCY OF LAKE WATERS,**
llege of Literature and Science, Tokyo (Japan).
ographical Inst.
nkichi Yoshimura.
c Imperial Acad Japan, Vol 9, No 9, pp 502-
, 1933. 3 tab, 1 ref.

scriptors: *Lakes, *Light penetration, *Optical
perties, *Color, Limnology, Eutrophication,
gotrophy, Dystrophy, Succession.
ntifiers: *Transparency, *Secular changes,
an, Anabaena planctonica, Lake Noziri, Lake
ki, Lake Nakatuna, Lake Kizaki, Lake Haruna,
e Inawasiro, Acidotrophy, Mesotrophy.

tical properties of lake water offer convenient
gh evidence of trophic status and productivity.
lor and transparency relate to lake type thus:
e and transparent water indicates oligotrophy;
en-yellow water of reduced transparency,
rophy; less transparent brown water, dystrophy.
thor records available data for minimal trans-
encies (depth of disappearance of white disc,
30 centimeters diameter) for six Japanese lakes.
lor determination techniques are not described.
tween 1907 and 1933, transparency ranges for
r mountain lakes (N = number of observations)
re: oligotrophic Noziri, 7.0-10.8 meters (N=17);
gotrophic Aoki, 5.6-13.8 meters (N=12),
gotrophic Nakatuna, 3.0-7.0 meters (N=12),
sotrophic Kizaki, 5.0-7.9 meters (N=15). Lack
secular trends in data supports hypothesis that
le eutrophication occurred here, notwithstand-
substantial cultural development along shores
ring last 15 years of period. In 1906, trans-
ency (N=6) of caldera Lake Haruna decreased
m 9.5 to 1.3 meters and color (N=2) increased,
dencing eutrophy. This was substantiated in
29 by sudden appearance of Anabaena. Vol-
ic eruption (1902) made caldera Lake In-
asiro acidotrophic and turbid. By 1930, increase
transparency (N=7) from 14.0 to 27.5 meters
d decrease in color (N=4) indicated return to
gotrophy. (Eichhorn-Wis)
9-04022

**TROGEN FIXATION IN TWO WISCONSIN
KES,**
sconsin Univ., Madison. Dept. of Zoology.
n J. Goering, and John C. Neess.

Limnol Oceanogr, Vol 9, pp 530-539, 1964. 5 fig, 6 tab, 23 ref.

Descriptors: *Wisconsin, *Lakes, *Nitrogen fixation, Nitrate, Ammonium, Rates, Limnology, Eutrophication.

Rates of biological nitrogen fixation in two Wisconsin lakes are given. Fixation occurs at moderate rates throughout the ice-free season in Lake Wingra. In Lake Mendota the rate is normally zero throughout the ice-free season, but occasional, sometimes high, rates are observed. Glucose had no consistent effect on nitrogen fixation in the dark and appeared to inhibit fixation in the light. The effects of added ammonia and nitrates, as well as incubation time, were inconsistent. The maximum rate of nitrogen fixation was obtained with a light intensity of 3750 lux. Within the temperature range 16 to 30 deg C, fixation increased at a constant rate. (Konrad-Wis)
W69-04026

AXENIC CULTURE AND NUTRITIONAL STUDIES OF AQUATIC MACROPHYTES,
Michigan State Univ., Hickory Corners. W. K. Kellogg Biological Station.
Robert G. Wetzel, and Don L. McGregor.
Amer Midland Naturalist, Vol 80, No 1, pp 52-64, July 1968. 3 fig, 8 tab, 21 ref.

Descriptors: *Cultures, *Nutrient requirements, *Aquatic plants, Algae, Bicarbonates, Organic compounds, Calcium, Chara, Chlorophyll, Eutrophication, Growth stages, Invertebrates, Iron, Lakes, Light, Magnesium, Oxidation-reduction potential, Oligotrophy, Phosphates, Photosynthesis, Plant growth regulators, Pondweeds, Potassium, Sodium, Vitamin B.
Identifiers: *Axenic culture, Macrophytes, Marl lakes, Cations, Naja flexius, Amnicola lustrica, Amnicola limosa, Candona inopinata, Darwinula stevensoni, Angiosperms, Potamogeton, Chemo-organotrophic growth, Heterotrophy, Terazolium, Thin-layer chromatography, Gibberellic acid, Indole-3-acetic acid, Cyanocobalamin, Biotin, Thiamine, Osmoregultion.

Author studied growth and nutrition of Najas, Potamogeton and Chara in cultures resulting from sterilization of propagules with alcohol and/or hypochlorite. Low light intensities decreased and mild heat treatment without light increased percentage germination of Najas. Low light intensities (visible spectral range) provided more favorable conditions for germination of Chara. Najas germinated as well in aerated liquid media as in agar of low redox gradient. Cationic concentrations of media insignificantly affected germination of Najas and Chara. Brief treatment with indole-3-acetic acid (1000 mg/liter) and gibberellic acid (100 mg/liter) reduced germination markedly. Enhanced growth of Chara in cultures incorporating invertebrate feces evidenced chemo-organotrophic growth. Radioassay of carbon dioxide from van Slyke combustion of plants after uptake of labelled bicarbonate permitted estimation of photosynthetic rates. Photosynthesis decreased in Najas cultured in media with concentrations of divalent calcium ion greater than 20 mg/liter or with ratios of monovalent:divalent cationic concentrations less than one. Such conditions are consonant with those of environments of parent marl lakes. Of water-soluble vitamins, only cyanocobalamin (B-12) stimulated photosynthesis in Najas, a response similar to that observed from phytoplankters of marl lakes. (Eichhorn-Wis)
W69-04027

THE TAXONOMY AND ECOLOGY OF LEECHES (HIRUDINEA) OF LAKE MENDOTA, WISCONSIN,
Skopeje Univ. (Yugoslavia).
J. A. Sapkarev.
Wis Acad Sci, Arts Lett, Trans, Vol 56, pp 225-253, 1967-68. 18 fig, 3 tab, 39 ref.

Descriptors: *Wisconsin, *Ecological distribution, *Systematics, Ecology, Invertebrates, Lakes, Limnology, Animal parasites, Eutrophication, Bioindicators, Biomass.
Identifiers: *Lake Mendota (Wis), *Leeches, Population density, Piscicola, Glossiphonia, Batracobdella, Helobdella stagnalis, Placobdella, Dina, Erpobdella, Nephelopsis, Haemopsis.

Systematic monthly sampling of a single transect during September 1964-August 1965 and a sampling of 10 other transects (May 1965) of eutrophic Lake Mendota, Wisconsin, revealed that its leech fauna consist of 16 species in seven genera and three families. An additional family, genus, and species had been reported in the literature. Based upon total numbers encountered during sampling, dominant species was Helobdella stagnalis (dominance, 75.58%). Ranked according to dominance (ranges indicated), remaining species were: Glossiphonia complanata, Erpobdella punctata, Nephelopsis obscura, Dina parva (7.66-1.01%); G heteroclita, Helobdella elongata, Haemopsis marmorata, Batracobdella phalera (0.94-0.36%); Placobdella ornata, Helobdella lineata (0.10%); Placobdella sp (0.02% P parasitica, P montifera, B picta, Helobdella punctata-lineata (0.01%). Most eurytopic form, Helobdella stagnalis, occurred on widest variety of bottom types; in littoral, sublittoral, and rim of profundal zones; at depths from shoreline to 11 meters. Number of species limited to shallower areas bounded by isobaths indicated are: five in 0.5 meter; three in 1 meter; three in 2 meters; and one each in 3, 3.5, 4, 4.5, and 11 meters. Peak leech populations occurred in July when dominant species' young entered the population. (Eichhorn-Wisc)
W69-04028

2I. Water in Plants

RIME AND HOARFROST IN UPPER-SLOPE FORESTS OF EASTERN WASHINGTON,
Forest Service (USDA) Wenatchee, Wash. Pacific Northwest Forest and Range Experiment Station.
H. W. Berndt, and W. B. Fowler.
J. Forest. 1969, 67 (2): 92-95, illus.

Descriptors: *Rime, *Frost, *Interception, *Water equivalent, *Winter, *Mountain forests, Air temperature, Saturation, Dew, Dewpoint, Water balance, Biomass.
Identifiers: *Horizontal interception.

Horizontally intercepted moisure--rime and hoarfrost--was studied in a lodgepole pine stand. Results show that this generally unmeasured supplemental precipitation amounts to 0.05 to 0.06 inch of moisture equivalent per day during periods of accumulation and could contribute as much as 3 to 4 inches total moisture in an entire winter.
W69-03807

NITROGEN FERTILIZER AND WHEAT IN A SEMI-ARID ENVIRONMENT 4: EMPIRICAL YIELD RESPONSE MODELS AND ECONOMIC FACTORS,
Cunningham Lab., Brisbane (Australia).
For primary bibliographic entry see Field 03F.
For abstract, see .
W69-03877

FERTILIZING DRYLAND SPRING AND WINTER WHEAT IN THE BROWN SOIL ZONE,
Agricultural Research Service, Bozeman, Mont.; and Agricultural Research Service, Huntley, Mont.
For primary bibliographic entry see Field 03F.
For abstract, see .
W69-03878

THE GREAT INDIAN DESERT. PERSPECTIVES IN THE ECOLOGY AND PHYSIOLOGY OF SMALL DESERT MAMMALS,
Western Australia Univ., Nedlands (Australia). Dept. of Zoology.

K. G. Purohit.
Mammalia, Vol 31, No 1, pp 28-49, 1967. 22 p, 8 tab.

Descriptors: *Mammals, *Deserts, *Ecology, Rodents, Water balance, Water requirements, *Animal physiology, Arid climates, *Animal metabolism, Thermal stress, Habitats, Food habits, Breeding, Urine, Microenvironment, Moisture stress, Nocturnal.
Identifiers: *Indian Desert, Thermoregulation, Renal function, Water deprivation, *Gerbils, Rajasthan (India).

Meteorological and biological characteristics of the Great Indian Desert place it in the category of the hot deserts under the Thornewaite classification of climate. The results of studies on the ecology, reproduction, thermoregulation, water metabolism and kidney function of small mammals and especially Meriones hurrianae, a rodent very resistant to the deprivation of water and food were explained and discussed. Small mammals do not use water for thermoregulation, the absence of sweat in most mammals may be seen as an adaption for water economy. Meriones hurrianae does not store an excess of water but fulfills its water requirements by economically spending water available in food and metabolic water. (Affleck-Arizona)
W69-03889

TREE-RING ANALYSIS: A TOOL FOR WATER RESOURCES RESEARCH,
Arizona Univ., Tucson. Lab. of Tree-Ring Research.
For primary bibliographic entry see Field 02A.
For abstract, see .
W69-03963

A MICROPSYCHROMETER TO MEASURE WATER POTENTIALS OF INTACT PLANT MATERIAL,
Nottingham Univ. (England). Dept. of Horticulture.
Man Singh Manohar.
Science and Culture, Vol 33, No 3, pp 134-136, March 1967. 2 fig.

Descriptors: *Hygrometry, *Germination, *Seeds, *Instrumentation, *Measurement, Osmosis, Plant physiology.
Identifiers: *Water potential, *Pea, Thermocouple, Psychrometers, Micropsychrometer.

The thermocouple psychrometer was modified to overcome its limitations with respect to pea seeds. Water potentials of a germinating pea seed and the germination medium were measured. Increase in water potential of an imbibing seed was expected but the slight decrease in water potential just after radicle emergence is as yet unexplained. No change in water potential of the germination medium was registered and pea seeds therefore do not appear to exude appreciable quantities of osmotically active materials during germination. The psychrometer could be used to measure water potential of seeds that are planted in arid regions of the world. (Blecker-Ariz)
W69-04109

EFFECTS OF EXTERNAL SALT CONCENTRATIONS ON WATER RELATIONS IN PLANTS: I. ABSENCE OF OSMOTIC ADJUSTMENT IN THE ROOT XYLEM,
California Univ., Riverside. Citrus Experiment Station.
J. J. Oertli.
Soil Science, Vol 102, No 3, pp 180-186, September 1966. 3 fig, 10 ref.

Descriptors: *Osmotic pressure, *Kinetics, *Salts, *Root systems, *Xylem, Saline soils, Salinity, Transpiration, Moisture deficit, Plant physiology, Equations, Flow rates, Solutes, Leaves, Model studies, Absorption.
Identifiers: Water transport.

A model of salt and water passage into and across plants was proposed. It involved a barrier in roots, mass flow in the xylem and another barrier around leaf vacuoles. These barriers were crossed by water and by solutes at different rates. It was shown that for various reasonable rate laws for salt and water transport, an osmotic adjustment within the xylem was not possible under saline conditions and under conditions of high transpiration. Under conditions of low transpiration and relatively low external salt concentrations, the same kinetics predicted the development and concentration dependence of root pressure. Soil salinity is a major area of concern since vast areas of arid lands are affected by this soil condition. (Blecker-Ariz)
W69-04113

SOIL-SALINITY CHANGES WITH FALLOW AND A STRAW MULCH ON FALLOW,
Agricultural Research Service, Grand Forks, N. Dak.; and Argicultural Research Service, Mandan, N. Dak.
L. C. Benz, F. M. Sandoval, and W. O. Willis.
Soil Science, Vol 104, No 1, pp 63-68, July 1967. 4 fig, 1 tab.

Descriptors: *Saline soils, *Fallowing, *Water table, *Mulching, Land reclamation, Crop production, Moisture content, Soil water, Soil properties, Sampling, Salt tolerance.
Identifiers: *Straw.

The purpose of this study was to determine effects of fallow and applied straw mulch on soil salinity in a water-table area and their possible utilization as a reclamation practice. Under the straw treatment, soil salinity decreased progressively during the three years to a depth of 91 cm. Salinity increases may have resulted from below normal rainfall or possibly noncultivation. Results showed that on bare fallow a soil mulch should be maintained to induce any reduction in soil salinity. Under straw mulch a singificant reduction in salinity was accomplished that allowed the growing of less salt-tolerant crops on the treated areas. The use of a straw mulch on saline soil could be another possible way of correcting a soil condition that is common to arid soils. (Blecker-Ariz)
W69-04116

GERMINATION OF WINTERFAT SEEDS UNDER DIFFERENT MOISTURE STRESSES AND TEMPERATURES,
Forest Service (USDA), Albuquerque, N. Mex. Rocky Mountain Forest and Range Experiment Station.
H. W. Springfield.
Journal of Range Management, Vol 21, No 5, pp 314-316, September 1968. 1 fig, 2 tab, 10 ref.

Descriptors: *Germination, *Moisture stress, *Temperature, *Seeds, Soil moisture, New Mexico, Water requirements, Drying.
Identifiers: *Winterfat seeds.

The report summarized results of a study of effects of six levels of moisture stress (0.0, 0.3, 3.0, 11.0, and 15.0 atmospheres) at five temperatures (86, 78, 53, 43, 37 degrees F) ON GERMINATION OF TWO SOURCES OF WINTERFAT SEEDS. Objectives were to determine whether: (1) winterfat seeds would germinate under the higher moisture stresses, (2) temperatures influenced germination responses and (3) responses to moisture stress and temperature varied with the source of the seed. As moisture stress increased, germination generally was reduced, regardless of temperature. Germination of both seed sources was less at alternating temperatures of 86-68 F than at the other temperatures. Data suggested that soil moisture approaching field capacity was necessary for appreciable germination of winterfat during the summer when temperatures were in the 80-100 F range in arid New Mexico. (Blecker-Ariz)
W69-04129

2J. Erosion and Sedimentation

HYDROLOGY OF CORNFIELD WASH AREA AND EFFECTS OF LAND-TREATMENT PRACTICES, SANDOVAL COUNTY, NEW MEXISO, 1951-60,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 04D.
For abstract, see .
W69-03747

THE MOVEMENT OF BEACH SAND,
University of Southern California, Los Angeles. Dept. of Geology.
James C. Ingle, Jr.
Amsterdam, Elsevier Publ Co, Develop Sedimentology 5, 1966. 221 p, 116 fig, 5 tab, 214 ref, 4 append.

Descriptors: *Beaches, *Sands, *Sediment transport, *Tracers, *Marking techniques, Dye releases, Littoral drift, Erosion, Movement, Provenance, Sediment control, Sediment load, Aquatic drift, Currents (Water), Marine geology, Ocean waves.
Identifiers: Dyed sand, Sand tracing, Beach studies.

A large-scale investigation of beach and sand movement was made using fluorescent-dyed sand releases as sediment-drift tracers. The techniques and results of a 2-year study along the southern California coastline are reported. Dyed sand was released once a month in the surf zones of 5 beaches and the sand dispersion was mapped. Movement is described in terms of wave and current parameters, bottom configuration, and surf conditions. Offshore movement in rip currents is described. Movement of different sized particles was traced by the use of different hues of dye. The effect of sand control works and other man-made obstructions on beaches was studied. (Knapp-USGS)
W69-03754

INFLUENCE OF VARIOUS RANGELAND CULTURAL TREATMENTS ON RUNOFF AND SEDIMENT PRODUCTION FROM THE BIG SAGE TYPE, EASTGATE BASIN, NEVADA,
Nevada Univ., Reno. Renewable Resource Center.
For primary bibliographic entry see Field 02G.
For abstract, see .
W69-03873

RATES OF SLOPE DEGRADATION AS DETERMINED FROM BOTANICAL EVIDENCE, WHITE MOUNTAINS, CALIFORNIA,
Geological Survey, Washington, D. C.
Valmore C. LaMarche, Jr.
Geol Surv Prof Pap No 352-I, pp 341-377, 1968. 37 p, 36 fig, 2 plate, 8 tab, 39 ref.

Descriptors: *Erosion, *Mountains, *Measurement, *Bristlecone pine trees, California, Weathering, Degradation (Stream), Trees.
Identifiers: White Mountains (Cal).

Methods of calculating long-term rates of slope degradation were developed by studying the exposure of roots and ages of ancient bristlecone pines in dolomite areas in the semi-arid White Mountains of east-central California. The Precambrian Reed Dolomite underlies parts of a fluvially eroded terrane of high local relief. A subalpine bristlecone-pine forest covers dolomite areas between altitudes of 9,500-11,500 ft. A few living trees are known to be more than 4,000 yr old, but the average age of trees studied is about 1,000 yr. Age determinations were made by counting annual growth rings. There are uncertainties in some assigned ages due to incomplete growth records. Exposed tree roots are direct evidence of degradation. Local degradational rates are estimated from tree or root age and depth of root exposure. Data from 76 bristlecone pines at scattered points whithin a 20-sq mi area

gest that degradational rates vary from less than ft per 1,000 yr on the gentle lower slopes of ridges to perhaps 4 ft per 1,000 yr along the cent steep banks of channels incised into allu- fill. Degradational rates in crestal areas are and apparently increase with slope, whereas e of the main valley side slopes are lower and not closely related to slope angle. A rocky knoll been degraded at about 1.2 ft per 1,000 yr dur- the past 2,700 yr, whereas the rate on a long ey side slope has been only about 0.8 ft per 0 yr in the same period. These rates of radation are similar to denudational rates that e been estimated for comparable areas in other ons. (Knapp-USGS)
9-03943

THE MAINTENANCE OF ANOMALOUS ID PRESSURES: 1. THICK SEDIMENTARY QUENCES,
logical Survey, Washington, D. C.
. Bredehoeft, and B. B. Hanshaw.
l Soc Amer Bull, Vol 79, pp 1097-1106, Sept 8. 10 p, 6 fig, 2 tab, 25 ref.

criptors: *High pressure, *Connate water, draulic conductivity, *Porous media, *Un- dy flow, Filters, Pore pressure, Sedimentation, f coastal plain.
ntifiers: Anomalous pore pressure, Lithostatic ssure.

ious physical and chemical processes may be isioned which will cause anomalous pressures an underground fluid. In order to consider the ntenance of anomalous pressure, it is necessary onsider the problem as one of nonsteady fluid . The time rate of pressure change and main- ance depends upon the hydrodynamics of flow ough porous media and the particular boundary ditions. This paper presents a series of general tions to hydrodynamic models which are ger- ne to the problem of creating and maintaining ess-fluid pressures in a thick sedimentary uence. The creation and maintenance of fluid ssures approaching lithostatic pressure through rocess of continuous sedimentation was evalu- d. Our results indicate that a sedimentation rate 500 m/ million yr (reasonable for the Gulf ast) will create fluid pressures approaching ostatic in a sedimentary column that has a raulic conductivity of 0.00000001 cm per sec, ower. It is apparent that the creation of anoma- s pressure and its maintenance depends, to a ge degree, upon the hydraulic conductivity and, lesser extent, upon the specific storage of clay ers with the system. (USGS)
9-03954

ERT AND ITS SODIUM-SILICATE PRECUR- RS IN SODIUM-CARBONATE LAKES OF ST AFRICA,
ifornia Univ., Berkeley. Dept. of Geology and ophysics.
primary bibliographic entry see Field 02H.
abstract, see .
9-03955

VER ADJUSTMENT TO ALTERED DROLOGIC REGIMEN-MURRUMBIDGEE VER AND PALEOCHANNELS, AUSTRALIA,
ological Survey, Washington, D. C.
A. Schumm.
ol Surv Prof Pap 598, 1968. 65 p, 36 fig, 1 plate, ab, 96 ref.

scriptors: *Sedimentation, *Alluvial channels, aleohydrology, *Streams, *Channel morpholo- Sediment transport, Geomorphology, Sediment ld, Discharge (Water), Regime, Shape, Slopes, dth, Meanders.
ntifiers: Murrumbidgee River (Australia), leochannels.

e Murrumbidgee River which flows westward ross the Riverine Plain of New South Wales, Aus- tralia, is sinuous, narrow, and deep and transports relatively small quantities of sediment. On the flood plain of the modern river and on the surface of the Riverine Plain are traces of old aggraded and abandoned river channels or paleochannels. The ancestral-river channels resemble the channel of the modern river, but they are much larger. In contrast, the older prior-stream channels are relatively straight, wide, and shallow and are filled with cross-bedded sands. The differences can be attributed to the effects of Quaternary climate changes on the hydrologic regimen of the drainage basin. The prior streams moved large quantities of sand and were undoubtedly characterized by high flood peaks, but their runoff was probably less than that at present. The ancestral-river channels carried higher peak discharges and higher annual runoff than either the modern or prior-stream channels. Empirical equations were developed for stable alluvial rivers which demonstrate the influence of both discharge and type of sediment load on channel morphology. The induced changes may be difficult to recognize in a short span of time, but they will be significant over very long reaches of alluvial rivers, especially in arid to subhumid climatic regions. If possible, an adjustment of river gradient will be made by an increase or decrease of sinuosity. Deep incision of alluvial deposits in major river valleys may occur only as a result of diastrophism or of lowering of base level. Abrupt changes in sediment type in the stratigraphic record can reflect not only climatic and tectonic changes but also major river adjustments to these changes. (Knapp-USGS)
W69-03957

AGE AND COMPARATIVE DEVELOPMENT OF DESERT SOILS AT THE GARDNER SPRING RADIOCARBON SITE, NEW MEXICO,
Soil Conservation Service, University Park, N. Mex.
L. H. Gile, and J. W. Hawley.
Soil Sci. Soc. Amer. Proc., Vol 32, No 5, pp 709-716, Sept-Oct 1968. 4 tab, 6 fig.

Descriptors: *New Mexico, *Paleosols, *Sierozems, *Carbon radioisotopes, *Age, Arid lands, Erosion, Dating, Pleistocene epoch, Recent epoch, Soil formation, Paleoclimatology, Climatology, Alluvium, Calcareous soils, Soil horizons, Sediments, Topography.
Identifiers: *Charcoal horizons, Charcoal.

Radiocarbon ages have been obtained from seven charcoal horizons in a southern New Mexico arid region. Recent age highly calcareous alluvium deposits ranged from 1,100 to over 5,000 years. Pleistocene soils much older than 5,000 years occurred. Recent Pleistocene soils indicated present climate to be warmer and drier than Pleistocene pluvial climates. This could have decreased vegetative cover and caused erosion. Maximum and minimum ages for several soils formed in the deposits were established with the dated charcoal. Soil development of increasing age in Recent time was characterized by development of an A horizon, destruction of thin sedimentary strata, slight accumulation of carbonate, development of structure in materials of sufficiently fine texture and with continued carbonate accumulation, development of a weak calcic horizon. Pleistocene age soils could have distinct argillic horizons and strong horizons of carbonate accumulation. (Affleck-Ariz)
W69-04126

2K. Chemical Processes

MINERAL-WATER INTERACTION DURING THE CHEMICAL WEATHERING OF SILICATES,
Johns Hopkins Univ., Baltimore, Md. Dept. of Geography; Johns Hopkins Univ., Baltimore, Md. Dept. of Geology; and Maryland Geological Survey, Baltimore.
Owen P. Bricker, Andrew E. Godfrey, and Emery T. Cleaves.
Grant 665-G2 ACS, Grant GP 2660 NSF. Symp of Trace Inorg in Water, Advance in Chem Ser, No 73, pp 128-142, 1968. 15 p, 7 fig, 5 tab, 11 ref.

Descriptors: *Water chemistry, *Runoff, *Leaching, Infiltration, Silicates, Clays, Silica, Bicarbonates, Sodium, Magnesium, Calcium, Potassium, Maryland, Kaolinite.
Identifiers: Chemical weathering, Mineral-water interactions.

The geochemical balance of a 103 acre watershed underlain by silicate bedrock was investigated. Base flow composition of the stream water was essentially constant, but flood flows showed a decrease in concentration of silica, bicarbonate, and sodium and an increase in sulfate, magnesium, calcium, and potassium. Laboratory experiments indicate that fresh rock or soil reacts rapidly with distilled water and achieves a composition similar to the stream water, suggesting control of water composition by reaction with the silicate minerals. The alumino-silicate minerals react with carbon dioxide charged water to form kaolinite, releasing cations and silica to solution. The products of weathering are removed as particulate matter (0.28 metric tons/yr) and dissolved material (1.5 metric tons/yr).
W69-03724

THE STRONTIUM AND BARIUM CONTENT OF SEA WATER,
Naval Oceanographic Office, Washington, D. C.; and Massachusetts Inst. of Tech., Cambridge.
Neil R. Anderson, and David N. Hume.
Symp on Trace Inorg in Water, Advance in Chem Ser, No 73, pp 296-307, 1968. 12 p, 6 tab, 24 ref. AT (30-1)-2174, AT (30-1)-3145, AT (30-1)-905, Grant NSF-G12178.

Descriptors: *Trace elements, *Sea water, *Chemical analysis, Ion exchange, Flame photometry, Chlorides.
Identifiers: Strontium, Barium, Book.

Concentrations of strontium and barium in sea water were simultaneously determined by a combination of ion exchange concentration and flame photometry to ascertain more precisely strontium/chlorinity and barium/chlorinity ratios and to investigate the magnitude and nature of the strontium/chlorinity ratio variation if it was found. The results of the analyses of several ocean stations presented indicate that there is about 3%, but statistically significant, variation in the strontium/chlorinity ratio with respect to depth in sea water. An indication of a possible variation in the absolute amounts of strontium in sea water with the geographical location has also been observed. The barium/chlorinity ratio variation with respect to depth was found to be about 90% larger than that of strontium.
W69-03726

NEUTRON ACTIVATION ANALYSIS OF LANTHANIDE ELEMENTS IN SEA WATER,
Central Inst. for Industrial Research, Oslo (Norway); and Woods Hole Oceanographic Institution, Mass.
Ove T. Hogdahl, Sigurd Melsom, and Vaughan T. Bowen.
Symp on Trace Inorg in Water, Advance in Chem Ser, No 73, pp 308-325, 1968. 19 p, 6 fig, 7 tab, 14 ref. AT (30-1)-2174, AT (30-1)-1918, Grant NSF-GP-5319.

Descriptors: *Trace elements, *Sea water, Distribution patterns, Chemical analysis, Neutron activation analysis, Regression analysis, Elements (Chemical).
Identifiers: Lanthanide elements.

Neutron activation analyses of 16 samples of sea water (8 in duplicate) taken at 6 widely spaced stations in the Central Atlantic Ocean between 16 deg N and Equator at depths below 1000 m showed that the lanthanide patterns are relatively conservative characteristics of water masses. The differences in lanthanide distribution and total abundance between different water masses are small but significant. The absolute mass abundances of the lanthanides can be illustrated by

the following values for North Atlantic Deep Water: La, 0.0034 microgram/liter; Nd, 0.0028 microgram/liter; Gd, 0.00070 microgram/liter; Ho, 0.00022 microgram/liter; Yb, 0.00082 microgram/liter; Ce, 0.0012 microgram/litter; Sm, 0.00045 microgram/liter; Tb, 0.00014 microgram/liter; Er, 0.00087 microgram/liter; Lu, 0.00015 microgram/liter; Pr, 0.00064 microgram/liter; Eu, 0.00013 microgram/liter; Dy, 0.00091 microgram/liter; Tm, 0.00017 microgram/liter; Y, 0.0133 microgram/liter. (Samples were taken during the Atlantis II cruise.)
W69-03727

ALUMINUM SPECIES IN WATER,
Geological Survey, Menlo Park, Calif.
John D. Hem.
Symp on Trace Inorg in Water, Advance in Chem Ser, No 73, pp 98-114, 1968. 17 p, 13 fig, 1 tab, 16 ref.

Descriptors: *Aqueous solutions, *Aluminum, Water chemistry, Thermodynamics, Water properties, Kinetics, Microscopy.
Identifiers: Bayerite, Gibbsite, Aluminum polymers, Book.

Polymeric species of aluminum and hydroxide formed in 0.01M NaC10 sub 4 solutions, 10 esp -3.34 M in aluminum, after adding sufficient OH to reach pH 4.75 - 6.50 were identified by electron microscopy as gibbsite. The particles had diameters near 0.10 micron after 10 days of aging, when the molar ratio of bound OH/total Al (r) was between 2.0 and 3.0. The amount of OH in bridging positions in the polymer structure was determined by the kinetics of dissolution of the polymer in acid. When r exceeded 3 the precipitate formed was bayerite. Standard free energy values determined, in kcal per mole, include: AlOH ion, -165.2; Al (OH) sub 4 ion, -311.7; Al (OH) sub 3 (microcrystalline gibbsite), -272.3; Al (OH) sub 3 (bayerite), -274.0. Many natural waters contain enough fluoride that predominant aluminum solutes are fluoride complexes. (Knapp-USGS)
W69-03728

SODIUM-TO-CHLORINE RATIO IN HAWAIIAN RAINS AS A FUNCTION OF DISTANCE INLAND AND OF ELEVATION,
Hawaii Univ., Honolulu. Dept. of Chemistry; and Hawaii Institute of Geophysics, Honolulu.
For primary bibliographic entry see Field 02B.
For abstract, see .
W69-03735

DETERMINATION OF STRONTIUM-90 IN WATER,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 05A.
For abstract, see .
W69-03749

MINERAL SPRINGS OF THE DAYLESFORD DISTRICT,
Melbourne Univ., Parkville (Australia). Dept. of Geology.
R. J. W. McLaughlin, and Jennifer J. Macumber.
Proc Roy Soc of Victoria, Vol 81, Part 2, pp 143-148, Sept 27, 1968. 6 p, 2 fig, 2 tab, 22 ref.

Descriptors: *Water quality, *Spring waters, *Mineral water, Salts, Thermal water, Chemical analysis, Percolating water, Meteoric water.
Identifiers: Australia, Daylesford.

Mineral springs in the Daylesford region, Australia, were analyzed for Na, K, Li, Ca, Mg, Fe, Mn, B, carbonate, silica, phosphate, Cl, and Br. The ratios of the major cations are similar to those of normal surface waters, and silica and boron are low, indicating an origin from percolating meteoric waters with no contribution from nearby volcanic fumaroles despite close association with basalt. (Knapp-USGS)
W69-03933

OCCURRENCE OF SELECTED MINOR ELEMENTS IN THE WATERS OF CALIFORNIA,
Geological Survey, Washington, D. C.
William D. Silvey.
Geol Surv Water-Supply Pap 1535-L, pp L1-L25, 1967. 8 fig, 6 tab, 21 ref.

Descriptors: *Water treatment, *Water analysis, *Chemical precipitation, *Spectroscopy, California, Iron, Sea water, Streams, Springs, Wells.
Identifiers: *Pacific Ocean, *Minor element occurrence, Nickel, Vanadium.

Sea water, stream water, and deep-seated spring waters were studied for the occurrence of 17 minor elements. The occurrence of these elements was strongly influenced by the vertical position of the water relative to the Earth's surface, and occurrence and concentration are strongly affected by biota in the hydrologic environment. Where biologic activity is at a maximum, as in the case of sea water, the concentration and number of minor elements are at a minimum; the converse is also true. Well water and oil-field brine in an intermediate position between deep-seated water and stream water contain minor elements found in both deep-seated water and stream water. Iron, nickel, and vanadium most frequently occurred in the waters examined; beryllium was not found in any of the waters. (Llaverias-USGS)
W69-03966

HYDROCARBONS OF BLUE-GREEN ALGAE: GEOCHEMICAL SIGNIFICANCE,
Texas Univ., Port Aransas. Inst. of Marine Science.
Kenneth Winters, P. L. Parker, and Chase Van Baalen.
Science, Vol 163, No 3866, pp 467-468, 31 Jan 1969. 2 tab, 7 ref.

Descriptors: *Cyanophyta, *Geochemistry, Chromatography, Cultures, Analytical techniques, Gas chromatography, Estuaries, Saline water, Sediments.
Identifiers: *Hydrocarbons, Trichodesmium erythaeum, Coccochloris elabens, Microcoleus chthonoplastes, Nostoc muscorum, Agmenellum quadruplicatum, Plectonema terebrans, Oscillatoria williamsii, Lyngbya lagerhaimii, Anacystis nidulans, Intermediary metabolism, Monoenoic hydrocarbons, Dienoic hydrocarbons, Hypersaline environments.

Authors determined hydrocarbon composition of 11 species of cyanophytes derived from pure cultures and natural environments. Hydrocarbons were extracted with methanol and hexane, separated on silica gel columns, and identified from their retention times in the gas chromatograph. Compositions so determined are simple and qualitatively similar. The marine coccoids, Coccochloris elabens and Agmenellum quadruplicatum, contained only monoenoic (85-98%) and dienoic (2-13%) C-sub-19 compounds. Remaining species contain C-sub-15 to C-sub-18 hydrocarbons, with preponderance of saturated C-sub-17 compounds (36-95%). The fact that no C-sub-9 or C-sub-10 hydrocarbons were detected in Trichodesmium, a form whose fatty acids include 50% C-sub-10 saturated chains, suggests that fatty acids are not precursors of hydrocarbons. Compounds with molecular weights of C-sub-20 or higher were not detected. Although biological functions and restricted biosynthesis of hydrocarbons in the blue-green algae are not understood, it does appear that long chain hydrocarbons (20 carbon atoms and longer) found in ancient sediments are not derived from cyanophytes. (Eichhorn-Wis)
W69-04021

2L. Estuaries

STATISTICAL APPROACH TO ESTUARINE BEHAVIOR,
Federal Water Pollution Control Administration, Washington, D. C.; and Kansas City, Mo.
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-03732

IDENTIFICATION OF PETROLEUM IN ESTUARINE WATERS,
California State Dept. of Public Health, Berkeley.
For primary bibliographic entry see Field 05B
For abstract, see .
W69-03738

MICROBIOLOGY OF OCEANS AND ESTUARIES,
Miami Univ., Fla. Inst. of Marine Science.
E. J. F. Wood.
Amsterdam, Elsevier Publ Co Oceanogr Ser, 1967. 319 p, 29 fig, 8 plate, 19 tab, 521 ref.

Descriptors: *Microbiology, *Aquatic microbiology, *Estuaries, *Marine microorganisms, Marine algae, Marine animals, Marine bacteria, Marine fungi.
Identifiers: Estuarine microbiology.

A textbook on marine and estuarine microbiology is primarily intended for undergraduate students in marine biology and oceanography and may also be of use to research workers in marine microbiology. The problems usually encountered in study, including sampling techniques, taxonomy, and quantification, are discussed thoroughly. Environmental relationships and modifications by organisms of their environments are explained. Taxonomy is discussed with references to the most significant taxonomic works and workers in each group. Nutrition and reproduction are considered in detail. Economic aspects such as fouling, the relation of borers to fungi, microbial corrosion, fermentation, rotting of cordage and structures, fish spoilage, shellfish poisoning, and geobiological aspects and ore formation are discussed. (Knapp-USGS)
W69-03752

UNITED STATES V SMOOT SAND AND GRAVEL CORP (OWNER OF CONDEMNED RIPARIAN LANDS RIGHTS IN UNDERWATER GRAVEL DEPOSITS).
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-03910

DETERMINATION OF NITRATE IN ESTUARINE WATERS AUTOMATIC DETERMINATION USING A BRUCINE METHOD,
Federal Water Pollution Control Administration, Metuchen, N. J.
Lloyd Kahn, and Francis T. Brezenski.
Environ Sci Technol. Vol 1, No 6, pp 492-494, June 1967. 2 fig, 2 tab, 9 ref.

Descriptors: *Nitrate determination, *Automation, *Estuaries, *Analytical techniques, Methodology.

An automated procedure for the determination of nitrates in estuarine and sea waters is presented. The method is adapted from the manual determination described by Kahn and Brezenski, and a two-fold increase in precision resulted from the automation. Samples containing from 0.05 to 0.6 mg of nitrate-nitrogen per liter were analyzed with a standard deviation of less than 0.01 mg of nitrate-nitrogen per liter. A flow diagram for use with the Technicon Auto Analyzer is provided. (Konrad-Wis)
W69-04025

DEVELOPMENT OF OPTIMIZATION - SYSTEMS ANALYSIS TECHNIQUES FOR TEXAS WATER RESOURCES,
Texas A and M Univ., College Station. Water Resources Inst.
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-04133

. WATER SUPPLY AUGMENTATION AND CONSERVATION

. Saline Water Conversion

E STRONTIUM AND BARIUM CONTENT SEA WATER,
val Oceanographic Office, Washington, D. C.; Massachusetts Inst. of Tech., Cambridge.
primary bibliographic entry see Field 02K.
abstract, see .
9-03726

UTRON ACTIVATION ANALYSIS OF NTHANIDE ELEMENTS IN SEA WATER,
ntral Inst. for Industrial Research, Oslo (Nor-); and Woods Hole Oceanographic Institution, ss.
primary bibliographic entry see Field 02K.
abstract, see .
9-03727

UMINUM SPECIES IN WATER,
ological Survey, Menlo Park, Calif.
primary bibliographic entry see Field 02K.
abstract, see .
9-03728

LINITY AND ARIDITY,
primary bibliographic entry see Field 03C.
abstract, see .
9-03751

3. Water Yield Improvement

APORATION RETARDED BY ONOLAYERS,
mmonwealth Scientific and Industrial Research ganization, North Ryde (Australia). Wheat search Unit.
MacRitchie.
ence, Vol 163, No 3870, pp 929-931, Feb 28, 69. 3 p, 2 tab, 10 ref.

scriptors: *Evaporation control, *Hexadecanol, -water interfaces, Vapor pressure, Adsorption, ffusion, Convection, Surface tension, Thermal ess, Humidity.
ntifiers: *Monolayers, Surface pressure adient, Vapor transport.

duction in the steady-state rate of water aporation by hexadecanol monolayers is cussed and pertinent experiments are reviewed d correlated with work of various researchers. tardation depends only on the air velocity above surface and is independent of the absolute rate evaporation up to air velocities of 40 cm per cond. The hexadecanol monolayer exerts its ef-t by altering the hydrodynamic boundary condi-ns. It increases the size of the diffusion boundary er. The highest air velocity in the experiments scribed was 480 cm/sec so that, at a value of 0.15 the kinematic viscosity of air at 20 deg C, the ghest Reynolds No. calculated is 29x10 to the 4th wer. Laminar flow is assumed in all the experi-nts. Small surface pressure gradients can thus use significant changes in boundary layer proper-s and consequently evaporation rates. (Lang-GS)
69-03722

PROGRESS REPORT ON PROJECT SKY-ATER THE BUREAU OF RECLAMATION'S TMOSPHERIC WATER RESOURCES PRO-RAM,
ureau of Reclamation, Denver, Colo.
rchie M. Kahan.
Pap, Annu Meet Colo River Water Users Ass, Las Vegas, Nev, Dec 1968. 17 p, 4 fig.

Descriptors: *Weather modification, *Cloud seeding, Cloud physics, *Artificial precipitation, *Water resources development, Snowfall, Atmospheric precipitation, Research and development, Water resources, Precipitation (Atmospheric), Silver iodide, Planning, Instrumentation, Costs, Meteorological data.
Identifiers: *Atmospheric research, Bureau of Reclamation, Snowstorms, *Project Skywater, Silver iodide generators, Snow samplers.

This paper reports the present status of Project Skywater, the Bureau of Reclamation's Atmospheric Water Resources Program, discusses recent progress, and provides some details of the planned Colorado River Pilot Project. Thirty-seven research groups, with an annual total support level of $4,700,000, are engaged in studies designed to develop technology for precipitation management. Recent experimental evidence indicates that cloud seeding results can range from increases to decreases, depending on meteorological circumstances attendant to individual seedings. Mathematical models of cloud behavior are available to guide field experimentation. Instrumentation for tracing nuclei plumes is coming into widespread use. An operationally-oriented, randomized pilot project is being planned for the Upper Colorado River Basin. (USBR)
W69-03769

PROCEEDINGS: INTERNATIONAL SYMPOSIUM ON FOREST HYDROLOGY.
National Science Foundation, Washington, D. C.
For primary bibliographic entry see Field 02A.
For abstract, see .
W69-03806

RIME AND HOARFROST IN UPPER-SLOPE FORESTS OF EASTERN WASHINGTON,
Forest Service (USDA) Wenatchee, Wash. Pacific Northwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 02I.
For abstract, see .
W69-03807

EVAPORATION OF WATER: ITS RETARDATION BY MONOLAYERS,
Columbia Univ., New York. Dept. of Mineral Technology; and Calif. Univ., Berkeley. Dept. of Mineral Technology.
Victor K. LaMer, and Thomas W. Healy.
Science, Vol 148, No 3666, pp 36-42, April 3, 1965. 7 p, 4 fig, 1 tab, 33 ref.

Descriptors: *Evaporation control, *Alcohols, *Monomolecular films, Reservoir evaporation, Retardants, Lakes, Molecular structure, Costs, Solvents, Thermal properties, Rates of application, Economic feasibility, *Water loss, *Resistance, Winds, On-site tests.
Identifiers: Hydrocarbon chain, Capillary waves.

Utilization of monolayers to reduce evaporation on lakes and reservoirs was outlined. Principles of using monolayers were examined with respect to the way in which water evaporates. Also considered were molecular architecture of the monolayer, mixed monolayers, impurities in short-chain alcohols, spreading solvents, capillary waves and the thermal history of monolayer materials. Practical aspects of using monolayers were discussed, using bodies of water where the alcohols were applied at different rates and under different climatic conditions. (Blecker-Arizona)
W69-03884

AUGMENTING COLORADO RIVER BY WEATHER MODIFICATION,
Bureau of Reclamation, Denver, Colo.
Patrick A. Hurley.
ASCE Proc, J Irrig and Drainage Div, Vol 94, No IR4, Pap 6271, pp 363-380, Dec 1968. 18 p, 7 fig, 2 tab, 19 ref.

Descriptors: *Weather modification, *Water supply, *Colorado River Basin, *Cost-benefit ratio, Meteorology, Runoff, Precipitation (Atmospheric), Research and development.

An overall perspective on the promising potential for increasing winter precipitation over mountains of the Upper Colorado River Basin is presented in an engineering context for water development planners. The resulting augmented spring runoff, regulated by existing reservoirs, can provide additional water to meet growing demands for the region where present water supplies are becoming critically short. Increasing the November through April precipitation by 15% over 14,200 sq mi of target areas generally located at elevations above 9500 ft will yield an average additional runoff of 1,870,000 acre-ft annually. This practical capability to enhance the winter snowfall should be developed by the mid-1970's through the outlined $25,000,000 applied research field program. Exclusive of initial research costs, regular production costs by weather modification are estimated at $1.00 to $1.50 an acre-ft for the new water. Average additional benefits are estimated to be $20,000,000 to $25,000,000 annually, for a highly favorable benefit-cost ratio of about 10 to 1.
W69-03950

INCREASING WATER YIELD IN THE NORTHEAST BY MANAGEMENT OF FORESTED WATERSHEDS,
Forest Service (USDA), Upper Darby, Pa. Northeastern Forest Experiment Station; and Forest Service (USDA), Parsons, W. Va. Northeastern Forest Experiment Station.
Howard W. Lull, and Kenneth G. Reinhart.
Forest Serv Res Pap NE-66, 1967. 45 p, 1 fig, 3 tab, 56 ref, 2 append.

Descriptors: *Watershed management, *Clear-cutting, *Herbicides, *Water yield improvement, Cutting management, Northeast U. S., Erosion control, Forest management, Land management, Watersheds (Basins), Weed control.
Identifiers: Experimental forests, Experimental watersheds.

Increasing water yield from forested watersheds by total or partial forest removal is discussed. Forest removal by cutting or herbicides is analyzed in terms of effectiveness, yield, and cost. Prevention of yield reduction by reforestation or by long-term policies of forest protection is also discussed. Precautions and safeguards necessary for production and maintenance of high-quality water from managed watersheds are listed. (Knapp-USGS)
W69-03980

WATER PROBLEMS IN THE NORTHEAST AND INCREASING FEDERAL REGULATION,
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-04052

WIND-TUNNEL INVESTIGATION OF AIR FLOW OVER A HEXADECANOL MONOLAYER SPREAD ON A WATER SURFACE,
Maryland Univ., College Park; and Oklahoma State Univ., Stillwater.
W. F. Schwiesow, and F. R. Crow.
Transactions of the ASAE, Vol 11, No 4, pp 553-557, July-Aug 1968. 11 fig, 2 tab.

Descriptors: *Monomolecular films, *Hexadecanol, *Tunnels, *Air circulation, *Winds, Air-water interfaces, Evaporation control, Regression analysis, Least squares method, Ponds, Reservoir evaporation, Equations, Barriers, Analytical techniques, Surfaces, Water loss, Variability.
Identifiers: Wind tunnel.

An investigation was conducted in the laboratory using a 4 by 4 by 50 ft wind tunnel to study the air flow over a small pond on which barriers were erected to prevent the loss of hexadecanol film due to wind. Experiments were conducted to determine hexadecanol film coverage on test reservoirs without barriers, with vertical barriers of varied height, with barriers having different amounts of open area, with low flat barriers and sloping barriers. A prediction equation was developed relating the length of hexadecanol film covering a water surface to the wind shear force that acts on the film. A multivariable regression analysis was used to evaluate film coverage when no barriers were present. Linear regression analysis was used to determine the several barrier influence relationships. (Affleck-Ariz)
W69-04125

3C. Use of Water of Impaired Quality

SALINITY AND ARIDITY,
H. Boyko.
The Hague, Dr. W. Junk Publ, 1966. 408 p, 37 fig, ref.

Descriptors: *Arid climates, *Arid lands, *Saline soils, *Salt tolerance, Salinity, Irrigation, Saline water systems, Dunes, Sands.
Identifiers: Saline water irrigation, Book.

New approaches to the problem of supplying irrigation water to arid and saline regions are surveyed with particular emphasis given to the use of saline water or seawater for irrigation. The methods and results of experiments on the effects on plants of using saline irrigation water in various countries are presented in articles covering local research. It is shown that the salt tolerance of most plants is highest in dune sand. Salt water of concentrations as high as sea water can be used to grow some crops in dune areas. Desalination techniques and the effects, causes, and remedies for soil salinization are discussed in detail. (Knapp-USGS)
W69-03751

MINERAL-WEATHERING CORRECTION FOR ESTIMATING THE SODIUM HAZARD OF IRRIGATION WATERS,
Agricultural Research Service, Riverside, Calif. Salinity Lab.
J. D. Rhoades.
Soil Sci Soc Amer Proc, Vol 32, No 5, pp 648-652, Sept-Oct 1968. 5 p, 2 fig, 2 tab, 10 ref.

Descriptors: *Sodium, Hazards, *Irrigation water, Water quality, Soil science, Water pollution, Mineralogy, Forecasting, Calcium, Carbonates, *Soil chemical properties, *Soil properties, Saline soils, Irrigation, Laboratory tests, Solutes, Drainage water, Minerals, Leaching, Calcareous soils, Lysimeters.
Identifiers: *Sodium adsorption ratio.

An equation for evaluating the sodium hazard of irrigation waters has been modified to include the effect of soil-mineral weathering on changes occurring in the SAR (sodium adsorption ratio) values of waters applied to soils. The modification involves incorporating a coefficient that reduces the predicted soil drainage-water SAR values by various amounts, depending on the mineral properties of the soil and the leaching regime used. The value of the coefficient required in the equation can be determined by simple laboratory procedures. The modified equation was tested on a calcareous soil by comparing SAR values predicted from the equation with values obtained in a controlled lysimeter experiment. The applicability of the equation is supported by the excellent correspondence obtained between calculated and observed SAR values. (USBR)
W69-03791

THE EFFECT OF SOIL-MINERAL WEATHERING ON THE SODIUM HAZARD OF IRRIGATION WATERS,
Agricultural Research Service, Riverside, Calif. Salinity Lab.
J. D. Rhoades, D. B. Krueger, and M. J. Reed.
Soil Sci Soc Amer Proc, Vol 32, No 5, pp 643-647, Sept-Oct 1968. 5 p, 1 fig, 7 tab, 10 ref.

Descriptors: Water quality, Water pollution, Arid lands, Soils, Salts, Minerals, *Sodium, Hazards, *Irrigation water, Cation exchange, Calcium, *Weathering, Mineralogy, Effluents, Magnesium, Soil science, Solutes, *Soil chemical properties, Saline soils, Permeameters, Laboratory tests, *Soil properties.
Identifiers: *Sodium adsorption ratio.

The extent to which the release of solutes from soil-mineral weathering processes changes the composition of applied irrigation waters was evaluated for 6 arid-land soils. Soil samples were packed in plexiglas permeameters and pretreated to: (1) remove readily soluble organic matter, (2) minimize subsequent microbial activity, and (3) equilibrate soil exchange complexes with irrigation waters. Soil solutions were displaced from the nearly saturated columns and analyzed at biweekly intervals until a steady composition was attained. Effluent solutions were 3-5 milliequivalents/liter higher in total salt content than the applied waters. Gains were accounted for primarily by Ca plus Mg and hydrogen carbonate ions. The net effect of these changes in solution compositions was a 30-90% reduction in SAR (sodium adsorption ratio) values of applied solutions. SAR reductions were greatest for waters of lower salt concentrations, but were significant even for waters containing as much as 15-20 meq of salt per liter. This phenomenon reduces the Na hazard expected with certain irrigation waters, and should be considered in water quality evaluation.
W69-03792

TOWARDS ECONOMIC EVALUATION OF THE QUALITY OF WATER IN IRRIGATION,
Hebrew Univ., Jerusalem (Israel).
Dan Yaron.
For 8-Volume Proceedings see Vol 2, No 9, Field 06B, W69-03305. International Conference on Water for Peace, Vol 6, pp 749-756, 1968. 12 p, fig, 1 tab, 13 ref.

Descriptors: *Irrigation water, *Water quality control, Salt balance, Statistical methods, *Water supply, *Water demand.
Identifiers: *Saline water systems, Evaluation.

Water quality is controllable. Therefore, the quantity and quality of water should be considered as economically meaningful parameters in water resource development or management decisions. The effects of irrigation with saline water on crop yields are reviewed. Next, a highly simplified economic model, which optimizes possible quantity - quality combinations within a framework of the supply and demand for irrigation water, is presented. In making this model more realistic, the supply side is treated only indirectly but the distinction is explicitly made between the supply and demand. The major portion of this paper deals with the evaluation of the quality of water in irrigation. (Grossman-Rutgers)
W69-04059

3D. Conservation in Domestic and Municipal Use

PUBLIC UTILITIES - LIGHT AND WATER SUPPLY.

N J Stat Ann secs 40:62-88, 40:62-89 (1967).

Descriptors: *New Jersey, *Hydroelectric power, *Public benefits, *Pumping plants, Legislation, Lighting, Power plants, Condemnation, Construction, Water supply, Pumps, Water storage, Streams, Rivers, Artesian wells, Water distribution, Local governments, Cities.

The body in charge of the public water supply in any municipality may use any property which has been used for the purpose of supplying water, or acquire additional property by purchase or condemnation, for the purpose of generating electrical energy to supply that municipality with light, or for other public use. That body may also acquire land for the purpose of furnishing water power to drive and operate pumping stations or other machinery used in storing water from streams, rivers and artesian sources and in distributing such water for use in the municipality. (Shevin-Fla)
W69-03856

WATER RESOURCES OF THE MARQUETTE IRON RANGE AREA, MICHIGAN,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 06D.
For abstract, see .
W69-03971

KANE V VILLAGE OF RED HOOK (FIRE PROTECTION REQUIREMENTS DETERMINATIVE OF 'EXCESS WATER' OF SUPPLY CONTRACT).

10 A D 2d 960, 201 N Y S 2d 590-591 (1960).

Descriptors: *Surplus water, *Excess water (Legal aspects), *Supply contracts, *Supply, Water tanks, New York, Judicial decisions, Water storage, Water requirements, Water works, Water utilization, Legal aspects.
Identifiers: Fire protection (Water needs).

Plaintiff taxpayers brought suit to restrain the performance of a contract whereby the defendant village agreed to supply water from its system to homes outisde the village. The lower court held for the taxpayers, and the village appealed. This court affirmed with modifications. New York law provides that a village may only sell 'surplus water' for use outside the village, and the plaintiffs contended that the village must consider the needs of fire protection when determining whether there is 'surplus water'. The court found that the present supply would not deliver 1,000 gallons per minute to a fire for six hours even if no water was being used for other purposes. This being so, the lower court was correct in holding that the defendant had no surplus water. Two concurring judges would have allowed the village to maintain the contract provided its system could be modified so as to cut off or reduce the water supply to homes outside the village during a fire or other emergency within the village. (Blunt-Fla)
W69-04005

CITY OF COLD SPRING V CAMPBELL COUNTY WATER DISTRICT (RIGHT OF MUNICIPALITY TO SERVE CUSTOMERS OUTSIDE ITS CORPORATE LIMITS).

334 S W 2d 269-275 (Ct App Ky 1960).

Descriptors: Kentucky, Judicial decisions, *Administrative agencies, Permits, *Water districts, *Cities, Water distribution, Public utilities, *Boundary disputes, Water permits, Water supply, Water delivery, State jurisdiction, Water rates, Water works, Distribution systems, Legal aspects.

The water district brought this action to establish that it, and not the defendant municipality, had the exclusive right to provide water service in the area comprising the district. The city of Cold Spring had requested and gained the permission of the State Public Service Commission to construct lines to purchase additional water from the city of Covington. The controversy arose out of the city's supplying water to some 43 homes, located five miles beyond the city limits, which were along the path of

new line. The water district has never served e people, and they had requested city water ce. The city based its alleged right on the cer- ate from the Public Service Commission, while district claimed exclusive rights within its terri- The city appealed a ruling in favor of the dis- this court reversed with directions. The deci- was based on a construction of a state statute e, the court held that the question whether the ict had exclusive privileges was a question of or the court and not a question of fact for the ic Service Commission. Where a controversy is een persons or corporate bodies engaged in ic utility enterprises the right to construct new ties is based on facts to be determined by the mission in deciding which party shall be issued ertificate. Courts may decide whether statutes one party an exclusive privilege to the exclu- of another, but, failing to find such exclusive lege, the controversy and its resolution are n the Commission's jurisdiction. (Blunt-Fla) -04006

ER PROBLEMS IN THE NORTHEAST INCREASING FEDERAL REGULATION,
primary bibliographic entry see Field 06E.
bstract, see .
-04052

Conservation in Industry

ER REQUIREMENTS OF THE IRON AND EL INDUSTRY,
ogical Survey, Washington, D. C.
primary bibliographic entry see Field 06D.
bstract, see .
-03965

LOGY AND GROUNDWATER OF THE ANNAH RIVER PLANT AND VICINITY, TH CAROLINA,
ogical Survey, Washington, D. C.
primary bibliographic entry see Field 02F.
bstract, see .
-03970

IERIES JURISDICTION BEYOND THE RITORIAL SEA - WITH SPECIAL ERENCE TO THE POLICY OF THE TED STATES,
primary bibliographic entry see Field 06E.
bstract, see .
-04046

ECTOR OF IRRIGATION.

Code tit 8, sec 9 (1) (1967 Supp).

riptors: *Alabama, *Irrigation districts, *Ad- strative agencies, Legislation, Water conserva- Inter-agency cooperation.
ifiers: *Director of irrigation.

e shall be established in the state department nservation, the office of the director of irriga- The director shall be appointed by the gover- rom a list of qualified nominees and shall serve r year term at a salary of $12,000 per annum. duties of the director shall be to work with and any irrigation district established or osed. The director shall assist in formulating for establishing districts, shall supervise all in connection therewith, and shall exercise ral supervision whenever state interests or icts arise with respect to state programs of ir- on and water conservation. (Kahle-Fla) -04167

LIC UTILITIES - POWERS AND DUTIES.

Stat Ann sec 48:19-22 (1940); N J Stat Ann 48:19-13 to 48:19-20 (1968-69 Supp).

Descriptors: *New Jersey, *Public utilities, *Water supply, Legislation, State governments, Cities, Municipal water, Water consumption (Excludes consumptive use), Pipes, Conduits, Condemnation, Eminent domain, Administrative agencies, Roads, Reservoirs, Diversion, Legal aspects.
Identifiers: Water companies.

This section allows water companies to take and direct sources of water supply. They can build and maintain reservoirs, lay pipes, establish conduits, etc. Water companies may enter upon land for purpose of examination, measurements, and levelings when necessary. They may also take, use, or occupy any land or divert any spring or stream when necessary, providing the proper governmental agency has so authorized. The companies are allowed to lay pipes under such public roads, streets, etc, as is necessary. Such pipe must be three feet below the surface and not unnecessarily obstruct or interfere with public travel or damage public or private property. Procedure to obtain consent to lay such pipe is set forth in this article. Finally, the statute provides for a proportional refund on water rents by the water company to the consumer if water is not supplied for five days. 'Consumer' refers to individuals, firms, private, public, and municipal corporations furnished with water for any purpose other than motive power. (Logan-Fla)
W69-04199

PUBLIC UTILITIES - WATER POWER COMPANIES.

N J Stat Ann secs 48:14-14 (1940); N J Stat Ann secs 48:14-9 to 48:14-13, 48:14-15 to 48:14-19 (1968-69 Supp).

Descriptors: *New Jersey, *Dams, *Dam construction, *Electric power, Legislation, State governments, Public utilities, Cities, Canals, Laterals, Condemnation, Eminent domain, Backwater, Low water mark, Locks, Gates, Fish passages, Water pollution, Electric power, Potable water, Damages, Legal aspects, Diversion, Obstruction to flow, Water supply compensation.
Identifiers: Water power companies, Raceways.

This section allows water power companies, after taking a survey of the location, to enter and take possession of the land as a site for dam construction. Owners of the land must be fully compensated. The flow back and raising of the waters behind these dams cannot exceed ten feet above common low waters of these rivers and streams, and the companies may be required to construct the dam in such a manner as to allow for navigation and to provide for the passage of fish. The companies may construct canals or raceways (both main and lateral). All water so diverted must be returned to the rivers or streams as unpolluted as before it was so diverted. These companies cannot supply any municipality or the public with water for potable or other domestic use, and they are not entitled to damages for a diversion of the water of a stream or river for the water supply of a municipality. Finally, provisions are made herein for the erection of poles by the companies to sustain their wires and fixtures. (Logan-Fla)
W69-04200

3F. Conservation in Agriculture

PLAN FOR UTILIZING THE WATER RESOURCES OF THE UPPER KUBAN',
V. S. Konviz.
Hydrotech Constr, No 2, pp 87-93, Feb 1968. 7 p, 2 fig, 1 tab.

Descriptors: Water resources, *Water resources development, Rivers, Planning, River basin development, River basins, Hydroelectric power, Arid lands, Fish, Irrigation, Sprinkler irrigation, Flood irrigation, Rice, Irrigation canals, Canals, Foreign projects, Hydroelectric plants.
Identifiers: *Kuban' River (USSR), USSR, Hydroelectric resources.

Plans for completing the development of the Upper Kuban' River basin in Russia are outlined. A method of flood irrigation for a highly arid steppe region and a large flood irrigation project intended for rice growing are being investigated. The latter area will approach 250,000 ha in size. Other areas in the densely populated middle section of the basin are being evaluated. The entire water resources of the Kuban' River are estimated to provide flood irrigation for 9 million ha and sprinkler irrigation for 1 million ha; 7-8 cu km of water will be required annually for this purpose. Economically important fish life in the Sea of Azov, threatened by past construction operations, must be preserved in future development of the basin. Plans are outlined for using the hydropower resources of the Upper Kuban' basin, estimated to be 17.4 billion kwh/yr; 7-9 billion kwh/yr are in the European part of the USSR. (USBR)
W69-03767

MOISTURE STORAGE AND SPRING WHEAT YIELDS ON LEVEL-BENCH TERRACES AS INFLUENCED BY CONTRIBUTING AREA COVER AND EVAPORATION CONTROL,
Agricultural Research Service, Mandan, N. Dak.
H. J. Haas, W. O. Willis, and G. O. Boatwright.
Agronomy J, Vol 58, No 3, pp 297-299, May-June 1966. 3 p, 4 tab.

Descriptors: *Water storage, Water conservation, Evaporation control, *Wheat, Grasses, *Runoff, Fallowing, Erosion control, Bench leveling, Terracing, Spring, Crop production, Cover crops, Snowmelt, Cloudbursts.
Identifiers: Contributing area.

Purposes of the study were to determine the effect which different types of contributing area covers would have on both moisture storage and spring wheat yields on level bench terraces and how much moisture could be conserved by partial evaporation control of wheat from harvest to seeding time. Soil moisture storage on benches without a contributing area was about the same as on benches with a grass or wheat contributing area. Partial evaporation control increased moisture storage by an average of 2 inches for fallow and 1 inch for annual cropping. Principal advantages of level-bench terraces in arid climates appear to be preventing runoff of torrential-type rains, reducing erosion and increasing yields through moisture conservation. (Blecker-Arizona)
W69-03871

THE EFFECTS OF EVAPORATION, POTENTIAL TRANSPIRATION AND RAINFALL ON DEPLETION OF SOIL MOISTURE BY IRRIGATED PERENNIAL PASTURE,
State Research Farm, Werribee (Australia).
L. F. Bartels.
Aust J Exp Agric and Anim Husb, Vol 8, No 35, pp 720-724, Dec 1968. 5 p, 2 fig.

Descriptors: *Evaporation, Evaporation pans, Rainfall, Irrigation effects, Irrigation efficiency, Transpiration, Forecasting, *Soil moisture, *Irrigated land, *Pastures, *Moisture deficit, Semiarid climates, Drying, Regression analysis, Water loss, Weather data.
Identifiers: *Evaporimeters, Australia, Perennial, Soil moisture depletion, Penman's formula, *Evaporative index.

The predictability is discussed of soil moisture depletion from evaporation and rainfall measurements which were taken in Werribee, Australia. Depletion of soil moisture by an irrigated perennial pasture was shown to be closely related to an evaporative index (E-R), the accumulated difference between evaporation (E inches) and rainfall (R inches) subsequent to the last irrigation. This index was calculated for three types of evaporimeter, the standard Australian tank evaporimeter, the American Class A pan evaporimeter, and the Wright-Rain Irrigation Indicator. The index was directly proportional to the difference between Penman's potential transpira-

tion and rainfall, for drying cycles of more than 7 days duration. It was suggested that (E-R) might be a useful guide for irrigation scheduling, whether Penman's estimate of potential transpiration was found to be reasonably accurate. (Affleck-Arizona)
W69-03875

NITROGEN FERTILIZER AND WHEAT IN A SEMI-ARID ENVIRONMENT 4: EMPIRICAL YIELD RESPONSE MODELS AND ECONOMIC FACTORS,
Cunningham Lab., Brisbane (Australia).
J. S. Russell.
Aust J Exp Agr and Anim Husb, Vol 8, No 35, pp 736-748, Dec 1968. 13 p, 1 fig, 10 tab.

Descriptors: *Fertilizers, Rainfall disposition, Model studies, Statistical models, *Wheat, Forecasting, Economic feasibility, Soil moisture, *Nitrogen, *Crop response, Crop production, Equations, Rates of application, Climatic data, Variability, *Semiarid climates, Regression analysis, Profit.
Identifiers: *Australia, Parameters.

Difficulties in predicting grain yield response to applied nitrogen under conditions of low and variable rainfall were discussed in this report. Three models of grain yield response to applied nitrogen fertilizer for each of two strategies were proposed, based on data from field experiments carried out in South Australia. In the first strategy (nitrogen applied at sowing) the parameters were May-August rainfall, October mean maximum temperature and one of three alternative site criteria: initial soil nitrate content, 15-atmospheres soil moisture percentage, or estimated nitrogen status. In the second strategy (nitrogen applied in late winter) the parameters were similar, except that May-July rainfall replaced May-August rainfall. Response surfaces were examined using a calculated most profitable rate of application with a range of grain to fertilizer price ratios from 2 to 8. These calculations emphasized the importance of economic factors in affecting fertilizer use in areas where responses are small and variable. Limitations of the models and problems associated with the use of predicted climatic criteria were discussed. (Affleck-Arizona)
W69-03877

FERTILIZING DRYLAND SPRING AND WINTER WHEAT IN THE BROWN SOIL ZONE,
Agricultural Research Service, Bozeman, Mont.; and Agricultural Research Service, Huntley, Mont.
Paul L. Brown, and Ralph E. Campbell.
Agronomy J, Vol 58, No 3, pp 348-51, May-June 1966. 4 p, 5 tab.

Descriptors: *Fertilizers, Productivity, *Nitrogen compounds, Wheat, Phosphates, Dry farming, Precipitation (Atmospheric), *Brown soils, Moisture content, *Moisture availability, *Soil moisture, Montana, Crop response, Crop production, Winter, Spring, Moisture stress.

Wheat fertilizer research on dryland was conducted at Huntley, Montana, in order to determine responses of spring and winter wheat to nitrogen (N) and phosphorous (P) fertilization. In general, yields were directly related to precipitation during the growing season (April through July). From emergence to heading the N-P-fertilized plots used significantly more water than the water treatments. From heading to maturity, the N-P plots used significantly less water than the other treatments because the available supply was less. Supplemental soil moisture more than doubled average grain yields but was not enough to cause the fertilizer to increase grain yields above check treatment yields. Total water use from early joint to maturity was not significantly affected by fertilizer because all available water was used. Fertilization of wheat in an arid climate has a great deal of influence on the plant with respect to development, yield and soil moisture efficiency. (Blecker-Arizona)
W69-03878

ISOLATION AND CHARACTERIZATION OF HYDROLOGIC RESPONSE UNITS WITHIN AGRICULTURAL WATERSHEDS,
Agricultural Research Service, Beltsville, Md. Soil and Water Conservation Research Div.
C. B. England, and C. A. Onstad.
Water Resources Research, Vol 4, No 1, pp 73-77, June 1968. 5 p, 4 fig, 1 tab.

Descriptors: *Hydrologic data, *Hydrologic aspects, *Watersheds (Basins), *Soil groups, Soil formation, Soil physical properties, Runoff, Hypsometric analysis, Parametric hydrology, Topography, Infiltration, Petrography, Geomorphology.
Identifiers: *Hydrologic response units.

To extrapolate hydrologic relations from small to large areas, a watershed can be partitioned by isolation of units of relative homogeneity with respect to soil type, landform and land use that fall into a sequence compatible with the hydraulics of overland and subsurface flows. Size and distribution of hydrologic response units of different characteristics within a watershed may profoundly affect the areal-and time-distribution of potential over the area. Partitioning the hypsometric curve on the basis of soil group distribution may offer some clues as to the differences in hydrologic behavior of different sized watersheds within a given area. The methods discussed in the paper can be applied to arid watersheds to determine their hydrologic response performance. (Blecker-Arizona)
W69-03879

CONSERVATION BENCH TERRACES IN EASTERN COLORADO,
Agricultural Research Service, Akron, Colo. Soil and Water Conservation Research Div.
Rome H. Mickelson.
Trans of the American Soc of Agricultural Engineers, Vol 11, No 3, pp 389-392 May-June 1968. 4 p, 3 fig, 4 tab.

Descriptors: Runoff, *Fallowing, *Land forming, *Water storage, Soil water, Water utilization, *Terracing, Rainfall-runoff relationships, Erosion control, Colorado, *Bench leveling, Crop production, Conservation, Land management, Sorghum, Precipitation (Atmospheric).

Research was done at Akron, Colorado, on conservation bench terraces in order to determine the optimum ratio of contribution to level bench area on silt loam soils: runoff from two cropping systems on the contributing area; and relationship between available water supplies and crop yields. Benches with fallow contributing areas gained 4.1 inches of soil water, compared with 3.5 inches in benches with sorghum contributing areas. In general, benches with fallow were more efficient in water utilization. Level-bench terraces in arid areas are an improvement over the conventional ridge terrace because they distribute water over a larger area and they can be designed to provide storage for higher intensity storms. (Blecker-Arizona)
W69-03880

LEVEL PAN CONSTRUCTION FOR DIVERTING AND SPREADING RUNOFF,
Agricultural Research Service, Akron, Colo. Soil and Water Conservation Research Div.
Rome H. Mickelson.
Trans of the American Soc of Agricultural Engineers, Vol 9, No 4, pp 568-70, 1966. 3 p, 2 fig, 5 tab.

Descriptors: Water storage, *Runoff, *Land forming, Flood routing, Moisture content, Fallowing, *Rainfall-runoff relationships, Crop response, Evaporation control, *Water spreading, Watersheds (Basins), Economic feasibility, Moisture availability, *Dry farming, Water utilization, Water management, Land management.
Identifiers: *Level pans.

The spreader system used in this experiment involved leveled areas (pans) that were constructed in natural drainage ways in order to intercept, spread and store the runoff that normally flowed through them. The experiment was to evaluate the economic feasibility of utilizing watershed runoff on leveled dryland areas for annual cropping, to study management problems and to observe response of different crops to intermittent flooding. Available moisture content in unleveled continuously cropped area was about half of that in level pans. Level pans located in arid climates conserve and utilize the moisture more efficiently than fallow or annual cropping on unleveled areas. (Blecker-Arizona)
W69-03881

WATER DISTRIBUTION UNDER SPRINKLER IRRIGATION,
Agricultural Research Service, Kimberly, Idaho. Snake River Research Center.
Claude H. Pair.
Transactions of the ASAE, Vol 11, No 5, pp 648-651, Sept-Oct, 1968. 4 p, 7 tab.

Descriptors: *Irrigation efficiency, *Irrigation systems, *Water distribution (Applied), *Sprinkler irrigation, Wind velocity, Rates of application, *Uniformity coefficient, Laterals, Infiltration, Idaho, Distribution systems.

Water distribution from a handmove sprinkler system was studied during a normal irrigation season in southern Idaho. Five types of sprinkler systems operating individually and three types of systems operating simultaneously had uniform sprinkler heads, nozzle sizes, sprinkler spacing on the lateral, nozzle pressure and wind conditions. Water distribution was compiled from spray catch cans. Comparison of water distribution from three types of sprinkler systems operating simultaneously showed that the straight-lateral, self propelled sprinkler gave a higher coefficient of uniformity than the handmove or side move with trailer line systems. Multiple irrigations by handmove portable sprinkler laterals gave acceptable seasonal water distribution as measured by the Christiansen coefficient of uniformity, even though some individual irrigations yielded poor water distribution. (Affleck-Arizona)
W69-03892

FUTURE IRRIGATION DEMAND IN THE SUSQUEHANNA BASIN,
Chesapeake Bay-Susquehanna Rivers Basins Project, Susquehanna Field Station.
Howard Miller.
ASCE Proc, J Irrig and Drainage Div, Vol 94, No IR4, Pap 6278, pp 391-399, Dec 1968. 9 p, 2 fig, 1 tab, 2 ref.

Descriptors: *Irrigation, *Forecasting, *Water utilization, Pennsylvania, New York, Low flow, Droughts, Water loss, Water resources, Water supply, Seepage.
Identifiers: Susquehanna River Basin.

Some years hence, during drought years, irrigation probably will have significant and locally detrimental effects on the surface water economy of the Susquehanna Basin, that is, barring changes in water laws or watershed development projects. Support for the theory that practice of irrigation will grow comes from an analysis of rainfall frequency and crop production deficiencies in drought years. From this, average annual profit per acre can be estimated. From designs of irrigation systems under a range of conditions, annual cost per acre can be estimated. By logic it can be assumed that crops with the greatest profit potential will be irrigated in the future. Tempering the synthetic predictions with consideration of current irrigation practice and trends, predictions of future irrigation withdrawals are made. Whether irrigation withdrawals will be significant or detrimental depends on amounts of streamflow available during drought periods and the frequency of such drought occurrences.
W69-03934

ACE IRRIGATION HYDRAULICS-KINE-
CS,
rnia Univ., Davis. Dept. of Water Science
gineering; and Washington State Univ., Pull-
ept. of Agricultural Engineering.
n E. Hart, Day L. Bassett, and Theodor
ff.
Proc, J Irrig and Drainage Div, Vol 94, No
ap 6284, pp 419-440, Dec 1968. 22 p, 8 fig,
3 append.

ptors: *Surface irrigation, *Infiltration,
e, Hydraulics, Mathematical models, Mathe-
l studies, Unsteady flow, Non-uniform flow,
hannel flow, Recession curves.
ers: Irrigation water advance, Irrigation
ecession.

athematical solutions of surface irrigation
d infiltration are reviewed. Their similarities
easy classification and simplification. An
ch is proposed which uses defined shape fac-
solve the advance of water, surface storage,
depletion, recession, and infiltration during
ly nonuniform flow over a porous bed. True
ns of the mass-conservation equation are
d and compared. Methods of numerically
the equations are developed and discussed.
ns are presented as dimensionless advance
which can be used for field applications. (K-
SGS)
3936

OF IRRIGATION IN THE WEST'S EX-
NG ECONOMY,
of Reclamation, Washington, D. C.
E. Dominy.
Proc, J Irrig and Drainage Div, Vol 94, IR4,
81, pp 401-418, Dec 1968. 18 p, 3 fig, 5 tab,

ptors: *Irrigation, *Irrigation programs,
benefit ratio, *Multiple-purpose projects,
mic impact, Agriculture, Reclamation,
ce allocation, Social aspects, Water de-

ers: *Bureau of Reclamation, Western U.S.

1902 the Bureau of Reclamation has
ed water supplies and facilities for about
00 acres of irrigated land. About one-third
acreage was formerly raw land not previ-
used for crop production. Goals of the
Reclamation Program include: (1) Effi-
se of resources; (2) economic growth to
ture requirements for national security; (3)
anding economy, and adequate production
y; (4) equitable sharing of national
es; (5) water and land conservation; (6)
cial and economic development of Indian
er groups. Irrigation, originally a dominant
e, has been joined by hydroelectric power,
pal and industrial water, recreation, flood
, and fish and wildlife enhancement. In addi-
the creation of permanent local economic
rrigation builds markets and commerce by
of the induced demands for goods used in
ction and operation of the project and the

3940

R DEVELOPMENT AND WATER
NING IN THE SOUTHWESTERN UNITED
S,
Univ. (Denmark). Inst. of Economic and
d Geography.
mary bibliographic entry see Field 06B.
tract, see .
3949

TY OF SURFACE WATERS FOR IR-
ION, WESTERN STATES, 1963,
ical Survey, Washington, D. C.
mary bibliographic entry see Field 02E.
tract, see .
3968

GEOLOGY AND WATER RESOURCES IN THE FRENCH PRAIRIE AREA, NORTHERN WILLAMETTE VALLEY, OREGON,
Geological Survey, Washington, D. C.
Don Price.
Geol Surv Water-Supply Pap 1833, 1967. 98 p, 18 fig, 2 plate, 7 tab, 33 ref.

Descriptors: *Water management (Applied), *Stratigraphy, *Surface waters, *Groundwater, Precipitation (Atmospheric), Recharge, Irrigation wells, Water chemistry, Oregon.
Identifiers: *Northern Willamette Valley, French Prairie Area, Willamette River, Pudding River.

Methods to determine the efficient development and effective management of the groundwater resources in the French Prairie area were studied in an attempt to supplement the meager summer precipitation during the main growing season. Nearly 600 wells are used for irrigation in this area, and the chemical suitability of the groundwater for this and other purposes was evaluated. Water quality from most wells tapping nonmarine sedimentary rocks was found to be excellent for irrigation; however, water from several wells contained objectionable concentrations of dissolved iron. The groundwater reservoir is recharged during winter months by downward percolation of precipitation, and is drained naturally by evapotranspiration and by discharge through seeps and springs. There is little natural recharge during summer months and the water table declines less than 5 ft along the alluvial plains and more than 20 ft in parts of French Prairie. (Llaverias-USGS)
W69-03977

GEOLOGY AND GROUNDWATER RESOURCES OF LARAMIE COUNTY, WYOMING,
Geological Survey, Washington, D. C.
Marlin E. Lowry, and Marvin A. Crist.
Geol Surv Water-Supply Pap 1834, 1967. 71 p, 16 fig, 2 plate, 4 tab, 42 ref.

Descriptors: *Groundwater, *Surface waters, *Water quality, Water resources, Aquifers, Irrigation, Wells, Water utilization, Wyoming.
Identifiers: *Laramie County, *Pine Bluff-Carpenter area.

Tabular data are presented on the effect of the development of groundwater on the hydrology of the area, the hydraulic properties of the aquifers and the extent to which water can be developed from them. The total amount of groundwater pumped from wells in Laramie County during 1964 is estimated to be 28,000 acre-ft, of which 6,000 acre-ft was used for municipal and industrial supplies, 17,000 for irrigation in the Pine Bluffs-Carpenter area, and about 5,000 for other purposes. Large quantities of water suitable for irrigation can be obtained by deeper wells drilled in the north central part of the country. Groundwater supplies have been intensively developed for municipal use near Cheyenne and Federal, and for irrigation use in the Pine Bluffs lowland. The chemical quality of water from the principal aquifers and streams is generally suitable for domestic, irrigation, and industrial uses. (Llaverias-USGS)
W69-03979

STOMATA IN RELATION TO DROUGHT RESISTANCE OF WHEAT VARIETIES,
West Pakistan Agricultural Univ., Lyallpur. Dept. of Plant Breeding and Genetics.
Khrushid Alam, and Muhammad Yusuf.
Pakistan Jour of Sci Res, Vol 19, No 4, pp 171-179, Oct 1967. 1 fig, 4 tab.

Descriptors: *Drought resistance, *Stomata, *Wheat, *Moisture stress, *Pores, Diurnal, Arid lands, Evapotranspiration, Plant physiology, On-site data collections, Frequency.
Identifiers: *West Pakistan, Carnoy's fluid.

A study was conducted of the stomatal mechanism operative in several local and exotic wheat varieties together with its relationship with their drought enduring capacity. The daily activity of the stomata and their size and frequency were studied using Carnoy's fluid to arrest instantly the stomatal movements. Data indicated that varieties having a larger frequency of small sized stomata were more drought resistant than the varieties with larger stomatal pores. This combination can be used, therefore, as a criterion for selection of varieties suitable for cultivation under moisture stress conditions. This problem of drought resistance is of considerable importance in West Pakistan, where a significant portion of wheat acreage is located in areas where artificial means of irrigation are lacking or are inadequate. (Affleck-Ariz)
W69-04117

ECO-PHYSIOLOGICAL STUDIES ON PLANTS IN ARID AND SEMI-ARID REGIONS IN WESTERN AUSTRALIA. I. AUTECOLOGY OF RHAGODIA BACCATA (LABILL.) MOQ,
Western Australia Univ., Nedlands. Dept. of Botany.
Erhart O. Hellmuth.
Jour of Ecology, Vol 56, No 2, pp 319-344, July 1968. 13 fig, 7 tab.

Descriptors: *Ecology, *Plant physiology, *Draught resistance, *Heat resistance, *Photosynthesis, Arid climates, Semiarid climates, Water loss, Soil moisture, Osmosis, Moisture deficit, Shrubs.
Identifiers: *Autecology, *Australia, *Coastal saltbush.

Investigations were conducted on the autecology of Rhagodia baccata, which is highly valued as a pasture species in certain arid and semi-arid regions of Western Australia. This species was shown to exert marked control over water loss and to have a higher net assimilation rate than other native plants of Western Australia investigated so far. It was found to have high heat resistance. These drought-resistant properties, together with its capacity to grow on a wide range of soil types, its ease of propagation, and its papatability for sheep, make R baccata potentially useful as a pasture plant for the arid and semi-arid regions of Western Australia. (Affleck-Ariz)
W69-04118

AN ANALYTIC APPROACH TO DETERMINE IRRIGATION SPRINKLER SPACING,
Minnesota Univ., St. Paul.
Tung Chu Shu, and E. R. Allred.
Transactions of the ASAE, Vol 11, No 4, pp 540-545, July-Aug 1968. 8 fig, 2 tab.

Descriptors: *Sprinkler irrigation, *Spatial distribution, *Analytical techniques, *Networks, *Irrigation systems, Equations, Depth, Uniformity coefficient, Regions, Irrigation design, Mathematical studies, Water distribution (Applied), Rotations.
Identifiers: Parameters, Non-uniformity.

One of the important problems in the design of an irrigation system using rotating sprinklers is arrangement of sprinklers so that over-all distribution of water is uniform. The conventional method for determining appropriate spacing for a system of rotating irrigation sprinklers is based on use of the uniformity coefficient. The purpose of this paper was to derive an expression of nonuniformity by considering the depth of water of a network of sprinklers as a continuous function. In order to reduce laborious calculation procedures, and to obtain a more clear understanding of the problem, nonuniformity was expressed in terms of the depth of an isolated sprinkler. (Affleck-Ariz)
W69-04121

COMMERCE AND TRADE: MINING BUREAU.

Me Rev Stat Ann, tit 10, secs 2103 (5), 2108, 2109 (1964).

Descriptors: *Maine, *Legislation, *Mining, *Water rights, Excavation, Mineral industry, Pumping, Boundaries, Royalties, State governments, Locating, Mapping, Permits, Ownership of beds, Dam construction, Ditches, Mining engineering, Tunnels, Bodies of water.
Identifiers: Prospecting, Buoy markers.

The statute describes the methods by which a person or corporation with a prospector's permit may locate his claims by defining the boundaries. If the claim extends into a body of water, he may locate his claim by establishing a post or buoy markers. As an alternative, he may place posts on dry land which are marked with the exact distances and directions to over-water claims. A person or corporation in possession of a recorded claim shall have the rights to any minerals and metals except water, sand, and gravel. Any person with a license to mine may receive a permit allowing him to construct and use ditches or pipes over public lands, together with the right to construct dams, to bring in water necessary for mining operations. The State receives a royalty on all mined commodities produced from mineral deposits below bodies of water to which the State has title. (Stewart-Fla)
W69-04165

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on THE Surface

FLOOD PLAIN INFORMATION-HUTTON BRANCH AND COOKS BRANCH, DALLAS COUNTY, TEXAS.
Corps of Engineers, Fort Worth, Tex.

Corps Eng Flood Plain Rep, Oct 1968. 59 p, 9 fig, 18 plate, 17 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, Texas, Maximum probable flood, Rainfall-runoff relationships, Urbanization.
Identifiers: Dallas County (Tex), Carrolton (Tex), Renner (Tex), Trinity River (Tex), Hutton Branch (Tex), Cooks Branch (Tex), Standard Project Flood, Intermediate regional flood.

Flooding on Hutton Branch and Cooks Branch, tributaries of the Elm Fork of the Trinity River, Dallas County, Texas, is described in a report of the flood plain problems based on records of rainfall, runoff, and historical and current flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-03707

FLOOD PLAIN INFORMATION - VOLUME IV OF DENVER METROPOLITAN REGION, COLORADO.
Corps of Engineers, Omaha, Nebr.

Corps Eng Flood Plain Rep, Oct 1968. 62 p, 32 plate, 11 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, Colorado, Maximum probable flood, Urbanization.
Identifiers: Denver (Colo), South Platte River (Colo), South Platte River tributaries (Denver-Colo), Standard project flood, Intermediate regional flood.

Flooding of the tributaries of the South Platte River in the Denver Metropolitan area, Colorado, is described in a report of flood plain problems based on records of rainfall, runoff, and historical and current flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-03708

FLOOD PLAIN INFORMATION OF CONGAREE CREEK AND SIX MILE CREEK IN LEXINGTON COUNTY, SOUTH CAROLINA.
Corps of Engineers, Charleston, S. C.

Corps Eng Flood Plain Rep, Jan 1969. 52 p, 8 fig, 34 plate, 9 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Flood protection, Non-structural alternatives, South Carolina, Maximum probable flood.
Identifiers: Congaree Creek (SC), Six Mile Creek (SC), Lexington (SC), Standard project flood, Intermediate regional flood.

Flooding of Congaree Creek and Six Mile Creek, Lexington, South Carolina, is described in a report of flood plain problems based on records of rainfall, runoff, and historical and current flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-03709

FLOOD PLAIN INFORMATION-PETERS CREEK AND LICK RUN, ROANOKE, VIRGINIA.
Hayes, Seay, Mattern and Mattern, Roanoke, Va.

Corps Eng Flood Plain Rep, Aug 1968. 33 p, 5 fig, 11 plate, 10 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, Virginia, Maximum probable flood.
Identifiers: Roanoke (Va), Peters Creek (Va), Lick Run (Va), Intermediate regional flood, Standard project flood.

Flooding of Peters Creek and Lick Run, Roanoke, Virginia is described in a report of flood plain problems based on records of rainfall, runoff, and historical and current flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-03710

PRELIMINARY FLOOD PLAIN INFORMATION-CHATTAHOOCHEE RIVER, BUFORD DAM TO METROPOLITAN ATLANTA, GEORGIA.
Corps of Engineers, Mobile, Ala.

Corps Eng Prelim Flood Plain Rep, 1968. 9 p, 2 fig, 11 maps.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Flood protection, Non-structural alternatives, Georgia, Maximum probable flood.
Identifiers: Chattahoochee River (Ga), Atlanta (Ga), Standard project flood, Intermediate regional flood.

Flooding of the Chattahoochee River, Atlanta, Georgia, is described in a preliminary report of flood plain problems based on records of rainfall, runoff, and historical and current flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-03711

FLOOD PLAIN INFORMATION - FOUNTAIN CREEK, PUEBLO, COLORADO.
Corps of Engineers, Albuquerque, N. Mex.

Corps Eng Flood Plain Rep, Oct 1968. 45 p, 10 fig, 16 plate, 11 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, Colorado, Maximum probable flood.
Identifiers: Pueblo (Colo), Fountain Creek (Colo), Standard project flood, Intermediate regional flood.

Flooding on Fountain Creek at Pueblo, Colorado is described in a report of flood plain problems based on records of rainfall, runoff, and historical and current flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-03712

FLOOD PLAIN INFORMATION-OUACHITA RIVER, CAMDEN, ARKANSAS.
Corps of Engineers, Vicksburg, Miss.

Corps Eng Flood Plain Rep, Sept 1968. 29 p, 11 fig, 9 plate, 5 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, Arkansas, Maximum probable flood.
Identifiers: Camden (Ark), Ouachita River (Ark), Standard project flood, Intermediate regional flood.

Flooding of the Ouachita River at Camden, Arkansas is described in a report of flood plain problems based on records of rainfall, runoff, and historical and current flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-03713

FLOOD PLAIN INFORMATION-CUMBERLAND RIVER AND OBEY RIVER, CELINA, TENNESSEE.
Corps of Engineers, Nashville, Tenn.

Corps Eng Flood Plain Rep, Oct 1968. 53 p, 8 fig, 14 plate, 12 tab.

riptors: *Floods, *Flood damage, Flood s, Flood control, Non-structural alternatives, essee, Maximum probable flood.
ifiers: Celina (Tenn), Cumberland River n), Obey River (Tenn), Standard project , Intermediate regional flood.

ling of the Cumberland and Obey Rivers at a, Tennessee is described in a report of flood problems based on records of rainfall, runoff, istorical and current flood heights. Prediction ture flood heights takes into account the water effects of a major dam now under con- tion. Maps, photographs, profiles, and cross ons indicate the extent of flooding that has oc- d and which may be expected to occur in the e. The information is for use in study and ing to minimize vulnerability to flood ges by control of flood plain use by zoning subdivision regulation, the construction of control works, or by combinations of these aches. (Knapp-USGS)
03714

OD PLAIN INFORMATION, CHRISTINA R, MUDDY AND BELLTOWN RUNS, NEW TLE COUNTY, DELAWARE.
s of Engineers, Philadelphia, Pa.

s Eng Flood Plain Rep, Oct 1968. 47 p, 7 fig, ate, 12 tab.

riptors: *Floods, *Flood damage, Flood , Flood control, Non-structural alternatives, vare, Maximum probable flood.
fiers: Christina River (Del), Muddy Run , Belltown Run (Del), Standard project flood, nediate regional flood, Wilmington (Del).

ing of the Christina River, Muddy Run, and own Run, New Castle County, Delaware, is ibed in a report of flood plain problems based cords of rainfall, runoff, and historical and nt flood heights. Maps, photographs, profiles, ross sections indicate the extent of flooding as occurred and which may be expected to in the future. The information is for use in and planning ways to minimize vulnerability od damages by control of flood plain use by g and subdivision regulations, the construc- f flood protection works, or by combinations se approaches. (Knapp-USGS)
03715

TEXAS WATER PLAN.
Water Development Board, Austin.
rimary bibliographic entry see Field 06B.
ostract, see .
03729

LOGICAL CONSIDERATIONS IN THE GN OF RESERVOIR SEEPAGE CONTROL EMS,
rimary bibliographic entry see Field 08A.
ostract, see .
03763

ER GENERATION UNDER IJC REGULA-
York State Power Authority, Niagara Falls.
ge T. Berry.
Amer Soc Civ Eng, J Power Div, Vol 94, No pp 217-231, Nov 1968. 15 p, 9 fig, 1 tab, 2 ref, d.

iptors: *River regulation, Flood control, ed storage, Lakes, *Navigation, Water rces, *Hydroelectric power, Streamflow ds, *Electric power production, Streamflow, ated flow, St. Lawrence River, Economics, , Outflows, Feasibility, Great Lakes, Lake *Lake Ontario.
fiers: *Operating criteria, Niagara River, ra Falls, Great Lakes Power Dvlpmt., St. ence Power Project (Canada).

The International Joint Commission and its Boards of Control comprise the principal authority prescribing the limits within which the hydroelectric resources of the St. Lawrence and Niagara Rivers are put to use. To facilitate developing regulation plans appropriate for presently existing Great Lakes Basin conditions, a homogeneous set of unregulated Lake Ontario levels and flows consistent with existing diversion to and from the Great Lakes, existing Lake Superior regulation, and existing stage-discharge relationships for the connecting channels were derived by adjusting the natural record for changes to these factors. Criteria used for developing Lake Ontario regulation plans are given. Regulation plans have evolved as experience has been gained, resulting in better use of water resources. Flexibility in the St. Lawrence releases and pumped storage facilities at the Niagara Project can be used to improve efficiency and reduce the cost of power required from thermal sources to meet New York power needs. Studies are underway to determine how much additional value Niagara power output would have if Lake Erie outflows were controlled. (USBR)
W69-03781

DRAINAGE OF AGRICULTURAL LAND; AN ANNOTATED BIBLIOGRAPHY OF SELECTED REFERENCES, 1956-1964,
National Agricultural Library, Washington, D. C.; and Agricultural Research Service, Beltsville, Md. Soil and Water Conservation Research Div.
Charles B. Crook.
U S Department of Agriculture, National Agricultural Library, Library List 91, pp 1-524, July 1968. 524 p.

Descriptors: *Drainage engineering, Subsurface drainage, Surface drainage, Construction equipment, Hydraulic structures, Land management, Farms.

Many publications have been written throughout the world on drainage research and its applications. Since 1955, materials such as plastics have opened up new fields of drainage and seepage control; machinery has been developed for all types of drainage materials; new methods have been used to speed up drainage; improved practices have been developed for irrigation and salinity control; and better maintenance has helped solve some of the problems of drainage in the field. Moreover, research in related areas such as soil physics, hydrology, and hydraulics has created new instruments and techniques which have improved drainage procedures. To keep up with the demand for information on both surface and subsurface drainage, this annotated bibliography has been compiled. It brings up-to-date 'Drainage of Agricultural Land, a Bibliography of Selected References', by E. G. Davis and M. L. Gould, published in May 1956 as U. S. Department of Agriculture, Miscellaneous Publication no. 713. Arrangement is alphabetical under broad subject classification. Call numbers following citations are those used in the National Agricultural Library.
W69-03809

MCFARLAND V DEKALK COUNTY (DAMAGES ATTRIBUTABLE TO SURFACE WATER NUISANCE).
163 SE 2d 827-829 (Ga 1968).

Descriptors: *Georgia, *Drainage water, *Damages, *Surface runoff, Judicial decisions, Legal aspects, Surface waters, Condemnation, Cities, Easements, Water law.
Identifiers: Nuisance.

Plaintiff brought an action for damages and to enjoin defendant from continuing trespass by reason of dumping increased quantities of surface waters onto plaintiff's land. The defendant, a local governmental unit, had an easement to dump surface waters on plaintiff's land received from upper areas by gravitation. The plaintiff claimed that defendant had increased the quantities of waters dumped over that which had been dumped in previous years. The court held that evidence of damages to plaintiff's land due to the increased dumping of waters was proper for jury consideration. Such activity would be a continuing nuisance authorizing an equity court to restrain it and to require defendant to cease and desist until and unless land was condemned for public purposes. Furthermore, plaintiff was allowed to show all damages resulting up to and until the time of showing the existence of a permanent nuisance. (Holt-Fla)
W69-03812

FLOOD PROTECTION.

N Y Conserv Law dec 835, art 6 secs 6.1, 6.2 (McKinney Supp 1968).

Descriptors: *New York, *Flood control, *Flood plains, *Classification, Civil law, Legislation, State governments, Administrative agencies, Conservation, Planning, Flood damage, Flood protection, Multiple-purpose projects, Watershed management, Flood plain zoning, Non-structural alternatives, Economic feasibility, Public health, Standards, Legal aspects.

The conservation commission must propose and implement projects and facilities it deems necessary for flood plain development and flood damage reduction. The commission should classify lands with reference to flooding, and establish standards for flood plain use which will promote economic development and protect public health, welfare, and property. These standards should be adopted only after interested persons have been given notice and an opportunity to be heard. In addition, when adopting, amending, or repealing such standards, the commission should consider the effect of particular uses of the flood plain on the health and safety of persons and property, the economic and technical feasibility of measures available for developing the flood plain and the responsibilities, if any, of local, state and federal governments connected with the use or proposed use of the flood plain. (Scott-Fla)
W69-03813

PETERS V AUBIN (ACTION TO RESTORE WATERCOURSE).
242 NE 2d 427-430 (Mass Sup Jud Ct 1968).

Descriptors: *Massachusetts, *Obstruction to flow, *Watercourses (Legal), *Natural flow, Landfills, Judicial decisions, Water law, Downstream, Upstream, Floodwater, Flood damages, Backwater, Channels, Culverts, Remedies, Waterways, Depth, Width, Dimensions.

Defendant filled and blocked a watercourse across her land. The obstruction of the flow caused flooding of the upstream owner's land. The upstream owner filed suit in equity to require the defendant to restore the watercourse. The lower court ordered defendant to restore the watercourse to a specific depth and width, taking into consideration the dimensions of the channel at the point it entered defendant's land from the next upland property. The appellate court affirmed, but modified the decision in part. The court stated that the downstream owner should not be required to make the land of upstream owner less subject to flooding than before the obstruction to flow. The modified decree also allowed defendant to excavate an alternative watercourse to give the desired relief, ruling that an upstream owner's right is not interfered with by a change by a downstream owner, provided the full and free flow is not dimished or impeded. (Wheeler-Fla)
W69-03816

MILLER V DARBY (DIVERSION OF SURFACE WATERS).
143 NE 2d 816-819 (Mass 1957).

Descriptors: *Massachusetts, *Surface drainage, *Surface waters, *Diversion, Judicial decisions,

Natural flow doctrine, Drainage, Alteration of flow, Ditches, Relative rights, Landfills, Trenches, Culverts, Roads, Overflow, Drains, Channels, Reservoirs, Prescriptive rights, Legal aspects, Surface runoff, Floods.

Plaintiff and defendant owned adjacent parcels of land. Plaintiff sought an injunction restraining defendant from discharging water upon plaintiff's premises. Defendant filled in his property, and in so doing left a narrow strip unfilled, thus creating a kind of trench near the bottom of which was exposed a culvert used to drain plaintiff's basement. This culvert ran from plaintiff's basement under a public road and discharged upon defendant's lot; this privilege rested upon the oral permission of defendant's predecessor in title, and was revocable at will by defendant. After defendant's lot was filled, plaintiff had serious trouble from the flooding of her cellar. Plaintiff plugged up the drain herself, and sought injunctive relief to prevent the reoccurance of the flooding. The court held that where defendant's predecessor in title knew when he conveyed to the defendant of the existence and purpose of the culvert, plaintiff had a prescriptive right to have the culvert maintained. Even though obstruction or alteration of surface water flow by a landowner affords no cause of action in behalf of a person who may suffer loss from such actions, he has no right to collect surface waters into artificial channels or reservoirs and then release the captive waters by a culvert or other artificial means upon the land of his neighbor. The court held that the collection of the surface water in the trench and the discharging of it by means of the culvert upon plaintiff's land constituted a continuing trespass, and granted the injunction. (Scott-Fla)
W69-03823

WIESE V MIEHER (ALTERATION OF DRAINAGE).
14 Ill App 2d 126, 143 NE 2d 404 (1957).

Descriptors: *Illinois, *Drainage, *Surface drainage, *Diversion, Judicial decisions, Natural flow doctrine, Surface waters, Alteration of flow, Ditches, Relative rights, Legal aspects, Cultivation.
Identifiers: Upper landowners, Lower landowners.

Plaintiff sought an injunction to prevent defendant from draining his land in a southerly direction into and over the lands of the plaintiff and to compel defendant to drain the property in a northerly direction, alleging that natural drainage of the property was, and had been for the past sixty years, to the north. The court, in granting the injunction, held that while the owner of upland property may cultivate it according to good methods of husbandry, he has no right to collect surface waters from his lands and divert and deposit them in undue and unnatural quantities upon the lands of his neighbor by the construction of ditches or other artificial structures. If he attempts to do so, a court of equity will intervene, as in this case, to prevent such acts. (Scott-Fla)
W69-03824

KEISER V MANN (DIVERSION OF SURFACE WATERS).

143 NE 2d 146-149 (Ct App Ohio 1956).

Descriptors: *Ohio, *Landfills, *Surface drainage, *Diversion, Judicial decisions, Natural flow doctrine, Drainage, Surface waters, Alteration of flow, Legal aspects, Reasonable use, Relative rights.
Identifiers: Upper landowners, Lower landowners.

Plaintiff sued defendants for damages to his property that were allegedly caused when defendants filled in their property with earth, gravel and shale, completely destroying natural drainage so as to divert surface waters from a creek onto plaintiff's premises. The court stated that in urban areas the owner of a lot that receives the natural flow of surface water from an adjoining lot may divert the natural flow of such water by filling his lot or by erecting structures on it without liability arising in favor of the adjoining owner, so long as such filling and erecting is done in a reasonable manner. The evidence tended to show that after defendants' lot was filled in it still was lower than the road which separated their lot from that of the plaintiff. Therefore, plaintiff had failed to establish that defendants had acted in an unreasonable manner or that any water flowed from defendants' land onto plaintiff's land. The action was dismissed. (Scott-Fla)
W69-03825

SOMERS V HILL (DIVERTING OF WATER ONTO ADJOINING LAND).

143 Conn 476, 123 A 2d 468-470 (1956).

Descriptors: *Connecticut, *Drainage effects, *Natural flow doctrine, *Alteration of flow, Judicial decisions, Drainage water, Surface runoff, Surface waters, Drainage, Drainage practices, Water law, Water rights.
Identifiers: *Governmental immunity.

Plaintiff owned a parcel of land bordering on defendant's property. Defendant had bought his land subject to a right of way for drainage over, under, and across given to the State of Connecticut. Co-defendant state highway commissioner had catch basins and culverts constructed to collect and discharge surface water from a nearby road. This water went onto plaintiff's land causing damage. Plaintiff sued to enjoin the discharge of the water. The court, in holding for the defendants, noted that it is illegal to diver the natural flow of water in such a manner as to divert it upon, and to the detriment of, a neighbor's land. However, it was held that since this action was against the highway commissioner, it was in effect against the State. Therefore it could not be maintained without the State's consent - which apparently was not given. (Heckerling-Fla)
W69-03833

YENCHKO V GRONTKOWSKI (ACTION FOR DAMAGE DUE TO INTERFERENCE WITH NATURAL FLOW OF SURFACE WATERS).

385 Pa 272, 122 A 2d 705-706 (1956).

Descriptors: *Pennsylvania, *Surface runoff, *Obstruction to flow, *Natural flow, Surface drainage, Damages, Storm runoff, Floodwater, Lakes, Surface waters, Water law, Judicial decisions, Drainage rain water, Drainage systems, Legal aspects.
Identifiers: Trespass, Act of God.

Defendants owned land, with a lake, which was used as a park. Plaintiffs owned adjacent land devoted to housing development. The natural flow of surface waters had been from defendants' land toward plaintiffs' land, but to a considerable extent in a direction towards the lake. Defendants deposited dirt along a side of the lake, and knowingly allowed an intake pipe, leading to the lake, to be blocked with rags. Upon a heavy rainstorm, large volumes of water were diverted to plaintiffs' land. Plaintiffs brought a trespass action to recover flood damages, and were able to show at trial that the damage was caused by defendants' interference with the natural flow of surface waters. Judgment for plaintiffs was entered. On appeal, defendants argued insufficiency of evidence, and asserted an act of God as a defense. In affirming the court ruled that evidence was sufficient, and held that the burden is on the party asserting the defense of act of God to produce proof of its effect, which defendants failed to do. (Wheeler-Fla)
W69-03834

PASHLEY V UNITED STATES (FLOOD DAMAGE THROUGH ERECTION OF DAM).

156 F Supp 737-740 (Ct Cl 1957).

Descriptors: *Dam failure, *Eminent domain, *Flood damage, Colorado River Basin, Columbia River Basin, Floodwater, Watersheds, Reservoir sites, Water levels, Flood control, Flood protection, Land use, Washington, Dams, Dam construction, Damsites, Flooding, Foundation failure.

Plaintiff landowners here bring a successful eminent domain action against the United States for flood damage for devaluation of mineral extraction rights of sodium sulphate deposits. Plaintiffs contended that the flooding was the direct and natural consequence of the erection of the O'Sullivan Dam, a part of the Columbia Basin Project of the Bureau of Reclamation. The United States Court of Claims agreed with this contention on the ground that defendant knew that impounding water above the dam would probably cause property below the dam to be inundated due to defendant's exhaustive geological investigation and the great pains taken by defendant to prevent water seepage from the dam. The case contains a great deal of geographic and historical information concerning the Columbia River Basin. (Carruthers-Fla)
W69-03835

DRAINAGE.
NJSA secs 40:30-1 to 40:30-21 (1967).

Descriptors: *New Jersey, *Drainage districts, *Financing, *Direct benefits, Taxes, Legislation, Legal aspects, Contracts, Surface water, Assessments, Appropriation, Bridges, Watercourses (Legal), Drainage, Cities, Ditches, Administration, Administrative agencies.
Identifiers: *Drainage commission, Bonds, Administrative appropriations.

Districts of any county which have drainage problems detrimental to public health may petition the Superior Court to provide plans for the erection of a drainage system. A commission is subsequently appointed to implement the plan. County bonds may be issued to pay for the drainage works. Lands benefited by the works are assessed to provide for payment of the bonds. If the assessments are insufficient to pay the costs of drainage works, county taxes are to be used to pay the excess. Additional expenses necessary to provide drainage works requiring annual expenditures are to be appropriated by the board of freeholders. Any county may construct, operate, and maintain ditches or watercourses necessary to control the flow of surplus and surface waters. Construction of bridges and roads across the ditches and watercourses is within the board's power. The board can acquire property necessary for exercising its drainage powers. The board of freeholders is authorized to provide for payment of any work authorized herein. The board can contract with any municipality in the county to share costs of drainage works therein. (Holt-Fla)
W69-03839

SURFACE DRAINAGE.

N J Stat Ann sec 40:63-20 (1967).

Descriptors: *New Jersey, *Surface water, *Surface drainage, *Roads, Drains, Construction, Legislation, Local governments, Cost, Payment, Administrative agencies.

When the governing body of any municipality finds it necessary to construct a drain for surface water in any county road of the county in which the municipality is located, and the board of chosen freeholders of the county shall have approved the plans for the proposed drain and shall have appropriated a specific sum towards its construction with the proviso that the municipality shall construct the drain and that the municipality shall pay the balance of the cost thereof, then, and in such case, the governing body may, by ordinance or resolution, cause such drain to be constructed, and may provide for the payment of the balance of the cost thereof. (Shevin-Fla)
W69-03859

RY ON LAND TO MAKE SURVEYS.
Stat Ann sec 46:11-1 (1940).

riptors: *Surveys, *Surface drainage, *Land mation, *New Jersey, Swamps, Grasslands, slation, Statutes, Drainage programs, Legal cts, Inspection, Judicial proceedings, Water

tifiers: *Entry on land, *Rights of interested ons, *Limited access, *Right to drain land.

y proceeding to lay out, alter, vacate or open a c road or street, or to determine possible en- chment upon or narrowing of such road or t by an adjacent landowner or possessor, and y proceeding to enable the owner of swamp or low ground to drain that ground, and in any r proceeding touching a public improvement, practical surveyor, with necessary assistants, is employed by any person interested in any proceeding, may enter on the adjacent lands nds to be drained, or other lands, for the pur- of making necessary surveys, doing as little ge as possible. (Harris-Fla)
-03867

ER V NORMANOCH ASS'N, INC (OWNER- OF LAKE BED).

J 407, 136 A 2d 645-654 (1957).

riptors: *New Jersey, *Ownership of beds, al waters, *Public rights, Judicial decisions, l aspects, Lake beds, Easements, Littoral, eation, Riparian rights, Water law, Lakes.

tiffs sought a declaratory judgment to deter- whether as owners of property adjacent to a water lake they have any right to recreational f the lake. Plaintiffs acquired title to the land the state but the grants reserved title to the bed and such title was subsequently conveyed fendants. The lake was used by the general c and plaintiffs for several years before defen- objected to such use. The court held that tiffs had no right to use the lake. In New Jer- inland bodies of water are either public or te. All tidal waters are public but the general c has no right to recreational use of private . When land bordering upon a natural lake is eyed, the grant extends only to the water's unless expressly stated otherwise. Plaintiffs unable to show that the nature of their use ssary for the creation of an easement by ription was adverse or hostile, to rebut the mption that their use was permissive. (Mol- la)
-03898

R V CITY OF MILWAUKEE (SURFACE TER DRAINAGE).
sc 2d 561, 85 NW 2d 349-352 (1957).

riptors: *Surface waters, *Wisconsin, *Repul- *Common enemy doctrine, Legal aspects, Ju- decisions, Railroads, Prescriptive rights, nage, Culverts, Surface drainage, Flooding, nage water, Surface waters, Damages, Natural

tiff brought this action to restrain defendants flooding his land and to seek an award of ges for past flooding. Plaintiff's land was ated from defendant's by a railroad right-of- The railroad had built a culvert through which ce water from plaintiff's land was carried off. city, pursuant to an agreement with the defen- filled in his low-lying land hampering the al drainage of plaintiff's land and causing ge to it. Plaintiff claims that the ditch which ed his property had been adversely used by for twenty years. Wisconsin adopts the com- enemy doctrine as applied to surface water; ny proprietor may fight off or control as he will urface water on his land, even if such actions damage to others. The court held that under law the plaintiff had no cause of action for ges caused by the action or by changing the natural flow of water. The court held that there was insufficient evidence to show twenty years of adverse possession of the ditch by the plaintiff, and a directed verdict for the defendants was affirmed. (Shevin-Fla)
W69-03899

KERLEY V WOLFE (NAVIGABILITY OF LAKES).
349 Mich 350, 84 N W 2d 748-752 (1957).

Descriptors: *Michigan, *Riparian rights, *Navigable waters, *Public rights, Judicial decisions, Legal aspects, Recreation, Lakes, Riparian rights, Riparian lands, Boating, Fishing, Boundaries (Property).
Identifiers: Fences.

Adjacent land owners brought this action to force removal of a fence placed across a lake by a riparian landowner. Plaintiff and defendant are adjoining riparian owners. Defendant placed a fence at the neck of the lake to prevent passage of several boats from the upper end of the lake, where the plaintiff's land is located, into the main body of the lake. The plaintiff filed this bill to abate the fence and enjoin its maintenance. Defendant claims the vicinity of dispute is non-navigable and simply marsh land. The court found that the waters extending from plaintiff's premises to the deeper part of the lake were and are navigable in fact by small boats and the fence erected by the defendant interferes with the rights plaintiff possesses as a riparian owner. Whatever filling has taken place by nature's processes has not destroyed the navigable character of the upper end of the lake. When such part of the lake is navigable in fact, it is navigable in law. So long as boatable waters stand or flow in the upper reaches of the lake, people having lawful access to such waters may boat and fish in them. No upper or lower riparian owner may dispute passage by water of his riparian neighbor, when the stream or lake commonly enjoyed by all has been made navigable in fact by nature. (Shevin-Fla)
W69-03900

HEITSCH V CLARK (INJUNCTION TO ENJOIN CHANGE IN LAKE LEVEL).

346 Mich 381, 78 NW 2d 105-106 (1956).

Descriptors: *Michigan, Judicial decisions, Water law, Administrative agencies, Dams, *Legislation, Riparian land, Rivers, Riparian rights, Lakes, *Water levels, Reservoirs, *Drainage districts, Legal aspects, Remedies, Local governments.

Plaintiff landowners brought this suit in equity to enjoin the determination of a lake level behind a dam by the county drain commissioner. The trial court dismissed the complaint and dissolved the temporary injunction. The Supreme Court of Michigan, on appeal, affirmed the decision of the trial court holding that the plaintiffs should pursue their statutory remedy rather than invoking the aid of equity. The statute provided that interested persons may, at any time within five years after the lake level has been fixed by the drain commissioner, challenge the action in circuit court. (Watson-Fla)
W69-03901

BLACK MARSH DRAINAGE DISTRICT V ROWE (TAXATION FOR IMPROVEMENT OF DRAINAGE DISTRICT).
350 Mich 470, 87 N W 2d 65-69 (1957).

Descriptors: *Michigan, *Drainage Districts, *Public health, *Assessments, Cost, Project purposes, Depth, Administrative agencies, Legal aspects, Judicial decisions, Drainage, Tile drainage, Cities, Taxes.

This is an action by the drainage district against taxpayers for a declaratory decree that a drainage project was necessary. In 1955, two cities filed a petition for the improvement of the Black Marsh Drain. The Black Marsh Drainage Board had adopted a resolution determining that it had become necessary for the public health to tile said drain and make necessary changes in its depth. The defendants are taxpayers from each of the two cities protesting the assessment of the cost of the improvements against their respective properties. Witnesses testified that the improvement was necessary for the preservation of the health of the residents in the community. The court held that the drain project was necessary for the public health. (Shevin-Fla)
W69-03904

BRATONJA V CITY OF MILWAUKEE (ACTION TO RECOVER DAMAGES DUE TO FLOODING FROM HEAVY RAIN).
3 Wisc 2d 120, 87 N W 2d 775-780 (1958).

Descriptors: *Wisconsin, Judicial decisions, Surface runoff, Surface waters, *Sewers, Storm runoff, *Flood damage, Flood protection, Cloudbursts, Rain, *Rain water, Water law, Elevation, Local governments, Cities, Legal aspects, Damages, Drainage systems.
Identifiers: Negligence, Nuisance.

Plaintiffs owned buildings fronting on city streets. The area was within a natural saucer-like depression. A storm sewer in the area was laid in 1906. Improvements after that time mostly by the city, caused the level of the streets to be raised and soil by which rainfall would normally be absorbed to be covered. A relief sewer was later added. At least one plaintiff had suffered damages as a result of flooding due to a series of heavy rains. In 1949, another heavy rain fell, whereupon, several buildings in the area became flooded. Plaintiffs brought actions against the city, both on negligence and nuisance theories. The trial court found that there was no inadequacy or insufficiency in the original sewer plan, that the rainfall in 1949 was extraordinary, and that the city did not maintain the sewer system negligently. The appellate court affirmed, ruling that the city was under no obligation to collect the rainwater in the street; but if it actually took possession of such water and thereby assumed responsibility for it, it may have been liable for subsequently permitting it to escape on adjoining property. The plaintiffs failed to prove what part if any of their damage resulted from the backing up of the water in the sewer, contrasted with that from the flooding by surface water. The court held that attempting to label the condition a nuisance could not change the respective rights. (Wheeler-Fla)
W69-03905

COLLINS V WICKLAND (FLOOD DAMAGE DUE TO NATURAL DRAINAGE OBSTRUCTION).

88 N W 2d 83-88 (Minn 1958).

Descriptors: *Minnesota, *Watercourses (Legal), *Natural flow, *Drainage water, Judicial decisions, Water law, Flood damage, Surface runoff, Floodwater, Surface waters, Channels, Drainage, Unsteady flow, Legal aspects, Drainage systems, Channel flow, Damages, Land development, Land use, Reasonable use, Rainfall-runoff relationships.
Identifiers: Upper land owners, Lower land owners.

Plaintiff owned a city lot and building adjacent to defendant's lot. Before improvement of defendant's lot, draining water followed the contour of the land and formed a drainway on the land of both plaintiff and defendant. This channel had a maximum width of three feet and a maximum depth of nine inches. The flow through this channel from rains and melting snows was irregular and occassional. Defendant leveled his lot and used it as a parking lot. In so doing, the prior channel was eliminated, and the surface of his lot was raised above that of plaintiff, and an earthwall was created along plaintiff's lot. Defendant installed his own drainage system for his lot. After these changes, plaintiff's

land did not drain adequately. After heavy rainfalls, water backed up into plaintiff's basement, and stored equipment was damaged. Plaintiff brought suit for damages caused by the flooding. The trial court, in allowing recovery, applied the law governing natural water-courses, and held that defendant unlawfully obstructed natural flow. The appellate court reversed and granted a new trial, ruling that the correct law that should be applied for surface water was the reasonable-use doctrine. The court ruled that the minor, sporatic, surface water drainway did not constitute a natural watercourse. The court also held that any determination of the reasonable use of land requires a consideration of the normal use and development of land in the locality. (Wheeler-Fla)
W69-03906

LONG V EITNER HOMES, INC. (RIGHTS OF LAND OWNER TO CHANNEL SURFACE WATER ONTO ADJACENT LAND).

6 Bucks 91-107 (CP PA 1956).

Descriptors: *Pennsylvania, *Surface drainage, *Natural flow, *Diversion structures, *Alteration of flow, Judicial decisions, Ditches, Drainage, Surface runoff, Surface waters, Channel, Grading, Legal aspects, Watercourses.

Plaintiff owner of a tract of land sought to enjoin the former owner and developer of an adjoining upland tract from artificially altering and concentrating the flow of surface waters onto Plaintiff's land. The court held that defendant subdivider had the right to have surface water flowing on his property artificially altered and concentrated by the use of drains and to channel such water into a natural water course on adjoining land. It was held that an owner of land had the right to make proper and profitable use of his land even if this resulted in some change in the surface water flowing on to the adjoining lower land, provided such change did not divert the water from its natural water course on the adjoining land; resulted in no permanent change, diversion, or damage to the natural water course; and, did not unreasonably or unnecessarily change the quantity or quality of surface water on the abutting property. (Logan-Fla)
W69-03907

CLAIMS FOR DAMAGE GENERALLY ADJUSTMENT OF CLAIMS OF OWNERS OF PRIVATE DAMS.
N Y Canal Law secs 120, 121 (McKinney Supp Dec 1968), 2 p.

Descriptors: *New York, *Canals, *Damages, *Dams, Legislation, Accidents, Navigation, Appropriation, Waterways, Legal aspects, Impounded waters, State governments, Administrative agencies, Transportation.

Section 120 provides that every person shall be paid the amount of damages sustained from the canals or their use resulting from any accident of the negligence of any officer. The amount of the damages shall be ascertained by the court of claims and paid by the State, but only if the same evidence would create liability against an individual in court. The commissioner of transportation may make a settlement if it does not exceed $500. This provision does not apply to damages resulting from navigation. No payment for appropriation of land or water, or for damages will be made until the person demanding such damages produces a satisfactory abstract of title showing that he is legally entitled to them. Section 121 states that whenever the state utilizes private dams as essential parts of improvements to the canal system, the department of transportation may settle the claims of the owner and make provisions for the ownership of such dams provided no right or title to the use of any part or portion of water impounded by the dams is conveyed to the owners. (Shevin-Fla)
W69-03913

SEC 82 DEPOSIT OF REFUSE IN NAVIGABLE WATERS, SEC 81 SUPPLYING DEFICIENCIES OF WATER, SEC 83 SEIZURE OF OBSTRUCTION.
N Y Canal Law secs 81, 83 (McKinney Supp Dec 1968), 2 p; N Y Canal Law sec 82 (McKinney 1968), 1 p.

Descriptors: *New York, *Canals, *Wastes, *Water shortage, Legislation, Damages, Navigation, Obstruction to flow, Appropriation, Transportation, Legal aspects, Water supply, Sewage, Leases.

Section 82 states that it is unlawful to deposit any refuse in the canal system or any waters dredged at public expense and used for the canal system. A person violating the ordinance shall be responsible to the state for damages in the amount required to restore the waters to meet the needs of canal navigation. It is also unlawful to obstruct the navigation of a canal in any way. Section 81 provides that whenever there is a deficiency of water in any part of the canal system, the commissioner of transportation shall supply such deficiency by resuming use of surplus water leased, and, if the deficiency still exists, by using all water necessary to supply the deficiency. Damages shall be determined and paid by the state to people loosing their water rights. Under section 83, the commissioner may seize any object in the canal system not under the control of any person. Then he shall sell all objects at a public auction after posting notice unless the owner appears to claim the object and pay the expenses of removal. The Commissioner may remove any other object from the canal system that he deems is obstructing navigation and pay the owner appropriate damages. (Shevin-Fla)
W69-03914

DRAINAGE FACILITIES.
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-03917

GRANTS OF LANDS UNDERWATER.
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-03918

FLOOD PLAIN INFORMATION OF LEFT-HAND CREEK, VOLUME 1, BOULDER COUNTY, COLORADO.
Corps of Engineers, Omaha, Nebr.

Corps Eng Flood Plain Rep, Jan 1969. 24 p, 9 plate, 3 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, Colorado, Maximum probable flood.
Identifiers: Left-Hand Creek (Colo), Boulder County (Colo), Standard Project flood, Intermediate regional flood.

Flooding of Left-Hand Creek, Boulder County, Colorado is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-03926

FLOOD PLAIN INFORMATION, MOJAVE RIVER (VICINITY OF BARSTOW), SAN BERNARDINO COUNTY, CALIFORNIA.
Corps of Engineers, Los Angeles, Calif.

Corps Eng Flood Plain Rep, Oct 1968. 34 p, 17 fig, 49 plate, 7 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, California, Maximum probable flood.
Identifiers: Mojave River (Cal), Barstow (Cal), San Bernardino County (Cal), Intermediate regional flood, Standard project flood.

Flooding of the Mojave River near Barstow, California is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-03927

FLOOD PLAIN INFORMATION, AUGLAIZE RIVER, WAPAKONETA, OHIO.
Corps of Engineers, Detroit, Mich.

Corps Eng Flood Plain Rep, May 1968. 37 p, 4 fig, 11 plate, 12 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Historic flood, Non-structural alternatives, Ohio, Maximum probable flood.
Identifiers: Wapakoneta (Ohio), Auglaize River (Ohio), Standard project flood, Intermediate regional flood.

Flooding of the Auglaize River, Wapakoneta, Ohio is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-03928

FLOOD PLAIN INFORMATION, ALLEGHENY RIVER, LITTLE VALLEY AND GREAT VALLEY CREEKS, SALAMANCA, NEW YORK.
Corps of Engineers, Pittsburgh, Pa.

Corps Eng Flood Plain Rep, Sept 1968. 56 p, 12 fig, 16 plate, 14 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, New York, Maximum probable flood.
Identifiers: Allegheny River (NY), Little Valley Creek (NY), Great Valley Creek (NY), Standard Project flood, Intermediate regional flood.

Flooding of the Allegheny River, Little Valley Creek, and Great Valley Creek, Salamanca, New York is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-03929

FLOOD PLAIN INFORMATION, OUACHITA RIVER, WEST MONROE, LOUISIANA.
Corps of Engineers, Vicksburg, Miss.

Corps Eng Flood Plain Rep, Nov 1968. 29 p, 13 fig, 10 plate, 6 tab.

riptors: *Floods, *Flood damage, Flood
s, Flood control, Maximum probable flood,
d forecasting, River forecasting, Flood protec-
Hydrograph analysis, Louisiana, Flood plain
g, Historic flood.
ifiers: Ouachita River, West Monroe, Loui-
.

ding of the Ouachita River flood plain at West
roe is described in a report by the U.S. Army
s of Engineers on the basis of the study of
term records of runoff, rainfall, and other data
rved since 1884. Maps, photographs, profiles,
sections, and several plates (10) given in the
rt indicate the extent of flooding that has oc-
d and which may be expected to occur in the
e. In general the report should be of value in
ning ways to minimize the intensity of flood
ge by using zoning and subdivision regula-
, and by constructing flood-protections works.
Gabriel-USGS)
-03930

OD PLAIN INFORMATION, CONCORD SHAWSHEEN RIVERS, BEDFORD, MASHUSETTS.
s of Engineers, Waltham, Mass.

s of Eng Flood Plain Rep, Sept 1968. 54 p, 3
2 plate, 8 tab, 3 append.

riptors: *Floods, *Flood damage, Flood
s, Flood control, Non-structural alternatives,
achusetts, Maximum probable flood.
ifiers: Concord River (Mass), Shawsheen
(Mass), Bedford (Mass), Intermediate re-
l flood, Standard project flood.

ding of the Concord and Shawsheen Rivers,
ord, Massachusetts is described in a report of
plain problems based on records of rainfall,
ff, and historical and present flood heights.
, photographs, profiles, and cross sections in-
e the extent of flooding that has occurred and
h may be expected to occur in the future. The
mation is for use in study and planning ways to
nize vulnerability to flood damages by control
od plain use by zoning and subdivision regula-
, the constructions of flood protections works,
combinations of these approaches. (Knapp-
S)
-03931

OD PLAIN INFORMATION-SOUTH FORK RIVER, WEOTT TO MYERS FLAT, HUMDT COUNTY, CALIFORNIA.
s of Engineers, San Francisco, Calif.

s Eng Flood Plain Rep, June 1968. 38 p, 11
5 plate, 12 tab.

riptors: *Floods, *Flood damage, Flood
s, Flood control, Non-structural alternatives,
ornia, Maximum probable flood.
ifiers: Eel River (Cal), Humboldt County
), Standard project flood, Intermediate re-
l flood.

ding of the South Fork Eel River, Humboldt
ty, California is described in a report of flood
problems based on records of rainfall, runoff,
historical and present flood heights. Maps,
ographs, profiles, and cross sections indicate
xtent of flooding that has occurred and which
be expected to occur in the future. The infor-
on is for use in study and planning ways to
nize vulnerability to flood damages by control
od plain use by zoning and subdivision regula-
, the construction of flood protection works,
combinations of these approaches. (Knapp-
S)
-03932

T PENETRATION TECHNIQUE FOR PAGE MEASUREMENT,
cultural Research Service, Phoenix, Ariz.
r Conservation Lab.

Herman Bouwer, and R. C. Rice.
ASCE Proc, J Irrig and Drainage Div, Vol 94, No IR4, Pap 6304, pp 481-492, Dec 1968. 7 fig, 2 tab, 2 ref.

Descriptors: *Seepage, *Infiltration, *Open channel flow, *Tracers, *On-site tests, Laboratory tests, Reservoirs, Canals, Irrigation.
Identifiers: Salt penetration, Seepage tracers.

Seepage rates in open channels or reservoirs are determined from the rate of salt penetration into the bottom material. A portion of the bottom is covered with crystals of a non-deflocculating salt. After dissolving, part of the salt enters the bottom with the seepage flow. The rate of advance of the peak of the resulting salt concentration 'wave' in the bottom material is measured with an electrical-conductivity probe. Laboratory studies showed that the seepage rate could be calculated by multiplying this salt penetration rate by the porosity of bottom material. A field study in a reservoir showed excellent agreement between the seepage obtained in this manner and the rate of fall of the water surface. The salt-penetration technique is simple and it can be carried out under a wide variety of canal conditions
W69-03935

CAROLINA BEACH FISHING PIER, INC V TOWN OF CAROLINA BEACH (STATE'S RIGHT TO TAKE PRIVATE BEACH LAND).

163 S E 2d 363-372 (N C 1968).

Descriptors: *North Carolina, *Eminent domain, *Water law, *Beach erosion, Judicial decisions, Legal aspects, Beaches, Sea walls, Landfills, Dredging.

Plaintiff brought action against defendant, a municipal corporation, for just compensation of land taken for a public purpose. Pursuant of Chapter 511 of North Carolina Session Laws of 1963 beaches that had eroded in Hanover County could be restored with sand and protected by construction of a seawall. Furthermore, any landowner affected by the provisions of the act could file a claim within six months after establishment and recording of a building line. The building line had to be filed within thirty days after completion of construction of the seawall. Defendant brought in fill to restore the beach on plaintiff's land, and filed a map of the building line on May 8, 1964, before beginning construction of the seawall. Plaintiff filed his suit May 19, 1965, over six months after defendant had filed the building line. Defendant completed construction of seawall in June, 1965. Defendant claimed the statute of limitations barred plaintiff's suit. The court held that plaintiff's suit was timely. It interpreted the statute in its entirety, saying the limitation period did not begin until thirty days after completion of construction. (Holt-Fla)
W69-03982

PROTECTION OF NAVIGABLE WATERS AND STREAMS; EXCAVATION OR FILL; DAMS AND DOCKS; PERMIT.
NY Conserv Law secs 429-b, 429-c (McKinney 1967) as amended and supp by NY Conserv Law sec 429-b (McKinney Supp 1968).

Descriptors: *New York, *Navigable waters, Water courses, *Obstruction to flow, Legislation, Excavation, Landfills, *Permits, Navigation, Barriers, Dams, Specifications, Administration, Control, Water law, Docks.

These sections require a permit in order to excavate or place fill in the navigable waters of the state or to erect or repair any dam, artificial obstruction, or structure used as a landing place in or across a natural stream or watercourse. Provision is made for the procedure of application and the standards which the Water Resources Commission uses in determining whether to grant or withhold such permit. Certain types of structures are exempted from the application of these sections. These sections are supplemented and sec 429b (1) is amended. (Childs-Fla)
W69-03984

GENERAL DUTIES - BOARDS OF RIVER REGULATING DISTRICTS.
NY Conserv Law sec 583 (McKinney 1967).

Descriptors: *New York, *Reservoir sites, *Flood control, Legislation, Rivers, Reservoirs, Maps, Specifications, Administrative agencies, *River regulation, Administrative decisions, Water law.

The board of the river regulating district may prepare a plan for the regulation of the flow of the rivers in its district. The plan is to show the available and feasible reservoir sites, the extent of land to be flowed by each reservoir and the ownership and value of such lands. Maps, profiles and other necessary data are to accompany the plan. The completed plan, if approved by the board of the river regulating district, is certified to the Water Resources Commission for its approval. After approval by the Water Resources Commission, the plan shall be known as the 'official plan' for the regulation of the flow of the rivers of the district. (Childs-Fla)
W69-03985

RIGHT OF ENTRY; UNLAWFUL INTERFERENCE WITH DRAINAGE WORKS.
NY Conserv Law secs 534,535 (McKinney 1967).

Descriptors: *New York, *Drainage programs, *Drainage district, *Easements, Legislation, Administrative agencies, Compensation, Condemnation, Real property, Legal aspects, Right of way, Taxes, Ditches, Water law.

The Water Resources Commission may enter upon any lands, structures or waters in order to carry out surveys and examinations required by Part 5, Article 5 to determine what rights in and to such property are to be acquired. If the owner of any property to be acquired or over which an easement is needed fails to agree with the Commission upon the compensation to be paid, the Commission shall proceed to take title thereto or the required rights, enter immediately and devote the property to public use. Notice must first be given and a deposit, as fixed by the court, must be made. A ditch or channel in use for at least 20 years is conclusive proof that a right of way and all other rights in the premises through which it passes were duly obtained. Real property acquired by a drainage improvement district is exempt from taxation. It is unlawful to interfere with drainage works, although construction of approved private drainage works is not prohibited. (Childs-Fla)
W69-03986

PROHIBITED DIVERSIONS.
NY Conserv Law sec 521 (McKinney 1967).

Descriptors: *New York, *Diversions, *Alteration of flow, Legislation, Jurisdiction, Administrative agencies, Administrative regulation, Legal aspects, Permits, Water law.
Identifiers: State waters.

The drawing, diversion or use of certain waters, after notice to desist has been given, is a misdemeanor punishable by fine. In addition, the Water Resources Commission may institute an action for the recovery of the sum of $50 per day for each day the prohibited activity continues. When the state has a proprietary right in the waters, the bed of such waters, or other real property necessary for the use of such waters; or if the waters are boundary waters of the state, this section shall apply. (Childs-Fla)
W69-03987

WASHINGTON GOLF AND COUNTRY CLUB V BRIGGS AND BRENNAN DEVELOPERS (ACTION FOR DAMAGE CAUSED BY FLOODING).

198 Va 586, 95 S E 2d 233-239 (1956).

Descriptors: *Virginia, Judicial decisions, *Flood damage, *Surface waters, Storm drains, Erosion, Legal aspects, *Damages.
Identifiers: Topographic change, Debris.

Plaintiff sued for injunctive relief and damages. It was alleged that defendant by changing the topography of his land, constructing roadways, and installing drains and storm sewers had caused the surface waters to collect in artificial channels diverting its natural flow. The result complained of was the discharge of this surface water in a materially augmented volume, mingled with silt and debris, upon plaintiff's golf course. Plaintiff appealed from a decree granting an injunction but failing to award damages. The court held that damages are not uncertain because they cannot be calculated exactly. One whose wrongful conduct has rendered difficult the ascertainment of precise damages cannot complain of their inexact measurement. The lower court decision was reversed with instructions to empanel a jury to decide the issue of damages. (Childs-Fla)
W69-03993

LAKE BARCROFT ESTATES V MCCAW (WATER DAMAGE DUE TO FLOODGATE OPENING).

93 S E 2d 124-126 (Va 1956).

Descriptors: *Virginia, *Floodgates, *Floods, *Dams, Judicial decisions, Flow control, Washouts, Damages, Flood damage, Rain, Sluices, Control structures, Reservoir operation, Legal aspects, Riparian rights, Riparian land.

William McCaw, a riparian owner, sued Barcroft Estates for damages to his real estate allegedly the result of the willful and deliberate opening of the flood gates on the defendant's dam during a heavy rainfall. The defendant admitted that the opening of the floodgates caused the damage, but denied that its employees had opened the gates. The defendant asserted that the gates opened automatically when the water rose as the result of the heavy rains. The circuit court found for the plaintiff and this court affirmed. The record disclosed that an employee of the defendant had manually opened the flood gates thereby releasing a far greater quantity of water on the lands below the dam than had accumulated in the reservoir as a result of the rains. Though the employee had opened the gates because he feared that the entire dam would washout if the water continued to accumulate, no evidence was introduced tending to establish the reasonableness of such fears. Since the defense counsel offered no objection to the testimony concerning the manual opening of the gates, the jury was free to believe whichever version seemed most reasonable. (Blunt-Fla)
W69-03995

HOUGH V OHIO RIVER SAND CO (BOUNDARY LIMITATION WHEN DEED CONVEYS TO THE LOW WATER MARK).
288 S W 2d 655-656 (Ct App Ky 1956).

Descriptors: *Kentucky, Judicial decisions, Rivers, *Ownership of beds, *Boundaries (Property), Damages, *Low water mark, Navigable waters, Boundary disputes, Land tenure, Beds.

Plaintiffs brought this action for damages and injunction on the ground that defendants dug sand on plaintiffs' submerged land causing the river banks along plaintiffs' lots to cave in. Plaintiffs' right to maintain this action depends on the ownership of the bed of the river. Defendants maintained that the boundary as expressed in plaintiffs' deed was to the 'low water mark,' which excluded the river bed. The court reached the opposite conclusion; that there is a presumption that the grantor intended to convey the bed of the stream as far toward the center as he owns. To rebut this presumption there must be a clear declaration of an intent to limit. Thus, the plaintiffs held to the thread of the stream. (Childs-Fla)
W69-03996

LEE-PHILLIPS DRAIN DIST V BEAVER BAYOU DRAIN DIST (UPPER OWNER'S RIGHT TO DRAIN WATERS ACROSS LOWER LAND CONDITIONED UPON PAYMENT FOR ANY IMPROVEMENTS NEEDED TO PROVIDE FOR HIGHER THAN NATURAL FLOW).
289 SW 2d 192-195 (Ark 1956).

Descriptors: *Arkansas, Judicial decisions, *Drainage districts, Surface drainage, Drainage systems, Drainage water, *Riddance (Legal aspects), Cost allocation, *Cost sharing, Separable costs, Canals, Legal aspects, Cleaning, Natural flow, Obstruction to flow, Relative rights.

Plaintiff lower drainage district sought to enjoin the defendant upper drainage district from improving its drainage canal until the plaintiff could improve its canal so as to safely carry the extra flow of water from the defendant's canal. The plaintiff also asked that the defendant district be compelled to share in the costs of improving the plaintiff's canal, or, failing that, to annex the plaintiff district's land in the canal area as part of the defendant's system. The defendant asserted that it had by purchase and prescription secured a permanent easement to discharge its waters into the plaintiff's canal. The defendant also stated that, since both canals were natural watercourses, it, as an upper owner, had a legal right to drain its waters into the canals of the plaintiff lower owner. The lower court granted an injunction against the defendant until it paid 93% of the cost of improving the plaintiff's canal: this court reversed and remanded. The defendant being an upper district, had a right to allow its natural flow of waters to follow the natural drain of the lower district's canal without obstruction. The lower district was responsible for the costs of providing for the natural drainage from the upper district, but the upper district was to pay any costs necessary to improve the plaintiff's canal to handle the extra flow of water as a result of the proposed improvements to upper district's land. (Blunt-Fla)
W69-03997

CLAUSS V BAUMGARTNER (AGREEMENT ON OWNERSHIP OF ACCRETIONS).
305 SW 2d 116-119 (Ark 1957).

Descriptors: *Arkansas, Judicial decisions, *Accretion, Riparian rights, Rivers, Riparian land, *Boundary disputes, Equitable apportionment, Land tenure, *Boundaries (Property), Riparian land.
Identifiers: Arkansas River, Rules of apportionment.

Adjacent riparian owners both claim accretions on the west bank of the Arkansas River. Pierce and Munn, previous owners of the land now owned by Clauss, had agreed with Baumgartner that the dividing of the accretion land would be the south line of Section 34 extended easterly to the river. It was agreed that this boundary line would extend to the southeast corner of Section 34 if the river added accretions for that distance. A fence was constructed along this line and the parties exercised acts of ownership on their lands divided by this division line. This evidence was held sufficient to sustain a finding that plaintiffs' predecessor in title had entered into a parole agreement with defendants as to the division line, which related to lands in existence and lands subsequently formed. (Childs-Fla)
W69-03998

ESSO STANDARD OIL CO V JONES (OWNERSHIP OF BED OF FORMER NAVIGABLE STREAM IS IN RIPARIAN OWNER).

98 So 2d 236-250 (La 1957)

Descriptors: *Louisiana, Judicial decisions, Royalties, Mississippi River, *Ownership of beds, Streambeds, Navigable waters, Oil wells, Low water mark, *Riparian rights, *Accretion, Legal aspects, Channels, Rivers

A concursus proceeding was intitiated to determine the rights to royalties on oil taken from wells located on land formerly a part of the Mississippi river bed. The land was now above the rivers mean low water mark, the main course having changed following the cutting of a water control channel. The State of Louisiana claimed that since the oil wells are on land formerly the bed of a navigable stream, the land belonged to the state by right of sovereignty; and for this reason, the royalties belong to the state. The court held that the fact that an act of mankind had something to do with the change in the river channel did not prevent accretions to adjoining land from becoming the property of adjoining riparian owners. However, rights of accession are limited to lands abutting on a river or stream and have no application to lakes. But water does not have to flow continuously in order for a water course to be a river or stream. Thus, the riparian owners were held to be entitled to the oil royalties since the land had built up by successive and imperceptable accretions. (Childs-Fla)
W69-03999

EAST BATON ROUGE PARISH COUNCIL V KOLLER (NO OFFSET AGAINST DAMAGE AWARD FOR BENEFITS CONFERRED).
94 So 2d 505-507 (Ct App La 1957).

Descriptors: *Louisiana, Judicial decisions, *Drainage project, Damages, *Condemnation, Local governments, *Project benefits, Public benefits, Legal aspects, Excavation, Flood control, Drainage, Condemnation value.
Identifiers: Expropriation, Servitude.

Plaintiff appeals from an award to defendant landowner of $750 for a fifty-foot servitude for drainage purposes. Defendant's answer requesting an increase of the award to $1,100 was not filed until after oral argument and therefore could not be considered. The only two shade trees on the land would also be lost and plaintiff maintains that the award was erroneously arrived at because the trees were valued independently of the land. The court held that the valuation, considering the testimony, was of the land taken including the trees and while consequential damages such as loss of esthetic values are not per se compensable, they are properly considered if they diminish the value of the remaining property. The court also held that the damages awarded should not be offset by general benefits accruing, better drainage and less danger of flooding, because these are benefits which are shared by all property owners in the community. (Childs-Fla)
W69-04000

CITIZENS UTILITIES COMPANY V FEDERAL POWER COMMISSION (FPC JURISDICTION).

279 F 2d 1-3 (2d Cir 1960).

Descriptors: *Hydroelectric project licensing, *River flow, *Navigable rivers, *Dams, Legislation, Jurisdiction, Federal Power Act, Judicial decisions, Hydroelectric plants, Rivers, Diversion dams, Flow control, Impoundments, Public benefits, Water supply, Federal government, Administrative agencies, Administrative decisions

The petitioner, a Delaware corp, built hydroelectric dams at several places on the Clyde River, Vermont. The occasion of this suit is the petitioner's construction of a new project including a diversion

a canal, and a power plan across the river
the dam at the outlet of Clyde Pond. The
al Power Commission (FPC) began to in-
ate this partially completed power project in
to determine whether it was in the public in-
to control it in order to preserve the naviga-
nd the water supply of the Clyde River. The
etermined that not only the Clyde Pond pro-
ut also the petitioner's other projects af-
the navigability of the river; and thus the
ner was required to apply for a license. The
neld that the evidence was sufficient to prove
ie dams even at nonnavigable points on the
re, at the will of the petitioner, capable of af-
temporarily the flow of water in the naviga-
rtion of the river below Clyde Pond. The
affirmed the order of the FPC requiring an
ation for a license as required by section 817
e 16, USCA. (Smith-Fla)
04002

LAND HOLDING COMPANY V
AMM (PRESCRIPTIVE RIGHTS).
2d 697-701 (2d DCA Fla 1960).

ptors: *Florida, *Ditches, *Surface
ge, *Prescriptive rights, Judicial decisions,
ents, Dams, Surface water, Drainage, Cul-
Water law, Artificial watercourses, Natural
s.

datory injunction sought by and granted to
aintiffs in the suit below required the defen-
o remove a dam which they had constructed
an outfall drainage ditch. The ditch was con-
ed by persons unknown and had provided
ge for surrounding lands in excess of 45
It had through the years been used without
ion by anyone concerned and all had
sced in its use. The road department con-
ed drainage ditches west and east of US 1,
connect with the drainage ditch here in-
. The road department periodically cleaned
ch and maintained it from the time US 1 was
ucted to the time of the instant suit. The ap-
as advanced upon the sole proposition that
was no proof of an adverse use and hence
could be created no easement by prescrip-
The court affired the trial court's ruling and
nat the use was so continuous and notorious
mpute to the owners of the lands that the clai-
were exercising their privilege under a claim
nt adverse to the owners for the required
of 20 years. (Smith-Fla)
04003

S V HOME BUILDING AND LOAN ASS'N
HOMASVILLE (LOWER OWNER'S OB-
CTION OF UNDERGROUND FLOW).
2d 638-648 (NC 1960).

ptors: North Carolina, Judicial decisions,
rground streams, *Percolating waters,
sources, *Obstruction to flow, Barriers,
ral flow doctrine, Relative rights, Damages,
ng, Flood damage, Deflection, Channels,
courses (Legal), Legal aspects.

ffs' basement was continually flooded al-
due to an underground basement on defen-
adjoining lower lot. The plaintiffs contended
e concrete walls of the basement obstructed
w of a subterranean stream and forced water
ough the floor of the plaintiffs' basement.
defendants contended that there was no
ce showing the existence of a subterranean
in the area and appealed a jury verdict for
aintiffs. This court vacated the judgment of
wer court and ordered a new trial to deter-
whether the defendant had negligently ob-
d percolating waters. Plaintiffs' evidence
sufficient to raise a jury submissible issue as
ther the waters obstructed constituted a sub-
ean stream. All underground waters are
ned to be percolating, and the burden is on
aintiffs to prove otherwise. The plaintiffs had
ablish the presence of a stream or body of
water flowing in fixed or definite channels, the location of which is known or ascertainable by men of ordinary powers from surface indications or other means without excavations for that purpose. The rights and liabilities with respect to subterranean streams, unlike percolating waters, are generally governed by the rules of law applied to surface streams. A person who obstructs a known subterranean stream known with reasonable certainty that he will break the natural flow, and the obstruction is therefore, intentional. A person who obstructs the flow of percolating waters usually has no certain knowledge what the consequences will be and can only be liable on the ground of negligence should harm result. (Blunt-Fla)
W69-04004

THE LAW OF WATER IN NEW JERSEY,
Rutgers - The State Univ., New Brunswick, N. J.
Eva Morreale Hanks.
Rutgers Law Review Vol 22, No 4, Summer 1968, pp 621-715. 94 p. OWRR-14-01-0001-594, OWRR Project A-001-NJ.

Descriptors: *Riparian rights, *New Jersey, *Water rights, *Legal aspects, Judicial decisions, Natural flow doctrine, Reasonable use, Repulsion (Legal aspects).

This study deals with riparian rights in surface watercourses and the law governing diffused surface water. New Jersey has, in the past, been categorized by most authors and commentators as a riparian state, committed to the doctrine of natural flow. That doctrine says that owners of riparian land are entitled to the flow of the water in surface water-courses in its natural state, undiminished in quantity and quality. This picture of New Jersey water law is inaccurate. New Jersey is a true natural flow doctrine state in only one respect, namely, in regard to the so called 'merchandising' of water. That is, an abstraction of water for purposes of sale and use in connection with non-riparian land is per se unlawful. If the controversy, on the other hand, centers around the use of water or riparian land or involves conduct allegedly leading to pollution of the source, the appropriate standard by which to judge the defendant's behavior is that of reasonableness. The infliction or noninfliction of injury on the plaintiff is an element of judging the reasonableness of the defendant's behavior. The rule of reason also applies to drainage. (Whipple-Rutgers)
W69-04055

VERTICAL ALIGNMENT OF SEWER AND DRAINAGE SYSTEMS BY DYNAMIC PROGRAMMING,
Massachusetts Inst. of Tech., Cambridge, Mass.
Douglas Albert Haith.
M S Thesis, Massachusetts Institute of Technology, Dept Civil Eng, Aug 1966. 75 p, 29 fig, 3 ref, 1 append.

Descriptors: *Dynamic programming, Sewers, Constraints, Pipelines, Economic efficiency, *Drainage systems, *Design, Computer programs, Network design, Water conveyance, Hydraulic design, Hydraulic gradient.

A design procedure based on the principles of dynamic programming was presented for the analysis of vertical alignment of open channels. The design of conduits as a special case of open channels was developed in detail. The objective was to find the optimum (least cost) solution given the elevation of pipe at the beginning and end of the line. The effect on cost of a constraint against decreasing downstream pipe diameters was investigated, and the analysis was extended to the design of simple branched networks. The Computer program for determining pipeline construction costs and performing the dynamic programming was presented. Several examples were analyzed using this program. (Gysi-Cornell)
W69-04150

CARD V NICKERSON (ACTION FOR DAMAGES FOR OBSTRUCTION OF NATURAL WATER COURSE).
104 A 2d 427-431 (Me 1954).

Descriptors: *Maine, *Watercourse (Legal), *Obstruction to flow, *Judicial decisions, Natural flow, Flow, Landfills, Channel flow, Channels, Backwater, Damages, Rock fill dams, Abatement, Streamflow, Drainage systems, Drains, Pipes.
Identifiers: Nuisance.

Water flowed through a natural watercourse from plaintiff's land to and through adjoining land of defendant, which he had purchased from plaintiff, and then into a pond and brook. The watercourse was well-defined and rarely dry. Defendant filled in part of the course on his property and installed inadequate drains, with the result that water backed up onto plaintiff's land. Plaintiff brought an action for damages. The trial court gave judgment to plaintiff and excluded evidence that defendant told plaintiff, prior to the execution of the deed, that he planned to cause the fill. The jury was allowed to base the award upon permanent damage. The appellate court reversed, holding it proper to exclude the parole evidence about the warning, but ruling it error for the award to have been given for permanent damage. The court said permanent damage to real estate cannot be recovered in such nuisance cases where the cause may be abated or removed. (Wheeler-Fla)
W69-04151

PUBLIC UTILITIES COMMISSION.

Me Rev Stat Ann tit 35, secs 9, 11-14 (1965).

Descriptors: *Maine, *Project planning, *Public utilities, *Water resources development, Legislation, Water storage, Water resources, Dams, Dam construction, Basins, Reservoir storage, Watershed management, Regulation, Geological surveys, Legal aspects.

The Public Utilities Commission is directed to collect information relating to the State's: (1) water resources, (2) river flow and drainage area, (3) lakes, in regard to their capacity as storage reservoirs, and other data to enable the Commission to devise methods for improving the natural storage basins of the State and to provide for new reservoirs. The Commission may cooperate with the United States Geological Survey in the preparation of hydrologic and geological surveys. Anyone proposing to erect or develop a water storage basin must file a statement and plan with the Commission. The Commission's biennial report shall contain an account of operations. The report may also include (1) data pertaining to the water powers and resources of the State, (2) plans for the improvement and creation of water storage basins. Anyone proposing to construct a new water system must file a plan and specifications therefor. Ice or debris in the bed of any stream above tidewater which may cause property damage may be removed with the permission and under the direction of the Commission. (Molica-Fla)
W69-04160

PARTICULAR NUISANCES.
Me Rev Stat Ann tit 17, sec 2802 (Supp 1968-69).

Descriptors: *Maine, *Nuisance, *Wells, *Water pollution, Legislation, Shafts, Excavations, Navigable waters, Navigation, Obstruction to flow, Barriers, Stream pollution, Diversion, Alteration of flow, Natural flow doctrine, Routing, Riparian rights, Diversion structures, Legal aspects.
Identifiers: *Public nuisance.

This statute declares certain acts to be public nuisance. Such acts include the following: permitting abandoned wells to remain uncovered; obstructing, without legal authority, the passage way of any navigable water; corrupting or polluting the waters of a river, stream, or pond, and; finally, unlawfully diverting water from its natural course or

state to the injury or prejudice of others. (Stewart-Fla)
W69-04161

HOPSON V DOWNS (OBSTRUCTION TO NATURAL FLOW OF SURFACE WATER).

340 S W 2d 475-478 (Ct App Ky 1960).

Descriptors: *Kentucky, *Civil law, *Natural flow doctrine, *Drainage, Remedies, Adjudication procedure, Surface drainage, Floods, Legal aspects, Relative rights, Surface runoff.
Identifiers: Negligence.

The owner of upper land brought an action against a lower owner for damage caused by water which backed up behind a fill constructed on the lower land. An injunction against the lower owner was also sought. The Circuit Court found for the defendant and plaintiff appealed. Kentucky follows the civil law rule that a lower owner has no right to create any obstruction to the natural flow of surface water from upper to lower land. The only issue that should have been submitted to the jury was whether defendant's fill caused flooding of plaintiff's land. Here the case was submitted under theory of negligence in construction of fill. The plaintiff upper owner offered an instruction embodying negligence as the basis of liability, so he could not complain of error. The plaintiff was not entitled to an injunction when the jury determined that the lower owners had committed no wrongful act. (Kahle-Fla)
W69-04172

NEMETH V COUNTY OF GENESEE (ACTION FOR CROP DAMAGE FROM ENLARGEMENT OF DRAINAGE DITCH).

347 Mich 65, 78 NW 2d 634-640 (1956).

Descriptors: *Michigan, *Drainage systems, *Flooding, *Culverts, Judicial decisions, Water law, Damages, Drains, Outlet works, Pipes, Roads, Surface drainage, Drainage, Ditches, Drainage effects, Drainage engineering, Drainage water, Administrative agencies, Drainage districts, Surface runoff, Flood damage.
Identifiers: Negligence.

Plaintiffs brought action against the drain commissioner and county to recover for crop damages. They alleged that the damage resulted form the enlargement of a drainage ditch traversing their land without corresponding enlargement of the culvert into which the drain waters flowed. The lower court held for the defendants, and the Supreme Court of Michigan affirmed holding that the evidence sustained the finding that the plaintiffs had not been damaged because of any breach of duty on the part of the defendants. The Supreme Court stated that the drain commissioner had a duty to exercise ordinary care and judgment in the discharge of his duties, but he was not an insurer of any particular project and would not be liable for a mere mistake in judgment. Furthermore, the evidence did not prove that the enlargement of the drainage ditch caused the damage. The court also stated that it is a matter of common knowledge that low, flat land with surface depressions, as involved in the present case, presents difficulties with reference to drainage. (R H Watson-Fla)
W69-04175

CITY OF MERIDIAN V NEW ORLEANS AND NORTHEASTERN RR (INADEQUATE DRAINAGE THROUGH CULVERTS).

291 F Supp 303-307 (SD Miss 1968)

Descriptors: *Mississippi, *Culverts, *Flooding, *Engineers estimates, Judicial decisions, Legal aspects, Floods, Backwater, Cities, Railroad, Bridges, Rivers, River flow, Flood control, Obstruction to flow, Rainfall, Drains
Identifiers: Trestles

Defendant's railroad track, on an open wooden trestle, crossed a stream located within the limits of plaintiff city. In 1955, defendant installed metal culverts under the trestle's trackbed and filled in the area between the culverts. Plaintiff sought to have defendant remove the culverts which allegedly caused flooding at this point and other points upstream because of the inadequacy of the culverts to handle the flow during periods of heavy rain. Evidence showed that flooding had occurred before as well as after the changes. However, the flowage capacity of the culverts was less than adequate according to engineering studies. The court held that the plaintiff had a cause of action because the city has a duty to maintain bridges and roads affected by flooding and it may abate a nuisance. The defendant has a duty not to impair the flow of the creek and the court directed defendant to make such changes at the crossing as would be required to meet reasonable forseeable floods. (Molica-Fla)
W69-04176

KUSHNER V PAZ CONSTR (STORM SEWER DRAINAGE).

171 NYS 2d 1007-1009 (S Ct 1958).

Descriptors: *New York, *Easements, *Storm drains, *Obstruction to flow, Legal aspects, Judicial decisions, Manholes, Sewers, Drainage water, Flooding, Surface runoff, Natural flow, Relative rights.

Plaintiff sold the westerly portion of her parcel of land to the defendant. A storm sewer ran along the rear of both parcels and water in it naturally flowed in a westerly direction. The deed did not reserve an easement for the storm sewer in plaintiff's favor. To stop the flooding of his land due to a blockage of the sewer to the west of him, the defendant filled in a manhole located on his property. This caused a flooding of plaintiff's cellar. The court held that plaintiff was not entitled to a temporary injunction to compel the defendant to remove the obstruction and that an easement for sewer drainage over defendant's land would not be implied by law. (Molica-Fla)
W69-04179

FELSON V ASPEGREN (TO ENJOIN DIVERSION OF ARTIFICIAL STREAM AND CREATION OF ARTIFICIAL POND).
178 NYS 2d 679-681 (S C 1958).

Descriptors: *New York, *Riparian rights, *Artificial watercourses, *Ponds, Judicial decisions, Water law, Drainage water, Natural streams, Drainage systems, Surface runoff, Tiles, Drainage, Streams, Damages, Legal aspects, Diversion, Alteration of flow.

Plaintiff sought injunctive relief to prohibit the diversion of waters from an artificial stream which flowed through his land. The Supreme Court of Westchester County held that the relief could not be granted because the golf course, upon which the stream was created and the diversion occurred, was not joined as a defendant. The court further stated, however, that the plaintiff had no riparian or proprietary rights in regard to the stream because it was not a natural watercourse. The injunction was granted, however, to prohibit the creation of an artificial pond on the defendant's land from the diverted water. The water from the pond seeped and overflowed onto the plaintiff's adjoining property. Damages were not awarded because the relief granted would restore the property value. (Watson-Fla)
W69-04180

KOSSOFF V RATHGEB-WALSH (ACTION FOR DAMAGE CAUSED BY SURFACE WATER FLOW).
3 NY 2d 583, 170 NYS 2d 789-795 (Ct App NY 1958)

Descriptors: *New York, *Surface waters, *Natural flow, *Reasonable use, Relative rights, Judicial decisions, Surface runoff, Runoff, Surface drainage, Drainage water, Overland flow, Prescriptive rights, Damages, Seepage, Flow, Gravitational water, Land development, Elevation, Legal aspects.
Identifiers: Upper landowner, Lower landowner.

Plaintiff owned land on a slope below and abutting defendant's unimproved lot. While defendant's land was still unimproved, a store was built on plaintiff's land. Defendant later built a gas station, which involved a slight raising of the level of his lot where it adjoined plaintiff's land. No pipes, ditches, or other artificial drains were employed by defendant. After these changes, surface water from defendant's lot seeped through the wall of plaintiff's building and caused damage. Plaintiff brought suit to recover damages, contending that defendant's improvements caused an increase of flow, and that once changes of the natural state were made, he was required to take preventive measures to protect the lower land. The trial judge dismissed the complaint, ruling that defendants had the right to make reasonable improvements, even though the effect was to increase the flow to plaintiff's land. The appellate court affirmed using the common law approach that either owner may improve his land according to his own desire in any manner to which the land is suited, without being liable to the abutting owner for change in surface water flow, provided he does not use drains, pipes, or ditches. The court further stated that the fact that one lot was improved first gave no cause for a prescriptive right. (Wheeler-Fla)
W69-04181

DRAINAGE OF AGRICULTURAL LANDS; PROCEDURE.

NY Conserv Law sec 575 (McKinney 1963).

Descriptors: *New York, *Swamps, *Condemnation, *Land reclamation, Legislation, Bogs, Lakes, Land, Ditches, Easements, Maps, Surveys, Assessments, Damages, Administrative decisions, Administrative agencies, Land resources, Drains.

Any person owning a swamp or other low or wet agricultural lands, who wishes to drain them in order to make the land more productive and deems it necessary that a drain be constructed or maintained on the lands of others, may condemn an easement pursuant to the Condemnation Law. If he has been unable to agree with the other owner as to damages, he may file a petition with the Commission. He must present the names of the owners of the land to be occupied and appropriate maps and surveys. The Commission will undertake investigation to determine the validity of the request. The Commission must notify all interested parties as to the date and location of the hearing. The Commission can view the premises and determine the necessity of the drainage; and, if it finds the action necessary, it shall assess the damages. Both the petitioner and the owner may review the findings of the Commission. (Shevin-Fla)
W69-04185

RIVER REGULATION BY STORAGE RESERVOIRS - DEFINITIONS AND CONSTRUCTION.
NY Conserv Law secs 580 (1) (2) (11) (12) (13) (McKinney 1967).

Descriptors: *New York, *River regulation, *Reservoir storage, *Regulated flow, Legislation, Land, Lakes, Ponds, Streams, Riparian rights, Dams, Easements, Basin, Rivers, Bridges, Sluices, High water mark, Low water mark, Public health.
Identifiers: *Real estate.

Real estate includes all lands above and below water, the waters of any lake, pond, or stream, all riparian rights, water powers, dams and every estate in land or water acquired or used for railroad, highway, or other public purpose. The 'regu-

eservoir' is a basin for impounding all waters
l or enlarged by a dam or any other barrier
ıcture which cannot be removed without
g damage. All lands under water impounded
hatever other lands may be necessary to
re the sanitary condition of the reservoir are
ed within the term 'regulating reservoir.' The
ow line is the line which will be made around
ervoir by water at the level of the crest of the
ir spillway. The low flow line is made by the
f the reservoir at its lowest level. Unsanitary
on or conditions mean such condition or
ons as are a menace to public health.
n-Fla)
4186

TION OF RIVER REGULATION DIS-
S.

nserv Law sec 581 (1) (McKinney 1967).

ptors: *New York, *River regulation,
voir operation, *Public health, Legislation,
s, Reservoir construction, Water control,
nents, Taxation, Eminent domain, Adminis-
agencies, Legal aspects.
ers: *River regulating districts, Public wel-

egulating districts may be created to main-
l operate reservoirs for the purpose of regu-
he flow of streams, when required by the
welfare, including public health. Such dis-
re declared to be public corporations and
ave perpetual existence and the power to
such real estate and other property as may
ssary, to sue and be sued, to incur contract
es, to exercise the right of eminent domain
assessment and taxation, and to do all acts
ercise all powers authorized by this title.
owers shall be exercised by and in the name
oard of the district. (Shevin-Fla)
4187

INI V DELILLIS (ACTION TO REQUIRE
VAL OF DITCH OBSTRUCTION).

190-92 (Super Ct N J 1948).

tors: *New Jersey, *Surface runoff,
es, *Obstruction to flow, Drainage, Water
ance, Diversion structures, Drainage water,
decisions, Surface drainage, Drainage
, Artificial watercourses, Natural flow,
ourses (Legal), Surface waters, Damages,
ge effects.

f and defendant both owned produce farms
me low-land area. Drainage of excess water
ins and melting snows was accomplished by
of ditches. For at least fifty years, a main
carried water from plaintiff's property,
land of his adjoining neighbor, and then
defendant's property. Defendant blocked
n ditch at a point where it passed through
nt's land in order to divert the water into a
ry ditch. However, due to a difference in
on of the outlets of the two ditches, the
evel of the main ditch was raised. Plaintiff
this action to require the removal of the
tion, alleging that plaintiff's land became
e as a farm for lack of proper drainage. The
ave judgment for plaintiff, upholding prior
rsey cases which held that no one has a right
uct or divert water which has flowed in the
urse for more than twenty years, regardless
her it involved a natural water course or an
l ditch. (Wheeler-Fla)
4194

Groundwater Management

SUBSIDENCE IN PLEASANT VALLEY
FRESNO COUNTY, CALIF.,
of Reclamation, Sacramento, Calif.
nary bibliographic entry see Field 02F.
ract, see .

W69-03797

OFFENHARTZ V HEINSOHN (EASEMENT TO ALLOW UNDERGROUND TRANSPORT OF WATER).

150 N Y S 2d 78-86 (S C 1956).

Descriptors: *Easements, *Water conveyance, *Closed conduit flow, Reservoir, Springs, Right-of-way, Damages, New York, Legal aspects.

Plaintiff sued to enjoin interference with conveyance of water beneath defendant's land from springs to a reservoir on plaintiff's land. Plaintiff's deed purported to grant an easement on defendant's property with rights to transport water under it via pipes and conduits. When defendant subsequently purchased the land between the springs and plaintiff's property from a third party, the deed she took acknowledged no easement in plaintiff's favor. The court found no adverse possession by plaintiff, although water from the spring had been transferred by means of gravity flow through the conduits to plaintiff's reservoir for 15 years (while defendant was in possession) prior to this action. The court held that underground transfer of water to the reservoir could have established an easement only if it was done with defendant's knowledge and permission. (Kelly-Fla)
W69-03908

GEOLOGY AND GROUNDWATER RESOURCES OF LARAMIE COUNTY, WYOMING,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 03F.
For abstract, see .
W69-03979

DIGIACINTO V NEW JERSEY ZINC CO (LANDOWNER'S RIGHTS TO TAKE PERCOLATING WATER).

Lehigh L J 307-317 (C P Lehigh County Pa 1957).

Descriptors: *Pennsylvania, *Percolating water, *Mining, *Grouting, Judicial decisions, Drilling, Wells, Domestic water, Domestic use, Groundwater, Pumping, Legal aspects, Underground streams, Damages.
Identifiers: Trespass, Correlative rights doctrine.

Plaintiff brought action in trespass against defendant to recover damages to property allegedly caused by defendant's pumping operations. Both parties owned land in the same township. Plaintiff obtained his domestic water supply from a well. Defendant, a mine operator, pumped water from the ground in an effort to lower the water table so as to make mining operations feasible. The defendant admitted that his mining operations were responsible for plaintiff's well going dry. The court held for defendant, saying that underground water is presumed to be percolating water unless such presumption is rebutted by competent evidence. If a landowner destroys his neighbor's percolating water supply through lawful purposes carried out on owner's land without malice, there is no liability for such destruction. In order to prove malice, it must be shown that the owner had knowledge of the injury inflicted upon his neighbor and that his activities must stem from a motive other than legal and economic use. The court adopted the absolute ownership rule and failed to recognize the correlative rights doctrine as applied to groundwater. (Holt-Fla)
W69-04038

4C. Effects on Water OF Man's Non-Water Activities

EFFECTS OF URBAN DEVELOPMENT ON FLOODS IN NORTHERN VIRGINIA,
Geological Survey, Richmond, Va.
Daniel G. Anderson.
Geol Surv open-file rep, 1968. 26 p, 5 fig, 5 tab, 9 ref.

Descriptors: *Floods, *Urbanization, *Virginia, *Flood routing, Drainage systems, Storm runoff, Hydrographs, Hydrograph analysis, Routing, Forecasting, Time lag.
Identifiers: Urban hydrology, Urban floods.

Graphical and mathematical relations are presented to estimate the flood peak magnitudes having recurrence intervals ranging up to 100 yr for drainage basins with various degrees of urban or suburban development. Five independent variables are required for use of the relations. They are basin size, length, and slope which may be measured from maps, and percentage of impervious surface and type of drainage system which may be evaluated by a basin inspection, but which in actual practice will usually be estimated for future developed conditions. The estimating relations are based upon analysis of flood information for 81 sites, 59 of which are in the Washington, D. C., metropolitan area. The relations are judged to be of adequate accuracy for design of drainage systems and for definition of flood limits. Urban and suburban development are shown to significantly affect flood flows. Improvements to the drainage system may reduce the lag time to one-eighth that of the natural channels. This lag time reduction, combined with an increased storm runoff resulting from impervious surfaces, increases the flood peaks by a factor that ranges from 2 to nearly 8. The flood-peak increase depends upon the drainage basin characteristics and the flood-recurrence interval. (Knapp-USGS)
W69-03706

STRICKLAND V STATE (DISCHARGE OF SURFACE WATER - STATE'S LIABILITY FOR NEGLIGENT INDEPENDENT CONTRACTOR).

177 NYS 2d 983-989 (Ct Cl 1958).

Descriptors: *New York, *Surface waters, *Road construction, *Flood damage, Highways, Surface drainage, Surface runoff, Erosion, Rainfall, Rainfall-runoff relationships, Rainfall intensity.
Identifiers: Debris.

Plaintiff owned property located on a 10% grade ascending to a highway. The State employed a contractor to resurface the highway and install gutters and culverts. Plaintiff's property was damaged when a heavy, but not unprecedented, rain fell in the area and washed large amounts of dirt, stones, and debris onto his land. The State's contractor had failed to cover the gutters with concrete, as was specified in the contract plans, thus leaving loose gravel and other material susceptible to erosion. The court found such omission to be negligence and the proximate cause of plaintiff's injury. However, the State was not liable since it and the contractor were not in the relationship of 'master and servant' or 'principal and agent.' An employer is not liable for the torts of an independent contractor unless: (1) the employer is independently negligent; (2) the employer is negligent in hiring the contractor; (3) the legislature otherwise provides; (4) the employer ratifies, adopts, or concurs in the tort; or (5) the work is inherently dangerous. (Bozarth-Fla)
W69-03820

IN RE SHIPPINGTON FERRY CO (RIGHTS OF FERRY OWNER AGAINST STATE FOR FRANCHISE INFRINGEMENTS).

247 A 2d 466-467 (Pa 1968).

Descriptors: Judicial decisions, *Legal aspects, *Eminent domain, Bridges, *Pennsylvania, *Ohio River, Water law, Bridge construction, State governments.
Identifiers: Franchise, Ferry.

Appellant, Shippingport Ferry Company, claimed damages against the State due to the construction of a bridge across the Ohio River. The court said that appellant had no action against State either under an eminent domain theory or a property damage theory. The franchise granted to appellant neither assured it of continued patronage nor the only means of traversing the river. The State did not impinge upon, appropriate, or extinguish the franchise it granted appellant prior to the bridge construction. (Holt-Fla)
W69-03903

SEC 40 ACQUISITION OF PROPERTY - SEC 43 EXCHANGE OF PROPERTY.

N Y Canal Law secs 40, 43 (McKinney Supp 1968), 8 p.

Descriptors: *New York, *Appropriation, *Canals, *New York State barge canal system, Legislation, Transportation, Surveys, Streams, Lakes, Highways, Rights-of-way, Easement, Navigation, Legal aspects, Easements, Administrative agencies, Maps.

Section 40 provides that the acquisition of property for use by the canal system will be by appropriation by the commissioner of transportation. All lands are subject to appropriation regardless of the interest retained in the land. After a map of the land is prepared and filed with the Attorney-general, the commissioner must file a notice of appropriation directed at the owners of the land with the county clerk. Each owner must be served personally. Commissioner may cause the owner to be removed from the land, make settlements of claims for damages, and make arrangements for payment of moving expenses. The State will be liable for any damages incurred in the maintenance of the canal system. All costs will be appropriated from the commissioner's office. The commissioner acquires streams, lakes, streets, roads, highways and rights-of-way. When the use of acquired property is no longer needed, the easement right may terminate and the property vest back to the owner. Under section 43 payment for property acquired may be made by exchange of property no longer needed in the barge canal system. The properties should be of equal value. The land to be exchanged must first officially be declared to be abandoned and then the Commissioner may obtain a quit-claim deed to effectuate such exchange. (Shevin-Fla)
W69-03915

DISPOSITION OF STATE UNDERWATER LANDS.
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-03919

WATER DEVELOPMENT AND WATER PLANNING IN THE SOUTHWESTERN UNITED STATES,
Aarhus Univ. (Denmark). Inst. of Economic and Applied Geography.
For primary bibliographic entry see Field 06B.
For abstract, see .
W69-03949

PEOPLE AND WATER,
Oregon State Univ., Corvallis, Oreg. Water Resources Inst.
Charles A. DeDeurwaerder, Thomas C. Hogg, Arnold M. Westling, DeWitt Nelson, and Raymond C. Vars
Proc Water Resources Res Inst Seminar, Spring Quarter 1968, Oregon State Univ., July 1968. Total 109 p, 16 fig, 4 tab. Funds for publication supplied by OWRR, Dept of Interior

Descriptors: *Water resources development, *Social aspects, *Urban sociology, *Water requirements, Legal aspects, Water rights, Aesthetics, Recreation, Population, Social function, Social needs, Water demand, Industries, Economics, Floods, Flood plains.
Identifiers: Willamette Basin (Ore), Flood plain use, Urban hydrology.

The relations of people to water, particularly of urban people, industry, and urban areas to rivers, are discussed in the record, a series of weekly seminars held at Oregon State University, Spring 1968. The individual seminar topics are: water as a determinant of urban form; social and cultural impact of water development; people and water at the local level; interpreting water resources problems; income redistribution through project design; rights of the public and water use; recreational demand; flood plain occupance; and the Willamette Basin study. All the seminars are primarily social in emphasis, stressing legal aspects, urban development, and water rights, and do not involve water as a strictly physical resource problem. (Knapp-USGS)
W69-03953

WATERFRONT RENEWAL.
Wisconsin Dept. of Resource Development.

Wisconsin, Department of Resource Development, Madison, 1966, 68 p, 5 map, 71 photo, 17 dwg.

Descriptors: *Methodology, *Local governments, *Wisconsin, Harbors, Transportation, Land use, Efficiencies, Storms, Shoreline protection, Water quality, Public benefits, Multiple purpose, Aesthetics, Education, Legal aspects.
Identifiers: *Urban waterfront renewal, *Waterfront deterioration, Shoreline structures, Upland benefits, Municipal responsibilities.

The first chapter discusses urban waterfront problems and classifies the typical causes of waterfront blight. Main types of causes include changing port use, changing land transportation, deteriorating shoreline structures, natural factors, and change in waterfront land use. The second chapter discusses the need for urban waterfront planning and lists necessary objectives of any urban waterfront renewal plan. These goals include transportation efficiency, reducing storm damage, insuring shoreline maintenance, improving surface water quality, increasing public use, increasing upland benefits, and creating multiple use of waterfront land. Discussed are means of developing the great esthetic potential of waterfront areas and described are the wide range of possible uses of a waterfront. Chapter III lists methods by which local governments can avert or overcome waterfront deterioration. Possible activities include encouraging orderly transitions in waterfront land use, education of riparian owners and the public enforcement of codes requiring maintenance of waterfront structures, municipal improvement of its own share of the waterfront, selective clearance of structures, and total clearance and redevelopment. Several renewal projects which have taken these actions are illustrated. The chapter ends with a description of renewal proposals for selected Wisconsin waterfronts. (Gossen-Chicago)
W69-04033

CITY OF HUNTSVILLE V MILLER (MUNICIPAL WATER).

127 So 2d 606-611 (Ala 1958).

Descriptors: *Municipal water, *Surface waters, *Drainage effects, *Alabama, Drainage, Municipalities, Drainage systems, Damages, Ditches, Rain water, Sewers, Water works, Controlled drainage, Adjudication procedure, Judicial decisions, Legal aspects, Discharge (Water).

Plaintiffs, owners of land adjacent to water collection facilities of the City of Huntsville, filed a bill in equity against the city seeking to enjoin as a nuisance the collection of surface waters in the vicinity of plaintiffs' lands and the depositing of such waters thereon. The plaintiffs also sought damages to the lands resulting therefrom. The trial court denied injunctive relief but awarded damages. The Alabama Supreme Court never reached the merits of the case in holding that the equity court, after denying all equitable relief, could not retain jurisdiction to grant damages at law. The Alabama Supreme Court held void the decree purporting to award damages and dismissed the appeal. On rehearing the issue was whether the maintenance by the city of an already existing system for the drainage of surface waters which caused injury or damage to another's land was subject to abatement in equity. The court relying on case law, held negatively and denied rehearing. (Carruthers-Fla)
W69-04166

4D. Watershed Protection

HYDROLOGY OF CORNFIELD WASH AREA AND EFFECTS OF LAND-TREATMENT PRACTICES, SANDOVAL COUNTY, NEW MEXISO, 1951-60,
Geological Survey, Washington, D. C.
D. E. Burkham.
Geol Surv Water-Supply Pap 1831, 1967. 87 p, 25 fig, 1 plate, 13 tab, 33 ref.

Descriptors: *Erosion control, Sediment control, Land management, Precipitation intensity, Runoff, Sedimentation, Evaporation, New Mexico.
Identifiers: *Cornfield Wash Basin, *Land treatment.

To reduce and control erosion, keep sediment at its source, and rehabilitate damaged land, a 10-yr program was initiated in the Cornfield Wash basin. Data acquired indicate that precipitation averaged 6.07 in. for the warm season, and that from 1951 to 1955 much of the precipitation came in short torrential downpours. The total composite inflow to the 19 reservoirs in this basin was 5,720 acre-ft, and the original total storage capacity of the 19 reservoirs was reduced from 845 to 455 acre-ft as a result of the impoundment of 390 acre-ft of sediment. Reservoir backwater accounted for an additional 20 acre-ft of sediment. By inducing sediment accretion upstream, the reservoirs are effective; also, they impede abrupt headcuts downstream as long as the spillage is slight and the spillway stays intact. These reservoirs also effectively reduce flood peaks. (Llaveria-USGS)
W69-03747

PROCEEDINGS: INTERNATIONAL SYMPOSIUM ON FOREST HYDROLOGY.
National Science Foundation, Washington, D. C.
For primary bibliographic entry see Field 02A.
For abstract, see .
W69-03806

PROJECTS TO PREVENT SHORE EROSION.

NY Unconsol Laws secs 1531, 1532, 1534, 1535, 1536, 1537, 1538, 1539 (McKinney Supp Dec 1968), 5 p; NY Unconsol Laws sec 1533 (McKinney 1966) 2 p.

Descriptors: *New York, *Shore protection, *Beach erosion, *Erosion control, Legislation, Cities, Shores, Projects, Administrative agencies, Check structures, Damages, Embankments, Taxes, Federal project policy, Ownership of beds, Construction costs, Cost allocation, Bulkheads, Maintenance, Maintenance costs.

The commissioner of conservation is authorized to construct bulkheads, groins, jetties, fills and other works upon non-privately owned land in order to arrest erosion and protect against storms. The construction cost includes the cost of preparing plans, specification and engineering services. The municipalities affected shall reimburse the state for fifty percent of the construction costs. Upon completion the municipalities affected shall have ownership of the improvements and shall bear the

enance expense. The state is not liable for any ges resulting from such improvements. The may make grants to municipalities of sub- d lands to carry out the purpose of this act. rovisions of this act shall not apply to projects taken by the federal government. The act es for acceptance of federal funds for pro- uthorized by the state but limits the states bution to the amount appropriated for the t. One million dollars is appropriated to pay tes share. (Childs-Fla)
04183

WATER QUALITY ANAGEMENT AND ROTECTION

Identification F Pollutants

RED AERIAL SURVEYS IN ENVIRON- AL ENGINEERING,

rce Inst. of Tech., Wright-Patterson AFB, nd Oklahoma State Univ., Stillwater. School Engineering.
mary bibliographic entry see Field 07B.
tract, see .
3744

RMINATION OF STRONTIUM-90 IN R,

ical Survey, Washington, D. C.
hnson, and K. W. Edwards.
urv Water-Supply Pap 1696-E, 1967. 10 p, 2 f.

ptors: *Radiochemical analysis, *Analytical ques, Strontium radioisotopes, Water quali- er chemistry, Fallout, Pollutants, Water pol- ources.
ers: *Strontium-90 analysis.

hod is described for the determination of um-90 in waters free of strontium-89, or for ination of gross radiostrontium activity as um-90. The method is suitable for use on water samples and other aqueous systems in ence of high concentrations of organic sub- which form stable complexes with stronti- e minimum detection limit at the 95% con- level is 0.55 picocuries/l for the recom- d 500-ml sample. (Knapp-USGS)
3749

CHROMATOGRAPHIC ANALYSIS OF PON IN WATER,

tural Research Service, Denver, Colo.; and of Reclamation, Denver, Colo.
rank, and R. J. Demint.
n Sci Technol, Vol 3, No 1, pp 68-71, Jan p, 4 fig, 1 tab, 4 ref.

ptors: *Chemical analysis, *Chromatog- Water analysis, *Gas chromatography, ation techniques, Solvents, Analytical ues, Solvent extractions, *Dalapon, Herbi- Pesticides, Chlorinated hydrocarbon pesti- Pesticide residues, Ethers.

methods for analyzing 2,2- opropionic acid (dalapon) residues have ported. These methods require a great deal and lack the sensitivity required for most -day residue analysis. An efficient and sensi- ocedure for extraction and analysis of in water is described. Acidified and NaCl- ed samples containing dalapon are extracted ethyl ether. After partitioning the extract bicarbonate and back to ether, dalapon is ed to its methyl ester. Electron-capture gas tography is used for the analysis. Recove- dalapon from water averaged 96%; the m level of detection was 0.1 ng. This rapid, reliable, and highly sensitive method was developed for analyzing dalapon in water, but should be adaptable for analyzing dalapon in soils and water. (USBR)
W69-03755

RADIOACTIVE WASTE DILUTION IN THE CLINCH RIVER, EASTERN TENNESSEE,

Geological Survey, Washington, D. C.
P. H. Carrigan, Jr.
Geol Surv Prof Pap 433-G, pp G1-G9, 1968. 9 p, 10 fig, 15 ref.

Descriptors: *Path of pollutants, *Radioactive wastes, *Waste dilution, *Tennessee River, Tennessee, Turbulence, Reservoirs.
Identifiers: Clinch River (Tenn), Oak Ridge National Laboratory, Tennessee Valley Authority.

A convenient, direct measure of simple volumetric dilution of low-level radioactive liquid wastes released from the Oak Ridge National Laboratory by waters of the Clinch River has been defined. This measure of dilution is called the dilution factor. The dilution factor is the ratio of flow in the Clinch River to flow of the radioactive liquid waste stream (Whiteoak Creek) for concurrent periods of time. Dilution characteristics of the Clinch River and Whiteoak Creek have been described by means of several types of statistical analyses: central tendencies, extremes, cumulative frequency distribution, seasonal trends, and magnitude-duration-frequency curves of minimum dilution factors. In order to apply results of these statistical analyses, complete and steady mixing of the waters of the Clinch River and Whiteoak Creek must be assumed. Exploratory diffusion tests indicate that complete mixing in the cross section has occurred within a reasonable distance downstream from the mouth of Whiteoak Creek. Flows in the Clinch River in the vicinity of Whiteoak Creek have been affected considerably by releases from Norris Lake for peak-demand hydroelectric power. Other exploratory tests indicate that the effects of the variation in flow of the Clinch River were almost completely evened out through processes of turbulent diffusion. (USGS)
W69-03956

5B. Sources of Pollution

CONTAMINANTS IN GROUNDWATERS NEAR WASTE STABILIZATION PONDS,

Cincinnati Univ., Ohio. Dept. of Civil Engineering.
H. C. Preul.
J Water Pollut Contr Federation, Vol 40, No 4, pp 659-669, Apr 1968. 11 p, 5 fig, 2 tab, 13 ref.

Descriptors: *Groundwater, *Path of pollutants, Alkylbenzene sulfonates, Ammonia, Phosphates, Nitrification, Soils, Minnesota, Stabilization, Biodegradation.
Identifiers: *Groundwater contamination, Stabilization ponds.

Field observations were made over a 3-yr period on nutrient concentrations found in groundwaters near 10 waste stabilization lagoons in Minnesota which treat domestic wastewater from small municipalities. Subsurface soils were sandy or silty, and the ponds had high percolation rates. The nitrogen in pond percolation waters was mainly in the form of ammonia; nitrification did not appear to occur significantly. Ammonia nitrogen concentrations were largely depleted within about 200 ft (60 m) of a pond, with the decrease apparently due to adsorption. Phosphates were not found in significant concentrations in the groundwaters; they are adsorbed by soils over a wide pH range. Alkyl benzene sulfonate was found in the range of 0.5 mg/l as far as 200 ft (60 m) from a pond, which may be true of other organics resistent to biodegradation.
W69-03718

STATISTICAL APPROACH TO ESTUARINE BEHAVIOR,

Federal Water Pollution Control Administration, Washington, D. C.; and Kansas City, Mo.
T. A. Wastler, and Carl M. Walter.
ASCE Proc, J Sanit Eng Div, Vol 94, No SA6, Pap 6311, pp 1175-1194, Dec 1968. 20 p, 5 fig, 7 tab, 6 ref, append.

Descriptors: *Estuaries, *Density stratification, *South Carolina, *Statistical methods, *Time series analysis, Estimating, Salinity, Stratification, Water pollution, Path of pollutants.
Identifiers: *Charleston Harbor (SC), Spectral analysis.

Data analysis techniques used in a study of Charleston Harbor, South Carolina, show how spectral analysis can be used to characterize hydraulic interactions within the estuary. The technique was used to establish the water quality and hydraulic patterns existing during the field study period and to predict future water quality and hydraulic structure under conditions of greatly reduced river inflow. Methods of calculating cross-spectra and associated statistics are presented, and the use of these techniques in carrying out the data analysis is shown. Results of the study show that very strong vertical stratification exists at high river discharges, and that the stratification breaks up as river discharge decreases. (Knapp-USGS)
W69-03732

IDENTIFICATION OF PETROLEUM IN ESTUARINE WATERS,

California State Dept. of Public Health, Berkeley.
Claude Z. Maehler, and Arnold E. Greenberg.
ASCE Proc, J Sanit Eng Div, Vol 94, No SA5, Pap 6172, pp 969-978, Oct 1968. 10 p, 8 fig, 8 ref.

Descriptors: *Pollutant identification, *Water pollution, *Estuaries, *Oil, *Analytical techniques, Water pollution sources, Pollutants, Chromatography, Sampling, Gas chromatography, Spectrophotometry.
Identifiers: Infrared spectrophotometry.

The increased concern about spills of petroleum products in the estuarine environment has brought about increased demands for analytical methods equal to the task of identifying pollutants and their possible sources. A number of qualitative comparative procedures have been described which permit the clear recognition of petroleum products in water. These procedures are capable of demonstrating characteristics of petroleum materials peculiar to individual lots but analysis should generally include several of the techniques. They are therefore useful in comparing oil spills with reference samples. A simple sequential scheme is presented which includes gas chromatographic analysis of vapor space gas and solvent extraction followed by infrared spectrophotometric and paper chromatographic examinations.
W69-03738

AMMONIA NITROGEN LOSSES FROM STREAMS,

San Diego State Coll., Calif. Dept. of Civil Engineering.
Frank E. Stratton.
ASCE Proc, J Sanit Eng Div, Vol 94, No SA6, Pap 6282, pp 1085-1092, Dec 1968. 8 p, 2 fig, 4 tab, 7 ref. Grant NSF-GK-1623.

Descriptors: *Nitrogen cycle, *Aeration, *Streams, *Turbulent flow, Sanitary engineering, Water quality, Temperature, Reduction (Chemical), Photosynthesis, Vegetation effects, Waste water disposal.
Identifiers: *Ammonia nitrogen losses, *Stream turbulence.

Results of studies of gaseous ammonia nitrogen losses caused by stream turbulence are presented and the potential significance of such losses in reducing fertilization of downstream receiving

waters is given. In describing the experimental procedure a graphic plot is shown of measured ammonia concentration versus time; tables show the rate constants for ammonia nitrogen loss, comparison of temperature effects of rate constants, pH effects on rate constant, and flow times and distances needed to effect 50% reduction in ammonia nitrogen concentration at various temperature and pH values. Since algae can raise the pH of streamwaters during active photosynthesis periods, small shallow streams with vegetal growths can loose large quantities of ammonia nitrogen to the atmosphere. (Lang-USGS)
W69-03745

OIL FACTORIES IN RARITAN AND SANDY HOOK BAYS.

N J Stat Ann secs 23: 9-108 to 23: 9-112 (1940).

Descriptors: *Legislation, *New Jersey, *oil industry, *Industrial plants, Fish, Bays, State jurisdiction, Boats, Oil wastes, Legal aspects, Fishing, Flow control, Water pollution, Water pollution sources.
Identifiers: *Raritan bay, *Sandy Hook Bay, Debris, Penalties.

These sections deal with oil factories in Raritan and Sandy Hook Bays. Section 108 states that no person shall, for the purpose of pressing or obtaining oil from fish in these waters or any of the tributaries thereof: (a) Erect a floating factory, or (b) place on board a vessel with intent to use machinery for such purpose. Section 109 forbids the flow into these waters of any soap, pumice, debris, residuum or refuse matter arising from the pressing or manufacturing of oil from fish. Section 110 provides that a vessel or floating erection of any kind found on these waters carrying machinery and materials for manufacturing oil from fish will be forfeited to the state. Section 111 makes violation of these provisions a misdemeanor and punishable by fine of $200, or imprisonment at hard labor not exceeding one year, or both. Section 112 allows the informer to receive one-half of any fine and forfeiture recovered; the other one-half being paid to the state treasure. (Heckerling-Fla)
W69-03848

CORRUPTING WATERS FORBIDDEN.

Me Rev Stat Ann tit 38, sec 571 (1965).

Descriptors: *Legislation, *Maine, *Water pollution, *Contamination (Water), Toxins, Nuisance (Water law), Wells, Springs, Lakes, Ponds, Public health, Rivers, Reservoirs, Water supply, Ice, Legal aspects, Pollutants.
Identifiers: Poisoning, Penalties (Criminal).

This section provides that whoever knowingly and willfully poisons, defiles, or in any way corrupts the waters of any well, spring, brook, lake, pond, river, or reservoir used for domestic purposes by man or beast; or whoever knowingly corrupts the sources of any public water supply, or the tributaries of said sources of supply, in such manner as to affect the purity of the water so supplied; or whoever knowingly defiles such water in any manner, whether the same be frozen or not, or puts the carcass of any dead animal or other offensive material in said waters or upon the ice thereof, shall be punished by a fine of not more than $5000 or by imprisonment for any term of years. (Heckerling-Fla)
W69-03863

BLOOD V CITY OF NEW YORK (ACTION TO RECOVER DAMAGES FROM TURBIDITY ALLEGEDLY CAUSED BY DAM).

237 F 2d 855-856 (2d Cir 1956).

Descriptors: *New York, *Turbidity, *Dam construction, *Downstream, Impaired water quality, Judicial decisions, Dams, Damages, Mud, Legal aspects, Physical properties, Opacity, Suspension, Rivers, Delaware River, Riparian rights.

Plaintiff owned resort properties on the Delaware River, downstream from the confluence of the Delaware and Neversink Rivers, and about forty-five miles below the dam constructed by defendant. Plaintiff brought suit to recover damages on the ground that the dam caused river water, as it passed by the resort, to be turbid and muddy. Plaintiff alleged the dam violated his rights as a property owner and interfered with his business. Plaintiff conceded that the defendant had a right to build the dam. The lower court gave judgment to defendant, primarily due to the insufficiency of evidence introduced by plaintiff. The appellate court affirmed, ruling that the trial judge's decision was not clearly erroneous. (Wheeler-Fla)
W69-03909

HOWARD V ATLANTIC COAST LINE RR (ACTION FOR DROWNING IN ABANDONED WELL).
231 F 2d 592-595 (5th Cir 1956).

Descriptors: *Florida, *Bodies of water, *Drowning, *Shallow wells, Risks, Judicial decisions, Wells, Legal aspects, Swimming, Safety, Railroads, Water sources, Water wells.
Identifiers: Abandoned wells, Negligence, Attractive nuisance.

Defendant railroad company had dug a well to furnish water for steam locomotives. The well, located on posted railroad property, was twenty feet by twenty feet, and had been abandoned. Railroad employees placed boards over the well to prevent it from being used. However, children removed the boards and began to use the well as a swimming hole. Efforts by the railroad to replace the boards and order the children off the property failed. A few days prior to when the well was to be filled, a young boy slipped into the well and drowned. The boy's mother brought action for the death of her son. The trial judge entered a judgment for defendant notwithstanding a jury verdict for plaintiff. The appellate court affirmed, ruling that the owner of an artificial body of water is not guilty of actionable negligence for drownings therein unless it is so constructed as to constitute a trap or unless there is some unusual element of danger lurking about it not existent in ponds generally. The court held that the steep sides of the well did not constitute sufficient hidden danger, and that the facts did not warrant a finding of an attractive nuisance. (Wheeler-Fla)
W69-03924

WATER POLLUTION IN THE GREAT LAKES BASIN,
Federal Water Pollution Control Administration, Great Lakes Region, Chicago, Ill.
H. W. Poston.
Limnos, Vol 1, No 1, pp 6-11, Spring 1968. 6 p, 6 photo.

Descriptors: *Great Lakes, *Water pollution, *Water pollution control, Water pollution effects, Eutrophication, Fishkill, Algae, Oxygen sag, Water quality, Chlorides, Phosphorus, Sulfates, Hardness (Water).
Identifiers: Great Lakes basin, Bacterial pollution.

The causes of water pollution of the Great Lakes basin, presently available remedies, and recommendations for action in pollution control are discussed. The Lakes, particularly Lake Erie, are becoming eutrophic because of waste discharges. Tertiary treatment with phosphorus removal will alleviate the problem and also reduce biochemical oxygen demand. Chlorides, sulfates, and hardness are increasing. Bacterial pollution is a serious problem in tributaries, and in local zones in the Great Lakes near population centers where recreational demand is also highest. Elimination of combined sewers as well as better sewage treatment will help. Chemical contamination caused by industrial waste disposal is widespread. Oxygen levels are s in streams, small lakes, and the central basin Lake Erie. An unusual form of pollution is over-population of alewives in Lake Michig Periodic fishkills litter the shore. One of the m difficulties in solving Great Lakes problem diversity and need for coordination of governm agencies in the basin. Creation of the water qua standards and the Great Lakes Basin Commis should help. (Knapp-USGS)
W69-03948

PESTICIDE OCCURRENCE, CONCENT TION, AND DEGRADATION IN FREE WAT SYSTEMS,
Massachusetts Univ., Amherst.
C. W. Miller, H. B. Gunner, and B. M. Zuckerm
Water Resources Res Center Proj Completion R Dec 1968. 14 p. 14-01-0001-1389, OWRR Pro A-019C-MASS Originally A-010-MASS.

Descriptors: *Pesticide residues, *Plants, *S *Water, *Biodegradation, Pesticide kinetics, sorption, Distribution patterns, Leaching, Pesti toxicity.
Identifiers: Pesticide degradation.

Parathion was detected in young bean leaflets following its application to soil. Uptake contin for 24 hr following soil application, but slowed siderably after the first 6 hr. Most if not all parathion molecule remained intact within plant after 22 hr. Younger leaflets accumul higher concentrations than older leaflets. parathion was detected in root exudates 24 hr a foliar application. Sucking insects did not die a being exposed to leaves 24 hr after soil applicat Water samples were taken from a stream run through a cranberry bog treated by helicopter parathion at a rate of 1 lb/acre. Samples taken f the surface and from 15 inches below the sur were taken at 2-hr intervals for 24 hr, 900 downstream. In surface water, parathion was tected in large quantities after 2 hr (0.124 pp and decreased sharply after 6 hr (0.42 p Residues 15 in. below the surface varied from ppb immediately after application to 0.5 ppb 1 after application. Samples of impounded w taken 1 in. below the surface contained 214 pp parathion. After 4 hr the detectable amount parathion decreased to 5.03 ppb and the paratl content remained fairly constant for another 14 hr. (Knapp-USGS)
W69-03962

PROCEEDINGS BEFORE THE COMM SIONER (LEGAL ACTION AGAINST SOUR OF POLLUTION).

N Y Pub Health Law sec 1242 (McKinney S 1968).

Descriptors: *New York, *Water pollu sources, *Sewage disposal, *Bodies of w Water pollution control, Industrial wastes, Sew Legal aspects, Legislation, Administrative a cies, Regulation, Sewage, Public health, Water Water pollution, Disposal, Effluents, Sewage fluents, Investigation.

The Commissioner shall investigate any allege of pollution of any waters of the State. If the C missioner discovers wastes being discharged the waters of the state, or into sewers which mately empty into the waters of the state, he notify the persons responsible for the discharg answer charges against them at a hearing; w hearing shall be held at least twenty days after notice is served. The accused shall file an answ the charges with the Commissioner along wi statement of any measures being taken to pre the discharge of pollutants into the waters of state. The burden of proof with respect to v tions is on the Commissioner. After the hearing Commissioner shall enter a final order and shal vise the accused of the substance of such o There is an emergency provision whereby the C

missioner, if he deems such discharge of sewage dangerous to the health of the people, may inform the person responsible that he must discontinue such discharge immediately. (Sisserson-Fla)
W69-03989

VIOLATION; INJUNCTION AND ABATEMENT (WATER POLLUTION SOURCES).
N Y Pub Health Law sec 1102 (McKinney 1954).

Descriptors: *New York, *Water pollution, *Potable water, Legislation, Administrative agencies, Administrative regulation, Cities, Water supply, Legal aspects, Regulation, Inspection.
Identifiers: Board of health.

When an inspection discloses a temporary or permanent source or act of contamination, notice of such violation of regulations shall be served on the person responsible. If there is not compliance, an examination shall be held. If it is found that a violation has in fact occurred, the board of health is to enforce compliance. The commissioner of water supply, gas and electricity of New York or the board of water supply may summarily enforce compliance with the regulations and may summarily abate or remove the cause of the violation. The City of New York is entitled to maintain an action for the recovery of the penalties incurred by such violation and for an injunction restraining the person from violating the regulation. This section is annotated. (Childs-Fla)
W69-03991

AN ACT TO REPEAL SECTIONS 204.030, 204.100, AND 204.170, RSMo 1959, RELATING TO WATER POLLUTION AND TO ENACT IN LIEU THEREOF FOUR NEW SECTIONS, RELATING TO THE SAME SUBJECT, WITH PENALTY PROVISIONS.

Mo Laws H 319 (Aug 7, 1967).

Descriptors: *Missouri, Legislation, Permits, Pollution abatement, *Water pollution control, Water pollution sources, Industrial wastes, Organic wastes, Sewage, Abatement, Regulation, Damages, *Costs, Discharge, Disposal, *Water pollution.
Identifiers: Injunction.

It is unlawful for any person to cause pollution as defined in Mo Rev Stat sec 204.010 (1959), and it is declared that such pollution constitutes a public nuisance that may be forcibly abated by the county at the property owner's expenxe. It is unlawful to construct or modify a disposal system for industrial or sewage wastes without first securing a permit from the county board. The board can require the submission of plans, specifications and other information to aid it in deciding whether a permit will be issued. It shall be the board's function to determine whether the discharge will cause pollution contrary to the public interest. The board may investigate any apparent violation and may, after public hearing, revoke or modify the permit of anyone found to be violating its orders. The board must furnish the permit holder thirty days notice of its intent to revoke or modify said permit. County prosecuting attorney may apply to any court of competent jurisdiction for an injunction to restrain violation of this law. Any person violating this law may be fined not less than $25 nor more than $500.00 and/or be imprisoned for no more than 90 days. Each day on which a violation occurs shall constitute a separate offense. In addition to the above penalties, the state or its subdivisions has a cause of action in tort for actual damages against any person violating this section. Mo Rev Stat secs 204.030, 204.100, and 204.170 (1959) are repealed by the addition of this legislation. (Blunt-Fla)
W69-04007

DEVELOPMENT AND APPLICATION OF A RATIONAL WATER QUALITY PLANNING MODEL,
Clemson Univ., S. C.
Benjamin C. Dysart, III, and William W. Hines.
Water Resources Center, Georgia Institute of Technology, WRC-0668, January 1969. 195 p, 46 fig, 11 tab, 48 ref, 2 append. OWRR Project A-012-Ga.

Descriptors: *Water quality control, Dissolved oxygen, Water temperature, Georgia, Systems analysis, *Mathematical models, *Simulation-analysis, Reaeration, Waste assimilative capacity, Biochemical oxygen demand, Streamflow, Waste treatment, *Organic wastes, *Thermal wastes, Water quality standards, Decision making, Methodology.
Identifiers: Chattahoochee River, Atlanta (Georgia).

Methodology for water quality planning and management which considers interacting wastes in a stream has been developed and demonstrated. The methodology demonstrates a procedure for minimizing the total abatement cost for thermal and organic wastes in a river basin while satisfying multiple stream standards. The pollutants used in the studies were heat and BOD. A generalized stream was modeled as an N-stage serial system, with principal waste outfalls, major tributaries, changes in standards, etc., constituting stage boundaries. Initial-value, two-dimensional dynamic programming was used to optimize the system and determine the minimum-cost abatement policy which allowed specific standards to be attained. The Chattahoochee River basin was used to illustrate the methodology. The river was modeled as a four-stage serial system. Optimal policies as to abatement of thermal and organic wastes were determined for a wide range of (a) streamflow, (b) deoxygenation coefficient, (c) reaeration coefficient, and water quality standards (DO, maximum temperature, and allowable temperature rise). Although limited by the quality and consistency of input data, the methodology developed would provide considerable aid to persons and agencies in planning and management of water quality.
W69-04017

NITRATE AND OTHER WATER POLLUTANTS UNDER FIELDS AND FEEDLOTS,
Agricultural Research Service, Fort Collins, Colo. Soil and Water Conservation Research Div.
B. A. Stewart, F. G. Viets, Jr., G. L. Hutchinson, and W. D. Kemper.
Environ Sci Technol, Vol 1, No 9, pp 736-739, Sept 1967. 2 fig, 1 tab, 1 ref.

Descriptors: *Nitrate, *Pollutants, *Agricultural watersheds, Nitrogen compounds, Feedlots, Groundwaters, Water pollution, Eutrophication.

The effect of agriculture on nitrate pollution of groundwater was investigated in the South Platte Valley of Colorado. Nitrate-nitrogen was determined in core profiles of land under various kinds of use. Nitrate was highest under feedlots; however, indications are that irrigated lands are contributing more total nitrate to the groundwater (the ratio of irrigated land to that in feedlots for the study area was approximately 200:1). Average nitrate-nitrogen levels ranged from 70 kg/ha under alfalfa to 1282 kg/ha under feedlots. Groundwater samples often contained high concentrations of nitrate, and those obtained beneath feedlots contained nitrite-nitrogen and organic carbon. Because feedlots are usually located near homesteads, further concern about the effect of feedlots on underground water supplies arises. (Konrad-Wis)
W69-04024

WATER QUALITY MANAGEMENT IN THE DELAWARE RIVER BASIN (FEDERAL AND INTERSTATE COMPACT TO SOLVE POLLUTION PROBLEMS),
Delaware River Basin Commission, Trenton, N. J.
For primary bibliographic entry see Field 05G.
For abstract, see .
W69-04039

POLLUTION.
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-04050

DEVELOPMENT OF OPTIMIZATION - SYSTEMS ANALYSIS TECHNIQUES FOR TEXAS WATER RESOURCES,
Texas A and M Univ., College Station. Water Resources Inst.
Roy W. Hann, Jr.
Technical Report No 17, Feb 1969. 57 p. OWRR Project A-004-Tex.

Descriptors: *Water quality, *Estuaries, Simulation, *Optimization, Reservoir management, Economic analysis.

Several analytical models which were obtained and modified for use in evaluating water resource problems are described. A method for evaluating the optimum blend of water from two or more reservoirs to meet several concurrent quality criteria is presented. The special importance of estuarine analysis methods relating to water quality is outlined and two models are presented one for a steady state dispersion of wastes in partially mixed estuaries and the other an optimization scheme using linear systems analysis to determine the optimum waste loads into an estuarine system under a variety of constraints. Interbasin transfer of water is examined and one plan evaluated to demonstrate the use of analytical models for streamflow evaluation, field determination and reservoir simulation. The use of a Leontif input-output model to predict economic growth as a function of resource use is developed and an example presented using the area affected by the Blackburn Crossing Reservoir in East Central Texas.
W69-04133

INFLUENCE OF FATTY ALCOHOLS AND ACIDS ON THE CLARITY AND BIOTA OF IMPOUNDED RESERVOIRS,
Texas A and M Univ., College Station. Water Resources Inst.
William B. Davis, and Tom D. Reynolds.
Technical Report No. 18, Feb 1969. 76 p, 9 tab, 33 fig. OWRR Project A-003-Tex.

Descriptors: Evaporation control, Monolayer films, *Oxygen diffusion, *Ecology, Oxygen deficiency, *Hexadecanol, *Octadecanol.

This project presents results on a laboratory and field investigation of some of the biological and physical effects as a result of the use of a 1:1 mixture of hexadecanol and octadecanol. Laboratory investigations were concerned with changes in pH, hardness, alkalinity, turbidity, surface clarity, oxygen diffusion, diurnal oxygen, chlorophyll, bacterial counts, some unicellular algae, some filamentous algae, waterweeds (Anacharis) and fish (Gambusia affins and Fundalus notatus).LD AND LABORATORY INVESTIGATIONS WERE ALSO CONCERNED WITH THE DERIVATION AND EXPERIMENTAL VALIDATION OF AN EXPRESSION TO GIVE THE DISSOLVED OXYGEN CONCENTRATION DURING THE CRITICAL NIGHT PERIOD FOR A SMALL LAKE OR POND TREATED WITH A +:1 mixture of hexadecanol and octadecanol.
W69-04134

UNLAWFUL DISPOSAL OR TAKING OF BALLAST.
Me Rev Stat Ann tit 38, sec 124 (1965).

Descriptors: *Legislation, *Maine, *Boats, Admiralty, Flotsam, Jettsam, Water pollution, Highway beautification, Community development, Harbors, Islands, Beaches, Legal aspects.
Identifiers: *Ballast, Penalties (Criminal).

This section provides that no master of any vessel shall throw overboard ballast in any road, port or harbor, under penalty of $60, and no person shall take any stone or other ballast from any island, beach or other land, without consent of the owner, under a penalty of not more than $7 for each of-

fense, to be recovered in a civil action by any prosector, 1/2 for himself and 1/2 for the town where the offense is committed. (Heckerling-Fla)
W69-04158

LITTERING AND DUMPING.

Me Rev Stat Ann tit 17, sec 2251 (Supp 1968-69).

Descriptors: *Maine, *Garbage dumps, *Waste disposal, *Domestic wastes, Legislation, Garbage, Recreation facilities, Recreation wastes, Public lands, Parks, Refuse, Tidalwaters, Inland waters, Navigable waters, Non-navigable waters, Legal aspects.
Identifiers: Debris.

This statute prohibits throwing or depositing any garbage or other refuse upon public areas, both land and water. All garbage should be placed in the proper containers. If the throwing or depositing is done from a motor vehicle, such fact shall constitute prima facie evidence that such was done by the driver. (Stewart-Fla)
W69-04162

WARREN PETROLEUM CORP V LEE (ACTION TO RECOVER DAMAGES FOR POLLUTION OF CREEK).

234 F 2d 207-211 (5th Cir 1956).

Descriptors: *Mississippi, *Saline water intrusion, *Water pollution effects, *Oil industry, Riparian rights, Saline water, Water storage, Fish toxins, Downstream brine disposal, Fishkill, Path of pollutants, Pollutants, Salinity, Water pollution, Lethal limit, Salt tolerance, Seepage, Wells, Judicial decisions, Damages.

Defendant petroleum company purchased land, upstream from plaintiff's land, for underground storage of liquified gas. The operation consisted of drilling wells into an underlying salt dome, pumping water in to create cavities, and removing the water. The water, which had a high salt concentration, was then stored in earthen pits. The controversy arose when some of the stored water began to seep into the creek that led through plaintiff's pasture land. Livestock, which drank from the creek, became ill. Some died and plaintiff sustained additional damages in selling sick cattle at a loss. Dead fish and breeding salt marsh mosquitoes caused further annoyance. Plaintiff brought suit to recover damages as a result of the salt pollution allegedly caused by defendant's operations. The jury returned a verdict for the plaintiff and awarded monetary damages. The appellate court affirmed, holding that evidence was sufficient for the jury to find that the salt poisoning was a probable cause of the disorder which affected plaintiff's stock, and that defendant's operations were the probable source of the salt. (Wheeler-Fla)
W69-04170

CHAPMAN V BEAVER DAM COAL CO (DRAINAGE OF MINE WATER).
327 S W 2d 397-400 (Ct App Ky 1959).

Descriptors: *Kentucky, *Acid mine water, *Strip mines, *Judicial decisions, Mining, Coal mines, Mine drainage, Mine acids, Mine water, Coal mine wastes, Legal aspects, Water pollution sources, Acidic soils, Acid streams, Streams, Farms, Damages, Discharges (Water).
Identifiers: Injunctions

Plaintiff, a farmer, brought an action for damages and, in the alternative, for a permanent injunction against defendant coal companies. Defendants owned and worked land adjacent to plaintiff's farmland. Defendants were engaged in strip mining, and discharges from this mining operation flowed into a creek which ran through plaintiff's land. Plaintiff claimed damage to his farm and sought a permanent injunction prohibiting the discharge of mining wastes. The trial court dismissed the complaint, and the court of appeals affirmed, holding that no present damage had been shown and that the court could not grant an injunction based on fear of some possible damage in the indefinite future. (Sisserson-Fla)
W69-04173

BUSBY V INTERNATIONAL PAPER COMPANY (ACTION FOR DAMAGES AND INJUNCTION DUE TO STREAM POLLUTION).

95 F Supp 596-598 (W D La 1951).

Descriptors: *Louisiana, *Judicial decisions, *Water pollution, *Pulp wastes, *Riparian rights, Waste water (Pollution), Effluents, Water law, Mills, Industrial plants, Industrial wastes, Water pollution control, Water pollution sources, Pollutants, Pollution abatement, Damages, Downstream, Streams.
Identifiers: Injunction.

Defendant paper mill's discharge of effluent into a stream deprived plaintiff lower riparian owner of the ability to cultivate a small portion of land. Plaintiff sued for damages, and in the alternative, for an injunction against further pollution. The trial court allowed judgment for damages and reserved decision on the application of injunction as a question in equity. Defendant appealed. The appellate court denied the injunction, ruling that defendant was granted an adequate remedy at law. The court stated that the mill was a substantial asset to the community, and that the balancing of benefits and conveniences would induce court of equity to deny harsh remedy of injunction. Mention was made that plaintiff restricted its discharge to the seasons when crops had been substantially gathered, the stream full, and fishing, for practical purposes, had ended. (Wheeler-Fla)
W69-04174

CITY OF OXFORD V SPEARS (CITY'S LIABILITY FOR DUMPING SEWAGE INTO STREAM WHICH PASSES THROUGH PRIVATE PROPERTY).

87 So 2d 914-917 (Miss 1956).

Descriptors: *Mississippi, *Water pollution, *Damages, Judicial decisions, Water pollution sources, Wastes, Mortality, Pollution abatement, Riparian rights, Municipal wastes, Cities, Reasonable use.

Plaintiff landowner sued defendant city for damages to his land and loss of profits in his cattle business due to the city's dumping of raw sewage into a watercourse running through his land. This court affirmed the trial court's decisions to the city's liability for maintaining the nuisance but reversed it on the issue of damages. If maintenance of a nuisance renders land permanently unusable one is entitled to an amount equal to the market value of the land destroyed, measured by its value in the undamaged condition and fixed by the use to which the land was put. If land is temporarily damaged the measure of damages is the diminution in rental or usable value of the land. If the nuisance is abatable the amount of damages is limited to the loss of rental value over the period in which the nuisance is maintained plus any provable special or incidental damages, such as annoyance, discomfort, inconvenience and sickness. Where the evidence showed only a possibility that two cows died as a result of the contamination, the plaintiff was not entitled to recover any damages relating thereto. (Blunt-Fla)
W69-04177

5C. Effects of Pollution

THE EFFECT OF INDUCED TURBULENCE O THE GROWTH OF ALGAE,
Georgia Inst of Tech. Atlanta School of En gineering and Georgia Inst. of Tech., Atlant Water Resources Center
Lawrence W. Olinger.
Georgia Inst Tech, WRC Rep 0468, Dec 1968. 8 p, 20 fig, 2 tab, 47 ref, 4 append. 5T1-WP-62-0 and 04, FWPCA.

Descriptors: *Algae, *Photosynthesis, *Growt rates, *Turbulence, Chlorrela, Scenedesmu Kinetics, Ecosystems
Identifiers: Algal growth kinetics, Monod growt equation, Incident light utilization

A laboratory study was made of the relationshi between turbulence and utilization of incident ligh by algal cultures. It was found that the maximu growth rate constant of the Monod growth equa tion increased with increasing turbulence and tha the rate at which constant growth occurred was function of turbulence. With constant illuminatio of 600 ft - candles and variable turbulence, th growth rate constant varied from 1.65 to 8.5. (K napp-USGS)
W69-03730

MICROBIOLOGY OF OCEANS AND ESTUA RIES,
Miami Univ., Fla. Inst. of Marine Science.
For primary bibliographic entry see Field 02L.
For abstract, see .
W69-03752

FISH HATCHERIES: POLLUTION OF WATER USED BY FISH HATCHERIES.

NJ Stat Ann sec 23:8-5 (1940).

Descriptors: *Legislation, *New Jersey, *Wate pollution effects, *Fishkill, Fish hatcheries, Wate pollution sources, Fish toxins, Sewage disposa Drainage practices, Water pollution control, Lega aspects.
Identifiers: *Poisonous substances.

This statute deals with the prohibition against pol luting any waters used by a state fish hatcher. I provides that no person shall put any poisonou substance in the water. Neither shall any poisonou substance be allowed to fend its way or run int such waters. In cases of pollution by substance known to be injurious to fish or fish food, it shal not be necessary to prove that the substances ac tually caused the death of any particular fish Violators of this section are subject to a $500 dolla fine. (Stewart-Fla)
W69-03843

WATER POLLUTION IN THE GREAT LAKES BASIN,
Federal Water Pollution Control Administration Great Lakes Region, Chicago, Ill.
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-03948

THE ECOLOGICAL ROLE OF PHOSPHORUS IN WATERS WITH SPECIAL REFERENCE TO MICROORGANISMS,
Dalhousie Univ., Halifax (Nova Scotia). Dept. o Biology.
John E. Phillips.
Principles and Applications in Aquatic Microbiolo gy, Proc Rudolfs Res Conf, Rutgers Univ, pp 61-81 1963. 11 fig, 14 ref, disc.

Descriptors: *Cycling nutrients, *Phosphorus *Microorganisms, Turnovers, Incubation, Lakes Sediments, Sediment-water interfaces, Plants Phosphorus compounds, Phosphorus radioisotopes.

mportance of microorganisms in exchange of phosphorus between water phase, sediments, higher plants and zooplankton is evaluated in terms of (turnover) time required for transfer of P-32 from one phase to another using glass-jar-simulated ake systems. On adding phosphate to water, the mmediate reaction is the transfer through the odies of unicellular suspended life forms. Turnover time for this may vary between 5 minutes and everal hours depending on factors such as temerature, light, cell density and availability of utrients. Next, within hours, slower incorporation f inorganic phosphate into organic forms occurs ithin microbial cells. This microbial component epresents a large phosphorus reserve in the water, resumably not available to other solid comonents until release and hydrolysis of the microbil cell phosphate occurs. Exchange with higher lants appears to involve only dissolved inorganic hosphate, turnover time being of the same order s organic exchange. Conversely, exchange with ooplankton, occurring primarily through feeding n microorganisms and excretion, has turnover me of 1-2 days. When bacteria are inactive, turover time for inorganic exchange with the sediient is 3 days for water, while the return to water is 5 days. (Harris-Wis)
V69-04023

HE SUCCESSION OF DIATOM ASSEMLAGES IN THE RECENT SEDIMENTS OF AKE WASHINGTON,
Vashington Univ., Seattle. Dept. of Zoology.
ohn G. Stockner, and Woodruff W. Benson.
imnol Oceanography, Vol 12, No 3, pp 513-532, ily 1967. 20 p, 8 fig, 6 tab, 44 ref.

escriptors: *Diatoms, *Eutrophication, *Sedients, Bioindicators, Data processing, Digital comuters, Oligotrophy, Organic matter, Phytoplankon, Sewage effluents, Washington, Water pollution effects, Water pollution sources, Sedimentaon rates, Nutrients, Plant pigments.
lentifiers: *Lake Washington (Wash), Samamish River (Wash), Mercer Island (Wash), edar River (Wash), Seattle, Centrales, Araidineae, Oscillatoria rubescens, Melosira italica, abellaria fenestrata, Asterionella formosa, agilaria crotonensis, Cyclotella, Shannon-Wiener formation function, Shannon function, Wilcox's rank comparison, RV Onar, Diversity, edundancy, Carotenoids, Chlorophyll degradaon products.

ecies composition of diatom remains in recent diment from Lake Washington is strikingly corre- ted with pattern of sewage enrichment over past years. In deeper sediment, deposited before cul- ral enrichment, relative composition of diatoms constant. Indices of diversity and redundancy, lculated by the authors, also reflect constancy d near steady-state conditions. Estimation of dimentation rates allowed derivation of an apoximate temporal sequence. Changes in proporns of many diatoms, considered as trophic incator species, correlated with historical changes discharge of sewage into lake. Statistical treatent revealed shifts in species ranking, including ange in dominance from Melosira italica to agilaria crotonensis at strata associated with setment of Seattle. Reversal of this relationship at ore superficial layers and its reestablishment near e mud-water interface correspond with diversion sewage from Lake Washington about 1930 and wage increases from 1941 to 1965. Authors inpret changes in species ranking, diversity, and dundancy in upper 30 cm of sediment as resulting m interaction between various species and gree of cultural enrichment. Ratio of Araidineae to Centrales (A/C) closely followed this ttern, and A/C seems to be much more reliable dicator of lake's trophic status than fluctuations individual indicator species.
69-04029

5D. Waste Treatment Processes

WASTEWATER REUSE,
New York State Dept. of Health, Albany. Environmental Health Services Research Unit.
D. B. Stevens.
J Water Pollut Contr Federation, Vol 40, No 4, pp 677-683, Apr 1968. 7 p, 2 fig, 1 tab, 15 ref.

Descriptors: *Water reuse, New York, Recharge, Injection wells, Artesian wells, Aquifers, Groundwater movement, Tertiary treatment.
Identifiers: Long Island (New York).

In the population-concentrated East, wastewater reuse is a necessity simply because there is no space where wastewater can be dumped without affecting water resources. New York State's program of groundwater recharge and tertiary treatment of wastewater for ground injection is a plan to utilize wastewater as a source of supplemental water supply. A background of the problem is discussed with a description of current operations and future plans. Highest-quality effluents with ultimate waste disposal are considered.
W69-03716

WATER REUSE IN MONTERREY, MEXICO,
Celulosa y Derivados S. A., Monterrey (Mexico). Copropiedad Grupo Quimico.
H. J. Gomez.
J Water Pollut Contr Federation, Vol 40, No 4, pp 540-545, Apr 1968. 6 p, 1 tab.

Descriptors: *Water reuse, Industries, Municipal water, Irrigation, Reclaimed water, Tertiary treatment, Sewage, Water sources, Water utilization.
Identifiers: *Mexico, Monterrey (Mexico).

Extensive reuse of treated domestic wastewater for industrial uses is practical in Monterrey, Mexico. The aridness of the region, an extended drought, industrial development, and the population explosion necessitated this practice as early as 1955. Some industries treat and reuse water independently; others use central treatment facilities through a cooperative association. The water is used for watering gardens, cleaning of buildings and equipment, fire protection, cooling, boiler feed, and various industrial processes, with treatment for each use suited to the quality demanded. About 60% of the wastewater from a city of 1,000,000 is reused.
W69-03717

WASTEWATER REUSE--HAS IT 'ARRIVED,'
Federal Water Pollution Control Administration, Washington, D. C.
D. G. Stephan, and L. W. Weinberger.
J Water Pollut Contr Federation, Vol 40, No 4, pp 529-539, Apr 1968. 11 p, 1 fig, 5 tab, 3 ref.

Descriptors: *Water reuse, Industries, Irrigation, Municipal water, Reclaimed water, Tertiary treatment, Water utilization.

Most of the U. S. population today uses raw water supplies containing water which has been used previously for industrial or municipal purposes, or both. Withdrawal is not consumption; water is only used, and it is reused over and over. Nondeliberate reuse has been going on throughout history. Deliberate reuse is a more recent concept. Wastewater renovation for reuse is technically feasible and costs are related to the degree of treatment required to meet a particular reuse purpose. Through federal grants research on renovation techniques is underway on several different processes in widely scattered U. S. locations. Data on current process development, nominal pollutant removals, reuse applications and costs, and federal research grants to date are given.
W69-03719

NEW APPROACHES TO WASTEWATER TREATMENT,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio. Cincinnati Water Research Lab.
R. L. Stenburg, J. J. Convery, and C. L. Swanson.
ASCE Proc, J Sanit Eng Div, Vol 94, No SA6, Pap 6296, pp 1121-1136, Dec 1968. 16 p, 9 fig, 5 tab, 10 ref.

Descriptors: *Waste water treatment, *Environmental sanitation, *Pilot plants, *Research facilities, *Research and development, Design data, Tertiary treatment, Biological treatment, Nutrients, Economic justification, Water reuse, Underground storage, Sanitary engineering.
Identifiers: *Advance treatment techniques, *Waste streams.

Several new wastewater treatment systems, mostly experimental or modified conventional processes are described. Aspects of research and development work on waste treatment technology by the Cincinnati Water Research Laboratory, FWPCA, are presented. Projects range from single-unit processes to complete treatment systems that use biological, chemical, and physical treatment techniques with flows ranging from 200 gpd to several million gpd on the various projects. Objectives include learning of methods for reducing water pollution of a given type or at a specific location such that water can be produced suitable for underground recharge to prevent salt water intrusion, or for reuse in industrial, agricultural, recreational or other applications. Typical treatment techniques are two-stage lime precipitation with lime recovery and reuse, granular activated carbon adsorption, and several biological and chemical methods for removing the algal nutrients, nitrogen and phosphorus. (Lang-USGS)
W69-03746

DEACTIVATION OF WASTE WATERS FROM RADIOCHEMICAL LABORATORIES AND ATOMIC REACTORS (RUSSIAN),
A. A. Khonikevich.
Moscow, USSR, Atomizdat, 1966. 232 p, 76 fig, 48 tab, 244 ref.

Descriptors: *Waste water treatment, *Radioactive waste disposal, *Water reuse, Water pollution control, Chemical degradation, Waste assimilative capacity, Ion exchange, Coagulation, Nuclear reactors.
Identifiers: *Radiochemical laboratories, Deactivation of wastes, USSR.

The principal methods of deactivation of waste waters from radiochemical plants and laboratories and nuclear reactors are outlined and described. Equipment and techniques necessary for waste water treatment and for water pollution control, including basic technological plant diagrams used in the Soviet Union, are described. Detailed data are given about treatment of weekly volumes of radioactive liquid wastes, including such technology as ionic exchange, coagulation and coprecipitation. The book contains chapters on radiochemical laboratories, liquid wastes of experimental atomic reactors, summary of the development of techniques for deactivation of waste waters, main technological plant designs for waste treatment, and group solutions of plant problems on deactivation of waste waters. (Gabriel-USGS)
W69-03964

CONTRACTS FOR PURIFICATION OF WATER AND SEWAGE - CONTRACTS FOR SEWERAGE DISPOSAL (RIGHT OF MUNICIPALITIES TO CONTRACT FOR EFFECT SEWERAGE).

N Y Gen Mun sec 120-120a (McKinney 1965).

Descriptors: *New York, *Legislation, *Sewage, *Contracts, Cities, Sewage disposal, Municipal wastes, Sewage districts, Sewerage, Water purification, Local governments, Legal aspects, Engineering.

Section 120 authorizes authorities of cities, towns and villages to enter into contracts with owners of any process or apparatus for the purification of water and sewerage and either contract for its use for a term of years or for its purchase. It is declared lawful for two or more municipalities to jointly provide a sewerage system and construct whatever is necessary to effect the system. They may contract with third parties for the removal of sewage. They may also contract with an engineer to survey and plan an effective sewage system. It shall be lawful for these authorities to enter at all times upon any land or water for the purpose of exploring, surveying, and laying out the routes of such sewerage system. Section 120-a provides that municipalities may contract with themselves or with third persons for a system for removal and disposal of sewerage. If a sewerage system from one municipality passes through another municipality, that municipality may contract for the privilege of connecting its system to it. (Shevin-Fla)
W69-03992

NITROGEN REMOVAL IN SEWAGE TREATMENT PROCESS,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).
K. Wuhrmann.
Verh Int Ver Limnol, Vol XV, pp 580-596, Feb 1964. 17 p, 9 fig, 30 ref, disc.

Descriptors: *Eutrophication, *Water pollution control, *Water pollution sources, *Nitrogen compounds, *Sewage treatment, Water quality, Tertiary treatment, Percolation, Trickling filters, Activated sludge, Cycling nutrients, Denitrification, Nitrogen cycle, Sewage effluents, Microbiology, Phosphorus compounds, Pseudomonas, Nitrogen fixation, Sewage lagoons, Sewage bacteria, Sulfur compounds, Groundwater.
Identifiers: Zurich (Switzerland), Heterotrophy, Land disposal, Sulphate reduction.

Nitrogenous compounds derived from sewage probably play a significant role in eutrophication and nitrate-enrichment of groundwaters, although detailed knowledge of their involvement is still forthcoming. Author has reviewed nitrogen removal by conventional treatment processes. Land disposal, pond treatment, and biological oxidation, in trickling filters or with activated sludge, remove not more than 50% of total nitrogen from waste water, percentages ineffective in preventing enrichment of receiving waters. Over 90% removal has been achieved with physico-chemical processes of ion exchange and ammonia stripping at high pH, methods which are presently uneconomical. Microbial denitrification may be a practical technique of nitrogen elimination. Already occurring during conventional biological treatment, denitrification can be optimized to achieve 90% elimination from sewage. Author describes technical scale experiments which easily achieved highly reliable denitrification. In the experiments, final effluents after treatment of domestic sewage (total nitrogen after preliminary sedimentation, 25-30 ppm) contained 2-4 ppm. Attainment of complete anaerobiosis during an extra detention step was essential for such removal. Subsequent phosphorus precipitation yielded effluent with 1-2 ppm total nitrogen. Report contains record of brief floor discussions relative to phosphate removal, characteristics of denitrifying flora, sulfate reduction, and nitrogen fixation by cyanophytes.
W69-04030

COLLECTION, CHARACTERIZATION, AND STUDY OF BIODEGRADABILITY AND CHEMICAL OXIDATION OF CARBON-ABSORBED MATERIALS FROM EFFLUENTS FROM SEWAGE TREATMENT PLANTS,
Iowa State Univ., Ames. Dept of Civil Engineering.
R. L. Johnson.
Eng Res Inst., Final Report, Dec 1968. 96 p, 3 tab, 32 fig, 11 ref, 1 append.OWRR Project A-007-Iowa.

Descriptors: Adsorption, *Biological treatment, *Effluents, Similitude.

Organic materials found in sewage treatment plant effluents were adsorbed on activated carbon filters. The adsorbed material, after solution and concentration from the activated carbon, was fractionated according to solubility. Attempts were made to identify and characterize the organic materials, but the task was almost impossible. Most fractions were capable of further biodegradation as well as chemical oxidation when in the more concentrated form. A new tertiary or secondary biological treatment process of Pulsating Adsorption Beds (PAB) was developed using the adsorption phenomena as a concentration effect to enhance biodegradability. The process showed removals of 80 to 90% of the soluble organic carbon in a synthetic sewage at 125 million gallons per acre per day hydraulic loading and 265 pounds BOD per thousand cubic foot per day organic loading.
W69-04132

AN EXAMINATION OF NON-TREATMENT PLANT ALTERNATIVES IN WATER POLLUTION CONTROL,
Harvard Univ., Cambridge, Mass.
Leonard Ortolano, and Harold A. Thomas, Jr.
Harvard Water Program, Discussion Paper No 67-4, Harvard Univ, Nov 1967. 37 p, 2 fig, 5 tab, 13 ref, 1 append.

Descriptors: *Mathematical models, *Water pollution control, Alternative costs, *Waste water treatment, Water management (Applied), Bypasses, Estuaries, Aeration, Sewers, Sediment-water interfaces, Standards, Dissolved oxygen, Economic efficiency, Stream improvement, River systems, Delaware River.
Identifiers: Non-treatment alternatives.

A series of mathematical programming models were presented to investigate the relative merits of: (1) primary; (2) secondary; and (3) tertiary sewage treatment plants; (4) increase in stream reaeration coefficients; (5) control of combined sewer overflows; (6) removal of bottom sediments; and (7) piping of wastes outside basin for ocean disposal, in a program to maintain a given DO concentration at minimum cost. Sample computations and results for the Delaware Estuary were shown. The models were used as preliminary screening tools, beginning with simplified static models of the estuarine geometry, and evolving to sectioned dynamic models. (Gysi-Cornell)
W69-04142

MODEL OF OPTIMAL COMBINATION OF TREATMENT AND DILUTION,
Oklahoma Univ., Norman.
George W. Reid, Leale E. Streebin, and Robert Y. Nelson.
Proc Third Annu Amer Water Resources Conf, San Francisco, pp 339-350, Nov 1967. 12 p, 1 fig.

Descriptors: *Input-output analysis, *Low-flow augmentation, Mathematical models, Streamflow, *Optimization, *Waste water treatment, *Water pollution control, Municipal wastes, Industrial wastes, Statistics, Reservoirs, Costs, Digital computers.
Identifiers: Sensitivity analysis.

Stream input-output models were developed in terms of responses to biodegradable, nutritional, chemical and thermal loads. The models were developed as a function of stream parameters (e.g. reaeration coefficients, effective length, velveity) and quality criteria (e.g. DO, phosphorus, chlorides and temperature increases). Bacterial and sediment limits were handled as constraints. Given stream parameters and pollution criteria, the model provided optimal or least-cost combinations of waste treatment and dilution (low-flow augmentation). The methodology was responsive to stochastic changes, and capable of sensitivity analyses of pollution parameters. The entire program was computerized. (Gysi-Cornell)
W69-04144

OPTIMAL WATER QUALITY MANAGEME AND MULTI-COMPONENT EFFLUENT CO TROL BY MEANS OF LINEAR PR GRAMMING,
John P. Carew, and R. M. Van Slyke.
Operations Research Center Report 68-1, Univ Calif, Berkeley, Jan 1968. 25 p, 6 tab, 14 ref.

Descriptors: *Linear programming, *Water qual control, Water management (Applied), Water p icy, *Waste water treatment, Industrial wastes, M nicipal wastes, Standards, Effluents, *Comparat costs, Economic efficiency, Planning, Wa resource development.
Identifiers: Multicomponent effluents, Imput costs.

A linear programming model for multicompone effluent control was presented. The objective of t model was to prescribe levels of treatment by dustrial and public classes of effluent dischargers order to minimize total cost of treatment, subject water quality constraints. Imputed costs per unit each effluent component were obtained, allowi comparison of costs for different effluent compo tion, evaluation of proposed treatment schem and estimation of the effects of changing qual standards and increased discharges on optin treatment policies. It was concluded that proj tions of future economic activity could be us with the model to predict future demands on tre ment capability. (Gysi-Cornell)
W69-04147

5E. Ultimate Disposal of Wastes

ULTIMATE DISPOSAL OF WASTE WATI CONCENTRATES TO THE ENVIRONMENT,
Federal Water Pollution Control Administratic Cincinnati, Ohio.
Robert B. Dean.
Environ Sci Technol, Vol 2, No 12, pp 1079-108 Dec 1968. 8 p, 52 ref.

Descriptors: Wastes, *Waste water, *Waste wat disposal, *Waste water treatment, Water polluti control, *Sewage disposal, *Sanitary engineerir *Sewage sludge, Sludge disposal, Sludge treatme Ultimate disposal, Municipal wastes, Bri disposal, Bibliographies, Pollution abateme *Sewage treatment.
Identifiers: Sewage stabilization.

The Ultimate Disposal Research Activity of t Federal Water Pollution Control Administration responsible for devising methods for treating wa residues so that they will not pollute the envirc ment. Land and ocean sludge disposal, agricultu markets for sludge, and the fuel value of sludge a discussed. Surface and underground disposal soluble waste, such as salt solutions, are al covered. Waste treatment processes described clude oxidation, aerobic digestion, phospha removal, lime treatment, nitrification ammor removal, ion exchange, and removal of various e ments and compounds. The only practical plac for disposing polluting substances after they ha been rendered innocuous are the air, land, a ocean. Surface fresh waters are not available f disposal. The ocean has long been used for wa disposal; however, warning signs are appeari showing that the ocean's assimilative capacity not infinite and that effluents are not always rapic dispersed. A pollutant is a substance that interfer with an intended use of the land, sea, or air, a society must decide on the best intended u (USBR)
W69-03798

5F. Water Treatment and Quality Alteration

SEWERS, DRAINS - CHANGE OF COURSE OR OUTLET.

N J Stat Ann secs 40:63-13, 40:63-14 (1967).

Descriptors: *New Jersey, *Outlet works, *Drains, *Subsurface drainage, Sewers, Construction, Legislation, Riparian rights, Easement, Costs, Local governments, Cities, Riparian land, Ownership of beds, Grants, State governments.

The governing body may change the course and outlet of any sewer or drain before or after the construction thereof upon the application of any person. The municipality may exchange lands which were acquired for such drains for other lands necessary to make such change. The cost of the change shall be paid by the applicant as fixed by the governing body. If, in the construction of such drain in its changed course, it shall be necessary to cross any lands of the state under water in order to obtain an outlet, such lands may be taken and used for that purpose, and any lands of the state under water that were taken for use in the construction of the original drain, shall upon construction of such new drain on its changed course, revert to the state. If there has been a grant of such land to a riparian owner subject to the easement of the drain, such easement shall cease and determine, and the title of such grant shall become absolute. (Shevin-Fla)
W69-03858

5G. Water Quality Control

EFFECTS OF TEMPERATURE ON STREAM AERATION,
Newark College of Engineering, N. J. Dept. of Civil Engineering.
Ivan Metzger.
ASCE Proc, J Sanit Eng Div, Vol 94, No SA6, Pap 6309, pp 1153-1159, Dec 1968. 7 p, 2 fig, 2 tab, 9 ref, append. WP-01099-01 FWPCA.

Descriptors: *Aeration, *Streams, *Hydraulic models, *Temperature, Mathematical models, Oxygenation, Dissolved oxygen, Solubility, Dilution, Sanitary engineering, Sewage treatment.
Identifiers: *Water flow dilution.

The temperature coefficient of oxygen absorption in water is shown not to be constant but to be dependent upon turbulence and water temperature. Values of the coefficient were predicted by using the film penetration model and verified in open-channel model studies and mechanically stirred tanks. (Knapp-USGS)
W69-03742

STREAM CONTROL COMMISSION - VIOLATIONS AND PENALTIES.

La Rev Stat secs 56:1442-1444 (1965).

Descriptors: *Louisiana, *Administrative agencies, *Regulation, *Water pollution control, Legislation, Legal aspects, Bodies of water, Gulf of Mexico, Investigations, Water quality control, Public health water policy, Waste disposal, Streams.
Identifiers: *Penalties, Attorney general.

Any person who deems himself aggrieved by an order of the Stream Control Commission may file a sworn petition with the commission asking for a hearing. The result of the hearing on such matters is conclusive, although a review of the order may be had de novo in the district court. Any person who fails to file a report under section 1441 is found to be continuing the violation and is subject to criminal prosecution. The attorney general shall prosecute all violators, and the penalties shall range from $25 to $1000 or up to one year in jail. (Sisserson-Fla)
W69-03836

DRAINAGE OF NOXIOUS OR POISONOUS SUBSTANCES INTO NATURAL WATERWAYS OR CANALS.

La Rev Stat secs 56:1451-1453 (1965).

Descriptors: *Louisiana, *Water pollution control, *Administrative agencies, *Regulation, Oil wastes, Saline water, Drainage, Bodies of water, Legislation, Legal aspects, Streams, Reservoirs.
Identifiers: Penalties, Poisonous gases.

No person shall knowingly or willfully empty from any reservoir, pump, well, or oil field, into any natural stream of the state, any oil, salt water, or noxious or poisonous gases or substances in quantities sufficient to destroy the fish therein. The Commissioner of Wild Life and Fisheries shall supervise all drainage of salt water and other noxious substances into the natural streams of the state, and any owner or operator of oil producing property who discharges such substances in quantities sufficient to kill the fish shall be notified by the Commissioner to impound such substances. Any violator of this part shall be fined not less than $100 nor more than $2000, or imprisoned for not less than 30 days nor more than 3 months for each offense. Each day that such substances are permitted to flow into the streams of the state constitutes a separate offense. (Sisserson-Fla)
W69-03837

PROTECTION OF WATER SUPPLY FROM POLLUTION.

N J Stat Ann sec 40:62-67 (1967).

Descriptors: *New Jersey, *Water pollution, *Public health, *Drains, Sewers, Sewage disposal, Legislation, Local governments, Cities, Drainage districts, Drainage systems, Construction, Water pollution control, Water quality control, Administrative agencies.

In municipalities having a public water supply obtained from a source beyond the municipal limits, the board or body having the control of such water supply may, when necessary to protect such water from pollution, construct, maintain and operate, within this territory from which the water is derived or through which it flows, a system of drains and sewers for intercepting, taking off and disposing of all sewage or other polluting matter. Every such system shall provide for the disposal of the sewage and other polluting matter taken up, at a place and in a manner to render the same harmless. The construction of such system of drains and sewers shall not be commenced or entered upon, unless and until the state department of health shall approve the construction thereof as a sanitary measure, shall approve the plans therefore, which shall be submitted to it, and shall define in a general way the limits of the district or territory within which or for which such system of drains or sewers shall be constructed. (Shevin-Fla)
W69-03855

PILOT STUDY OF DYNAMICS OF RESERVOIR DESTRATIFICATION,
Robert S. Kerr Water Research Center, Ada, Okla.
Lowell E. Leach, William R. Duffer, and Curtis C. Harlin, Jr.
Fed Water Pollut Contr Admin Rep, 1968. 22 p, 7 fig, 1 tab, 13 ref.

Descriptors: *Thermal stratification, *Reservoirs, *Dissolved oxygen, *Aeration, *Mixing, On-site tests, Oklahoma.
Identifiers: Eufaula Reservoir (Okla), Destratification.

A pilot study of the dynamics of destratification of a large reservoir by utilizing a compressed air diffusor system was made at Eufaula Reservoir, Oklahoma, in summer and early fall, 1967. Measuring stations were located 500 ft apart at 25 points in a cross-shaped pattern in the project area. Vertical temperature and dissolved oxygen profiles were measured at 5-foot intervals from the surface to the bottom. The thermocline was 22 ft below the surface. Dissolved oxygen ranged from 10 to 6 ppm at the surface and decreased to 5 ppm at 22 ft, and to near zero at the bottom. Destratification was attempted with a cross-shaped array of diffusors 40 ft square spaced 3 ft apart on the outer 9 ft of each leg. Air was delivered at 140 cfm and 65 psig initially, and 95 cfm and 45 psig after 25 days. Concentration of dissolved oxygen increased together with warming of water. After 2 days the 4.0 ppm oxygen level lowered from 28 ft to 35 ft with a radius of 1000 ft from the center of the system, to 40 ft with a radius of 6,500 ft after 4 days, and reached a maximum depth of 50 ft with a radius of 14,200 ft at 25 days. A volume of water of 65,800 acre-ft was aerated. (Knapp-USGS)
W69-03960

PESTICIDE OCCURRENCE, CONCENTRATION, AND DEGRADATION IN FREE WATER SYSTEMS,
Massachusetts Univ., Amherst.
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-03962

CITY OF FORT WAYNE V MAPLEWOOD PARK UTIL (CONSTITUTIONALITY OF STATE COMBINED SEWAGE DISPOSAL AND WATER ACT).

241 N E 2d 805-808 (App Ct Ind 1968).

Descriptors: *Indiana, *Public utilities, *Legislation, *Classification, Rural areas, Water works, Sewage disposal, Judicial decisions, Legal aspects, Cities, Sewers, Water supply, Water users.
Identifiers: *Constitutional law.

Maplewood Park Utilities, Inc., applied to the Public Service Commission for a certificate to render combined sewer and water service to an area outside the city of Fort Wayne. The City of Fort Wayne and its public works board opposed the application. The Commission awarded the certificate to Maplewood to render service exclusively. The constitutionality of the state Combined Sewage Disposal and Water Act of 1963 was attacked on appeal to this court. The court reversed the order of the commission, holding the act to be violative of the state constitution. The Act granted rights to private utilities to render combined sewer and water services, which it did not grant to municipal utilities, public water companies or public sewage companies. The court ruled that the basis of the Act had no reasonable relation to the end of providing residents in rural areas with water and sewage disposal service. (Wheeler-Fla)
W69-03983

NEW ENGLAND INTERSTATE WATER POLLUTION CONTROL COMPACT.

N Y Pub Health Law sec 1180 (McKinney Supp 1968).

Descriptors: *New York, *New England, *Water pollution, *Interstate compacts, Legislation, Interstate rivers, Administrative agencies, Administrative regulation, Water quality, Standards, Tidal waters, Sewage treatment, Navigation, Interstate commissions, Legal aspects, Bodies of water, Water pollution control.
Identifiers: Interstate Water Pollution Control Compacts, Contiguous waters.

This section reestablishes the New England Interstate Water Pollution Control Compact the purpose of which is to abate existing pollution and to control future pollution in the interstate waters of the New England area. The Compact provides for the composition and procedures to be followed by the control commission. One of the primary functions of the commission is the establishment of reasonable standards of water quality satisfactory

for various classifications of use. The signatory states agree to have their own classification of interstate waters approved by the commission and to establish programs of waste treatment which will meet the commission's standards. The signatory states also agree to provide for the abatement and control of pollution in interstate waters and to maintain these waters in a condition consistent with the highest classified use for each body of water. (Childs-Fla)
W69-03990

AN ACT CONCERNING INDUSTRIAL WASTE DISPOSAL PROPERTY...EXEMPTING FROM TAXATION CERTAIN TANGIBLE PERSONAL PROPERTY.

Indiana Laws ch 174 (1967).

Descriptors: *Indiana, *Taxes, *Industrial wastes, *Treatment facilities, Administrative agencies, Water pollution, Judicial decisions, Facilities, Industrial plants, Waste water treatment, Legislation.
Identifiers: *Exemptions (Tax), Stream pollution control board.

Indiana allows an exemption from ad valorem property taxation for industrial waste control facilities. These facilities must be tangible personal property. The exemption applies to the State and any of its political subdivisions. Application for the exemption must be made to and approved by the Stream Pollution Control Board of Indiana. If the board does not grant the exemption appeal may be made to the circuit court of the county for which the property claimed for exemption is located. The appeal will be tried by a judge without jury and is subject to further appeal as in other civil cases. (Watson-Fla)
W69-04001

WATER QUALITY MANAGEMENT IN THE DELAWARE RIVER BASIN (FEDERAL AND INTERSTATE COMPACT TO SOLVE POLLUTION PROBLEMS),
Delaware River Basin Commission, Trenton, N. J.
Ralph Porges.
International Conference On Water For Peace, Vol 8, pp 47-60, 1968. 13 p, 5 fig. For 8 volume Proceedings see Vol 2, No 9, Field 06B, W69-03305.

Descriptors: *Delaware River Basin Commission, *Water quality control, *Water pollution control, *Inter-agency cooperation, Delaware River, Administrative agencies, River basin commissions, River basin development, Waste water treatment, Water pollution treatment, Pollution abatement, Federal government, State governments, Water pollution, Rivers, River basins.

This water quality control article concerned the Delaware River Basin, which runs from the Catskill Mountains of New York down to the Delaware Bay below New Jersey. The pollution problem was centered on the estuary region, which begins at Trenton, New Jersey and extends some eighty-five miles to the Bay. The problem described results from municipal and industrial wastes being poured into the river. Control mechanisms of federal, state, and local agencies are discussed, and mention is made of municipal and industrial waste management programs. The article describes how the complexities of problems relating to streams forming state boundaries has led to the creation of interstate agency, which has been succeeded by the Delaware River Basin Commission. Under a 1961 compact, the Commission is an instrumentality of the four basin states and the federal government. The Commission's water resource development and water quality management responsibilities are discussed. Also included is how the Federal Water Pollution Control Administration aids the Commission. (Wheeler-Fla)
W69-04039

AIR AND WATER INTERSTATE COMPACTS.
Gulf Oil Corp., Philadelphia, Pa.

Nat Resources Lawyer, Vol 1, No 4, pp 60-69, Oct 1968, 10 p, 6 ref, 1 tab.

Descriptors: *Interstate compacts, *Water pollution, *Air pollution, Interstate rivers, Compacts, Federal government, State governments, Federal jurisdiction, Delaware River, Water control, Tennessee River, Water Resources Planning Act, River basin commissions, Legislation, Missouri River, Ohio River, Columbia River, Water quality control, Water pollution control, Legal aspects.
Identifiers: Potomac River, Susquehanna River, Water Pollution Control Administration, Air Pollution Control Act.

In recent years a number of interstate compacts have been negotiated in an effort to control air and water pollution. These compacts have become rather sophisticated in dealing with the numerous problem areas. The federal government has also become an active participant in a number of these agreements. It appears that Congress has, as a matter of policy, adopted the position that these compacts are to be encouraged, but, at the same time, has insisted that any standards set must meet federal criteria. The age of some of the water compacts and the striking lack of provisions to meet everyday problems encountered in pollution control render these compacts outdated and inadequate to meet modern day problems. It is possible that these and other conflicts will not be resolved this year or in the near future. If they are not, it is suggested that perhaps what is needed is an overall study and reevaluation of the use of the compact as an organizational form. (Heckerling-Fla)
W69-04047

POLLUTION.
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-04050

INDUSTRIAL WASTES ORDINANCE ENFORCEMENT HELPS ABATE POLLUTION AT CHICAGO,
Allen S. Lavin.
Water and Wastes Engineering, Vol 5, No 9, pp 1-27--1-29, Sept 1968. 2 p.

Descriptors: *Pollution abatement, *Industrial wastes, Industries, Industrial plants, Water pollution sources, Water pollution control, Water pollution, Public health, Sanitary engineering, Legislation.

The attorney for the Metropolitan Sanitary District of Greater Chicago states that there is no reason today to accept any type of pollution. The central problem lies in the sluggish pace of the enforcement program, and the solution lies in strengthening of this enforcement program. In this regard, the Metropolitan Sanitary District of Greater Chicago has recently taken the firm position, in hearings concerning violations by big industry of its anti-pollution ordinance, that the ordinance is clear, that there is a standard definition for pollution, and that costs and productive value to a particular industry is not the prime concern. The prime concern is the health, welfare, and economics of our entire community. The article concludes with the thought that we have the technical know-how, the money and the manpower; we now should develop the will to enforce anti-pollution laws. (Carruthers-Fla)
W69-04053

INTERSTATE WATER POLLUTION CONTROL ACT.
Me Rev Stat Ann tit 38, secs 491-537 (1965).

Descriptors: *Maine, *New England Interstate WPS Compact, *Water pollution control, *Legislation, Water quality, Water pollution, Water quality control, State governments, Cooperatives, Interstate compacts, Interstate rivers, Water policy, Water law, Interstate commissions, Legal aspects, Connecticut, New Hampshire, Massachusetts, Rhode Island, Vermont.

The State of Maine has enacted the New England Interstate Water Pollution Control Compact. The other signatory states are Connecticut, Massachusetts, New Hampshire, Rhode Island, and Vermont. The act represents a recognition of pollution problems of interstate streams, ponds, lakes and tidal waters ebbing and flowing past boundaries of two or more states. The stated purpose of the act is to foster cooperation between the New England states in establishing an effective interstate agency to work with the states. Subchapter (2) includes two articles: Article One describes the compact, including sections concerning waters covered by the act, and details the commission structure, standards and classifications, appropriations, and provisions for negotiation with New York. Article Two concerns the administrative provisions, including sections regarding the form of execution by the governor, appointment of commissioners, reservations, and appropriations. (Wheeler-Fla)
W69-04154

ARTICLE ONE, SUBCHAPTER TWO, NEW ENGLAND INTERSTATE WATER POLLUTION CONTROL COMPACT (DETAILS OF THE COMPACT).
Me Rev Stat Ann tit 38, secs 491-501 (1965).

Descriptors: *Maine, *New England Interstate WPS Compact, *Water pollution control, *Legislation, Interstate compacts, Water quality, Water pollution, Water quality control, State governments, Cooperatives, Interstate rivers, Water policy, Water law, Interstate commissions, Legal aspects, New York.

These sections of the Act limit its application to interstate inland and tidal waters. The Act creates a commission made up of five appointed members from each state, representing various fields of interest. Procedures for organization and operation are specified. Provision is made for the establishment of different standards of water quality for various classifications of use. A pledge is included providing for pollution abatement and future control of interstate waters. Maximum appropriation obligations of each state is set out, with Massachusetts being the major contributor. The commission is authorized to negotiate with New York regarding abatement of pollution in waters flowing between New England and New York. (Wheeler-Fla)
W69-04155

ARTICLE TWO; SUBCHAPTER TWO; NEW ENGLAND INTERSTATE WATER POLLUTION CONTROL COMPACT.
Me Rev Stat Ann tit 38, secs 531-537 (1965).

Descriptors: *Maine, *New England Interstate WPS Compact, *Water pollution control, *Legislation, Interstate compacts, Administrative agencies, Water quality, Water pollution, Water quality control, State governments, Cooperatives, Interstate rivers, Water law, Interstate commissions, Legal aspects.

The Governor of Maine is directed to execute the compact described under Article One in conjection with any one or more of the other six New England states listed. The Act directs that five commissioners be appointed from Maine, two of which are to be, respectively, the commissioner of Health and Welfare and the Chairman of the Water Improvement Commission. The other three are to be appointed by the Governor with a view toward representing municipal, industrial, and general public interests. The Commissioners are to serve without compensation, but expenses incurred in line of service are reimbursable. Reservation is made concerning appointees to the interstate com

mission from Maine; these persons have no authority to commit any interest within Maine to any higher classification than was already established by Maine law, nor to any classification of interstate waters of Maine which have not been assigned a classification under Maine law. Maine limited appropriations for commission expenses to $1000.00. The importance of pollution control of interstate waters is recognized, and the act states that the best method to accomplish the goal is through interstate cooperation. (Wheeler-Fla)
W69-04156

AN ACT RELATIVE TO EXPANDED STATE ACTIVITY IN THE FIELD OF WATER POLLUTION CONTROL.
Laws of New Hampshire ch 147 (1967).

Descriptors: *New Hampshire, *Surface waters, *Sewage disposal, Legislation, Administrative agencies, Sewage treatment, Water pollution sources, Classification, Permits, Regulation, Water policy, Grants, Shores.

Chapter 147 was passed to expand existing New Hampshire laws dealing with water pollution. The act created and defined the composition of the water supply and pollution control commission, as well as specifying the qualifications and numbers of the commission's employees. Existing standards for the classification of surface waters were amended. A permit was required to dispose of sewage into surface water. Marine toilets must have treatment devices attached to them and none of the treated sewage may be deposited within 500 feet of the shoreline. To receive state grants, recommended pollution control facilities must be installed and in operation. Chapter 147 also added a new chapter, 149E, which was entitled 'Sewage Disposal Systems Near Shorelines.' The purpose of the new chapter was to prevent pollution in the surface waters of the state. Any construction of a sewage system or a subdivision near the shoreline must be preceded by the submission of plans and specifications to the water pollution commission for approval. The chapter provided enforcement procedure and penalties for violations. (Sisserson-Fla)
W69-04178

NORTH CAROLINA STATE STREAM SANITATION AND CONSERVATION COMMITTEE.
NC Gen Stat sec 143-211--143-215.7 (1964).

Descriptors: *North Carolina, *Legislation, Water pollution control, *Administrative agencies, Water quality, Public health, Standards, Water pollution effects, Water quality control, Regulation, Inspection, Permits, Water policy.
Identifiers: Commissions, Penalties (Civil).

This article establishes a State Stream Sanitation Committee composed of 7 members who represent and have field experience in water pollution prevention and abatement. The Committee shall have the responsibility of identifying and classifying all the waters of the state per the criteria set forth in section 143-215 (d) (1-4). Prior to assigning a classification to an identified water body, the Committee shall conduct public hearings and receive evidence on the matter. After a stream is classified no person may alter the construction of, increase the quantity of, or change the nature of any sewage or disposal system, within the area without first receiving a permit from the Commission. The act encourages voluntary cooperation among those using pollution to act to eliminate it, but, if need be, the Commission is authorized to issue special orders ordering the abatement of pollution sources. The act specifies the effect of such orders when issued to private individuals or municipalities. The committee has the power to adopt, modify or revoke its regulations, conduct investigations and delegate its powers to its employees, etc. The act provides civil penalties for violation of Commission regulations. The act has no effect on the sections of the statutes regulating public water supplies and sewer systems. (Blunt-Fla)
W69-04193

06. WATER RESOURCES PLANNING

6A. Techniques OF Planning

EFFECTIVE WATER RESOURCE MANAGEMENT.
TRW Systems, San Bernardino, Calif.

TRW Syst, Inc Rep, Apr 15, 1968. 74 p, 26 fig, 4 append. Grant 1579. OWRR Project C-1084.

Descriptors: *Systems analysis, *Water resources development, *Water management (Applied), River basins, Management, Operations research, Personnel management, Employee relations, Leadership, Social aspects, Hydrologic aspects.
Identifiers: Systems, Project management.

The use of the systems approach to water management is explained in a handbook intended for the use of water resource managers. The most appropriate geographical unit for planning purposes is the river basin. River basins in the management sense include all human activities as well as the physical aspects of the area. The systems approach to management includes basin hydrological and meteorological analysis, planning, organizing, staffing, direction, and control. Flow charts illustrate the process of decision making in the operational and project modes. Organizational charts are used to present the recommended organizational structure. The Upper Santa Ana River Basin, California, is used as an illustration of the systems approach to water resource management. (Knapp-USGS)
W69-03702

DEVELOPMENT AND APPLICATION OF A RATIONAL WATER QUALITY PLANNING MODEL,
Clemson Univ., S. C.
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-04017

POOLING OF TIME SERIES AND CROSS SECTION DATA,
Columbia Univ., New York.
For primary bibliographic entry see Field 06D.
For abstract, see .
W69-04066

COMPETITIVE EQUILIBRIUM UNDER UNCERTAINTY,
California Univ., Berkeley.
For primary bibliographic entry see Field 06D.
For abstract, see .
W69-04078

THE DUAL IN NONLINEAR PROGRAMMING AND ITS ECONOMIC INTERPRETATION,
City Univ. of New York; and Princeton Univ., N. J.
For primary bibliographic entry see Field 06B.
For abstract, see .
W69-04088

DEVELOPMENT OF OPTIMIZATION - SYSTEMS ANALYSIS TECHNIQUES FOR TEXAS WATER RESOURCES,
Texas A and M Univ., College Station. Water Resources Inst.
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-04133

SIMULATION OF A NATIONAL FLOOD INSURANCE FUND,
Florida Univ., Gainesville; and Harvard Univ., Cambridge, Mass.
John C. Schaake, Jr. and Myron B. Fiering.

Water Resources Res, Vol 3, No 4, pp 913-929, 4th Quarter, 1967. 17 p, 4 fig, 10 tab, 6 ref.

Descriptors: *Simulation analysis, *Flood plain insurance, Flood damage, Compensation, Costs, Statistics, Optimization, Rates, Discount rate, Water management (Applied), Water policy, Synthetic hydrology.
Identifiers: National fund.

A simulation model of a national flood insurance fund was structured. The objective was to determine near optimal values of premium rates, discount coefficients, initial capitalized value, and the reinsurance structure. The model synthesized flow traces, mapped them into damages, collected premiums, indemnified losses, collected reinsurance premiums from the insurance industry, and indemnified that industry's excess losses. Relevant statistics were accumulated. The mean and variance of simulated flood damages agreed well with other studies. Exponential growth in the variance of the fund over time was observed. It was concluded that this growth could be controlled by proper management of the fund. (Gysi-Cornell)
W69-04138

AN EXAMINATION OF NON-TREATMENT PLANT ALTERNATIVES IN WATER POLLUTION CONTROL,
Harvard Univ., Cambridge, Mass.
For primary bibliographic entry see Field 05D.
For abstract, see .
W69-04142

6B. Evaluation Process

THE TEXAS WATER PLAN.
Texas Water Development Board, Austin.

Tex Water Develop Board Rep, Nov 1968. Main rep, total 207 p, 37 fig, 4 plate, 74 tab, sum rep, 50 p, 3 plate, 2 tab.

Descriptors: *Planning, *Water resources development, *Texas, *Inter-basin transfers, Interstate, Financial feasibility, Legal aspects, Legislation, Multiple-purpose projects.
Identifiers: Water importation, Texas Water Plan.

The Texas water plan is outlined and summarized. It is concluded that the projected water needs of the state may be satisfied only by a system for the redistribution of water within the state and importation of water to the state. Studies by the USGS, Bureau of Reclamation, Corps of Engineers, and the state of Texas of feasibility and engineering design of a water importation and distribution system are summarized. A list of recommendations for legislative action on the state, local, and national levels is presented. Texas expects to need 12-13 million acre-ft per yr of imported water by the year 2020. The proposed source is the Mississippi River, from which water will be moved westward into Texas and pumped over 3,000 ft up to the High Plains of west Texas and eastern New Mexico. (Knapp-USGS)
W69-03729

ANALYTICAL USES OF ENERGY BALANCES,
Bureau of Mines, Washington, D. C.
William A. Vogely.
Pap, World Power Conf, Aug 1968. 15 p, 6 tab.

Descriptors: *Energy, *Energy balance, *Forecasting, Models, Costs, Economies, Technology, Nuclear energy, Electric power production, Coals, *Analysis, *Electric power demand, Efficiencies, Resources, Petroleum, Hydroelectric power.
Identifiers: Fossil fuels, Nuclear power.

Four major analytical uses of energy balances are described and examples furnished. Forecasting: A projection to 2000 AD of the U S energy balance indicates a 3-fold increase in energy inputs with a substantial shift to electricity and nuclear power. Resource Adequacy: Models of all fuel economies

are used to test outside limits of resource adequacy. Such an approach is needed because of the high levels of substitution possible between energy sources. Resource Efficiency: Two approaches to efficiency are developed. The first indicates the cost (in resource terms) of the trend toward secondary energy use; the second illustrates the impact of resource-saving technology on gross energy inputs. Consumption Shift Analysis: A shift model of energy consumption (1947-1966) and a behavioral equation for each source by sector are developed. The equation permits historical changes to be distributed among 3 factors: market growth, price substitution, and a residual technology change. Analysis indicates that growth in the market is the major contributor to change, but that increased efficiency negatively affects growth in 3 sectors and new uses reinforce the change in household and commercial sectors.
W69-03772

WATER DEVELOPMENT AND WATER PLANNING IN THE SOUTHWESTERN UNITED STATES,
Aarhus Univ. (Denmark). Inst. of Economic and Applied Geography.
Johannes Humlum.
Kult Inst Skrift No 4, Aarhus Univ, 1969. 240 p, 107 fig, 15 tab, 191 ref.

Descriptors: *Water resources development, *Planning, *Southwest U. S., *Urbanization, California, Arizona, Central Valley Project, Interbasin transfers, Dams, Multiple-purpose projects, Irrigation, Recreation, Powerplants, Municipal water, Reclamation, Social aspects, Legal aspects, Economic impact.
Identifiers: NAWAPA, Urban growth-water import relationships, Urban environment.

Water planning in the southwestern U. S. in the last 50 yr is surveyed and future wide-scale plans for transferring water into irrigated areas are reviewed. The close dependence of the localization of population in southern California and central Arizona and the distribution of water is shown. The influence of water development on population congestion is self-reinforcing and results in growth which may not be socially or economically beneficial, and causes pressure for recreational facilities in areas that often cannot support heavy use. In the southwestern U. S., an originally fine climate attracted people until population growth took on a cancerous aspect. Urbanization and pollution have affected the climate and made the area less livable. The question of the desirability of furthering this development by constantly extending cities, roads, urban areas, and importing water is considered in detail in the worldwide outlook. The history and physical facilities of the water-supply works and irrigation projects of the southwest are described in detail. It is concluded that water demand can be satisfied only by increasingly long inter-basin transfers and desalination of sea water. The large-scale transfer projects must be studied carefully to avoid doing more harm to the environment and to the economy of water-exporting areas, than good to urban areas. Water rights laws need to be uniform and to take transfers into account. An annotated bibliography of 214 entries is included. (Knapp-USGS)
W69-03949

PEOPLE AND WATER,
Oregon State Univ., Corvallis, Oreg. Water Resources Inst.
For primary bibliographic entry see Field 04C.
For abstract, see .
W69-03953

GEOLOGY AS A GUIDE TO REGIONAL ESTIMATES OF THE WATER RESOURCE,
New Jersey Geological Survey, Trenton. Dept. of Conservation and Economic Development.
For primary bibliographic entry see Field 02F.
For abstract, see .
W69-03961

RESOURCES RESPONSIBILITY AND COORDINATION RELATED TO THE COMPREHENSIVE STUDY OF THE SUSQUEHANNA RIVER BASIN.
Interstate Advisory Committee on the Susquehanna River Basin.

Interstate Advisory Committee on the Susquehanna River Basin, 2101 North Front Street, Harrisburg, Pa., 1965, 83 p, 3 map, 23 chart.

Descriptors: *Methodology, *Decision making, *Inter-agency cooperation, *New York, *Pennsylvania, *Maryland, Water resources, Administrative agencies, State governments, Federal government.
Identifiers: Susquehanna River Basin.

After a brief description of the basin and of the purpose of projected programs, the report is divided into four sections. The first outlines what a comprehensive basin study should include. The second discusses and charts the complex organization of official bodies involved with the survey as well as their inter-relationships. The third section describes federal-state coordination, and newly created committees and task forces which deal with the interests and responsibilities of the participating 25 federal agencies. These charts are based on 10 subjects of major concern in the study. Simplified charts showing the channels of authority and communication between these agencies are also included. Finally, an outline of the interests and responsibilities relating to resources of agencies of the three basin states, New York, Pennsylvania, and Maryland. Channels of coordination between agencies within a state, in different states, and with the federal government are described. (Gossen-Chicago)
W69-04032

WATER LAW, PLANNING AND POLICY CASES AND MATERIALS,
Michigan Univ., Ann Arbor.
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-04037

ECONOMIC AND SOCIAL BENEFITS FROM IMPROVING HEALTH BY PROVISION OF SAFE DRINKING WATER SUPPLIES,
Public Health Service, Washington, D. C.
Floyd B. Taylor, William N. Long, and Paul W. Hughes.
For 8-Volume Proceedings see Vol. 2, No. 9, Field 06B, W69-03305. International Conference on Water for Peace, Vol 8, pp 107-116, 1968. 10 p, 3 tab, 4 fig, 9 ref.

Descriptors: *Social aspects, *Water quality, Supply.
Identifiers: *Public health, Economic terms.

This paper discusses the positive health assets of providing adequate water supplies in economic terms such as increased gross national product, savings in medical costs, increase in contributed taxes, and also in social terms such as effect on birth rates and improved morale. In terms of the world, water-borne disease is the major single cause of death and morbidity. Therefore, water supply becomes the principal focus of priority in needed environmental improvements. The effect of adequate quantity (as quantity increases there usually is betterment of health) is also discussed together with the interrelationships between quantity and quality. (Grossman-Rutgers)
W69-04056

TRIBUTARY AREA DEVELOPMENT: TVA'S APPROACH TO SUB-REGIONAL DEVELOPMENT,
Tennessee Valley Authority, Knoxville.
Richard E. Brown, and Glen D. Weber.
Land Economics, Vol 45, No 1, pp 141-146, Feb 1969. 6 p, 6 ref.

Descriptors: *Tenessee Valley Authority Project, Benefits.
Identifiers: *Tributary Area Development.

Tributary area development (TAD) is essential an approach which utilizes local interest and initi tive, both governmental and private citizen, carry forward a comprehensive resource develo ment effort directed at uplifting the social a economic well-being of residents of sub-regions the Tennessee Valley. The history of the TVA h been one of cooperation with local and sta governments in their efforts to develop local are This paper describes TVA's tributary area develo ment program. It reviews a few of its accomplis ments, and it suggests some problem areas f further consideration and research. (Grossma Rutgers)
W69-04057

TOWARDS ECONOMIC EVALUATION OF TH QUALITY OF WATER IN IRRIGATION,
Hebrew Univ., Jerusalem (Israel).
For primary bibliographic entry see Field 03C.
For abstract, see .
W69-04059

THE BIAS OF LIVIATAN'S CONSISTENT EST MATOR IN A DISTRIBUTED LAG MODEL,
Delhi Univ., (India).
A. L. Nagar, and Y. P. Gupta.
Econometrica, Vol 36, No 2, pp 337-342, Apr 1968. 6 p, 3 ref.

Descriptors: *Simulation analysis, *Statistic models, *Economics.
Identifiers: Bias, Liviatan's consistent estimato Distributed lag, Asymptotic covariance matrix.

In an earlier article published in the Internation Economic Review (1963) Liviatan proposed a co sistent estimator for a distributed lag model. In th present note the authors analyze the bias of th estimator to order 1/T, T being the number of ol servations. Water simulation studies often en counter the statistical problems of distributive la and autocorrelation and therefore this paper generalization of the consistent estimator proper for a distributive lag model is relevant to empiric models in water research which utilize this stru tural basis. (Loeb-Rutgers)
W69-04060

RESTRICTED BARGAINING FOR ORGANIZ TION WITH MULTIPLE OBJECTIVES,
Fondazione l'Einaudi, Turin (Italy); and Sta Univ. of New York, Buffalo.
Bruno Contini, and Stanley Zionts.
Econometrica, Vol 36, No 2, pp 397-414, Apr 1968. 18 p, 7 fig, 22 ref.

Descriptors: Organizations.
Identifiers: *Restricted bargaining, *Multiple ol jectives, Incentive, Imposed solution, Pareto op timal, Threat, Concession.

In this paper it is shown that a bargaining game wi yield a negotiated solution with certain reasonab properties if the rules of the game are appropriate restricted. The basic idea is to provide an incentiv for all the group components to engage in a proce of concession until the point where some agre ment is reached. The incentive consists of th threat of a preannounced 'imposed' solution whic will be enforced if no settlement can be reache Theories of non market decision making are ofte invoked in the case of public goods and this pap has theoretical relevancy to an array of water issu from water rights and level of governmental dec sion process on expenditure allocations among a ternatives. (Loeb-Rutgers)
W69-04061

A NOTE ON HOUTHAKKER'S AGGREGAT PRODUCTION FUNCTION IN A MULTIFIR INDUSTRY,
Massachusetts Inst. of Tech., Cambridge; an Hebrew Univ., Jerusalem (Isreal).
David Levhari.

Econometrica, Vol 36, No 1, pp 151-154, January 1968. 4 p, 1 fig.

Descriptors: Industries.
Identifiers: *Aggregate production function, Multifirm, Distribution, Factor proportions, Neoclassical production function, Density function.

This note deals with Houthakker's approach of aggregating a production function for an industry. It tries to reverse Houthakker's procedure and to derive the distribution function of factor proportions from a neoclassical production function. Specifically, it derives the distribution function for a CES production function. Economic studies of the 'water industry' are numerous and implicitly involve both the aggregation and factor distribution issues discussed in this paper. (Loeb-Rutgers)
W69-04064

SIMULTANEOUS CONFIDENCE INTERVALS IN ECONOMETRIC FORECASTING,
Michigan Univ., Ann Arbor.
Saul H. Hymans.
Econometrica, Vol 36, No 1, pp 18-30, January 1968. 13 p, 1 fig, 1 tab, 12 ref.

Descriptors: *Forecasting, Regression analysis.
Identifiers: Confidence interval, Econometrics, Confidence ellipsoid, Simultaneous equations, Random variable.

Forecasting a vector of jointly dependent random variables frequently leads to the consideration of a confidence ellipsoid. Joint confidence intervals can then be derived if the projections of the ellipsoid on a set of coordinate axes can be calculated. In this paper an expression for such projections is derived and then the application to econometric forecasting is presented. Much empirical work in water research employs regression analysis (demand estimations, stream simulations) and involves forecasting problems. The method of forecasting confidence ellipsoids suggested here has relevance to statistical water analyses that consider problems involving empirical forecasting. (Loeb-Rutgers)
W69-04065

QUANTITATIVE VS. QUALITATIVE STANDARDS FOR EVALUATING MANAGERIAL EFFICIENCY IN PUBLIC UNDERTAKINGS,
George C. Maniatis.
Indian Econ Jour, Vol 14, No 5, pp 576-89, Apr-June 1967. 24 p.

Descriptors: Management, Performance, Efficiencies, Administration, Profit, Economic efficiency, Economics, Cost, Social aspects.
Identifiers: Public enterprise, Cost minimization, Relative cost reduction.

While it is normally believed that the managerial efficiency of public enterprises must be appraised by a qualitative rather than a quantitative criteria, the author maintains that a properly qualified profitability test--a quantitative standard--would provide a workable efficiency norm. He suggests that a test of efficiency may have the following desiderata: objectivity, reliability, simplicity, management's efforts to minimize costs, judgment of management in light of the prevailing environment, and furtherance of the social responsibility of management. It would be profitable to discriminate the social from economic performance of the public enterprise and to emphasize the significance of the latter. The resultant profit, after taking due account of the cost and revenue effects that go with socio-political or socioeconomic aims, could be regarded as an index of the management's operating efficiency. This article is relevant to studies of the operation of public water agencies and institutions. (Winn-Rutgers)
W69-04068

ECONOMETRICS OF JOINT PRODUCTION,
H. D. Vinod.
Econometrica, Vol 36, No 2, pp 322-336, April 1968. 15 p, 1 fig, 2 tab, 19 ref.

Descriptors: Least squares method, Regression analysis, Forecasting, Joint costs.
Identifiers: *Econometrics, *Joint production, Canonical analysis, Ordinary least squares, Ratio elasticity, Production function.

It is argued here that in the presence of joint production, ordinary least squares regression, OLS, gives inconsistent estimates. An alternative estimation procedure is therefore developed. The application of the tool of canonical correlation analysis for econometric problems has so far been rather limited because of various problems. An attempt is made in the first part of this paper to extend the analysis in order to handle a greater variety of problems. A new way of looking at the canonical variables is suggested while developing an estimation technique for joint production functions. In the second part, empirical examples and a comparison with OLS are included. The forecasting accuracy is also compared, illustrating the superiority of the suggested estimation procedure. The 'production' of water may involve the joint product situation described in this article. The implications for the regression estimates when this is the case for the water good can be thought of as identical to the general case this paper discusses. (Loeb-Rutgers)
W69-04070

WHAT KIND OF REDISTRIBUTION DO WE WANT,
London School of Economics and Political Science (England); and Virginia Univ., Charlottesville.
James M. Buchanan.
Economica, New Series Vol XXXV, No 138, pp 185-190, May 1968. 6 p, 1 fig.

Descriptors: Resource allocation, *Taxes.
Identifiers: *Individual preference function, Income distribution, *Income transfers, Numeraire, Externality, Welfare surface.

In his papers (Economica, Feb. and May, 1967), Foldes examined redistribution in specific goods and services in a normative context. As Foldes suggests economists should pay more attention to this type of redistribution, as opposed to redistribution in general purchasing power, but this shift of emphasis can be justified on positive grounds. The hypothesis suggested here is that individuals desire the removal of certain specific behavioral results of poverty, not the equalization of incomes. Advocates of the negative income tax have failed to recognize this. The redistribution aspects of water projects have recently attracted research attention and accordingly this paper has suggested an approach to examine redistribution phenomena in a non-normative manner. (Sokoloff-Rutgers)
W69-04075

WHAT REDISTRIBUTION MAY ECONOMISTS DISCUSS,
London School of Economics and Political Science (England).
Kurt Klappholz.
Economica, New Series, Vol XXXV, No 138, pp 194-197, May 1968. 4 p.

Descriptors: *Resource allocation, Optimization, Ethics.
Identifiers: *Criterion, Individualistic, Social welfare function, *Hypotheses, *Normative.

This note criticizes the view of J. M. Buchanan, expressed in the same issue of Economica, that economists must not incorporate 'external norms' in their models. The author contends that Buchanan confuses two senses of 'norms': 'norms' in the snese of hypotheses concerning the preferences of individuals whose behavior is to be explained, and 'norms' in the sense of criteria for appraising economic arrangements. While there are methodological arguments against using 'external norms' in the sense of hypotheses, there are none against using 'external norms' in the sense of criteria. Water projects involving redistribution of income problems are relevant to this article. (Sokoloff-Rutgers)
W69-04076

OPTIMAL TIMING OF INNOVATIONS,
Washington Univ., Seattle.
Yoram Barzel.
Rev Econ and Stat, Vol 50, No 3, pp 348-355, August 1968. 8 p, 3 fig, 2 tab.

Descriptors: Timing, Benefits, Growth rates, Costs.
Identifiers: *Optimal timing, *Innovations, Pareto optimal, Technical change, Profit maximization.

When an economy expands, potential innovations progressively become more profitable, since the resource costs of developing an innovation are constant whereas the returns increase directly with the output of the commodity affected by the innovation. Profit maximization, however, does not guarantee optimal allocation of resources over time. On the one hand, the inability of innovators to capture all the benefits will cause a delay in innovating activity; alternatively, competition between potential innovators as to who will reach the market first will cause a premature application of resources to innovations. These two forces, in general, will not cancel each other. Under certain extreme conditions the net economic value of the innovation will be zero. Only when the innovator can exclude others from innovating and when all the benefits will accrue to him will the timing of the innovation activity be Pareto optimal. If an innovation is optimally timed, its net present value per unit of innovation investment will be $P/(r - p)$ where P is the rate of growth in the output of the commodity affected by the innovation and r is the rate of discount in the economy. Potential theoretical extensions of this article to water resources involve the timing of the introduction of new water technology as it effects Pareto efficiency conditions with the quantity of investment, need for governmental intervention and resource allocation problems also involved. (Loeb-Rutgers)
W69-04081

INVESTMENT BEHAVIOR AND NEO-CLASSICAL THEORY,
Northwestern Univ., Evanston, Ill.; and National Bureau of Economic Research, New York.
Robert Eisner, and M. I. Nadiri.
Rev Econ and Stat, Vol 50, No 3, pp 369-382, August 1968. 14 p, 6 tab, 13 ref, 1 append.

Descriptors: Prices, Investment, Capital.
Identifiers: *Investment behavior, *Neo-classical theory, Elasticity of capital stock, Relative prices, Output, Replacement.

Key propositions of Jorgenson's, 'theory of investment behavior based on the neo-classical theory of optimal accumulation of capital' are tested with post-war, quarterly time series data for manufacturing. These include Jorgenson's assumptions derived from the Cobb-Douglas production function that elasticities of capital stock, K, with respect to relative prices, P/C, and output, Q, as well as their product PQ/C, are all unity. Instead of constraining the elasticities to be unity, as Jorgenson does, the authors estimate them freely with general Pascal distributed lag estimators. The best estimates of the elasticity of capital stock with respect to PQ/C, which in Jorgenson's formulation is proportional to 'desired capital stock,' are then found to be less than .25, and significantly less than unity. The elasticity with respect to relative prices alone, even under the most favorable definition, are in the neighborhood of .16. The elasticity with respect to output is considerably higher, varying downward from .82. These results offer little support for Jorgenson's particular 'neo classical' explanation of investment. Other conclusions of Jorgenson and associates are shown to be derived from special assumptions of Jorgenson's model and to be unsubstantiated or contradicted by the data. Equivalent issues in treatments of water resource investment can use this article as a framework for the water investment problem. (Loeb-Rutgers)
W69-04082

ON THE PRINCIPLE OF CONSUMERS' SOVEREIGNTY,
California Univ., Berkeley.

Tibor Scitovsky.
Amer Econ Rev, Vol LII, No 2, pp 262-268, May 1962. 7 p.

Descriptors: Prices, Taste.
Identifiers: *Consumer sovereignty, *Collective goods, Social security, Health insurance, Innovation, Value judgments.

This paper concerns two issues, the choice between market and collective goods, and the problem of whether the market can cater to consumer's tastes truly and well. The author believes that the American public has a bias against collective goods which even prevents its forming and expressing rational preferences on the economic aspects of any choice involving them. However, crowding, increased life expectancy, secular inflation, uneven progress and the resulting change in relative prices call for a reconsideration of the question of which goods and services should be provided collectively and which through the market. Given present control of man over his fellow man's beliefs, should consumers' preferences still be considered as datum, and even by this questionable standard the market economy performs badly for reasons not even considered in traditional analysis. The provision of water resources as a public good involving collective consumption decisions can be placed in the context of problems raised in this article. (Sokoloff-Rutgers)
W69-04083

ECONOMIC THEORY AND THE MEANING OF COMPETITION,
Columbia Univ., New York.
Paul J. McNulty.
Quart Jour Econ, Vol LXXXII, No 4, pp 639-656, Nov 1968. 18 p.

Descriptors: *Competition, *Monopoly, *Costs.
Identifiers: Uncertainty, Inefficiency, Allocative efficiency, Economic growth, *Market structure production techniques.

Competition entered economics as a concept which had empirical relevance and operational meaning in terms of contemporary business behavior. Yet today with such common current practices as advertising and product variation, this usual definition of competition has allowed us to avoid defining this concept, as distinct from the concept of competitive market, in a way relevant and adequate both for economic analysis and economic policy. It is one of the great paradoxes of economics that every act of competition on the part of a businessman is taken as evidence, in theory, of some degree of monopoly power. Perfect competition, the only clearly and rigorously defined concept of competition found in economic theory means simply the existence of an indefinitely large number of noncompeting firms. There was an unfortunate merging of the concepts of competition and the market. Competition was never related in any systematic way to the technique of production or the organizational form of the firm itself. Also this concept has never been related in a systematic way to costs of production. A new dimension has been suggested in recent years in the various efforts to develop a 'behavioral theory' of the firm. The general aspects of competitive behavior as it applies to the 'water industry' are the broad topics treated by this article which can be conceived as relevant to study in the water area. (Sokoloff-Rutgers)
W69-04084

REVISITING MARSHALL'S CONSTANCY OF MARGINAL UTILITY OF MONEY,
Vandervilt Univ., Nashville, Tenn.
Nicholas Georgescu-Roegen.
Southern Econ Jour, Vol XXXV, No 2, pp 176-181, Oct, 1968. 6 p, 3 fig.

Descriptors: Income, Prices, Demand, Expenditures.
Identifiers: *Consumers' surplus, *Quasi-constancy, Utility structure, *Marginal utility, *Money, Consumer budget.

This paper aims to show that it is possible to vindicate the constancy of marginal utility assumption of Marshall at least for his intuition of the economic reality of which he was a witness. The argument is based upon two omissions in the previous indictments of Marshall. The first omission concerns the fact that Marshall held that the marginal utility of money is quasi-constant and not a constant in the mathematical sense. The second concerns the fact that these indictments implicitly assume that the utility structure is such that in absolutely any situation the optimal budget includes every commodity available on the market. Marshall may not have intended to construct a theory applicable to all conceivable situations and there are good reasons in support of the view that the assumption of quasi-constancy of marginal utility of money fits an important category of incomes, the middle class incomes. Also Marshall's dream was to provide economics with concepts directly useful to numerical analysis even at the price of heroic simplification. Water recreation studies often utilize the area under the demand curve as a benefit measure. The constant utility of money assumption is vital to the correct measurement of this area and thus this article has relevancy to water studies using this approach. (Sokoloff-Rutgers)
W69-04086

A NOTE ON THE GLOBAL STABILITY OF A SIMPLE GROWTH MODEL WITH MANY CAPITAL GOODS,
Pennsylvania Univ., Philadelphia; Harvard Univ., Cambridge, Mass; Chicago Univ., Ill., and Osaka Univ. (Japan).
Edwin Burmeister, Rodney Dobell, and Kiyoshi Kuga.
Quart Jour Econ, Vol LXXXII, No 4, pp 657-665, Nov, 1968. 9 p.

Descriptors: Investment, Rent, *Stability.
Identifiers: *Capital goods, Dynamic efficiency, *Capital gains, Asset prices, *Balanced growth, Solow model.

This paper analyzes a model which is, in a sense, a multigood version of Solow's simple model. Its local stability was demonstrated by Burmeister and Dobell; the present analysis proves the global stability. The model supposes an institutional environment in which services of capital goods are rented, like those of labor. The point of the model is that it does permit any number of different capital goods, but assumes investment decisions independent of capital gains anticipated on resale equipment. The model is globally stable, converging to an unique balanced growth equilibrium path. The paper has theoretical relevancy to treatments of water investment functions and water production functions where water has multi-purpose users (i.e. water is a multi-good). (Sokoloff-Rutgers)
W69-04087

THE DUAL IN NONLINEAR PROGRAMMING AND ITS ECONOMIC INTERPRETATION,
City Univ. of New York; and Princeton Univ., N. J.
M. L. Balinski, and W. J. Baumol.
Rev Economic Studies, Vol XXXXV, No 103, pp 237-256, July 1968. 20 p, 11 fig, 15 ref.

Descriptors: Return to scale, *Linear programming, Optimization, Profit, Rent, Alternative costs.
Identifiers: Separating hyperplane theorem, *Nonlinear programming, *Dual problem, *Shadow prices, Lagrange multiplier, Capacity.

This article describes how the notion of duality can be extended to nonlinear programs, satisfying the appropriate concavity-convexity conditions. It provides a definition of this duality and describes its motivation. Several fundamental theorems are stated and proved, including the interpretation of the dual variable as a marginal input yield. The dual constraints are shown in economic terms to be the precise counterpart of those in linear programming, with marginal values substituted for average values throughout. The nonlinear objective function is shown to include, in addition to the value of the inputs, a set of terms corresponding to economic rents. The difference can be explained in terms of the 'adding up controversy' of distribution theory and its resolution in terms of linear homogeneous production functions. A graphic interpretation of the linear and nonlinear dual programs is also provided. This paper has relevancy to water production problems which utilize both linear and nonlinear constraints and objective functions. (Sokoloff-Rutgers)
W69-04088

CONTINUOUS AND DISCRETE TIME APPROACHES TO A MAXIMIZATION PROBLEM,
Chicago Univ., Ill.
L. G. Telser, and R. L. Graves.
Review Economic Studies, Vol XXXV, No 103, pp 307-325, July 1968. 19 p, 10 ref, 1 append.

Descriptors: *Dynamics, *Monopoly, *Time, Interest rate, Investment, Demand, Mathematical models, Capital, Prices, *Stability, *Growth rates.
Identifiers: *Discrete, *Continuous, Present value, Maximization, Coefficients, *Difference equations, *Differential equations.

This paper deals with a class of economic problems in which a firm seeks a maximum present value of its return over an infinite horizon at a given interest rate. The problem has two versions. The main concern is with a monopolist who seeks a present-value-maximizing sales policy in the face of a given demand function such that quantity demanded depends linearly on past and expected future prices. In the second version a firm determines its stock of capital over time so as to maximize the present value of its net return. Surprising differences appear for a given model in discrete and in continuous time. For example, in the monopoly problem a solution exists in continuous time if there is an upper limit on the discount rate while in the discrete version a solution exists for all discount rates above a lower limit. This paradoxical result as well as other differences between continuous and discrete time approaches have important economic interpretations in terms of treatment of expectations and uncertainty implicit in these two approaches. Dynamic problems of pricing and maximizing rate of return as it applies to 'water producers' are the relevant extensions of this article to the water area. (Sokoloff-Rutgers)
W69-04091

THE PLANNING-PROGRAMMING-BUILDING-BUDGETING SYSTEM,
Harvard Univ., Cambridge, Mass.
Arthur Smithies.
Am. Economist, Vol 12, No 1, pp 7-12, Spring 1968. 6 p.

Descriptors: *Decision making, *Planning, Budgeting, Cost-benefit analysis, Governments, Federal Government.
Identifiers: *Planning-Programming-Budgeting System, United States Department of Defense, Public goods.

The Planning-Programming-Building-Budgeting System is essentially an application and extension of the economics of choice to public decision making. It assumes that explicit choice among alternative courses of action leads to more rational decisions than other methods of decision making. PPBS is not a method of reaching definite conclusions. It is a method organizing discussion and marshalling evidence in a way that will lead to an effective advocacy procedure. Most economic theory and operations analysis start with the assumption of a given preference function or objective function and seek an optimum situation under it. However, within a broad general context, the objective function itself must be articulated and refined as part of the decision-making process. Government decision makers must be aware of the continual interaction between ends and means. The process of determining goals and deciding on methods of attaining

em are part of the same process. The public good oblems of water resources involving budget ex-nditures, social objectives, and alternative out-s of public funds can be considered as the rele-nt issues in water research that are treated in this per. (Winn-Rutgers)
69-04092

MPIRICAL EVIDENCE ON THE ACCELERA-ON PRINCIPLE: A COMMENT,
G. Hines.
v Econ Studies, No 103, pp 347-49, July 1968. 3

escriptors: Capital, Investment.
entifiers: *Acceleration principle.

is note points out that the capacity formulation the acceleration principle fails to meet one of the o major criticisms of the principle since it does t take into account gestation lags which cause a screpancy between planned and actual invest-nt in any given period. It shows that the simple stributed lag version, which is identical to the pacity formulation given the assumption that in-stment plans are always realized within the unit riod, also suffers from the same defect. On cer-n assumptions the capacity version of the ac-leration principle is empirically indistinguishable m other hypotheses. Thus, although Smyth has uted the view that statistical evidence is in-riably unfavorable to the acceleration principle, e evidence which he adduces in its support is also nsistent with other hypotheses. This article is evant to attempts at theoretical (or empirical) atments of the aggregative impacts that water in-stment expenditures have on the economy via an celerator analysis. (Winn-Rutgers)
69-04096

ME EFFECTS OF TAXES ON RISK TAKING,
ckholm Univ., (Sweden).
Naslund.
v Econ Studies, Vol 35, No 103, pp 289-306, y 1968. 18 p, 9 fig, 21 ref.

scriptors: *Taxes, *Risks, Investment, Decision king.
entifiers: Proportional taxes, Utility analysis, ance-constrained programming.

ce there are several formulations of stochastic gramming under risk in the literature, it is of in-est to include taxes in such models in order to d their effect on risk taking. Thus, a major part the paper is concerned with the chance-con-ained programming formulation of the decision blem under risk. This formulation maximizes expected value of the criterion function subject probabilistic constraints indicating the risk that decision maker is willing to take. It is shown t if an investor holds some part of his assets in form of money, then he will hold the risky as-s in fixed proportions that are independent of his alth and of his utility function. It is also shown t when an investor holds risky and non-risky as-s, then a linear tax will increase risk taking. ater problems involving risk and their possible utions via stochastic programming are potential ter oriented applications of the users discussed his article. (Winn-Rutgers)
69-04097

EGALOPOLIS: RESOURCE CONSERVER OR SOURCE WASTER,
ke Univ., Durham, N. C.
eph J. Spengler.
tural Resources Journal, Vol 7, No 3, pp 376-5, July 1967. 20 p.

scriptors: *Natural resources, Efficiencies, opulation, Stochastic processes, Productivity, riculture, Pollutants.
ntifiers: Leisure, *Traffic, *Parking space, Liv-space, Social costs, Megalopolis, *Optimum e.

This article indicates certain major disadvantages which become more intense as city size increases. Furthermore, it may be inquired whether technological and economic trends are making, as are changes in tastes, for greater urban population concentrations and city size, or for smaller ones. There are as yet no clear-cut answers to this question, but at least three indications seem to be emerging. First, optimum plant size appears to be decreasing somewhat as a result of automation. Second, improvements in systems of communication and in managerial practice probably are reducing the economies associated with the location of several plants in the same community. Third, the relative importance of manufacturing is declining and that of services is rising; as a result a larger fraction of the labor force is now free to locate at will than was true in the past. Should these trends materialize, some dispersal to smaller cities may result. However, urban growth could be given a more rational direction by imposing sufficient taxes upon business undertakings to insure their continuing self renewal and by imposing taxes at progressively higher rates when cities exceed a stipulated size. Urban water issues are among the general problems that this article discusses. (Sokoloff-Rutgers)
W69-04098

METROPOLITAN RESOURCES IN A POLICY MATRIX,
State University of New York, Albany.
Richard J. Kalish, and Donald J. Reeb.
Natural Resources Journal, Vol 8, No 3, pp 505-509, July 1968. 5 p, 1 fig.

Descriptors: Resources, Urbanization, *Community development, Taxes.
Identifiers: Megalopolis, Matrix of Regional Policy Tools.

Spengler has asked if we have reached a point in our larger cities where the diseconomies associated with existent or continued agglomeration outweigh possible economies. Spengler points out that the majority of urban growth-affecting decisions are made by individual decision makers who are primarily concerned with making economic profits. Since private business investment decisions are the most powerful of these decisions, taxes on business can be used to aid rational city growth. This article shows that this policy has certain weaknesses--those associated with defining the locus of taxes, the concept that taxes can be effectively used as penalty instruments and the implication that regional development strategies depend upon tax expenditures for effectuation. Alternative economic tools for regional development are illustrated by the Matrix of Regional Policy Tools. Regional water development issues of taxation, benefits, and expenditures are relevant to the issues raised in this paper. (Winn-Rutgers)
W69-04099

MEGALOPOLIZATION AND LEISURE: A COMMENT,
George Washington Univ., Washington, D. C.
Justin Voss.
Natural Resources Journal, Vol 8, No 3, pp 510-512, July 1968. 3 p.

Descriptors: Time, *Urbanization, Resources, Resource allocation, Supply.
Identifiers: *Leisure, Megalopolization, Discretionary time, Aggravation effect.

Spengler has implied that time and space are complementary goods. In this comment, the author notes that Spengler's analysis of time and space centers primarily on demand. However, the cause-effect relationship on the supply side appears more relevant in assessing the availability of the time resource within the megalopolis. By Spengler's definition megalopolization means a reduction in urban space per capita. As the supply of space declines, general congestion increases and creates an aggravation effect. Here the familiar problem of urban traffic congestion is generalized to include the waiting involved in all activities. Whether or not the megalopolis proves to be a resource waster or resource conserver depends primarily upon whether the responses to the aggravation effect are moving the society toward or away from an optimal use of resources. If the costs (time and other) of megalopolization are outrunning the benefits (multiplicity of choice) a rational society at some future date may demand alternative patterns of social and economic organization. Urban water problems fit into the general orientation of this paper with implications for water benefit-cost analyses. (Winn-Rutgers)
W69-04100

A TRANSFORMATION USED TO CIRCUMVENT THE PROBLEM OF AUTOCORRELATION,
University of Western Ontario, London.
Koteswara Rao Kadiyala.
Econometrica, Vol 36, No 1, pp 93-96, January 1968. 4 p, 9 ref.

Descriptors: Markov processes, Regression analysis, Efficiencies.
Identifiers: Transformation, *Autocorrelation, Autoregressive process.

In this paper it is shown that, when the disturbances epsilon sub t = y sub t - the sum of (X sub tj) (beta sub j) from j = 1 to K in a regression model follow a first order autoregressive process with the parapeter p generating the process, there exist cases where the classical least squares regression analysis is applied to the n-1 observations: y sub t - py sub t-1, x sub tj - px sub t-1, j (j = 1, 2, ... , K; t = 2, ... , n), is less efficient than the classical least squares regression analysis as applied to the original n observations: y sub t, X sub tj (t = 1, ..., n). It is shown that the efficiency of the former could be arbitrarily close to zero in some cases. Water simulation studies often involve autoregressive stochastic terms and the conclusions of this article are relevant to empirical water studies where this problem arises. (Loeb-Rutgers)
W69-04101

PARAMETERS AND RELATIONS OF STOCHASTICALLY LAGGED AND DISAGGREGATIVE TIME SERIES,
Northwestern Univ., Evanston, Ill.
Haskel Benishay.
Econometrica, Vol 36, No 1, pp 155-171, January 1968. 17 p, 8 ref.

Descriptors: Stochastic processes, *Time series analysis, Inflow.
Identifiers: Parameter, Stock, Outflow, Stochastic lag, Random number, Subcomponent, Serial correlation.

A new approach is employed to construct the first of several models to describe a process consisting of three related time series; an inflow, a stock, and an outflow. The inflow, stock, and outflow series are related via a stochastic lag applicable to subcomponents of the inflow series. All three series are viewed as cumulations of a random number of subcomponents of randomly determined size. The exogenous variables of this model are (1) the number of subcomponents of the inflow, (2) the size of a subcomponent, (3) the life of a subcomponent. In this first model these exogenous variables are assumed naturally independent during an interval or a point in time and serially independent over time. In subsequent analyses some of these independent assumptions are relaxed. Among the interesting results are some relevant serial and cross serial correlations of the time series under consideration. These relations and others make it possible to evaluate the comparative advantage of lead series in forecasting lag series, and as such may be of value for the evaluation of stabilization policies. The model may be viewed as a description of several inflow-stock-outflow phenomena. This article is relevant to water simulation studies involving use of water flows, stocks and flow forecasts. (Loeb-Rutgers)

W69-04102

THE DECOMPOSITION OF ECONOMIC PRODUCTION SYSTEMS,
Chicago Univ., Ill. School of Business.
Roman L. Weil, Jr.
Econometrica, Vol 36, No 2, pp 260-78, April 1968. 19 p, 22 ref.

Descriptors: Input-output analysis, Leontief models.
Identifiers: *Production systems, *Decomposition, Tearing, Goods, Processes, Subeconomies, Decomposable economy, Equivalence classes.

Economic production systems may break up into subeconomies of goods and processes that can function independently of each other. This article first explores the various kinds of decompositions that may exist in production schemes, nonlinear as well as linear. Some recent techniques developed in graph theory are adopted to ascertain the decompositions possible for a given production system and the precedence relations between the subeconomies of the decomposition. Finally, it is shown how the concept of 'tearing' from simultaneous equations theory might be used to analyze square input-output models for potential decompositions. The integration of water into a general model of the interrelations among the various producing sectors of the economy is a useful extension of this article to the water resource area. (Loeb-Rutgers)
W69-04103

A NOTE ON PUBLIC GOODS SUPPLY,
Virginia Univ., Charlottesville; and Florida Univ., Gainesville.
James M. Buchanan, and Milton Z. Kafoglis.
Amer Econ Rev, Vol LIII, No 3, pp 403-414, June 1963. 12 p, 3 fig, 7 ref.

Descriptors: Equilibrium.
Identifiers: *Externality, *Pareto optimality, Marginal conditions, Payoff matrix, *Resource inputs, Game theory, *Non-reciprocal.

Independent or market organization of an activity that is acknowledged to embody relevant external economies need not result in an under-supply of aggregate resource inputs, relative to that amount required to satisfy the necessary marginal conditions for Pareto-optimality. In the first model where non-reciprocal external economies are present, it is necessary to distinguish between units of resources supplied and units of final output that may be consumed. The direct relationship between inputs and outputs is modified when some inter-personal substitutability in consumption is allowed. The word 'economies' suggests that a greater quantity of final output can be achieved with a given quantity of resource inputs when these economies are exploited. In the case of reciprocal externality there is a smaller total outlay on the service with either a larger or smaller total quantity being consumed. Insofar as the utilization of inputs is characterized by relevant external economies which stand in a substitute relationship the individual can under cooperative or collective arrangements, in one sense, 'purchase' the consumption of others. The public good aspect of water resources makes this article applicable to theoretical investigations of the externality issues of water. (Sokoloff-Rutgers)
W69-04104

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

EARMARKED TAXES AND MAJORITY RULE BUDGETARY PROCESS,
Virginia Polytechnic Inst., Blacksberg, Va.
Charles J. Goetz.
American Econ Rev, Vol 58, No 1, pp 128-136, March 1968. 9 p, 2 tab, 10 ref.

Descriptors: *Taxes, Government finance, Budgeting, Political aspects, Financing, Welfare economics.
Identifiers: *Earmarked taxes, Majority rule, *General funds budgeting.

Under certain conditions, the only possible budgetary adjustments which yield majority gains may require logrolling between members of the majority coalition on tax adjustment. General funds budgeting is a suboptimization process which renders cooperation between faction unlikely. By contrast, earmarking provides an enforceable 'tie-in' between tax concessions and expenditure concessions which may be necessary to construct a tax-and-expenditure package with net benefits for a majority of the voters in the budgetary process. The welfare implications of earmarking must be interpreted with caution since majority gains must be compared with minority losses. However, it is possible to explain earmarking's common usage as a perfectly rational device for coalition formation in a budgetary model where preference conflict exists. Important issues involving the relation of taxation, benefits and budget expenditures for water resource development are involved in the extension of this article to water studies. (Winn-Rutgers)
W69-04067

A SIMPLE MACROECONOMIC MODEL WITH A GOVERNMENT BUDGET RESTRAINT,
Johns Hopkins Univ., Baltimore, Md.
Carl F. Christ.
Jour Pol Econ, Vol 76, No 1, pp 53-67, Jan/Feb 1968. 15 p, 4 tab, 8 ref.

Descriptors: Equilibrium, Budgeting, Expenditures, *Tax rate.
Identifiers: Money issue, Monetary policy, High powered money, *Budget restraint, *Fiscal policy *Multiplier effect.

There is a government budget restraint, which requires that in each period total government expenditure (transfers plus purchases of goods and services) be equal to the total flow of financing from all sources (including fiat money). This is a constraint upon the government's freedom to choose arbitrary values of such policy variables as expenditures, taxes, net amount of new money issued, and net amount borrowed from the private sector. The government budget restraint is introduced into a simple theoretical static macroeconomic model of aggregate demand with a rigid price level to show how the analysis of macroeconomic policies is affected by the budget restraint. It is shown that the multiplier effect of a change in government purchases cannot be defined until it is decided how to finance the purchases. The one-year impact multiplier effect and the long-run multiplier effect of government purchases may be greater or less than the value obtained by ignoring the budget restraint, depending upon the method of financing. This article has relevance for governmental expenditure decisions in water resources. (Sokoloff-Rutgers)
W69-04069

A NOTE ON THE SYMMETRY BETWEEN BRIBES AND CHARGES,
Purdue Univ., Lafayette, Ind.
Charles R. Plott, and Stuart Mestelman.
Water Resources Research, Vol 4, No 1, pp 195-197, February 1968. 3 p, 3 ref.

Descriptors: Taxes.
Identifiers: *Symmetry, *Bribes, *Charges, Bribe method, *Externalities, Optimum output, Asymmetries.

It has been argued that within a dynamic setting, without complete information, the tax and bribe methods of correcting externalities give asymmetrical results. A model is presented which shows that the bribe under such conditions yields optimal results, whereas the tax alternative does not. This conclusion is the opposite of that drawn from other models advanced in the literature. It cannot be said that within such a setting one policy is better than the other, since all such conclusions depend upon the particular characteristics of each model. The problems of externalities and individual compensation in water resources are an oft-cited defense of the public-good aspect of water. This article has relevancy to theoretical treatments of compensation and taxation in water resources that generate externalities. (Loeb-Rutgers)
W69-04071

INCOME DISTRIBUTION AND GROWTH IN A MONOPOLIST ECONOMY,
Osaka Univ., (Japan).
Hiroshi Atsumi, and Hukukane Nikaido.
Zeitschrift Fur Nationalokonomie, Vol 28, No 3-4, pp 399-416, Aug-Dec 1968. 18 p, 7 fig, 3 ref.

Descriptors: Stability, *Labor supply, Capital supply, *Wages.
Identifiers: *Income distribution, *Steady growth state, Production function, Partial equilibrium analysis, Interdependence.

In sharp contrast to our fairly satisfactory knowledge about the mechanisms of income distribution under competitive pricing, there is no competent counterpart knowledge about noncompetitive situations. One reason for this may be that it is generally difficult to obtain a well-posed interrelations between all economic agent's shares to national income in a noncompetitive situation. In order to build a theory of income distribution in a noncompetitive economy, it is necessary either to explore the submerged part of the existing oligopoly theory--the interdependence of the relevant perceived demand functions or to invent alternative constructions replacing demand and supply functions. There is an exceptional case which can be met with the existing analytical machinery. This is the counterpart case under monopolistic pricing of the Solovian neoclassical growth. The principle concern of the paper is to consider income distribution and growth in this counterpart situation, including comparison of the long-run equilibrium real wage rate under monopolistic pricing and under competitive pricing. Pricing, distribution and supply problems in the non-competitive water industry are the implicit theoretical problems involved in this paper for water resources. (Sokoloff-Rutgers)
W69-04072

A NOTE ON A LOCATION PRINCIPLE,
Hunter College, New York.
Peter C. Rydell.
Journal of Regional Science, Vol 7, No 2, pp 185-192, Winter 1967. 8 p, 1 fig, 4 ref, append.

Descriptors: *Sites, Costs, *Pricing, Discriminatory pricing, Profits.
Identifiers: *Location principles, Delivery costs, Uniform delivered pricing, F.O.B. pricing, Principle of median location.

The principle of median location states that to minimize delivery costs a manufacturer must locate at the median of the distribution to his customers. When the delivery cost function is not linear or when consumers buy unequal amounts of the manufacturer's product, the principle of median location fails to apply. In a linear region with a unimodal distribution of consumers, a concave delivery cost function makes a manufacturer's optimal location lie between the median and mode of the distribution of consumers. This 'between the median and mode' location principle applies to three types of location problems: (1) locating to minimize the costs of distributing an equal amount of the product to each consumer in the region; (2) locating to maximize profits under a policy of spatial price discrimination; and (3) locating to maximize profits after choosing between uniform delivered and F.O.B. pricing. The relation of water cost to physical distance makes this article relevant to water pricing and supply problems. (Winn-Rutgers)

W69-04095

THE LONG-RUN COST FUNCTION OF WATER PRODUCTION FOR SELECTED WISCONSIN COMMUNITIES,
Dartmouth Coll., Hanover, N. H.
Lawrence G. Hines.
Land Economics, Vol 45, No 1, pp 133-140, Feb 1969. 8 p, 1 tab, 8 ref.

Descriptors: *Statistical methods, Least squares method, Surface waters, Subsurface waters.
Identifiers: *Wisconsin, Time-series analysis, *Cross-sectional analysis.

The empirical measurement of long run costs involves either: (1) time series analysis of single firm; or (2) cross-sectional analysis of a number of various sized firms in a given time period. The inability to measure size is a serious deficiency in the long-run study. The technology of today's water production is similar to that of fifty years ago. Water produced from an underground supply involves larger pumping and drilling costs, while treatment and reservoir costs are usually more important in water from surface sources. The production and distribution of water involves the collection, treatment, and distribution of water. The greatest diversity of unit cost is in the distribution of water. This study compiled a series of regression equations on cost-capacity-output of Wisconsin water production. The analysis was of cross-sectional data. The conclusion states that the general hypothesis of constant cost in surface water production is statistically rejected. (Grossman-Rutgers)
W69-04136

DYNAMIC PROGRAMMING FOR PROJECT COST-TIME CURVES,
California Univ., Los Angeles.
William S. Butcher.
Proc Amer Soc Civil Eng, Vol 93, No CO1, pp 59-73, Mar 1967. 15 p, 11 fig, 4 tab, 7 ref.

Descriptors: *Dynamic programming, Decision making, Cost allocation, *Project planning, Computer programs, Networks, Time, Optimization, Critical path method.
Identifiers: Time-cost function.

A dynamic programming approach was used to solve for the minimum project time versus total cost function, when the project was completed in sequential operations with each operation having an independent time-cost function. The decision variables were the amounts of money allocated to each stage of the project. A hypothetical three-stage project was solved in tabular form. The logic flow diagram for the computer program was shown. The method for simplifying parallel loops in a planning network so that the dynamic programming method can be applied was described, and a hypothetical example solved. It was concluded that the technique was applicable to simple project planning networks without inverval cross-connections. (Gysi-Cornell)
W69-04137

A CAPACITY EXPANSION PLANNING MODEL FOR MUNICIPAL WATER SUPPLY SYSTEMS,
Harvard Univ., Cambridge, Mass.
For primary bibliographic entry see Field 06D.
For abstract, see .
W69-04145

OPTIMAL WATER QUALITY MANAGEMENT AND MULTI-COMPONENT EFFLUENT CONTROL BY MEANS OF LINEAR PROGRAMMING,
For primary bibliographic entry see Field 05D.
For abstract, see .
W69-04147

VERTICAL ALIGNMENT OF SEWER AND DRAINAGE SYSTEMS BY DYNAMIC PROGRAMMING,
Massachusetts Inst. of Tech., Cambridge, Mass.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-04150

6D. Water Demand

MEETING TOMORROW'S ELECTRIC POWER NEEDS--NEW METHODS, NEW CONCEPTS,
Pacific Gas and Electric Co., San Francisco, Calif.
Robert H. Gerdes.
Pap, World Power Conf, Aug 1968. 19 p, 3 fig, 2 ref.

Descriptors: *Electric power, Peak power, Thermal power, Magnetohydrodynamics, *Electric power demand, *Electric power production, Electric power costs, Cooling water, Nuclear energy, Radioactivity, Research and development, Magnetic fields.
Identifiers: Fuel costs, Fossil fuels, *Thermoelectric generators, *Electrogasdynamics, Nuclear power, Geothermal powerplants.

The United States' electric power industry must increase 6-fold in the next 32 yr to meet the expected growth in electric energy use. To assure the soundest possible basis for the continued growth of the industry, new methods and concepts for power generation are being investigated. Nuclear power is dominating the industry's plans for new generation, and new methods are being developed. Nuclear magnetohydrodynamic (MHD) generators may require extensive development in reactors. Fossil-fueled MHD generators may be close to reality and appear economically attractive for peaking. Electrogasdynamic (EGD) generators would require virtually no cooling water and, theoretically, should have high thermal efficiencies, but the application of EGD generators to power systems awaits the development of an efficient EGD generator. Geothermal generation using natural steam from wells is an excellent power source in those limited areas where it is available. The United States' electric power industry is confident that it can provide reliable low-cost electricity to meet the growing needs of society with the methods discussed and with methods not yet conceived. (USBR)
W69-03770

LONG-RANGE HYDROELECTRIC POWER USE DESCRIBED,
A. A. Beschinskiy, and A. A. Borovoy.
Joint Publ Res Serv, Pap 46559, Sept 1968. 19 p, 4 tab.

Descriptors: *Long-term planning, Planning, *Hydroelectric power, Hydroelectric plants, *Multiple-purpose projects, Irrigation, Economics, Flood control, River regulation, Natural resources, Thermal power, River basin development, Electric power production, Foreign countries, Costs, Electric power demand, Transmission (Electrical), Electric power costs.
Identifiers: *Hydroelectric resources, *USSR, Load centers, Power system stability.

The planned use of the enormous hydropower resources is a major factor in creating and developing a large power base in the USSR and in the consistent and effective electrification of the national economy. The nation's potential and developed hydropower is reviewed, and problems of the dependability and stability of large interconnected systems discussed. Demands for water control and water power engineering in the USSR are being solved by building cascades of reservoirs to rationally regulate, and on lower reservoirs, reregulate river runoff in the best interests of all participants. Multiple-purpose projects and long-distance transmission of power from remote hydroelectric sites to industrial areas are considered in the power planning economy. (USBR)
W69-03780

WATER AND CHOICE IN THE COLORADO BASIN,
National Academy of Sciences-National Research Council, Washington, D. C. Committee on Water.
Gilbert F. White.
Nat Res Counc, Publ 1689, Washington, D. C., 1968. 107 p, 7 fig, 2 tab, 76 ref.

Descriptors: *Water resources, *Colorado River Basin, Colorado River, *Water management (Applied), *Arizona, Water conservation, Water costs, Water law, Arid lands, Water quality, Water policy, *Water, *Water shortage, Water transfer, Water utilization, Economics, Water resources development, Economic efficiency, Bibliographies.
Identifiers: *Substitutes, National Research Council, Committee on Water, *Regional planning, Water plans, *Water resources management.

The Committee on Water of the National Research Council gives its attention principally to water problems and management in the Colorado River Basin as a means of providing a concrete example of the general suggestions presented in their earlier report, 'Alternatives in Water Management.' Water management is only one of the major fields where a substantial investment may prove beneficial to a regional economy. For purposes of illustration in this context, the Committee has chosen the State of Arizona. Chapter 5 is devoted to several alternative fields for investment in regional economic development that could be at least equally beneficial. This chapter suggests that the choice with respect to water management programs is in 2 dimensions: (1) between water programs and other programs, and (2) between alternative water management programs. Chapter headings for other areas of discussion include: Problems of Water Supply in the Basin, The Range of Objectives in Planning for the Use of Colorado Water, and On the Enhancement of Choice. (USBR)
W69-03785

LAW OF THE RIVER,
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-03801

ALLOCATIONS, DIVERSIONS, AND RELEASES.
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-03920

WATER REQUIREMENTS OF THE IRON AND STEEL INDUSTRY,
Geological Survey, Washington, D. C.
Faulkner B. Walling, and Louis E. Otts, Jr.
Geol Surv Water-Supply Pap 1330-H, pp 341-394, 1967. 53 p, 4 fig, 1 plate, 8 tab, 86 ref.

Descriptors: *Water requirements, *Industrial water, *Thermal pollution, Water cooling, Intakes, Mine wastes, Water consumption, Water utilization.
Identifiers: *Iron and steel industry, Gross water use.

To help assure adequate management of water supplies of present and future industrial areas, water requirement data from a series of field surveys of iron and steel plants are presented. Principally for cooling purposes, gross water use in integrated steel plants ranged from 11,200 to 110,000 gal/ton of steel ingots, and in steel processing plants from 4,180 to 26,700 gal/ton. Fifteen iron ore mines and 15 ore concentration plants together withdrew annually about 89,000 million gal to produce 15 million tons of iron ore concentrate, or 5,900 gal/ton of concentrate. Surface-water sources accounted for about 97% of the water used; reclaimed sewerage and ground water, the rest. Reuse in the iron ore industry, and treatment of water for use in the iron and steel industry were not widely practiced. The quality of available water was found not to be a critical factor in selecting sites for steel plants. (Llaverias-USGS)
W69-03965

WATER RESOURCES OF THE MARQUETTE IRON RANGE AREA, MICHIGAN,
Geological Survey, Washington, D. C.
S. W. Wiitala, T. G. Newport, and E. L. Skinner.
Geol Surv Water-Supply Pap 1842, 1967. 142 p, 40 fig, 4 plate, 24 tab, 27 ref.

Descriptors: *Water resources development, *Benefication, *Surface groundwater relationships, Michigan, Groundwater, Industries, Natural flow, Geology, Discharge (Water), Recharge, Hydroelectric power.
Identifiers: *Marquette Iron Range area, *Escanaba River.

Water data are summarized on present availability of water, future potential, and other elements relating to the water resources. Benefication and pelletizing processes in the iron and steel industry require large quantities of water, and the best potential sources for immediate development are inland lakes and streams. The natural flow available is about 190 cfs, but the development of storage sites could increase this amount to about 450 cfs. Extensive outwash deposits, the best sources of groundwater, could also be developed. For most uses, the chemical quality of the surface and groundwaters is generally acceptable. Some management problems discussed are time distribution of available water supplies, distribution of water to points of use, effect of surface-water development upon groundwater, and possible conflicts with competing uses. (Llaverias-USGS)
W69-03971

GEOLOGY AND GROUNDWATER RESOURCES OF THE BIG SANDY CREEK VALLEY, LINCOLN, CHEYENNE, AND KIOWA COUNTIES, COLORADO,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02F.
For abstract, see .
W69-03974

WATER RESOURCES OF JACKSON AND INDEPENDENCE COUNTIES, ARKANSAS,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02F.
For abstract, see .
W69-03976

MAN AND HIS WATER RESOURCE,
Utah State Univ., Logan.
Dean F. Peterson.
32nd Faculty Honor Lecture, Utah State University, Feb 1966, 43 p, 3 fig, 1 photo, 12 ref.

Descriptors: *Pollution control, *Water resources development, *Research and development, *Institutional arrangements, *Water policy, Consumptive use, Water desalting, Cloud seeding, Water transfer.
Identifiers: Adaptation of environment, National water objectives.

Today, as in earliest civilization, growth is dependent upon overcoming a water-restricted environment and developing the water resource. Water institutions and policy problems are extremely important to our economic and racial future. Except for irrigation, actual consumptive use of water in the United States, is only about three per cent of all withdrawals. The author contends that the central problem in water resource management is therefore quality and not quantity. He further contends that on a national scale regional shortages may be reduced by such action as long-distance transfers, desalting and rainmaking and that the greatest benefits will accrue through improved planning and by pollution control. Adaptation of man's environment rather than dependence upon technological advances is proposed as a more efficacious approach to problem solving. While continuing research is needed in the physical and behavioral sciences, the author proposed that there is an even broader obligation -- the need for the intellectual community to evaluate and criticize the overall problem. Establishing national objectives rather than just trying to provide a sufficient supply of water is seen as needing the highest priority. (Starr-Chicago)
W69-04035

CREEKS, BROOKS AND RIVERS IN ROCKLAND COUNTY, NEW YORK AND THEIR RELATION TO PLANNING FOR THE FUTURE,
Geological Survey, Washington, D. C.
Gordon R. Ayer, and F. H. Pauszek.
New York State Dept. of Commerce, Bulletin No. 6, 1963, 140 p, 36 fig, 2 map, 4 photo, 50 tab, 11 ref, 1 append.

Descriptors: *Water quality, *Water supply, Human population, *Streams, *Rivers, Recreational demand, Usable storage, Pollution abatement, Drainage patterns, Flood control, Sediment load, Water temperature, Alteration of flow, Urbanization, Hardness (Water).
Identifiers: Industrial growth.

The report defines the quality and quantity of water resources available to Rockland County. Water supply is a future problem, since the population is increasing, industries are growing, and the demand for water recreation is widening. The report recommends additional storage of surface water to make a larger part of the streamflow available for use. Present problems include pollution abatement, drainage, and flood control. Drainage basin characteristics and water quality are discussed for each creek, brook, and river in the county. In general, the chemical quality of the surface water is satisfactory for many uses; but, for use as a public water supply, the level of dissolved solids must be reduced. The sediment load, a problem of moderate magnitude, and the temperatures of some streams are determined. Streamflow variability because of precipitation, geography, and man's regulation is described for major streams over a two-year period. Future problems caused by highway construction, urbanization, pollution, and changes in streamflow regimen are discussed. It is impossible to prescribe definite solutions for these problems because of the time scope of the study. (Gossen-Chicago)
W69-04036

WATER PROBLEMS IN THE NORTHEAST AND INCREASING FEDERAL REGULATION,
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-04052

ALTERNATIVE WATER DEMANDS AND THE ADEQUACY OF PRESENT ARRANGEMENTS,
North Carolina Univ., Chapel Hill. Inst. of Government.
Milson S. Heath, Jr.
Water Resources and Economic Development in the South, Agr. Policy Inst., North Carolina State University, pp 53-65, Aug, 1965. 13 p, 3 ref, 1 append.

Descriptors: Waste disposal, *Riparian rights, *City planning, Irrigation, *Legislation.
Identifiers: North Carolina, *Agricultural economics.

This paper is a progress report of a research project being carried out by the author. The research was done in the fields of agricultural economics, water rights law and regional water and sewer services. The following are the principal units of study of the project which this paper summarized: Industrial water use, municipal water supply, city and regional planning, irrigation, water recreation, water rights law, valuation of water in competing uses, public utility law, and ground water contamination. This paper also includes some conclusions of the author's project. (Grossman-Rutgers)
W69-04058

ESTIMATING DEMAND EQUATIONS,
Louvain Univ. (Belgium).
A. P. Barten.
Econometrica, Vol 36, No 2, pp 213-251, April 1968. 39 p, 10 tab, 18 ref, 2 append.

Descriptors: *Demand, Estimating, Income, Prices, Elasticity of demand.
Identifiers: *Demand equations, Restrictions, Nonlinear, Random shocks, Stochastic component, Interdependence, Systematic factors.

Attempts to estimate demand equations can, roughly, be classified into two groups. To the first group belong those studies which concentrate on an empirically acceptable explanation of demand for individual commodities, while the overall relationships between the quantities demanded of all commodities in the budget remain in the background. The second group of studies is chiefly concerned with the allocation aspect of consumer demand and has complete systems of demand equations as its object. The overall restrictions on demand equations provided by the theory of consumers' choice play a dominant role in these studies. This article belongs to the second group. It considers a complete system of demand equations with coefficients which satisfy the theoretical restrictions in an exact way. The estimation of these coefficients is complicated by the nonlinear nature of the restrictions and the interdependence between the equations. These difficulties are shown not to be insurmountable. This article is relevant for attempts to integrate the water commodity into a complete system of demand equations. (Loeb-Rutgers)
W69-04062

THE LINEAR AGGREGATION COEFFICIENT AS THE DUAL OF THE LINEAR CORRELATION COEFFICIENT,
Carnegie-Mellon Univ., Pittsburgh, Pa.
Yuji Ijiri.
Econometrica, Vol 36, No 2, pp 252-259, April 1968. 8 p, 32 ref.

Descriptors: *Aggregates, Leontief models.
Identifiers: *Linear aggregation coefficient, *Linear correlation coefficient, Aggregation, Degree of perfectness, Variance.

In this paper the linear aggregation coefficient is defined as a measure of the degree of perfectness of a linear aggregation function with respect to a given basic function, and its properties are analyzed in relation to its dual, the linear correlation coefficient. Implicit in estimated water demand functions (e.g. the demand for water recreation) and water industry production functions is the aggregation problem in econometrics and the linear aggregation coefficient suggested by this paper is relevant to empirical water studies where underlying functions are present. (Loeb-Rutgers)
W69-04063

POOLING OF TIME SERIES AND CROSS SECTION DATA,
Columbia Univ., New York.
V. K. Chetty.
Econometrica, Vol 36, No 2, pp 279-290, April 1968. 12 p, 2 fig, 21 ref.

Descriptors: Time series analysis, Regression analysis.
Identifiers: *Pooling, Time series, Cross section data, Bayesian analysis, Standard error, Statistical demand function, Certainty.

Estimates of parameters from cross section data are often introduced into time series regression as known with certainty, which leads to conditional estimates of the time series regression. This paper develops a method of pooling cross section and time series data from the Bayesian point of view, to estimate all the parameters simultaneously. It is shown that the parameters which are common to both the regressions will have on the average sharper posterior distributions. It is also demon-

strated that the traditional method often leads to underestimates of the standard errors of the time series estimates. The method is applied to estimate the statistical demand function for the U S based on cross section and time series data given in J. Tobin's, 'A Statistical Demand Function for Food in the USA.' The pooling technique of cross section and time series data is a relevant approach to estimating water demand functions and accordingly this modification in this technique suggested by this paper has equivalent applications in empirical studies of water demand. (Loeb-Rutgers)
W69-04066

NORMALLY, FACTOR INPUTS ARE NEVER GROSS SUBSTITUTES,
Illinois Univ., Urbana; and Washington Univ., St. Louis, Mo.
Trout Rader.
Jour Pol Econ, Vol 76, No 1, pp 38-43, Jan/Feb, 1968. 6 p, 11 ref.

Descriptors: *Marginal productivity, Returns to scale, Stability, Profit.
Identifiers: *Factor input, *Gross complements, *Gross substitutes, Maximization, General equilibrium, Production function, Concavity.

If increases in one factor increase the marginal productivity of other factors, the demand for factors by competitive firms always displays complementarity between the factors. Increases in one factor price always decrease demands for other factors. On the other factors increases relative to the factor whose price increases. Multivariate functions of the water production process are the relevant theoretical applications of this paper for water resource problems. (Sokoloff-Rutgers)
W69-04073

'INFERIOR FACTORS' AND THE THEORIES OF PRODUCTION AND INPUT DEMAND,
Michigan State Univ., East Lansing, Mich.
C. E. Ferguson.
Economica, New Series, Vol XXXXV, No 138, pp 140-150, May 1968. 1 p.

Descriptors: Prices, Elasticity of demand, Marginal costs, Profits.
Identifiers: *Input demand function, Imperfect competition, Input price, Production function, *Inferior factor, Maximization.

Let p denote commodity price and p (sub i) the parametric market price of the ith input used in producing the commodity. In a previous paper Ferguson proved that in general the sign of the partial derivative of p with respect to p (sub i) is indeterminant, even though a positive relation is normally expected. An inverse relation between commodity and factor prices can exist if, and only if, the input in question is 'inferior.' An input is inferior if an increase in its price leads to an increase in the equilibrium output of the firm. The following propositions are proved in the paper. A factor can be inferior only for a certain range of output; no inferior factors can exist if the Hessian of the production function contains only negative elements on the principal diagonal and negative elements elsewhere; for an inferior input the weighted sum of input demand cross elasticities is positive; the marginal cost of output varies inversely with the price of an inferior input. The concluding section points out the dangers of drawing graphical analogies between the theories of consumer and producer behavior. Industry water production functions which may involve 'inferior' inputs in some stages of production are involved in the arguments stated in this paper. (Sokoloff-Rutgers)
W69-04074

SAVING AND UNCERTAINTY: THE PRECAUTIONARY DEMAND FOR SAVING,
Harvard Univ., Cambridge, Mass; and Stanford Univ., Palo Alto, Calif.
Hayne E. Leland.
Quart Jour Econ, Vol 82, No 3, pp 465-473, August 1968. 9 p.

Descriptors: Risks, Income, Probability.
Identifiers: *Saving, Precautionary demand for saving, Future income, Risk aversion, Utility function, Consumption.

The paper considers a two period model of consumption. Income in the first period is known. A subjective probability distribution for income in the second period is also known. The consumer must determine his consumption for the first period before he knows the actual value of his second period income. The author is interested in the level of saving as future income becomes more uncertain about a given expected value. It is shown that risk aversion alone is insufficient to guarantee a positive precautionary demand for saving. But additional assumptions on certain risk properties of the utility functions, assumptions which would seem to have considerable intuitive and empirical support, are introduced to guarantee the positive effect of uncertainty on saving. A section is devoted to the important implications the theoretical results may have on the theory and estimation of the consumption function. This article has relevance to water demand estimation that is treated in a consumption function framework. (Loeb-Rutgers)
W69-04077

COMPETITIVE EQUILIBRIUM UNDER UNCERTAINTY,
California Univ., Berkeley.
Roy Radner.
Econometrica, Vol 36, No 1, pp 31-58, January 1968. 28 p, 2 tab, 7 ref.

Descriptors: Equilibrium, *Risks.
Identifiers: Nonconvexities, Information, Liquidity, Spot market, Neoclassical theory, Pareto optimum, Competitive equilibrium, Consumer.

This paper explores how far one can go in applying the modern theory of competitive equilibrium to the case of uncertainty. In the first part, the analyses of Arrow and Debreu are extended to the case in which different economic agents may have different information about the environment. The second part deals with the limitations of the Arrow-Debreu type of model, and discusses the difficulties associated with nonconvexities in the production of information, with information generated by spot markets, and with limitations on the computational capacities of economic agents. It is argued that the demand for liquidity arises from the last two phenomena, and thus does not appear to be amenable to analysis of the 'neoclassical' theory of competitive equilibrium. The issues raised in this paper are applicable to water demand and supply models that involve uncertainty of information. (Loeb-Rutgers)
W69-04078

THEORY OF CONSUMER BEHAVIOR WHEN PRICES ENTER THE UTILITY FUNCTION,
Purdue Univ., Lafayette, Ind.; and State Univ., of New York, Stoney Brook.
Peter Jason Kalman.
Econometrica, Vol 36, No 3-4, pp 479-510, July-October 1968. 14 p, 1 fig, 11 ref.

Descriptors: Prices.
Identifiers: Consumer behavior, Utility function, Generalized Slutsky equation, Commodities, Restrictions, Comparative statics.

In this paper, an extension of the theory of consumer behavior to cover situations when prices enter the utility function is considered. In Section 1 and 2 the author formulates the problem and derives a generalized Slutsky equation where the traditional Slutsky equation is a special case. He investigates the class of utility functions that yield homogeneous of degree zero demand functions in prices and income and also states that these do not exist for a certain class of utility functions. He than establishes theorems on 'substitutable' and 'complementary' commodities which are not, in general, valid for the traditional theory. Finally, a set of qualitative restrictions on demand functions is deduced, of which a subset is identical to the traditional restrictions. Water demand analyses involving underlying utility functions that contain price variables can be conceived as a behavior situation treated in this paper. (Loeb-Rutgers)
W69-04079

A NOTE ON THE DIFFERENTIABILITY OF CONSUMER DEMAND FUNCTIONS,
Pennsylvania Univ., Philadelphia.
Donald W. Katzner.
Econometrica, Vol 36, No 2, pp 415-418, April 1968. 4 p, 1 fig, 4 ref.

Descriptors: *Demand.
Identifiers: Differentiability, Consumer demand functions, Utility functions, Necessary condition, Sufficient condition.

An example of a twice, continuously, differentiable utility function whose generated demand functions are not differentiable everywhere is given, along with necessary and sufficient conditions for such differentiability. Utility functions are implicit in water market demand analyses and the particular category of utility functions presented here may have relevance in water studies. (Loeb-Rutgers)
W69-04080

ON PERVERSE CONSUMPTION PATTERNS,
Bruno Trezza.
L'Industria, Vol 102, No 3, pp 357-362, July-Sept 1968. 6 p, 2 fig.

Descriptors: *Growth rates, *Interest rate, *Consumption use.
Identifiers: Real wage, *Steady state, Monotonic, Techniques, Production function, *Reswitching, Marginal propensity to consume.

In their recent paper Bruno, Burmeister and Sheshinki have shown that in a steady state there may exist 'a perverse case in which a low interest rate is not always associated with high consumption' even without reswitching of techniques. They further add that conditions preventing reswitching between any pairs of techniques, which are overly strong to preclude reswitching of techniques on the outer envelope, may be necessary if monotonicity of per capita consumption as a function of the interest rate is to be preserved. In this paper it is shown that the above conjecture is incorrect insofar as it holds only for special values of the steady rate of growth. If the stationary state is abandoned nothing in general can be said about the relation between the rate of interest and per capita consumption even when a monotonic relation is assumed to exist between the rate of interest and the rate of growth. If a Kaldorian saving function is now added to the model the relation between per capita consumption and the rate of interest becomes negatively monotonic. Theoretical water consumption analyses could be involved with certain problems presented in this paper, in particular water production processes related to interest rate phenomena may be relevant. (Sokoloff-Rutgers)
W69-04089

AN INPUT-OUTPUT SYSTEM INVOLVING NON-TRANSFERABLE GOODS,
Osaka Univ. (Japan); and Kobe Univ. (Japan).
Michio Morishima, and Yasuo Murata.
Econometrica, Vol 36, No 1, pp 71-92, January 1968. 22 p, 14 ref.

Descriptors: Durability, Interest rate, Profit, Wages, Depreciation, *Input-output analysis.
Identifiers: *Capital goods, Malleability sectoral, *Flexible acceleration principle, Final demand, *Dynamic nonsubstitution theorem.

This paper distinguishes vintages of capital goods. These goods are assumed to be mobile within each industry, but immobile between industries. The replacement coefficients of the true dynamic input-output model are not generally constant but depend on the age composition of capital. A Sectoral Flexible Acceleration Principle is obtained instead of the simple one, upon which many writers have relied on the explanation of investment demands. The dynamic input-output equations of the traditional form can be validated only when capital goods are 'perfectly malleable.' This is a very stringent and unrealistic condition. When it does not hold, the replacement coefficients cannot be constant and deviate from Leontief's (constant) flow coefficients. If the assumption of perfect mobility were rejected, the dynamic nonsubstitution theorem could not be obtained. Finally it is shown that the equilibrium rate of growth calculated from the traditional model would not be very far from the one calculated from the model used in the paper, so that from the long run viewpoint, there is little difference between the two. Some water studies have used input-model analyses and the problems raised in this paper could have relevancy to the approach to water resource problems. (Sokoloff-Rutgers)
W69-04090

THE CONSTRAINED DEMAND FOR PUBLIC ASSISTANCE,
New York Univ., N. Y.
Peter S. Albin, and Bruno Stein.
Jour Human Resources, Vol III, No 3, pp 300-311, Summer 1968. 12 p, 4 fig, 9 ref.

Descriptors: *Demand, Wages, Income, Administration, Supply, Constraints.
Identifiers: *Public assistance, *Constrained demand, Relief income, Utility analyses, Work.

Public assistance is treated as a transaction with a demand and a supply side. The theory of demand is explored under the hypothetical condition of free choice to individuals between wage income and relief income. Then more realistic situations are examined in which able-bodied individuals are required to seek work if work is available at some social minimum wage rate. The work requirement is treated as one of several existing constraints upon choice. To this are added the various disutilities that, in effect, lower the value of relief income to the recipient and further alter his choice. The analysis suggests that welfare authorities (the supply side) can and do vary the constraints and disutilities so as to change the magnitude of the demand for public assistance. Administrative behavior then becomes a variable in the determination of the number of recipients, that equilibrates demand with supply. No direct analogy to water problems is present while the issue of public assistance can be conceived to involve the redistribution aspects often present in the development of water resources. (Winn-Rutgers)
W69-04093

ON THE MEASURE OF RISK AVERSION,
Harvard Univ., Cambridge, Mass.
M. S. Feldstein.
Southern Econ Jour, Vol 35, No 1, pp 58-59, July 1968. 2 p, 4 ref.

Descriptors: Risks, Measurement.
Identifiers: Risk aversion, Utility analysis.

If an individual's utility of wealth function is strictly concave so that u' (w) greater than 0 and u'' less than 0, he will be averse to risk. Arrow, Pratt and Schlaifer have suggested two ways of representing the intensity of risk aversion at each value of wealth by measures of the local concavity of the utility function. The first measure, which may be called 'absolute risk aversion,' is defined as r sub 1 (w) = -u'' (w)/ u' (w); the second measure, 'proportional risk aversion,' is defined as r sub 2 (w) = -u/u''/u' (w). The first purpose of this note is to provide further support for the assertion that r sub 1 (w) is an appropriate measure of risk aversion and not merely an indicator of utility function curvature. A second purpose is to indicate that r sub 1 (w) may be preferable to r sub 2 (w) as a measure of risk aversion. This article is relevant to water demand functions involving underlying utility functions that can be shown to have the risk properties derived in this paper. (Winn-Rutgers)
W69-04094

A CAPACITY EXPANSION PLANNING MODEL FOR MUNICIPAL WATER SUPPLY SYSTEMS,
Harvard Univ., Cambridge, Mass.
Clifford Springer Russell.
Harvard Water Program, Discuss Pap No 68-10, Sect 11 and 12, pp 251-301, July 1968. 51 p, 3 fig, 8 tab, 83 ref.

Descriptors: *Water supply, *Planning, Municipal water, *Mathematical models, Design, *Economic efficiency, *Growth rates, Water demand, Water shortage, Safe yield, Discount rate, Population, Constraints, Droughts, Water management (Applied).
Identifiers: Massachusetts, Sensitivity analysis.

A mathematical model was developed which determined the optimum (least-present value of costs and losses) expansion scheme for a municipal water supply system. The decision variables were the timing and sizes of system supply increments. It was assumed that information about growth of demand, population, losses due to shortages (information obtained earlier in the main report) were given. For the 60-year study period only four increments were allowed two being in year 0 and year 60. Also, the growth in safe yield was constrained to be equal to the growth in demand for the study period. Results of a parametric analysis on the 'drought-loss function parameter', the 'safe-yield cost scaling factor', discount rate, population and demand growth rates, for model solutions for several Massachusetts towns were tabled and discussed in the following section (Gysi-Cornell)
W69-04145

GROUND WATER AND COMPUTER SIMULATIONS,
TRW Systems Group, Redondo Beach, Calif.
For primary bibliographic entry see Field 02F.
For abstract, see .
W69-04149

6E. Water Law and Institutions

FUNCTIONS OF THE INTERNATIONAL JOINT COMMISSION,
International Joint Commission, Washington, D. C.
Eugene W. Weber.
Proc Amer Soc Civ Eng, J Power Div, Vol 94, No PO2, pp 177-181, Nov 1968. 5 p.

Descriptors: *International Joint Commission, Governments, Waterways, Management, Organizations, Planning, Water pollution, *Water resources, Water rights, Water control, River basin development, Water pollution, Control, Boundaries (Property), Treaties, International commissions, Federal Government.
Identifiers: *International relations, Water resources management, Canada.

Canada and the United States have a unique and effective joint organization for managing water resources and dealing with pollution and other matters of mutual concern along their common frontier. By treaty in 1909, the 2 countries established a permanent Commission of 6 members (3 from each country) to exercise certain delegated powers and, upon request, to prepare recommendations for joint action on other matters. The treaty prescribes basic principles applicable to the Commission's responsibilities. One main responsibility of the International Joint Commission is to approve or disapprove proposals for use, obstruction, or diversio of boundary waters and downstream waters tha would affect the natural level or flow of waters a the boundary. The Commission functions by callin upon established agencies in each country that ar qualified to deal with the problem at hand. Th system has worked harmoniously, and is being use increasingly for advance planning for joint action of mutual benefit and for settlement of curren problems. (USBR)
W69-03796

LAW OF THE RIVER,
William Burke.
Fed Reserve Bank San Francisco Mon Rev, pp 193 203, Oct 1968. 11 p, 4 fig.

Descriptors: *Water law, Rivers, *Legal aspects Riparian rights, *Southwest U. S., Water shortage *Water resources development, Colorado Rive Basin, Colorado River Compact, Arid lands California, Arizona, *History, *Reviews, Wate utilization, Colorado River, Demineralization Pacific Northwest U. S., Water management (Ap plied).
Identifiers: Water plans, Pacific Southwest Wate Plan, Colorado River Storage Proj., Centra Arizona Project, California Water Plan.

A half-century's wrangling over the law of the rive is proof that the supply of Colorado River water i severely limited in relation to other resources of th southwest. The imbalance is traceable to a nationa population that is ever growing and ever shiftin southwestward, and to the increasing water need of families, farms, and factories. On the supply side water planners are concerned because the river' flow has fallen far short of the amount apportione by the negotiators of the Colorado River Compac in 1922. The negotiators of that compact assume (on the basis of average flows since 1896) that 16.8 million acre-ft would be available for apportion ment between the Upper and Lower Basin state and exportation to Mexico. The average flow dur ing the 1922-67 period measured only 13.7 millio acre-ft; the flow over the last decade has average only 12.1 million acre-ft. To obtain their 21st-cen tury water supplies, the teeming millions of th Pacific Southwest may have to seed clouds, reclaim waste water, pump water out of the Pacific, o transport water across distant mountain ranges. A general history is given of legal struggles during thi century for water in the southwest. (USBR)
W69-03801

WATER FRONT HARBOR FACILITIES.

N J Stat Ann secs 12:5-1 to 12:5-11 (1968).

Descriptors: *New Jersey, *Harbors, *Permits *Administrative agencies, Legislation, Navigation Transportation, Riparian land, Regulation, State government, Cities, Docks, Bridge construction Planning, Marina, Harbors.
Identifiers: *Water-front facilities, *Harbor facili ties.

The Board of Commerce and Navigation's power and duties in relation to water-front and harbor facilities include: (1) investigation of harbor facili ties and reporting the condition to the legislature recommending measures for improvement of navigation and commerce; (2) prevention, by ap propriate court action, of encroachment upon navigable waters or riparian lands of the state, com pelling the removal of any detrimental structure (3) approval of any plan for development, by any person or municipality, of navigable water-front property; (4) consideration of and action upon any plans for water-front development when the water front is a local governing body, such action being the filing of objections and representing the state's interests at a public hearing; (5) upon the request of any political subdivision of the state, preparation of a plan for the improvement and development of the water-front of such subdivision. Also, any improvement made to the water front on navigable

waters without board approval is deemed a purpresture and subject to abatement by appropriate means. (Helwig-Fla)
W69-03810

UNITED STATES V 811.92 ACRES OF LAND,

404 F 2d 303-309 (6th Cir 1968).

Descriptors: *Kentucky, *Condemnation, *Condemnation value, *Property values, Water law, Recreation, Flood control, Reservoir construction, Planning, Judicial decisions, Real property, Legal aspects.

Land was condemned to build a reservoir as part of a flood control project. Later, additional land was condemned for construction of a recreational area. The owner of the land taken for the recreational area sued for additional compensation, claiming the land had enhanced value due to the flood control project. The court held that if the recreational area was within the original contemplation of the flood control project, that the landowner would not be entitled to any enhanced value derived from the project. (Hoffman-Fla)
W69-03811

MCFARLAND V DEKALK COUNTY (DAMAGES ATTRIBUTABLE TO SURFACE WATER NUISANCE).
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03812

FLOOD PROTECTION.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03813

LEASES OF STATE OWNED UNDER WATER LANDS FOR SHELLFISH CULTIVATION.
N Y Conserv Law sec 302 (McKinney 1968).

Descriptors: *New York, *Shellfish, *Aquaculture, *Leases, Legislation, Legal aspects, High water mark, Buoys, Rent regulation, Administrative agencies, State governments, Beds, Cultivation, Land management.
Identifiers: *State submerged land.

The department may lease state owned under water lands for the cultivation of shellfish, except those lands within five hundred feet of the high water mark. To lease such lands, one must have been a resident of New York for more than one year. The lease term is ten years, the size of the land plots not less than fifty acres, and the rental not less than one dollar per acre. The leases are renewable and transferable. The lots must be marked with corner buoys, and failure to comply is a misdemeanor. Lessee is required to post bond in an amount covering the total rental for the 10 year period, and failure to pay the annual rental within 90 days results in the forfeiture of the bond to the state and revocation of the lease. (Sisserson-Fla)
W69-03814

INTERNATIONAL JOINT COMMISSION - UNITED STATES AND CANADA,
Department of Interior, Washington, D. C.
Matthew Welsh.
For 8-volume Proceedings see Vol 2, No 9, Field 06B, W69-03305. International Conference On Water for Peace, Vol 5, pp 104-109 (1968). 8 p.

Descriptors: *International Joint Commission, *Treaties, *Administrative agencies, *Foreign waters, Great lakes, International waters, Administrative decisions, Federal government, Water rights.

The Boundary Waters Treaty of 1909 created the International Joint Commission to deal with waters forming boundaries between the United States and Canada, and waters flowing from one country to another. The treaty was passed to settle and prevent disputes, and to establish rules governing boundary waters. These rules are outlined. Commission procedures are discussed, and it is pointed out that the commission rarely divides along national lines on questions. The Commission's judicial, investigative, recommendatory, administrative, and arbitral functions are discussed. In a great number of cases, both governments accept the recommendations of the Commission. The role of the Commission in pollution control is outlined. Questions currently being investigated by the Commission are explained.
W69-03815

PETERS V AUBIN (ACTION TO RESTORE WATERCOURSE).
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03816

REGULATION OF MINING IN INTERNATIONAL WATER - FOUR POSSIBILITIES FACING THE MINING INDUSTRY TODAY.
Mining Engineering, Vol 20, No 7, pp 149-152, July 1968. 4 p.

Descriptors: *International law, *International waters, *International commissions, *Mining, Continental shelf, Foreign countries, Oceans, Jurisdiction, Mineralogy, Exploitation.
Identifiers: Convention On The Continental Shelf, Territorial waters.

The problem of mining outside the Continental Shelf and territorial waters is discussed. The basic objective is to arise at a viable regime which will encourage the exploitation of the minerals of the sea floor. Four alternatives are presented: (1) The wait and see approach. This basically calls for doing nothing until the issue is forced. This plan is not desirable as the absence of a regime would be a deterrent to exploitation. (2) The National Lake System. This calls for dividing up the bottom of the sea among the coastal states. It is unlikely to succeed due to the large number of lakes that would be created and the mass confusion that would result. (3) The Flag Nation Jurisdiction. This permits the exploiter to operate under the protection of the nation whose flag he flies. This plan is lacking since a large volume of rules would be required to effectively operate it and it favors the developed nations too heavily. (4) The most acceptable plan would create an International Authority. This authority would be set up with jurisdiction over the resources in the sea, and it could grant rights and extract rents and royalties for use of these resources. It is, of course, up to the more powerful nations to accept this regime for it to be workable. (Shevin-Fla)
W69-03817

CITY OF EAST ORANGE V TOWNSHIP OF LIVINGSTON (ASSESSMENT OF WATERSHED PROPERTY).

102 N J Super 512, 246 A 2d 178-193 (1968).

Descriptors: *New Jersey, *Assessments, *Agricultural watersheds, *Land classification, Local government, Judicial decisions, Rural sociology, Agriculture, Cities, Taxes, Watersheds (Basins), Water supply, Legal aspects.

Plaintiff, a municipal corporation, sought a judgment directing that defendant municipalities assess certain property owned by plaintiff as farmland under the Farmland Assessment Act of 1964. Plaintiff alleged that the lands, which constituted plaintiff's watershed, were actively devoted to agricultural uses. Defendants contended that the property was used principally for the purpose and protection of a public water supply; therefore, they asserted, the property was not entitled to be taxed especially under the act, and was not entitled to exemptions for recreational or educational uses. The court held that the land was not 'actively devoted' to 'agricultural use' within the meaning of the act, and should therefore be taxed as land used for providing and protecting a public water supply. The facts that the plaintiff had the land available to use as pasture, had requested assistance in starting possible training programs in soil conservation, and had received income through sales of hay, timber, and cordwood from the property were not sufficient to classify the property in issue as farmland within the meaning of the act. (Scott-Fla)
W69-03818

LUNTER V LAUDEMAN (PIER CONSTRUCTION PERMIT).
246 A 2d 540-548 (Md Ct App 1968).

Descriptors: *Maryland, *Local governments, *Piers, *Port authorities, Adjudication procedure, Administrative decisions, Community development, Judicial decisions, Harbors, Cities, Public health, Zoning, Water resources development, Boats, Boating, Water pollution, Administrative agencies, Legal aspects.

Defendant filed an application with the city port wardens to erect a pier with mooring piles, for noncommercial purposes only. This application was granted with certain modifications. Plaintiffs, neighbors of the defendant, appealed this decision to the major and local aldermen. Defendant appealed an order by the major and the aldermen directing him to reduce the length of the pier and the number of boat slips permitted. The court, in examining the city charter, found that the mayor and the aldermen were limited in their review of action of the city port wardens to ascertaining whether the port wardens acted within the scope of their powers and properly discharged their legal duties as provided in the city charter. Therefore, the action of the mayor and aldermen in modifying the order of the port wardens was void. The court further found that the provisions of the city charter were not intended to permit the port wardens to exercise any other police powers of the city. Therefore, objections to the port warden's granting of defendant's application on grounds of zoning violations or possible health and pollution problems should be handled by the city Zoning Board of Appeals or the City Health Officer. (Scott-Fla)
W69-03819

REYNOLDS V REFUGE PLANNING CO (LAND BOUNDARIES).
97 So 2d 101-104 (Miss 1957).

Descriptors: *Mississippi, *Boundaries (Property), *Levees, Judicial decisions, Legal aspects, Maintenance, Eminent domain, Right of way, Easements, Real property.

Under a constitutional provision and an act of the legislature, a right of way for a levee system was taken by eminent domain through an existing plantation. Some years later, the lands of the plantation were sold to two different corporations, the dividing line being the levee. Twelve years later the original grantor executed quitclaim deeds to plaintiff, appellant covering the lands taken by eminent domain. Plaintiff brought this action to cancel adjacent landowner's contract for maintenance of the levee by allowing his cattle to graze thereon, and to recover the reasonable value for grazing of cattle on the levee. The court held that the reversionary rights of the adjacent landowners ran to the center of of the levee, and that plaintiff's quitclaim deeds were worthless. '...where the monument is a stream, street or highway, the conveyance extends to and passes the title to the center thereof.' (Sisserson-Fla)
W69-03821

PEOPLE V METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO (CONSTITU-

TIONALITY OF SANITARY AUTHORITY ACT).
11 Ill 2d 476, 143 NE 2d 550-555 (1957).

Descriptors: *Illinois, *Sewage districts, *Legislation, *Legal aspects, Civil law, Judicial decisions, Local governments, State governments, Governments, Sewerage, Drainage systems, Financing, Public health, Environmental sanitation, Cities.
Identifiers: Due process rights.

Plaintiffs filed suit against the defendant sanitary district, challenging the constitutionality of amendatory legislation that empowered sanitary districts to construct a sewerage or drainage system, to extend or improve an existing system, to serve an area within its corporate limits and to pay the cost of these things by issuing and selling revenue bonds payable solely from the revenue derived from the operation of such systems. The court held that the act does not deny the due process guarantees of the state and federal constitutions. Even though the statute provides for notice by publication of a hearing, the corporate authorities are under no obligation to follow the wishes of persons appearing at the hearing. Provisions that charges against a user of the system may become a lien against the property of the user do not violate due process guarantees either. The court concluded that the act was constitutional, and that the fact that incorporated villages within the district have no power to delegate their authority over public health and sanitation to the district would not result in an unconstitutional usurping of municipal powers. (Scott-Fla)
W69-03822

MILLER V DARBY (DIVERSION OF SURFACE WATERS).
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03823

WIESE V MIEHER (ALTERATION OF DRAINAGE).
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03824

KEISER V MANN (DIVERSION OF SURFACE WATERS).
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03825

MARCHETTI V LUMAGHI COAL COMPANY (SURFACE SUBSIDENCE FROM UNDERGROUND MINESHAFTS).

13 Ill App 2d 526, 142 NE 2d 815-817 (1957).

Descriptors: *Illinois, *Coal mines, *Land subsidence, Judicial decisions, Mining, Mine water, Underground, Underground structures, Safety, Tunnels, Mineral industry, Subsidence, Settlement (Structural), Legal aspects.
Identifiers: Subjacent support, Mineral rights.

Plaintiff sued defendant for damages to his improved real estate that were allegedly caused by defendant mining company's failure to leave sufficient support under plaintiff's land, and by introducing large quantities of water into the mineshaft, thereby further weakening the support under the property. The court found that the owner of surface land subject to mineral rights granted has the right to subjacent support, and evidence of removal of such support without other proof is prima facie evidence that the removal caused the resulting surface subsidence. The burden of proof then shifts to the mine owner to show the contrary, if he can, by proof of underground conditions. Evidence was introduced that tended to show that defendant had pumped large quantities of water into the mining shaft less than a thousand feet from plaintiff's premises. The court held that there was sufficient evidence to justify submission of the case to a jury, who found in favor of the plaintiff. (Scott-Fla)
W69-03826

UNUSED WELLS, CISTERNS, ETC, TO BE COVERED OR FILLED - POISONING SPRINGS, WELLS, ETC.

Ala Code Tit 14, secs 384, 385 (1958).

Descriptors: *Alabama, *Poison, *Well regulations, Legislation, Legal aspects, Springs, Reservoirs, Water law, Cisterns, Shafts (Excavations)
Identifiers: Fines, Imprisonment.

Any person with an unused well, cistern, or mining shaft on their property is required to either fill or cover such well, etc. Failure to comply with this section will result in a fine of not less than $10 nor more than $50. Any person who willfully poisons a spring, fountain, well or reservoir of water shall, on conviction, be imprisoned in the penitentiary for 10 to 20 years. (Sisserson-Fla)
W69-03827

PROJECTS RELATING TO THE USE OF ATMOSPHERIC WATER RESOURCES.

N Y Gen Mun sec 119 P (McKinney 1965).

Descriptors: *New York, *Local governments, *Water resources development, *Metoric water, Legislation, State governments, Cities, Water resources, Planning, Projects, Taxes, Real property, Costs, Cost sharing.
Identifiers: Atmospheric water resources.

Any municipal corporation is authorized to engage in activities designed to develop the use of atmospheric water resources and to make scientific evaluations of such activities. A municipality may also contract and expend money for these purposes. Two or more municipalities may join in such projects, and may allocate the share of the cost between them by contract. Money for such projects may be raised through taxes on real property. Municipal corporations may accept and disburse grants of public or private money paid or made available by the state or federal government for any such purpose. (Scott-Fla)
W69-03828

BUILDINGS AND OTHER THINGS INCLUDED IN DEEDS TO LAND.

NJ Stat Ann sec 46:3-16 (1940).

Descriptors: *Ownership of beds, *Water rights, *Implied benefits, *New Jersey, Land tenure, Legislation, Ground water ownership, Surface water ownership, Property boundaries, Water rights, Water law, Real property.
Identifiers: *Deeding of land, *Watercourses.

Every deed conveying land shall, unless an exception shall be made therein, be construed to include all buildings, improvements, ways, woods, waters, watercourses, rights, privileges, hereditaments and appurtenances; and the reversions and remainders, rents, issues and profits thereof. (Harris-Fla)
W69-03829

VODOPIJA V TENNESSEE GAS TRANSMISSION CO (DAMAGE TO OYSTERS).

152 F Supp 14-17 (E D La 1957).

Descriptors: *Louisiana, *Dredging, *Spoil banks, *Oysters, Judicial decisions, Bays, Pipelines, Legal aspects, State jurisdiction, Leases, Damages.

Plaintiff owned two oyster leases in Sandy Point Bay granted by the state of Louisiana. The state granted defendant a permit to construct a pipelin which at one point crossed the mouth of Sand Point Bay. Plaintiff alleged that when defendar dredged a canal for the pipeline, the spoil banl caused thereby covered his oysters and killed them There were various problems with proof offered b the testimony of witnesses, and it also appeare that one of the leases had not been issued when de fendant commenced operations. The court hel that defendant had as much right to lay its pipelir across the bay as plaintiff did to plant his oyster Therefore, to recover, plaintiff must prove that de fendant acted negligently and that his damag resulted from such negligence. The court held tha plaintiff had not proved these essential elements c his case, and granted judgment for defendant. (Wi liams-Fla)
W69-03830

WALKER V FELMONT OIL CORP (CLAIM TO OIL AND GAS RIGHTS UNDER OHIO RIVER).
240 F 2d 912-918 (6th Cir 1957).

Descriptors: *Kentucky, *Ohio River, *Ownershi of beds, *Leases, Oil natural gas, Relative rights Judicial decisions, Federal jurisdiction, Navigabl waters, Riparian land, Riparian waters, Legislatior Administrative agencies, Legal aspects.

Plaintiff and defendants claimed oil and gas right in the bed of the Ohio River between the thread o the stream and the low-water mark on the northern shore opposite the Kentucky shore. Plaintiff claimed under land patents from the Common wealth of Kentucky. Defendants claimed unde leases from the County and the State Property and Buildings Commission. Plaintiffs filed action fo declaratory judgment to adjudicate the conflictin claims. The district court entered judgment adverse to plaintiffs. The Court of Appeals did not discus the merits, but remanded back for determination o federal jurisdictional questions, including diversity of citizenship. The court, however, did state tha title to the Southern half of the Ohio River, from thread of stream to the Kentucky shore, is in ripari an landowners in Kentucky, and title to northern half of river bed, from thread of stream to low water mark on northern shore, is in the Common wealth of Kentucky. (Wheeler-Fla)
W69-03831

GOODMAN V ELLISH (IMPLIED EASEMENT ON PRIVATE LAKE).
170 NYS 2d 465-468 (S Ct 1958).

Descriptors: *New York, *Easement, *Lakes, Riparian rights, Fishing, Boating, Judicial decisions, Swimming, Legal aspects.
Identifiers: *Private lake.

Plaintiffs bought lakefront lots from defendant corporation, which had developed the property and enlarged the lake. Defendant advertised the lake as a private lake for fishing, boating, and swimming for use of residents only. For several years unrestricted use was made of the lake by purchasers of the lakefront property. Then defendant began collecting a fee in varying amounts from the users of the lake for maintenance. Plaintiffs brought action to enjoin the collection of the fee and opening the lake to the public. The court held that oral representations, advertising and conveyances with reference to a map, all which represented the lake was for the private use of the property owners, created an implied easement to use the lake for boating, fishing, and swimming by the property owners only. Defendant corporation was enjoined from collecting the fee and from opening the lake to the general public. The property owners' right to use lake, however, was dependant on compliance with health laws by some responsible person or corporation for them. (Heckerling-Fla)
W69-03832

SOMERS V HILL (DIVERTING OF WATER ONTO ADJOINING LAND).
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03833

YENCHKO V GRONTKOWSKI (ACTION FOR DAMAGE DUE TO INTERFERENCE WITH NATURAL FLOW OF SURFACE WATERS).
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03834

PASHLEY V UNITED STATES (FLOOD DAMAGE THROUGH ERECTION OF DAM).
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03835

STREAM CONTROL COMMISSION - VIOLATIONS AND PENALTIES.
For primary bibliographic entry see Field 05G.
For abstract, see .
W69-03836

DRAINAGE OF NOXIOUS OR POISONOUS SUBSTANCES INTO NATURAL WATERWAYS OR CANALS.
For primary bibliographic entry see Field 05G.
For abstract, see .
W69-03837

DRAINAGE.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03839

BEACH COMMISSION.

NJSA secs 40-55A-1 to 40:55A-12 (1967).

Descriptors: *New Jersey, *Beaches, *Financing, Legisislation, Budgeting, Water law, Legal aspects, Contracts, Cities, Recreation, Recreation facilities, Management, Taxes, Profit, Administrative agencies, Local governments.
Identifiers: *Beach commission.

The beach commission has the general power to manage and control the construction, maintenance, and use of the beach and all property contiguous to the beach, formerly owned and controlled by the municipality. The commission has full power to perform all contracts, agreements, or obligations made theretofore by the municipality dealing with subject matters within the scope of the beach commission's powers. The unexpended balance of the monies formerly controlled by the municipality for beach purposes is to be turned over to the beach commission to be appropriated as the commission shall determine. The comptroller is to credit the beach commission with all funds appropriated to the beach by tax levies. The commission is to submit an annual budget to the board having charge of finances of the municipality. The budget shall include all expenditures and revenues of the beach commission. It is the intent of this statute to make the beach commission self-sustaining. (Holt-Fla)
W69-03840

GENERAL AND REGULATORY POWERS (POWER OF CITIES TO REGULATE SWIMMING).

NJSA sec 40:48-1.9 (1967).

Descriptors: *Legislation, *Swimming, *New Jersey, Ordinances, Legal aspects, Water law, Governments, Cities.

The statute gave the governing body of every municipality the power to regulate and prohibit swimming or bathing in the waters of, in, or bounding the municipality. (Holt-Fla)
W69-03841

WATER FRONT IMPROVEMENTS.
NJSA secs 40:68-1 to 40:68-4, 40:68-7, 40:68-8, 40:68-12 to 40:68-16 (1967).

Descriptors: *New Jersey, *Regulation, *Local governments, *Permits, Cities, Legal aspects, Water law, Piers, Docks, Appropriation, Legislation, Federal government, Leases, Bulkheads, Taxes, Financing, Construction.
Identifiers: *Water front improvements.

Power is given to the governing body of the municipality to acquire and improve water front property within its boundaries. Detailed plans and advertising the letting of contracts are prerequisites for improvements or constructions on acquired property. The governing body may lease improved property for not more than ten years. Ordinances may be passed by the governing body to regulate acquired water front property, and regulation within the municipality is to be done through licenses and permits. Maximum rates for public wharfage, dockage, and cranage may be set by the governing body. All income received by the municipality from water front property within its boundaries is to be allocated for the upkeep of water front property owned by the municipality. The governing body is to provide funds for supervising wharves, docks, and ferries. Before construction or improvement of wharves may begin a license must be obtained the governing body. Construction without a license is deemed a nuisance and one causing such a nuisance is subjected to a criminal penalty. Docks must be dept free from obstructions. The municipality may contribute funds to the federal government for work it performs to preserve water front property and inland channels. (Holt-Fla)
W69-03842

FISH HATCHERIES: POLLUTION OF WATERS USED BY FISH HATCHERIES.
For primary bibliographic entry see Field 05C.
For abstract, see .
W69-03843

PUBLIC WORKS AND IMPROVEMENTS.

NJ Stat Ann secs 40:102-1 to 40:102-9 (1967).

Descriptors: *Legislation, *New Jersey, *City planning, *Community development, Utilities, Municipal wastes, Urban areas, Administration, Seashores, Reservoir construction, Cisterns, Local government, Public benefits, Legal aspects, Financing, Costs, Planning, Assessments, Taxes, Tax rate.
Identifiers: *Seaside associations.

These sections pertain to public works and improvements of seaside associations. Section 1 allows corporate authorities of an incorporated seaside association to open, lay out, or improve streets or sidewalks and to construct cisterns for holding water for public benefit. Section 2 provides that the cost of improving sidewalks or streets shall be assessed upon the lands benefited by them. Section 3 provides that the assessment procedure shall be to draw up a map showing the amount assessed. Thirty days notice shall be given of any meeting to hear objections to the assessments. Section 4 makes the assessment a lien on the land and collectable in such manner as the board may determine. Section 5 allows the corporate authorities of any incorporated seaside association to provide necessary works to supply the inhabitants and premises with artificial light; to keep in repair the streets; to remove garbage; and to appoint peace officers. Section 6 provides that the corporate authorities shall appoint from their number a competent person to keep accounts of all expenditures in making improvements. Such books shall be open to inspection of real estate owners within the seaside association. Section 7 allows the costs of improvements to be assessed upon the owners of real estate benefited, but the cost shall not exceed the sum of five dollars per annum per lot. Section 8 provides that when the improvement is completed, a certificate showing the amount assessed shall be filed with the treasurer and kept within the corporate limits. Section 9 makes all assessments made under this chapter liens on the real estate assessed. (Heckerling-Fla)
W69-03844

FISH AND GAME: NON-RESIDENT FISHING.

N J Stat Ann sec 23: 9-1 (Supp 1968), N J S A sec 23: 9-2 (1940).

Descriptors: *New Jersey, *Legislation, *Angling, *Permits, Tidal waters, Fresh water, Saline waters, Atlantic Ocean, Inland rivers, Inland waters, Delaware River, Regulation.
Identifiers: Delaware bay, Non-resident license, Fishing licenses.

This statute deals with non-resident fishermen. It provides that no non-resident above the age of 14 shall fish in the Delaware River or any inland tidal water, unless he first acquires a non-resident fishing license. The prohibition does not apply to fishing in the Delaware Bay or any of the bays or waters of the Atlantic Ocean or tidal rivers emptying into the Atlantic Ocean. Any violators of this provision shall be liable to a penalty of $20 for each offense. (Stewart-Fla)
W69-03845

FISH AND GAME: DELAWARE RIVER AND BAY AREAS BETWEEN NEW JERSEY AND DELAWARE.

N J Stat Ann secs 23: 9-39, 23: 9-42, 23: 9-46, 23: 9-50 to 23: 9-55 (1940), N J S A secs 23: 9-40, 23: 9-41, 23: 9-44 (Supp 1968).

Descriptors: *New Jersey, *Legislation, *Angling, *Fish, Commercial fishing, Fish management, Fishing equipment, Fishkill, Seines, Nets, Sport fish, Water pollution effects, Pan fish, Fish control agents, Bait fish, Delaware River, Legal aspects.
Identifiers: Delaware bay.

The provisions of this article apply to the waters of the Delaware River and bay lying between New Jersey and Delaware. The first section specifies what devices may be used to catch bait fish. The next section prohibits the use of net fishing at certain prescribed times of the week. The third provision describes the size limitations that must be met before a fish may be kept. The Statute further provides that no person shall willfully break, damage, or destroy a net or seine. The fifth provision deals with the prescription against placing any explosive or poisonous substances in the water to catch or kill fish. The next provision prohibits the sale of food fish except during open season and six days thereafter. The Statute also makes it unlawful for a person to attempt to deter or prevent a warden from enforcing the law. The eighth section prohibits a non-resident from fishing with any device except a rod and reel or handline. The new statutory supplement defines game, bait, and food fish. It goes on to provide that a person may use only a rod and reel or handline to catch game fish. Finally, the Statue describes the devices and defines the seasons that apply to food fish. (Stewart-Fla)
W69-03846

FISH AND GAME: OYSTER FISHING.

N J Stat Ann secs 23: 9-56 to 23: 9-58 (1940).

Descriptors: *Legislation, *New Jersey, *Commercial shellfish, *Dredging, Bays, Inlets, Gill nets, Legal aspects.
Identifiers: Penalties, Misdemeanor.

This article deals with the prohibition against dropping anchor on specified flats while dredging for oysters between sunset or sunrise of any day prior to May 25th of each year. The statute also provides that a person who throws a dredge or other appliance from a vessel into a fill net shall be guilty of a misdemeanor. (Stewart-Fla)
W69-03847

OIL FACTORIES IN RARITAN AND SANDY HOOK BAYS.
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-03848

SHREWSBURY AND NAVESINK RIVERS.

N J Stat Ann secs 23:9-112.1, 23:9-112.2 (Supp 1968).

Descriptors: *Legislation, *New Jersey, *Ice fishing, Rivers, Fishing, State jurisdiction, Legal aspects.
Identifiers: Misdemeanor, Navesink River, Shrewsbury River, Penalties (Criminal).

These sections deal with ice fishing on the Shrewsbury and Navesink Rivers. The statutes provide that lawful holes made by persons fishing on this river shall not make an opening in the ice larger than 10 inches in diameter or within 15 feet of any other hole in the ice. Any person violating the provisions of this act shall be guilty of a misdemeanor. (Heckerling-Fla)
W69-03849

HUDSON RIVER BETWEEN NEW JERSEY AND NEW YORK.

N J Stat Ann secs 23:9-120 (1940).

Descriptors: *Legislation, *New Jersey, *Hudson River, *New York, State governments, State jurisdiction, Interstate rivers, Interstate compacts, Rivers, Water law, Legal aspects, Fishing.

This section deals with the arrest and punishment of violations on the Hudson River between New Jersey and New York. It provides that if and when the State of New York shall enact a similar law for the arrest and punishment of violations of the game or fish laws of this or the State of New York, committed or attempted to be committed by any person or person fishing in that portion of the Hudson River lying between such States, any game protector, fish warden or other person of either state , who is authorized to make arrests for violations of the game and fish laws of such States, shall have power and authority to make arrests on any part of such river between such States or the shores thereof and to take the person or persons so prosecute such person or persons according to the laws of such state. (Heckerling-Fla)
W69-03850

HUDSON RIVER, NEW YORK HARBOR AND SANDY HOOK BAY (NEW).
N J Stat Ann secs 23:9-122--23:9-125 (Supp 1968).

Descriptors: *Legislation, *New Jersey, *Fishing, *New York, Fish management, Fish conservation, Fish, Hudson River, Bays, Legal aspects.
Identifiers: *Sturgeon, Penalties.

These sections pertain to the taking of sturgeon in the Hudson River, New York harbor and Sandy Hook bay. Section 122 provides that sturgeon taken from this water must be at least 22 inches if the short-nosed variety and 42 inches if a sea sturgeon. Any sturgeon less than these lengths must be returned immediately to the water. Section 123 prohibits possession or sale of sturgeon less than the length herein prescribed. Section 124 provides the term sturgeon shall include fish commonly known as pelican and pinkster. Section 125 specifies the fine for violation of the provisions of this act to be up to ten dollars for each and every fish so caught and had in possession. (Heckerling-Fla)
W69-03851

WATER FRONT IMPROVEMENTS.

N J Stat Ann secs 40:179-122--40:179-125 (1967).

Descriptors: *New Jersey, *Beaches, *Recreation facilities, *Financing, Legislation, Cities, Recreation, Swimming, Parks, Leases, Construction costs, Costs, Atlantic Ocean.
Identifiers: Boardwalks, Pavilions, Streets.

It is lawful for any city on or near the Atlantic Ocean to build, maintain and improve public boardwalks, streets, drives, parks or pavilions for the use of the public and to acquire property for these purposes. Such city shall have the power to issue bonds to raise money for beach improvements, provided that the creation of any indebtedness beyond the limit fixed in its charter shall be submitted to a referendum election. The pavilions built under authority of this act shall not be leased to any person. (Helwig-Fla)
W69-03852

EXCHANGE OF RIPARIAN LANDS.

N J Stat Ann sec 40:176-9 (1967).

Descriptors: *New Jersey, *Legislation, *Riparian lands, *Cities, City planning, Eminent domain, Administrative agencies, Local governments, Public benefits.

Any city of the first class owning any riparian lands which have ceased to be suitable or convenient for the use for which they were acquired may exchange the lands for other riparian lands in the same city which are more suitable or convenient for public use, conveying all rights to the land and any structures upon it. The Board of Commerce and Navigation must approve of any exchanges made under this act. (Helwig-Fla)
W69-03853

LEASE OF OCEAN FRONT PROPERTY.
N J Stat Ann sec 40:176-20 (1967).

Descriptors: *New Jersey, *Oceans, *Shores, *Leases, Legislation, Recreation, Recreation facilities, Cities, Coasts, Contracts, Beaches, Local governments.

This statute authorizes cities having a population of less than 25,000 to lease property or buildings bordering on the ocean without public bidding in the following cases: (1) leases to charitable or religious organization for less than 1 year; (2) leases not exceeding 2 weeks where the premises are to be used for amusement purposes. Leases shall be in writing and authorized by a resolution of the governing body of the city. Notice of intent to adopt a resolution shall be given prior to adoption of a resolution if the lease is to be for premises used for amusement purposes. (Helwig-Fla)
W69-03854

PROTECTION OF WATER SUPPLY FROM POLLUTION.
For primary bibliographic entry see Field 05G.
For abstract, see .
W69-03855

PUBLIC UTILITIES - LIGHT AND WATE SUPPLY.
For primary bibliographic entry see Field 03D.
For abstract, see .
W69-03856

STREETS AND PUBLIC PLACES - STREE ALONG STREAMS.
N J Stat Ann secs 40:178-3--40:178-7 (1967).

Descriptors: *New Jersey, *Legislation, *Ro construction, Roads, Highways, Civil engineerir Transportation, Road design, Planning, Co demnation, Easements, Cities, Local governmen Construction.
Identifiers: Ordinances.

This statute gives the body having control of stree and highways in any city the power, by ordinanc to open roadways over and along non-navigab natural streams, to alter the course of such strear to provide a more direct route for the roadway, a to acquire lands for such purposes. This power i cludes the power to provide construction to car the flow of the streams and support the roadwa Before enacting any ordinance under this act, t controlling body must publish notice, includi plans and costs of the proposed changes. If a public improvement contemplates the taking lands owned by a non-resident, personal notice mail must be given. The controlling body shall ha the power of condemnation. (Helwig-Fla)
W69-03857

SEWERS, DRAINS - CHANGE OF COURSE O OUTLET.
For primary bibliographic entry see Field 05F.
For abstract, see .
W69-03858

SURFACE DRAINAGE.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03859

LINES ALONG HIGHWAY AND ACROS WATERS.

Me Rev Stat Ann tit 35, sec 2341 (1965).

Descriptors: *Maine, *Legislation, *Transmissio lines, Transmission (Electrical), Public benefi *Bodies of water.

Section 2341 of title 35 pertains to transmissio lines along highways and across waters. It provide that every corporation organized under chapte 171 to 179 for the purpose of operating telegraph or telephones or for the purpose of transmittin television signals by wire may, except as limite construct, maintain or operate its lines upon an along the route or routes between the points state in its certificate of incorporations; and may, subjec to the conditions and under the restrictions pr vided in chapers 171 to 179, construct its line along, over, under and across any of the roads an streets and across or under any of the waters upo and along such routes, with all necessary erection and fixtures therefor. (Heckerling-Fla)
W69-03860

LEASES OR DEEDS OF RAILROAD OR CANA PROPERTY IN MORE THAN ONE COUNTY.
N J Stat Ann sec 46: 16-3 (1940).

Descriptors: *Legislation, *New Jersey, *Canals State government, Leases, Legal aspects.
Identifiers: Deeds, Railroads.

Section 3, Chapter 16, Title 46, provides that lease or deeds of conveyance of any railroad or cana located and constructed in more than one count of this state, made or to be made, shall and may when acknowledged or proved and certified as pro

vided by this title, be recorded in the office of the secretary of state, in a book by him to be provided for that purpose. (Heckerling-Fla)
W69-03861

OPERATING RESTRICTIONS ON WATERCRAFT.

Me Rev Stat Ann Tit 38, secs 281-285 (1965).

Descriptors: *Legislation, *Maine, *Boating, Boats, Recreation, Water sports, Tidewater, Municipalities, State jurisdiction, Bodies of water, Atlantic Ocean, Bays.
Identifiers: Crimes, Fines, Penalties.

Sections 281 through 285, Title 38, pertain to operating restrictions on watercraft, Section 281 makes it illegal to operate any watercraft, vessel, water skiis, surfboard, similar device or motorboat, upon the tidewaters of any municipality or on offshore waters at a speed greater than is reasonable and proper. Violations of this section are punishable by a fine of not less than $10 nor more than $100, or by imprisonment for not more than 90 days. Section 282 makes endangering any person or property by a watercraft punishable by a fine of not less than $10 nor more than $100, or by imprisonment for not more than 90 days, or by both. Section 283 makes operation of a watercraft in a wanton manner so as to cause injury to any person or property punishable by a fine of not less than $50 nor more than $200, or by imprisonment for not more than 3 months, or by both. A second conviction carries a fine of not less than $200 nor more than $500, or by imprisonment for not more than 11 months, or both. Section 284 makes operation of a watercraft while intoxicated or under the influence of any narcotic drug, barbituate or marijuana, punishable by a fine of not less than $10 nor more than $100 and/or imprisonment for not more than 90 days. Section 285 empowers every law enforcement officer in the state to enforce this subchapter. Any officer may hail a watercraft and board it in order to enforce said subchapter, and failure to stop shall be punished as provided in Section 282. (Heckerling-Fla)
W69-03862

CORRUPTING WATERS FORBIDDEN.
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-03863

BRIDGES OVER CANALS OR RAILROADS.

Me Rev Stat Ann tit 35, sec 815 (1965).

Descriptors: *Legislation, *Maine, *Bridges, Engineering structures, Bridge construction, Railroads, Canals, Transportation, Civil engineering, Roads, Legal aspects, Cities, Operation and maintenance, Repairing.

This section provides that a railroad may be constructed over or under a canal or railroad in such manner as to not unnecessarily impede the travel or transportation thereon. The municipal officers of any city or town may give notice in writing to such persons, parties, or corporations that a bridge required at a crossing has not been erected, or is out of repair and not safe and convenient, or that the crossing of any such highway or town passing such railroad at grade, within their respective cities or towns, is not made or maintained in a safe or convenient condition as is required by the act. Such persons, parties, or corporations shall erect or repair such bridge or shall make such crossing safe and convenient within 10 days from the service of said notice; otherwise, a court may order such delinquents to erect or repair such bridge or make such crossing conform to the requirements of the act. (Heckerling-Fla)
W69-03864

PUBLIC PARKS ON BEACH OR OCEAN FRONT.
N J Stat Ann secs 40:179-98 to 40:179-105 (1967).

Descriptors: *New Jersey, *Beaches, *Recreation facilities, *Public lands, Legislation, Oceans, Shore, Recreation, High water mark, Condemnation, Public benefits, Waves, Riparian lands, Riparian rights, Accretion (Legal aspects), Regulation, Financing, Costs.
Identifiers: Public use.

It is declared lawful for any city located on or near the ocean to open along the ocean front a park or resort devoted to public use exclusively. The interior or inland line of such park shall be established and worked, and a description filed in the office of the City Clerk. This interior line shall be no further inland than ordinary high-water mark. The city where the line is filed shall have the power to purchase or condemn all lands or interests within the interior and exterior lines, the latter established by the state riparian commissioners, and devoted such land to public use. The city shall have the authority to build a public boardwalk along the established interior line. The city may accept a dedication of land for public use in accordance with this act, and shall have the authority to construct any public walk so that the owners dedicating such land may secure the benefit of any natural accretions made to the land. The city shall regulate the use of the land devoted to public use. All lands condemned under this act shall become the property of the city so condemning and the proceedings shall follow the proper condemnation statutes. A benefit assessment shall be made upon all owners benefited by improvements made under the authority of this act. (Helwig-Fla)
W69-03865

SHAD FISHING ON HUDSON RIVER.

N J Stat Ann secs 23:9-14, 23:9-116--23:9-119 (1940); N J Stat Ann secs 23:9-115 (Supp 1968).

Descriptors: *Legislation, *New Jersey, *Fishing, *Hudson River, Fish management, Commercial fishing, Fish conservation, Nets, Fishing gear, Administrative agencies, State jurisdiction permits, Legal aspects.
Identifiers: *Shad, Crimes, Penalties (Criminal).

These sections pertain to shad fishing on the Hudson River. Section 114 makes it unlawful for any person to fish with, fix, fasten, draw or drift any net, of whatever description, for the purpose of taking shad in the Hudson River within New Jersey without a license to do so. Section 115 provides that after payment of $25.00 to the Board of Fish and Game Commissioners for each net, the Board may issue a license to fish for shad in the Hudson River for the period March 15 to June 15. No shad shall be taken from Friday noon until Saturday midnight. Any net set prior to Friday noon may be lifted at the next high water. Section 116 provides that no net shall be set within 1500 feet of any other licensees net in the above waters. The nets shall be numbered as may be determined by the board. Section 117 makes it unlawful for any person to take fish out of any net without the permission of the owner of the net, and further declares it to be unlawful to willfully cut, break, or mutilate any net set in the above mentioned waters. Section 118 provides that all licenses issued under this article shall expire on December 31 of the year issued. Section 119 makes any person violating this act subject to a fine of $20.00 for each offense. (Heckerling-Fla)
W69-03866

ENTRY ON LAND TO MAKE SURVEYS.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03867

STREAM CONTROL COMMISSION - POWERS AND DUTIES.

La Rev Stat secs 56:1431, 1433-1441 (1965).

Descriptors: *Louisiana, *Administrative agencies, *Regulation, *Water pollution control, Legislation, Legal aspects, Bodies of water, Gulf of Mexico, Investigations, Water quality control, Public health, Water policy, Waste disposal, Streams.

The Stream Control Commission of Louisiana consists of the heads of Wild Life and Fisheries, the Board of Health, Agriculture and Immigration, Commerce and Industry and the Attorney General. 'Waters of the state' are defined as all waters within the confines of the state and all bordering waters, including the Gulf of Mexico. The Commission is charged with control of pollution resulting from waste disposal into any waters of the state. The Commission may make rules and regulations regarding conduct of investigations necessary to carry out the provisions of this part. The Commissioner of Wild Life and Fisheries shall enforce and administer the provisions of this part. The Commission or its agents may enter public or private lands to inspect or investigate conditions relating to the pollution of any waters of the state. The Commission shall establish pollution standards and may prohibit any discharge resulting in pollution. It is illegal to discharge any waste which would tend to destroy fish or wildlife or be injurious to the public health. Persons deemed to be in violation of this part are served notice and must file a full report with the Commission showing what steps are being taken to control the pollution. (Sisserson-Fla)
W69-03868

MASSUCCO V VERMONT COLLEGE CORP (ABANDONMENT OF WATER RIGHTS EASEMENT).
247 A 2d 63-68 (Vt 1968).

Descriptors: Judicial decisions, *Vermont, Legal aspects, *Easements, *Springs, Subsurface waters, Subsurface flow, Water law, *Water rights, Buildings, Reservoirs, Diversion, Watercourses, Geologic investigations.

Plaintiff sought to restrain defendant from blocking his access to spring and reservoir and from diverting the subterranean watercourse which had formerly supplied him with water. Plaintiff acquired a water right easement on defendant's land through a prior conveyance. It was claimed by plaintiff that defendant built a dormitory over the spring that supplied plaintiff with water. Defendant asserted that plaintiff abandoned its water rights. The court found insufficient evidence to support plaintiff's claim. Defendant showed that geological tests prior to construction of the dormitory revealed no spring or subterranean waterway beneath building. However, it found that plaintiff had not abandoned its water rights. In order to extinguish water rights by non-use there must have been adverse conduct by owner of the servient estate in defiance of the easement, and such conduct must be continued for 15 years; or, to produce this effect, the owner of the water rights must show clear intent to abandon them and the servient owner must have relied or acted on this intention so that it would work harm to him if the easement was thereafter asserted. (Holt-Fla)
W69-03894

WATERS IMPOUNDED BY DAMS CONSTRUCTED FOR POWER PURPOSES IMPRESSED WITH PUBLIC INTEREST.
N Y Conserv Law sec 948-a (McKinney 1967).

Descriptors: *New York, *Fishing, *Impounded waters, Civil law, Legislation, State government, Administrative agencies, Water resources, Dams, Reservoirs, Public rights, Conservation, Hydroelectric plants, Legal aspects, Regulation, Warning systems.

The waters impounded by any dam constructed for power purposes on any stream or waterway shall be impressed with a public interest and open to the public for fishing. Such fishing must be in accordance with the rules and regulations of the conservation commissioner, and must not interfere injuriously with the operation and maintenance of the dam or of any manufacturing plant operated by power generated therefrom. The conservation commissioner may exempt from the provisions of this section the waters impounded by any dam constructed for power purposes. The rules and regulations of the commissioner shall be uniform, but may vary in different parts of the state. Warning signs must be posted as provided in this section. (Scott-Fla)
W69-03895

ST. REGIS TRIBE OF MOHAWK INDIANS V STATE (OWNERSHIP OF ISLAND).
4 Misc 2d 110, 158 N Y S 2d 540-551 (1956).

Descriptors: *New York, Judicial decisions, *Appropriation, Condemnation, Eminent domain, Ownership of beds, State governments, Leases, Compensation, Payment, Condemnation value, *Islands, *St. Lawrence River, Treaties.

Plaintiff, an Indian tribe, claimed ownership of an island in the St. Lawrence River which had been appropriated by the State. Plaintiff asked compensation for the taking as prescribed by eminent domain statute. The court pointed out that the right of occupation of lands granted by treaties to the Indian tribes was not a property right; rather, it was merely a right of occupancy which the soverign granted and protects against intrusion by third parties. It is axiomatic, therefore, that this right or privilege may be terminated and such lands fully disposed of by the sovereign itself without any legal obligation to compensate the Indians. On the other hand, where the sovereign has declared that the Indians were to hold certain lands permanently, compensation must be paid for a subsequent taking. The court held that in this case a jury submissible issue of fact existed, and that the case could not be summarily disposed of on a motion to dismiss by the State. (Scott-Fla)
W69-03896

UNITED STATES V SMOOT SAND AND GRAVEL CORP (OWNER OF CONDEMNED RIPARIAN LANDS RIGHTS IN UNDERWATER GRAVEL DEPOSITS).
248 F 2d 822-831 (4th Cir 1957).

Descriptors: *Virginia, *Condemnation, *Riparian rights, *Beds, Legislation, Riparian waters, Riparian land, Legal aspects, Federal government, Gravels, Sands, Eminent domain, Property value, Judicial decisions, Low water mark, Navigable waters, Dredging, Ownership of beds.

Smoot Sand and Gravel Corporation owned riparian land on a bay along the Potomac River. The United States instituted a condemnation proceeding to acquire the tract. The proceeding below involved a controversy concerning the valuation of the property rights of the corporation, and more specifically, whether the landowner had a property right in underwater gravel deposits for which he should be compensated. Virginia law provided that the rights to take underwater gravel may be leased from the State. The statute also provided that riparian owners may obtain a perpetual injunction against anyone removing material beyond the low water mark, and that damages, measured by the value of the material taken, may be recovered from violators. The trial judge interpreted these laws as allowing an exclusive right to riparian owners to dredge underwater sand, and instructed the jury to consider the value of the deposits beyond the low water mark in setting the condemnation award. The appellate court affirmed, ruling that the statutes, taken as a whole, conferred upon riparian owners a property rights, which, in case of infringement, entitled the owners to just compensation. (Wheeler-Fla)
W69-03910

GROVE LABORATORIES V FLOWOOD CORP (WELL WATER RIGHTS CONTRACT INTERPRETATION).
234 F 2d 371-373 (5th Cir 1956).

Descriptors: *Mississippi, *Water contracts, *Water wells, *Water rights, Judicial decisions, Legal aspects, Relative rights, Subsurface waters, Deep wells, Water supply, Wells, Water law, Income, Profit, Monetary benefits.

Plaintiff, defendant, and another party entered into a contract whereby they became joint owners of a well. The contract provided that each party was to own one-third of the well, that each party was to have rights to water without additional cost, and that the parties could agree to sales of water to other persons, with such income to be divided among the parties. Defendant made sales to another party and did not account to plaintiff for any share. Plaintiff brought suit to recover a one-third share of the income from the sales made by defendant. The lower court gave judgment for defendant. The appellate court affirmed, ruling that the right to water of each party under the contract was not limited in any way except possibly to not taking more than its share. (Wheeler-Fla)
W69-03911

SURRENDER OF GRANT.
N Y Pub Lands sec 76 (McKinney Supp 1968).

Descriptors: *New York, *Grants, Legislation, *Beds, Administrative agencies, Legal aspects.

This section provides for the optional surrender, without compensation, of lands under water by one to whom such lands were granted by the state. This section is annotated. (Childs-Fla)
W69-03912

CLAIMS FOR DAMAGE GENERALLY ADJUSTMENT OF CLAIMS OF OWNERS OF PRIVATE DAMS.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03913

GENERAL POWERS AND DUTIES OF COMMISSIONER OF TRANSPORTATION.
N Y Canal Law sec 10.1, 10.3, 10.4, 10.6, 10.7, 10.8, 10.9, 10.11, 10.12, 10.17, 10.22 (McKinney Supp 1968) 3 p.

Descriptors: *New York, *Canals, *Navigation, *Transportation, Legislation, Engineering, Boundaries, Maintenance, Management, Maps, Repairing, Inspection, Regulation, Statistics, Appropriation, Administrative agencies, State governments, Legal aspects.

The commissioner of transportation shall: (1) Have supervision of canal system and enforce administration of canal law; (2) Provide for all engineering services required in the improvement, maintenance, and repair of the canal system; (3) Cause surveys, maps, plans, specifications and estimates to be made for improvement of canal systems; (4) Cause inspections of the system to be made annually; (5) Determine boundaries of the canal system; (6) Keep and maintain the canals and their equipment in good condition; (7) Prescribe regulations for navigation and fines to enforce the rules; (8) Compile statistics relating to the traffic on the canal system; (9) Make an annual report to the legislature regarding the trade on, and the conditions of, the canal system; (10) Cause to be acquired such lands as are needed by the canal system and dispose of land no longer needed; (11) Seize any lands, equipment or supplies necessary to avert damage when an emergency arises endangering life or the canal system. (Shevin-Fla)
W69-03916

DRAINAGE FACILITIES.
N Y Town Law sec 64 (11-a) (McKinney 1968).

Descriptors: *New York, *Drainage syste *Floods, Legislation, Cities, Drains, Culve Ditches, Condemnation, Taxes, Bodies of wat Legal aspects, Local governments, Overflow
Identifiers: High waters.

The town board of any town may constr drainage facilities or otherwise improve any of t lakes, ponds, streams or water courses in order prevent overflow from high waters. The town boa may acquire real property for such purpose. Wh taxes are to pay for the expenditures, the adopti of a resolution by the town board authorizing t expenditures is subject to a permissive referendu (Childs-Fla)
W69-03917

GRANTS OF LANDS UNDERWATER.

N Y Pub Lands Law sec 75 (McKinney 1951) amended and supplemented N Y Pub Lands L sec 75 (McKinney Supp 1968).

Descriptors: *New York, *Grants, *Beds, Navig ble waters, Hudson River, Navigation, Administ tive agencies, United States, Recreation, Conserv tion, Agriculture, Usufructrary right, Jurisdictio Lighthouses, Cities, Islands, Legal aspects.
Identifiers: Adjacent landowner, Long Island.

This section authorizes grants of the use, occup tion and jurisdiction of land under water. The lan contemplated by this section are the submerg lands of navigable rivers and lakes including t Hudson river, the former bed of the Ononda creek and Tibbetts brook, the land adjacent to a surrounding Great Barn island but not so as to fect navigation, the land adjacent to and surroun ing Staten Island but within 500 feet from the lo water mark, and the land adjacent to and surroun ing Long Island. Such grants, except in spec cases, are to be made only to the owners of a jacent land and may be in perpetuity for agric tural, recreation, conservation or other specifi purposes. Various limitations are placed on t grants allowed. Grants may also be made to t United States for the purpose of improving navig tion but concurrent jurisdiction by New York a the United States must be maintained over su lands. This section has been amended and is su plemented. (Childs-Fla)
W69-03918

DISPOSITION OF STATE UNDERWATE LANDS.

N Y Pub Lands Law sec 3 (4) (5) (McKinney Su 1968).

Descriptors: *New York, *Beds, *Permits, Legisl tion, *Administrative agencies, Administrati regulation, Jurisdiction, Lake Erie, Navigatio Avulsion, Erosion, Sands, Gravels, Regulatio Legal aspects.
Identifiers: Canal lands, Salt spring conservati land.

The commissioner of general services is authoriz to transfer to any state department or agency t jurisdiction over any lands, including submerg lands, abandoned canal lands and salt springs res vation land. The commissioner may license a regulate the taking of sand, gravel or other mate als found in deposit in or upon the under wat lands of the state. The commissioner may authori the taking of soil from state under water land wh taken by an upland owner for the improvement the protection of his upland from the action of t water or for the restoration of his upland. (Chil Fla)
W69-03919

ALLOCATIONS, DIVERSIONS, AND RELEASES.

N Y Conserv Law sec 835 Art 3 sec 3.8 (McKinney Supp 1968).

Descriptors: *New York, *Water allocation (Policy), *Diversion, *Discharge (Water), Civil law, Legislation, State governments, Administrative agencies, Conservation, Planning, Water resources, Water conservation, Water supply, Withdrawal, Interstate commissions, Legal aspects, Basins.

The conservation commission shall have the power to allocate the waters of the basin among and to the various member states, to impose upon them related conditions, obligations, and release requirements, and to enter into agreements with other river basin commissions or other states with respect to in-basin or out-of-basin allocations, diversions, and withdrawals. Allocations made under this section shall not be considered prior appropriations or apportionments of the basin waters. This section does not limit or restrict the power of the commission to contract, with respect to water supply, for terms only as long as the creating compact continues in existence. (Scott-Fla)
W69-03920

POWERS AND DUTIES OF THE COMMISSION.
N Y Conserv Law sec 835 art 3 secs 3.1, 3.4 (2) (3) (4) (5) (McKinney Supp 1968).

Descriptors: *New York, *Water allocation (Policy), *Hydrologic data, *Water policy, Civil law, Legislation, State governments, Administrative agencies, Conservation, Planning, Water resources, Water conservation, Water supply, Water resources development, Administration, Legal aspects, Flood protection, Projects, Utilities, Research and development, Basins.

The commission shall develop and implement plans, policies, and projects relating to the water resources of the basin. Policies should be uniform and coordinated to conserve and manage water resources. The planning, development, operation, and financing of water resources projects shall be done under its direction. Such planning should include establishing standards for the above, including utilities, local flood protection works, watershed management programs, and ground recharging operations. It should conduct and sponsor research on water resources and their development, management, and control, and collect, and interpret, and publicize systematic surface and ground water data for use in flood warning, quality maintenance, and formulating and administering the comprehensive plan. (Scott-Fla)
W69-03921

SUSQUEHANNA RIVER BASIN COMPACT - PREAMBLE.
N Y Conserv Law sec 835 (McKinney Supp 1968).

Descriptors: *New York, *Water resources development, *Water policy, *River basin, Civil law, Legislation, State governments, Federal government, Administrative agencies, Conservation, Water resources, Planning, Water supply, Maryland, Administration, Pennsylvania, United States, Public benefits, Commissions, Interstate compacts, Legal aspects.

The Susquehanna River Basin Compact was signed by the member states for the purpose of the conservation, utilization, development, management and control of the basin under the control of comprehensive multiple purpose planning to bring the greatest benefits and produce the most efficient service in the public interest. The planning administered by a basinwide agency should provide flood damage reduction, conservation and development of surface and ground water supply for municipal, agricultural, and industrial uses, development of water recreational facilities, promotion of forest land management, soil conservation, and watershed projects, protection and aid to fisheries, development of hydroelectric power potentialities, control of salt water movement, abatement and control of water pollution, and regulation of streamflows toward attainment of these goals. Members of the compact include New York, Pennsylvania, Maryland, and the United States. The federal government, recognizing a national interest in the basin, has authorized the Army Corps of Engineers, the Department of Agriculture, the Department of Health, Education and Welfare, the Department of the Interior, the Federal Power Commission, the Department of Commerce, and other Federal agencies to cooperate in making comprehensive surveys and reports concerning the water resources of the basin. Concurrent legislation was passed by all members, thus creating the compact. (Scott-Fla)
W69-03922

WATER COMPACTS.
N Y Conserv Law sec 815 Art VI (B) (F) VII (A) (B) (C) (H) (McKinney 1967).

Descriptors: *New York, *Water resources development, *Water policy, *Administration, Civil law, Legislation, State governments, Administrative agencies, Conservation, Water resources, Planning, Water levels, Water pollution, Pollution abatement, Beach erosion, Floods, Navigation, Diversion, Interstate compacts, Legal aspects, Great Lakes Region.

The Commission shall have the power to recommend methods for the development, use, and conservation of the water resources of the basin and to recommend policies relating to water resources, including the institution and alteration of flood plain and other zoning laws and regulations. Each state that is a party to the compact shall consider the action recommended by the commission in respect to stabilization of lake levels, measures for combatting pollution, beach erosion, floods, and shore inundation, uniformity in navigation regulations, and diversion of waters from and into the basin. (Scott-Fla)
W69-03923

GREAT LAKES BASIN COMPACT.
N Y Conserv Law sec 815 art I, II, III, IVA (McKinney 1967).

Descriptors: *New York, *Conservation, *Water resources development, *Great Lakes Region, Civil laws, Legislation, State governments, Administrative agencies, Water resources, Planning, Water policy, Administration, Ohio, Pennsylvania, Illinois, Indiana, Michigan, Minnesota, Wisconsin, Great Lakes, Interstate compacts, St. Lawrence River, Legal aspects.

The purposes of the compact are to promote the orderly development and conservation of the water resources of the Great Lakes Basin, to enable the member states to derive the maximum benefit from utilization of public works, to help secure and maintain a proper balance among the various types of users of the water resources of the basin, and to establish an inter-governmental agency to help accomplish the purposes of the compact more efficiently. Members of the compact include Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, and Wisconsin; the Provinces of Ontario and Quebec may join at a later date. The Great Lakes Commission created by the compact shall exercise its powers in respect to the basins, which shall consist of the five Great Lakes, Lake St. Clair, the St. Lawrence River, all water interconnections between them, and all other rivers, lakes, ponds, streams, and all other watercourses which are tributary to the above lakes or comprise part of any watershed draining into said lakes. (Scott-Fla)
W69-03925

CONSERVATION LAW - DEFINITIONS - GENERAL JURISDICTION OF THE COMMISSION.
N Y Conserv Law secs 403 (5) 404 (McKinney 1967).

Descriptors: *New York, *Legislation, *Administrative agencies, *Water resources, Lakes, Bays, Ponds, Reservoirs, Springs, Wells, Rivers, Estuaries, Canals, Atlantic Ocean, Surface water, Public health, Drainage.
Identifiers: N Y State Water Resources Comm.

Sec 403 (5): Waters shall be construed to include lakes, bays, sounds, ponds, impounding reservoirs, springs, wells, rivers, streams, creeks, estuaries, marches, inlets, canals, the Atlantic Ocean within territorial limits of the State of New York, and all other bodies of surface or underground water, natural or artificial, inland or coastal, fresh or salt, public or private, which are wholly or partially within or bordering the state or within its jurisdiction. Sec 404: The New York State Water Resources Commission shall exercise its powers and perform its duties in any matter affecting the construction of improvements to, or developments of water resources for the public health, safety or welfare, including but not limited to the supply of potable waters for the various municipalities and inhabitants thereof, the use of water for industrial and agricultural operations, the developed and underdeveloped water power of the state, the facilitation of proper drainage and the regulation of flow and improvement of the rivers of the state. (Shevin-Fla)
W69-03988

NEW ENGLAND INTERSTATE WATER POLLUTION CONTROL COMPACT.
For primary bibliographic entry see Field 05G.
For abstract, see .
W69-03990

DARGAN V RICHARDSON (STATE REGULATION JURISDICTION OVER PRIVATE, MAN-MADE PONDS).

92 S E 2d 167-170 (S C 1956).

Descriptors: *South Carolina, *Ponds, *Permits, *State jurisdiction, Judicial decisions, Legal aspects, Regulation, Fishing, Farm ponds, Fish conservation, Fish management, Riparian rights, Fresh water.

Plaintiff, a private pond owner, obtained an injunction forbidding state and county game wardens from interfering with her customers who were fishing without licenses in her pond. The ponds in question had been excavated by the owner and were entirely segregated from other waters. The ponds were stocked, and persons desiring to fish them were permitted to upon payment of a fee to the plaintiff. The game warden arrested several of the plaintiff's patrons under a statute which forbade fresh water fishing with manufactured tackle without a license. Plaintiff contended that the actions of the defendant game wardens amounted to a taking of her property without the due process of law, and that artificial ponds entirely segregated from other waters were beyond the jurisdiction of the game wardens and the state statutes. This court reversed the trial court and set aside the injunction against the game wardens. After citing numerous statutes which regulated fishing privileges in waters of all descriptions within the state, the court held that while the private right of ownership may rest in the plaintiff, such property right or ownership is not such as to be beyond reasonable regulation by the State. The plaintiff's ponds, though segregated from other waters, still fell within the phrases 'fresh water of this state,' or 'the inland streams or waters of this state' as used in the conservation statutes. The power of the State to impose reasonable regulations (requiring fishing licenses) was not synonymous with and limited to ownership of property. (Blunt-Fla)
W69-03994

RESOURCES RESPONSIBILITY AND COORDINATION RELATED TO THE COMPREHENSIVE STUDY OF THE SUSQUEHANNA RIVER BASIN.
Interstate Advisory Committee on the Susquehanna River Basin.
For primary bibliographic entry see Field 06B.
For abstract, see .
W69-04032

OREGON'S WATER-MANAGEMENT DISTRICTS,
Oregon Univ., Eugene. School of Law.
William L. Hallmark.
Oregon Law Review, December 1967, pp 16-70.

Descriptors: *Oregon, *Water districts, *Interagency cooperation, Irrigation districts, Drainage districts, Boundaries, Eminent domain, State jurisdiction, Federal project policy.
Identifiers: Water control districts, Diking districts, Domestic water supply corporations, Water utilization corporations, Water control corporations, Conservation district constitutional problems.

The discussion of Oregon's districts reveals their potential uses and drawbacks and provides legislators a background essential for judging the validity of new proposals. A review of the origin of district laws is given. Seven main kinds of districts are described: (1) irrigation districts, (2) drainage districts, (3) water control districts, (4) diking districts, (5) domestic water supply corporations, (6) corporations for the use or control of water, and (7) soil and water conservation districts. Each is discussed in terms of territory, functions and powers, and formation process. The relationship of districts to each other is discussed, including territorial overlap and powers of eminent domain held by each. The relationship of districts to the state is discussed, including the powers and controls of the State Water Resources Board, State Engineer, State Tax Commission, Secretary of State, State Treasurer, and State Soil and Water Conservation Committee. Federal programs carried out by the Soil Conservation Service, the Bureau of Reclamation, and the Corps of Engineers are discussed. Finally, the article considers constitutional problems related to district laws, including legal contradictions in voting requirements and assessments. (Gossen-Chicago)
W69-04034

WATER LAW, PLANNING AND POLICY CASES AND MATERIALS,
Michigan Univ., Ann Arbor.
Joseph L. Sax.
New York, Bobbs-Merrill, 1968, 520. Contemporary legal educational series.

Descriptors: *Water law, *Riparian rights, *Appropriation, *Water management (Applied), Planning, Diversion, Water utilization, Administrative agencies, Federal government, Reclamation, Recreation, Conservation, Pollution abatement, Groundwater, Water pollution, Judicial decisions, Interstate compacts, Legal aspects.

This book was written as a textbook for law students. However, because of its approach to water law, it can also serve as a valuable reference volume. The author treats several current problems in the area of water resources management and, by means of an extensive factual background for each problem, including the influence of other related disciplines such as economics, political science and geography, allows the relevant legal doctrines to emerge from the problem itself. There are relatively few cases; the balance of the book being text and excerpts from articles and documents. The book begins with an introduction to the two basic legal doctrines in water law: riparianism and appropriation. Chapter 1 deals with public planning for water use, specifically the Northwest-Southwest division. Chapter 2 examines the influence of administrative agencies, federal and state, courts, federal management model, and urban water supply demands on managing water use. Recreation, conservation and aesthetics are the topics of Chapter 3. Chapter 4 discusses the problem of water pollution. The Fifth and final chapter concerns the legal problems related to groundwater and other special water sources. (Sisserson-Fla)
W69-04037

WATER QUALITY MANAGEMENT IN THE DELAWARE RIVER BASIN (FEDERAL AND INTERSTATE COMPACT TO SOLVE POLLUTION PROBLEMS),
Delaware River Basin Commission, Trenton, N. J.
For primary bibliographic entry see Field 05G.
For abstract, see .
W69-04039

MULTIPLE INTERESTS IN RIPARIAN LAND, SUBDIVISION PLATTING, AND THE ALLOCATION OF RIPARIAN RIGHTS,
Illinois Univ., Chicago; and Florida Univ., Gainesville. Coll. of Law.
Sheldon Plager, and Frank E. Maloney.
J Urban Law, Vol 46, No 1, pp 41-66, 1968. 26 p, 89 ref.

Descriptors: *Riparian rights, *High water mark, *Boundaries, *Water rights, Tidal waters, Water level fluctuations, Surveys, Meanders, Bodies of water, Shores, Easements, Water law, Legal aspects, Navigable waters, Judicial decisions, Public rights.
Identifiers: *Plats, Deeds, Right-of-access.

Riparian rights belong to the owner of land which abuts on a navigable waterbody. A problem arises both in deciding if the land abuts on the water, and, if it does, the rights which are thereby acquired. To do this, it is necessary first to decide where the water's edge is; second, to decide if the description of the land makes the water's edge or boundary; third, to decide, where more than one ownership abuts, how the riparian rights are to be allocated. The water's edge is the high water mark, and it is determined by tides, vegetation, and the soil. The question whether the land extends to the water's edge is a matter of intention of the grantor as set out in the deed. In urban areas, where the streets are platted, there is a question whether the street abuts on the water, and whether the public has merely an easement of a fee simple interest in the street. The problems here are whether: (1) the plat shows a water boundary; (2) there are lots abutting on only one side of the street; and (3) where the street is an easement, whether the public has rights of access. Generally, courts hold that plats purporting to withhold riparian rights cannot deny public access rights. (Hoffman-Fla)
W69-04040

THE RELATIONSHIP BETWEEN THE LAWS GOVERNING WATER RIGHTS AND THOSE GOVERNING OTHER NATURAL RESOURCES,
Northcutt Ely.
ABA Section of Mineral and Natural Resources Law (1962 Proceedings) pp 106-112, 1962. 7 p, 20 ref.

Descriptors: *Water rights, *Federal-state water rights conflict, *Riparian rights, *Prior appropriation, State governments, Federal governments, Surface waters, Subsurface waters, Desert Land Act, Legal aspects, Watersheds (Basins), Water law, Navigable waters, Non-navigable waters.

While the main concern of the author is demonstrating the parallel development of the law relative to water rights and oil, gas, and hard minerals, respectively, he places great emphasis on the development of water rights control in this country. Paying particular attention to the western states, the author points out how early conflicts concerning surface water control revolved around the riparian doctrine (that of reasonable use and correlative rights in water) as opposed to the appropriation doctrine ('first in time, first in right'). Strangely enough, the appropriation doctrine became commonplace for surface waters in dry arid regions while the riparian doctrine was used in more humid regions and for subsurface waters. This is no longer the important conflict. The conflict between the police powers of the states and the power of the federal government over interstate commerce has now come to the fore. Today the arena of dispute is not merely the courts but the floor of the legislature; the parties in interest are no longer private litigants but elements of our federal constitutional system, and the issues to be determined are such as will affect the destiny of entire watersheds. (Logan-Fla)
W69-04041

THE CONVENTION OF THE CONTINENTAL SHELF AND THE NEED FOR ITS REVISION AND SOME COMMENTS REGARDING THE REGIME FOR THE LAND BEYOND,
R. B. Krueger.
Nat Resources Lawyer, Vol 1, No 3, pp 1-18, July 1968. 19 p, 53 ref.

Descriptors: *Natural resources, *Continental shelf, *Oceans, *International law, International waters, Treaties, Oil industry, Law of the sea, Oceanography, Geology, Coasts, Marine geology, United Nations, Exploration, Exploitation, International commissions, Legal aspects, Technology, Legislation.

The Truman Proclamation in 1945 declared the resources of the seabed of the continental shelf contiguous to the United States, subject to its jurisdiction and control. This gave impetus to many claims by coastal nations that certain submarine areas were a part of the continental shelf. The 1958 Geneva Conventions on the Continental Shelf defined the shelf as the seabed adjacent to the coast, but outside the territorial waters, to a depth of 200 meters, or to where the superjacent water admit of exploitation. This definition has been widely criticized. The author points out that although such an open ended definition has allowed this country to exploit mineral resources beyond the 200 meter depth, it leads to international undersea land grabbing and should be revised. The undersea areas beyond the shelves are presently subject to no regulation and are open to exploitation by anyone. United Nations control and regulation of the deep sea areas has been proposed. The author discusses impending revision of the Convention definition of the shelf as well as its studies and proposals concerning the deep seas. He cites certain goals which might be achieved through international cooperation leading to beneficial use of the seas. (Helwig-Fla)
W69-04042

THE ADMINISTRATION OF THE OUTER CONTINENTAL SHELF LANDS ACT,
Department of the Interior, Washington, D. C. Office of the Solicitor.
Frank J. Barry.
Nat Resources Lawyer, Vol 1, No 3, pp 38-48, July 1968. 11 p, 11 ref.

Descriptors: *Legislation, *Exploitation, *Continental shelf, *Federal government, Exploration, Land tenure, Beds under water, Leases, Mineral industry, Mining, Legal aspects, Oceanography, Oil, Sulphur, Natural gas, Metals, International law, International waters.
Identifiers: Outer Continental Shelf Lands Act, Convention of the Continental Shelf.

The body of law dealing with exploitation of offshore mineral resources centers around the Outer Continental Shelf Lands Act of 1953 and the Convention on the Continental Shelf. The Act creates a federal jurisdiction over the submerged land beyond the three mile limit to the edge of the continental shelf. Federal control is exercised over all exploration and development of resources within the jurisdiction. The seas above the shelf are open to unimpeded international navigation. The International Convention on the Continental Shelf

et depth and distance limits for the shelf and escribed coastal nations' exclusive rights to exloitation of resources. Questions have been raised oncerning the adequacy of these laws. The author otes that the Act was apparently designed to apply nly to exploitation of oil, gas, and sulphur, but no ard minerals, in view of the provisions for leasing f submerged lands. Further questions were raised egarding the deep water exploitation beyond the helf, and the precise limits of national jurisdiction. he author maintains that the present body of law flexible enough to solve the problems and should ot be abandoned. (E. Kelly-Fla)
/69-04043

OMMENT, EMINENT DOMAIN - UNITED TATES V RANDS, 88 S Ct 265 (1967),
/yoming Univ., Laramie.
. L. Keene.
AND AND WATER L REV, Vol 4, No 1, pp 200-08, 1969. 9 p, 47 ref.

escriptors: *Judicial decisions, *Eminent domain, Navigable waters, *Condemnation value, Federal overnment, Evaluation, Condemnation, Riparian ghts, Riparian lands, Compensation, Navigation, ublic lands, Legal aspects, Political aspects, Proerty values.
dentifiers: *Navigational servitude, *Commerce ause, Fast land, Inverse condemnation.

n United States v Rands, 88 S Ct 265 (1967) the upreme Court, in a condemnation suit, denied a parian owner special compensation for port site roperty. The Court reasoned that if an owner can emand port site value, he gets the value of a right ven by the government in the exercise of its avigational servitude under the commerce clause. n the area of control of navigable waters, excepons are made to the requirement of just compenation for interference with private property. The overnment does not pay higher compensation for parian fast lands whose higher value was caused y its suitability for government use. The court has llowed this noncompensatory taking for two easons: (1) no property right is taken, rather, only ecapture of public right is effected; (2) the overnment is exercising its paramount navigaonal power. The author criticizes these reasons, uestioning their basis in fact. The policy that the nd is held for the public good and should be eveloped without paying private claims should be eplaced by a policy that when the public benefits, e public pays. The widening of the navigational rvitude doctrine is inconsistent with the liberal end in eminent domain laws. (Helwig-Fla)
/69-04044

ISHERIES JURISDICTION BEYOND THE ERRITORIAL SEA - WITH SPECIAL EFERENCE TO THE POLICY OF THE NITED STATES,
ewis H. Nomura.
/ashington L Rev, Vol 44, No 1, pp 307-334, Oct 968. 28 p, 129 ref.

escriptors: *Oceans, *Coasts, *International law, Jurisdiction, Legislation, Regulation, Zoning, oundaries (Surfaces), Federal-state water rights onflicts, Fisheries, Commercial fishing, Fish conrvation, Exploitation, Federal government, Legal spects, International waters, Continental shelf, cology, Wildlife.
dentifiers: Territorial seas, Exclusive fishing zones, 2 Mile Act, Contiguous zones.

his comment presents and evaluates the use of exusive fishery zones in the light of the primary inerests of conservation of fishery resources. After eviewing the United States policy on the breadth f territorial-sea boundaries, the comment reveals hat pressures of increasing exploitation of ground sh, shrimp, and king crab, off the coast of United tates by Soviet and Japanese fishing resulted in ederal legislation in 1966 establishing a nine-mile sheries zone contiguous to the territorial sea of he United States. The 12 Mile Act, 16 U S C secs 1091-94 (1966), is analyzed on the basis of measuring procedure, possible conflicts with state jurisdiction, administration and enforcement of laws and regulations, and the Bill's actual effect on American fisheries since 1966. The merits of such legislation are evaluated with respect to conflicting national and international interests. The comment concludes that the accomodation of American and world community interests will not be achieved successfully through use of exclusive fishery zones, and that the greatest likelihood of successful accommodation will result from the use of bilateral and multi-lateral agreements creating specific management regions for ecologically interrelated fish stocks. (Dean-Fla)
W69-04046

A HISTORY OF FEDERAL INVOLVEMENT IN THE MARINE SCIENCES: EMERGENCE OF THE NATIONAL SEA GRANT PROGRAM,
National Science Foundation, Washington, D. C.
For primary bibliographic entry see Field 09D.
For abstract, see .
W69-04048

THE DEVELOPMENT OF OCEAN MINERALS AND THE LAW OF THE SEA,
Consolidated Edison Co. of New York, Inc. New York.
Charles F. Luce.
Nat Resources Lawyer, Vol 1, No 3, pp 29-35, July 1968. 7 p, 1 ref.

Descriptors: *Law of the sea, *Continental shelf, *Coasts, *Boundary disputes, Ownership of beds, Beds under water, Administration, Mining, Exploitation, Water law, International commissions, Mineral industry, Mining engineering, Geological mapping, Subsurface mapping, Legal aspects.

The author states that a rapidly advancing technology is making the resources of the oceans available in growing abundance for exploitation by man. He concludes that, with the steady increase in extraction of minerals from ocean beds beyond the continental shelves, changes in the present legal regime regarding offshore boundaries will soon be required. The nations of the U. N. Commission on Intergovernmental Oceanography, including the United States, have conducted surveys concerning the present state of knowledge of undersea resources and have studied proposals for international cooperation. The author states that this type of action, culminating in some form of international regime to govern the disposition and/or use of mineral laden undersea lands, is essential to avoid power struggles between nations for control of the seas. He points out difficulties in implementation, such as disputes among coastal countries over boundaries and undersea rights, and hazards of locally unregulated offshore operations by foreign powers. He furthur cites difficulties in international administration which must be overcome, such as conflicts of interests over proposed usage and the nature of the legal rights which vest in the user. (Kelly-Fla)
W69-04049

POLLUTION.
Natural Resources Law Newsletter, Vol 1, No 3, pp 1, 5, April 1968. 2 p.

Descriptors: *Oil, *Water quality control, *Legislation, *Ships, Oil industry, Oil wastes, Pollutants, Water pollution sources, Water quality, Federal government, Water pollution control, Water pollution, Boats, Federal jurisdiction, Navigable waters.
Identifiers: Marine vessels, Oil Pollution Act.

This newsletter article directs itself to the problem of the pollution of navigable waters by marine vessel oil discharges. The existing federal law, the Oil Pollution Act of 1924, is said to be weak because gross negligence or willful misconduct must be present to establish a violation. Proposed legislation, which would make the owner or operator of a vessel absolutely liable for all clean-up costs regardless of fault, is criticized for going from one extreme to the other. The President urged that the legislation be broadened to apply to twelve miles offshore and to include spillages of other pollutants. This article discusses the problem of obtaining jurisdiction over the party responsible for spillages. Criticism is also directed at the proposed expansion to include discharges from shore installations, in that they are already covered by other laws. Several considerations are offered, including compulsory insurance, federal clean-up aid, limitation of liability, and special treatment for mobile marine transportation equipment. (C. W. Wheeler-Fla)
W69-04050

ACQUISITION OF RIPARIAN RIGHTS IN NEW YORK,
Theodore R. Lee.
A B A Section of Mineral and Natural Resources Law (1964 Proceedings), pp 13-21, 1964. 9 p, 29 ref.

Descriptors: *Water law, *New York, *Riparian rights, Water resources, Water supply, Right-of-way, Water rights, Alteration of flow, Civil law, Diversion, Fish management, Irrigation water, Legal aspects, Legislation, Municipal water, Natural use, Navigable waters, Obstruction to flow, Prior appropriation, Reasonable use, Relative rights, Riparian land, Riparian waters, Usufructuary right, Water utilization, Wildlife conservation, Hudson River, Public rights, Easements, Natural flow doctrine.
Identifiers: Mohawk River.

This article is a review of the law of riparian rights particularly as they relate to New York State. It briefly describes the various doctrines of riparian rights in effect in the United States, placing emphasis on the common law doctrine. The author discusses some of the issues raised in the New York City water supply proceeding, as well as certain limitations on the rights of riparian owners and some of the objections which have been made to the common law doctrine. Also mentioned is a proposal for changing the common law doctrine by legislation and the current attitude of the New York legislature toward possible changes. The article concludes that the common law doctrine of riparian rights applies generally in New York, although criticized; that the City of New York is required by statute to pay indirect real estate and business damages, as well as direct damages, in riparian proceedings; and that the New York legislature, at the present time, does not seem inclined to relieve the City of that obligation nor to materially change the common law doctrine with respect to payment for riparian rights. (D. Heckerling-Fla)
W69-04051

WATER PROBLEMS IN THE NORTHEAST AND INCREASING FEDERAL REGULATION,
Ernest R. Von Starck.
ABA Section of Mineral and Natural Resources Law (1966 Proceedings), pp 27-30, 1966. 4 p.

Descriptors: *Water management, *Water utilization, *Water supply, *Water shortage, Local governments, Federal government, Water resources, Droughts, Reservoir operation, Utilities, Water demand, Water storage, Water conservation, Water delivery, Water requirements, Northeast U S, Community development, Prior appropriation doctrine, Riparian waters, Reasonable use, Southwest U S.

Until recently, there has been no great water supply problem in the Northeast. With the drought conditions which began in 1962 and are continuing to the present time, the sense of non-involvement in major water supply problems has vanished. The current public water supply problems in the Northeast are due more to past deficiencies in

planning than to present lack of rainfall. The area has an abundance of water which has not been used because of a shortage of adequate facilities for collection, storage treatment, and delivery. Solution to the problem should be sought locally. Federal funds for multipurpose reservoirs in the Northeast will be necessary and will help with local problems, however, the water supply aspects of such projects should be financed and controlled on a regional basis. Federal intervention and ultimate control are neither justified nor desirable. The problem certainly provides no basis for federal legislation which restricts the further expansion of privately owned systems which have proven their ability to render service which encourages by subsidy the extention of the type which this drought has exposed as inefficient. (D. A. Heckerling-Fla)
W69-04052

N Y COMMON LAW AND STATUTORY RIGHTS PROTECTING THE INTERESTS OF THE INDIVIDUAL RIPARIAN OWNER IN THE RECREATIONAL AND AESTHETIC VALUES OF HIS ENVIRONMENT,
Cornell Univ., Ithaca, N. Y. Center for Water Resources and Marine Sciences.
William H. Farnham.
Modernization of Eastern Water Law: New York State: A Case Study (Exhibit C), Nov 22, 1968. 61 p, 337 ref.

Descriptors: *New York, *Riparian rights, *Recreation, *Water utilization, Legal aspects, Legislation, Lakes, Streams, Navigable waters, Boating, Fishing, Swimming, Remedies, Natural use, Riparian land, Eminent domain, Alteration of flow, Reasonable use, Water uses, Public benefits, Dams, Docks, Structures, Social values.
Identifiers: Police power, Aesthetic values, Obstruction to view.

The article discusses in depth the enactment of a 1966 New York Conservation Law. The Law creates two new riparian rights. It specifies: (1) that a riparian owner's view of the water upon which his land abuts shall not be interfered with to an unreasonable degree; and (2) that the natural beauty of such body of water shall not be unreasonably impaired. A discussion of the applicable common law and its interpretation by the courts is set out in detail. The problems which will be raised by the recent legislation are presented. The problem of what is 'unreasonable' should be handled by the use of an 'ordinary reasonable purdent man' standard. The act should be held constitutional as a reasonable exercise of the police power of the state. This argument has been successful in the area of zoning. The author feels this legislation is needed to fill the obvious void in the relevant case law. Public sentiment favors the preservation of scenic beauty, and, in addition, the aesthic value bargained for by the riparian owner when he purchased the property should be protected. (A. Shevin-Fla)
W69-04054

JULES DUPUIT AND THE EARLY THEORY OF MARGINAL COST PRICING,
Texas A and M Univ., College Station.
R. B. Ekelund, Jr.
Jour Pol Econ, Vol 76, No 3, pp 462-471, May/June, 1968. 10 p, 1 fig, 1 tab, 17 ref.

Descriptors: *Pricing, Monopoly, Welfare, Costs, Prices, *Cost-benefit theory, *Demand, Tariff.
Identifiers: Total utility, *Consumers' surplus, Producers' surplus, Price discrimination, *Marginal cost pricing, *Subsidies, Toll.

The purpose of this article is to assess the nature of Dupuit's contribution to welfare theory of marginal cost pricing. It is concluded that although Dupuit has rightful claims as the first cost-benefit economist, he was not a progenitor of the principle. Discovery of a short-run marginal cost principle in Dupuit's writings would require a contrived and incorrect interpretation of his remarks on costs and the efficacy of subsidies. Had Dupuit been equipped with Marshallian period analysis or had he specified or indicated that his bridge studies involved a long-run market period, the fixed and maintenance expenses would have indeed been marginal. A long-run approach, moreover, would have possibly been more in keeping with contemporary practice in cost-benefit studies. Yet Dupuit's early and original insights into welfare theory have provided the necessary backdrop against which an important and fruitful area of modern economics is being enacted. Vital water pricing problems involving short vs. long run cost and marginal vs. average cost criteria have as their basis Dupuit's classical treatment of welfare conditions under marginal cost pricing. (Sokoloff-Rutgers)
W69-04085

FINAL REPORT AS OF MARCH 24, 1967, OF CONCLUSIONS REACHED, LEGISLATION RECOMMENDED AND PROGRESS MADE.
Cornell Univ., Ithaca, N. Y. Center for Water Resources and Marine Sciences.

Report to the N. Y. Temporary State Comm on Water Resources Planning, March 31, 1967. 17 p, 33 ref.

Descriptors: *New York, *Riparian rights, *Riparian land, *Reasonable use, Legislation, Lend tenure, Prior appropriation, Property boundaries, Ownership of beds, Severance, Easements, Watersheds, Access routes, Docks, Navigable waters, Non-navigable waters, Irrigation, Diversion, Relative rights, Water resources development, Judicial decisions, Legal aspects.
Identifiers: *Proposed legislation, *Contiguous land, *Riparian rights transfer.

The Center recommends legislation declaring it to be lawful to commence 'reasonable' harmful activities to further use of riparian land, and that riparian owners may substitute non-riparian land, in the exercise of this privilege. The privilege would not extend to non-riparian owners, and legislation should enumerate factors determinative of reasonableness. Tentative recommendations include legislation allowing transfer of riparian rights with or without land to riparians or non-riparians, with adequate protection for riparians with related rights; present law is inadequate to base such transfers upon. In addition, legislation would supply accurate information readily available to private owners. Further, the recommended legislation would define riparian land and the effects of acquisition of contiguous land. The effect of severance and sale of portions of riparian land so that they no longer border on water are also dealt with. Existing case law supplies scant basis for accurate land classification and determination of related rights. (Harris-Fla)
W69-04105

A STUDY OF SELECTED ASPECTS OF THE POWERS OF NEW YORK STATE OVER THE WATERS OF THE STATE.
Cornell Univ., Ithaca, N. Y. Center for Water Resources and Marine Sciences.

Report to the N. Y. Temporary State Comm on Water Resources Planning, March 31, 1966, 102 p, 172 ref. Cont No C19518.

Descriptors: *New York, *Proprietary power, *Public rights, *Ownership of beds, Canals, Navigation, Compensation, Navigable waters, Non-navigable waters, State governments, Riparian rights, Usufructuary right, High water mark, Low water mark, Public lands, Conservation, New York State Barge Canal, Hudson River, New Jersey, Minnesota, Boundaries (Surfaces), Lake Ontario, St. Lawrence River, State jurisdiction.
Identifiers: *Public trustee doctrine, *Police power, Niagara River, Mohawk River.

The questions considered are: (1) whether the State of New York has proprietary rights or rights as trustee for the public in the waters of the state, as distinct from its police and navigation powers over such waters; (2) whether the state, by virtue of such rights, is authorized to modify riparian rights in furtherance of the public interest. New York's navigational system of canals and large waterways for public use make a definition of the state's authority to alter riparian rights valuable. Prior state power has been based on the navigation or policy powers, with any other confiscation of riparian rights being compensated. An in depth study of New York's statutory and case law on riparian and state water rights leads to the conclusion that the state holds rights in certain waters and beds in public trust, but the extent of the state's powers as trustee are ill-defined. New York law is uncertain as to whether proprietary rights and rights to modify without compensation exist in the state. (Harris-Fla)
W69-04106

CARD V NICKERSON (ACTION FOR DAMAGES FOR OBSTRUCTION OF NATURAL WATER COURSE).
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-04151

KENNEBUNK WATER DIST V MAINE TURNPIKE AUTH (RIPARIAN RIGHTS AND USES).

84 A 2d 433-440 (Me 1951).

Descriptors: *Riparian rights, *Water supply, *Proprietary power, *Maine, Judicial decisions, Water pollution, Competing uses, Municipal water, Reasonable use, Riparian land, Riparian waters, Eminent domain, Turbidity, Water rights, Ownership of beds.
Identifiers: *Turnpike Authority, Brooks.

Plaintiff water company brought suit against defendant authority for damages caused to the public water supply when defendant created a turbid condition in one of the brooks used by the district. A question of prime importance was whether or not the district had a proprietary right to use the waters of the brook as a source of supply. In a prior decision, the state supreme court held that the district did not establish a legitimate proprietary right. The district was allowed to amend certain defects0444444444 before rehearing. The district claimed that since it owned the lower riparian lands, which includes the banks and beds of the brook, it had a proprietary interest in the water. However, in holding for the turnpike authority, the court ruled that the plaintiff's proprietary rights to use the water, stemming from ownership of riparian lands, was restricted to riparian purposes. The use of water for public water supply is not a riparian use. If the use is non-riparian, the right must be acquired by eminent domain or purchase from the upper riparian owners who was the turnpike authority. Furthermore, the court held that the use by the turnpike authority of its own land was reasonable; therefore, it may do all things incidental thereto. (Stewart-Fla)
W69-04152

FLOATING TIMBER.

Me Rev Stat Ann tit 38, secs 971-979 (1965).

Descriptors: *Maine, *Lumber, *Lumbering, Legislation, Industries, Saw mills, Water utilization, Water conveyance, Water rights, Riparian land, Navigable waters, Riparian rights, Banks, Legal aspects.
Identifiers: Penalties (Criminal), Penalties (Civil).

Anyone who converts logs lying in a body of water or on its banks is liable to the owner of the logs and to the state for a specified amount per log. The conversion is larcenous if the taking is for the purpose of delivery to a market or mill; there is a presumption of guilt if the logs have been altered. One guilty of the statutory conversion and/or larceny is also li-

ble to the owner in a civil action for double the alue of the logs. One may peaceably enter nother's mill or raft of logs to search for his lost mber; a specified sum may be awarded in a civil ction of such entry is prevented. An owner may rive to the place of market the logs of others, hich become intermixed with his own and he is ntitled to compensation for so doing. Logs wash- g upon land may be confiscated by the landowner fter a specified waiting period; the log owner may emove his timber upon tender of reasonable com- ensation to the landowner. Damages are specified or conversion of railroad sleepers, ship knees and edar timber. Obstruction of timber passage on the aco River is actionable. (Molica-Fla)
V69-04153

NTERSTATE WATER POLLUTION CONTROL CT.
or primary bibliographic entry see Field 05G.
or abstract, see .
V69-04154

RTICLE ONE, SUBCHAPTER TWO, NEW EN- LAND INTERSTATE WATER POLLUTION ONTROL COMPACT (DETAILS OF THE OMPACT).
or primary bibliographic entry see Field 05G.
or abstract, see .
V69-04155

RTICLE TWO; SUBCHAPTER TWO; NEW NGLAND INTERSTATE WATER POLLUTION ONTROL COMPACT.
or primary bibliographic entry see Field 05G.
or abstract, see .
V69-04156

UBLIC FACILITIES FOR BOATS.

Ie Rev Stat Ann tit 38 secs 321, 321-A, 322, 323, 24, 325, 326, 327, 328 (Supp 1968-69).

escriptors: *Maine, *Legislation, *Boating, Recreation facilities, Boat-launching ramps, arks, Administration, Administrative agencies, onstruction, Operation and maintenance, Financ- g, Contracts, Legal aspects.

he Director of the Maine State Park and Recrea- on Commission is empowered to decide where ublic facilities for boats shall be located and shall onstruct and maintain them in the waters of the tate. The Director may place regulator markers n the waters where hazards exist. For these pur- oses the Commission or its agents may enter any nds or premises for inspection and it has the uthority to (1) exercise police supervision over ublic facilities, (2) establish rules and regulations, 3) control fires, (4) make leases and other agree- ents with the United States. The Commission is rovided with a fund to carry out its duties. The ommission may charge reasonable fees for the use f facilities to finance their supervision. 10% of the es may be set aside for maintenance purposes. he Director may lease land for a maximum of 30 ears to private individuals on which they may con- ruct restaurants, etc and he may lease from rivate individuals land or structures, for periods ot exceeding 99 years, to construct or maintain oat facilities. (Molica-Fla)
V69-04157

NLAWFUL DISPOSAL OR TAKING OF BAL- AST.
or primary bibliographic entry see Field 05B.
or abstract, see .
V69-04158

IARBOR MASTERS.
Ie Rev Stat Ann tit 38, secs 1, 2-5 (1965); Me Rev tat Ann tit 30, sec 2 (Supp 1968-69).

Descriptors: *Legislation, *Maine, *Port authorities, *Harbors, Boats, Local governments, Public benefits, Channels, Channel improvement, Coastal structures, Municipalities, Legal aspects, Navigation, Boating.
Identifiers: *Harbor masters, Moorings, Penalties (Criminal).

These sections pertain to harbor masters. Section 1 provides for the annual appointment of a harbor master by selectmen of towns. The master shall be subject to all the duties and liabilities of said office as prescribed by law with a fine of $25 for each willful neglect or refusal. The selectman may establish his salary and shall have power to remove him. Section 2 allows municipal officers to make rules for keeping channels open to the passage of vessels and to mark off the boundaries of these channels. The harbor master and his deputy, if appointed, or any other law enforcement officer of the state, may enforce these rules. Section 3 provides that, in all harbors where channel lines have been established, the harbor master may assign mooring positions and determine type of mooring to be used. Section 4 provides that in case of neglect or refusal of the master or owner of a boat to remove or replace his mooring, the harbor master may have it removed or changed and collect $2 for such service. Section 5 allows the harbor master to order any vessel obstructing free movement or safe anchorage of any vessel to move to a position designated by him. Failure to obey this order is a misdemeanor punishable by a fine or imprisonment. If no crew is aboard such vessel or if the master refuses to remove it, the harbor master may place a crew on board to move it and the charge shall be $2 plus the cost of the crew. (Heckerling-Fla)
W69-04159

ARSON.

Me Rev Stat Ann tit 17, sec 153 (1965).

Descriptors: *Maine, *Burning, *Boats, Legislation, Ships, Bridges, Piers, Locks, Fire, Legal aspects.
Identifiers: *Penalties (Criminal).

The statute declares that anyone who willfully and maliciously burns any vessel, bridge, lock or dam shall be punished by imprisonment from one to ten years. (Stewart-Fla).
W69-04163

WATER RESOURCES RESEARCH INSTITUTE.

Ala Code tit 8 secs 266-269 (1967 Supp).

Descriptors: *Alabama, *Research facilities, *Administrative agencies, Legislation, Laboratories.
Identifiers: *Water Resources Research Inst.

The board of trustees of Auburn University is authorized to establish a water resources research institute, which is designated as the state agency to accept federal funds for water resources research. The institute shall be subject to the control of the trustees and president of Auburn University and its programs shall be coordinated with the Geological Survey of Alabama. The results of research conducted by the institute shall be reported or published as the director of the institute may consider suitable and appropriate. (Kahle-Fla)
W69-04168

MCKEE V GAY (BOUNDARY LIMITATION WHEN DEED CONVEYS TO THE LOW WATER MARK).

293 S W 2d 450-452 (Ark 1956).

Descriptors: *Arkansas, *Boundaries (Property), *Ownership of beds, *Low water mark, Judicial decisions, Boundary disputes, Land tenure, Riparian land, Legal aspects, Riparian rights.
Identifiers: Brakes, Deeds.

Defendant held title to land which was shaped like a horseshoe. The deed described the curved boundary, formed by a brake, as beginning at a point at the low water mark of the brake on a line between certain sections and then running along such line between other sections to the low water mark on the north side of the brake, and then right, along the low water mark of the brake, to the point of beginning. The circuit court held that the deed was effective to convey only the land which was contained within the boundaries set out therein. Since his rights were fixed by the description in the deed, defendant was not entitled to claim to the middle of the brake as a riparian owner. (Childs-Fla)
W69-04169

ABOLT V CITY OF FORT MADISON (USE OF PUBLIC LAND BY PRIVATE INDIVIDUAL).

108 NW 2d 263-270 (Iowa 1961).

Descriptors: *Iowa, *Public lands, *Public rights, *Land use, Judicial decisions, Withdrawn land, Cities, Zoning, Industries, Federal Government, Land classification, Land development, Parks, Aesthetics, Eminent domain, Legislation, Legal aspects.

Plaintiff sought to restrain the defendant city from leasing 2.2 acres of a riverfront park for the construction of dock and warehouse facilities. The plaintiff claimed that the proposed lease amounted to allowing land reserved for a public park to be diverted to private use. The decision at trial was for the defendants and this court affirms. The city was laid out per an act of Congress which provided that a quantity of land on the river banks, running the length of the town, be reserved from sale for public use, and remain forever for public use, as public highways, and for other public uses. The city may not devote the land to private use nor dispose of it for other than public uses. The warehouses to be built under the lease are to be public bonded warehouses leased to a private business for a term of years. The fact that the leasee expects to derive profits from the warehouses does not require that his use be deemed private. Projects devoted to a public use are frequently undertaken with a view to private benefit. A legislative determination that lands taken under eminent domain are to be put to public use will not be interferred with by the courts unless it is palpably clear that the use is private in character. The congressional act did not limit the use of the land in question to any particular public use such as a park. An unrestricted dedication can be used for any purpose for which the municipal authorities may determine, as long as it is a public use. (Blunt-Fla)
W69-04171

AN ACT RELATIVE TO EXPANDED STATE ACTIVITY IN THE FIELD OF WATER POLLUTION CONTROL.
For primary bibliographic entry see Field 05G.
For abstract, see .
W69-04178

PETITION OF ALGONQUIN GAS TRANSMISSION CO (GRANTED RIGHTS IN RIVERBEDS).
2 Misc 2d 997, 157 NYS 2d 748 (S Ct 1956).

Descriptors: *New York, *Hudson River, *Easements, *River beds, Judicial decisions, Legal aspects, Utilities, Pipelines, Navigable rivers, Real property, Legal aspects, Ownership of beds, State governments, Assessments, Public benefits.
Identifiers: Franchises.

Petitioner gas company was granted a right to construct a pipeline in and upon a strip of land under the Hudson River. After the construction of the lines, respondent state assessed them as an exercise of a special franchise. The court held that petitioner's claim that the interest it acquired was an easement rather than a franchise was correct and as such it was not subject to an assessment. The state has two separate interests in the river, ownership of

the soil under the water and control over the waters for the benefit of the public. The latter is a sovereign power, but title to the river bed is ownership similar to that of a private owner of a parcel of land. The granting of rights in real estate in the bed of the river is a property right and not an attribute of sovereignty and is therefore an easement. (Molica-Fla)
W69-04182

ENTRY BY TOWN ENGINEER ON PRIVATE LANDS.

N Y Town Law sec 32-a (McKinney 1968). 2 p.

Descriptors: *New York, *Legislation, *Investigations, *Bodies of water, Land, Local governments, Real property, Surveys, On-site data collections, Legal aspects, Boreholes, Drilling.

The town engineer, or any of his agents, may enter upon any lands, waters or waterways, public or private, within the town to make surveys, examinations or investigations necessary to the performance of his duties. Any alterations, such as test pits or test borings made to the land, must be refilled, and the real property must be restored to its previous condition. (Sisserson-Fla)
W69-04184

LICENSING DIVERSION AND USE OF WATER FOR POWER.
N Y Conserv Law secs 501 (9), 502 (McKinney 1967).

Descriptors: *New York, *Eminent domain, *Diversion structures, *Permits, Legislation, Jurisdiction, Legal aspects, State jurisdiction, United States, Diversion, Power plants, Hydroelectric plants, River beds, Water management (Applied), Water control, Canals, Streams.

The Commission of Water Resources may issue licenses to public utilities to build power plants on waters in which the State of New York has a proprietary right or interest. The licenses may authorize the utility to divert water or condemn land, including river bottoms by eminent domain if necessary. The licenses must be signed by the governor. The approval of the federal authorities is further required where the United States has also assumed jurisdiction of navigable waters. (Watson-Fla)
W69-04188

RESERVATION OF STATE CONTROL OVER WATER POWER.
N Y Conserv Law sec 500 (McKinney 1967).

Descriptors: *New York, *Legislation, *Regulation, *Water rights, Control, Legal aspects, Jurisdiction, State jurisdiction, Water utilization, Riparian rights.

The State of New York reserves control over all waters in which it has proprietary ownership of the flow whether exclusive or concurrent with another jurisdiction. Any person who takes, diverts, appropriates, or otherwise uses these waters remains subject to the power and control of the state for the purposes of regulating, licensing, controlling, or terminating the use. The state may also exact a rent or charge for the use. (Watson-Fla)
W69-04189

CREATION OF WATER RESOURCES COMMISSION.
N Y Conserv Law sec 410 (McKinney 1967).

Descriptors: *New York, *Water resources, *Water policy, *Administrative agencies, Legislation, Water resource development, Conservation, Planning, Water conservation.

The Water Resources Commission, under the Conservation Department, is responsible for the integration of all water resource policy and planning activities. It has seven regular members and four advisory members appointed by the Governor. The advisory members must be comprised of a representative of: (1) industry, (2) state political subdivisions, (3) agricultural interests, (4) sportsmen. The advisory members are entitled to participate in all meetings but are not entitled to vote on any matters before the commission. (Molica-Fla)
W69-04190

WATER RESOURCES - LEGISLATIVE FINDINGS.
N Y Conserv Law sec 400a (McKinney 1967).

Descriptors: *New York, *Water resources development, *Water pollution control, *Water conservation, Legislation, Planning, Water resources, Water policy, Conservation, State governments, Public benefits, Legal aspects, Water supply, Water demand, Water control, Regulation, Economics, Administrative agencies.

The State of New York, pursuant to legislative findings, is deemed to have exclusive sovereign power in the control and regulation of water resources of the state except to the extent of any delegation of authority to the United States. The State recognizes that its water resources are important for economic growth, that an adequate supply of water is essential to the well being of its people and that the demands for water are on the increase. The State seeks to preserve all water life and condemn unreasonable and unregulated interference with its bodies of water which contribute to pollution. The Water Resources Commission has classified the waters of the state and is undertaking comprehensive planning to conserve and develop water resources. The use of water for domestic and municipal purposes has priority over its use for other purposes. (Molica-Fla)
W69-04191

BURNS V GARDNER (SUIT FOR DEATH OF CHILD BY DROWNING).
244 NC 602, 94 SE 2d 591-592 (1956).

Descriptors: *North Carolina, *Lakes, *Artificial watercourses, *Drowning, Judicial decisions, Water law, Hazards, Recreation, Safety, Swimming, Ponds, Lakes, Legal aspects.
Identifiers: Negligence.

The administration of the estate of a ten year old girl brought an action in negligence against the owners of an artificial lake, into which the girl had fallen and drowned. The trial court entered a judgment of non-suit and the Supreme Court of North Carolina affirmed. The supreme court held, in a per curiam decision, that the evidence was insufficient to warrant submission to a jury. The supreme court additionally stated that a person has the right to maintain an unenclosed pond or pool on his premises, and it is not an act of negligence to do so. (Watson-Fla)
W69-04192

ACTIONS TO DETERMINE TITLE TO RIPARIAN LANDS AND LANDS UNDER WATER.

N J Stat Ann secs 2A:62-23 to 2A:62-26 (1968).

Descriptors: *New Jersey, *Legislation, *Riparian land, *Ownership of beds, Water law, Beds, Administrative agencies, Navigation, Riparian rights, Streambeds, Real property, Legal aspects, State governments, Grants.
Identifiers: Title.

When a grant or conveyance in fee of riparian lands or lands underwater has been made by the State of New Jersey, or any of its agencies, to any person, or his lessee, who is in possession of the lands and the state denies the validity of the grant and desires to contest it, the Attorney General may maintain a suit in the superior court on behalf of the state to settle the matter. Upon application of either party, a jury trial shall be directed to try the validity of any claim to the affected lands. The final determination and judgment of the court shall fix and settle the rights of the parties in the affected lands, which shall be binding upon all the parties to the action. If the judgment of the court is in favor of the state, the court shall determine upon what equitable terms the grant or conveyance in fee shall be set aside and declared of no effect. (Watson-Fla)
W69-04195

NEW JERSEY AND DELAWARE - TERRITORIAL LIMITS AND JURISDICTION.

N J Stat Ann secs 52: 28-34 to 52: 28-38, 52: 28-40 to 52: 28-42 (1955).

Descriptors: *Delaware River, *New Jersey, *Boundaries (Property), *Interstate compact, Legislation, Delaware, Jurisdiction, Interstate rivers, Shellfish, State government, Riparian rights.
Identifiers: Criminal law.

Sections 52: 28-34 through 52: 38-38 and 52: 28-40 to 52: 28-42 pertain to the relationship of New Jersey and Delaware as regards the Delaware River. Section 52: 28-34, the Preamble, refers to a meeting in 1905 of commissioners from New Jersey and Delaware which produced a compact to prevent further controversies over the Delaware River and to eliminate those already existing. Section 52: 28-35 provides for criminal service of process issued by New Jersey against anyone committing a crime on the eastern half of Delaware River and allows service to be made anywhere on the river. Section 52: 28-36 allows reciprocal service of process by Delaware for crimes committed on the western half of the river. Section 52: 28-37 makes the river a common fishing grounds for the inhabitants of the two states. Section 52: 28-38 sets up a joint commission to draft laws relative to fishing and ascertaining a dividing line between the river and the bay separating the two states. Section 52: 28-40 provides that the shellfish industry is not affected by this agreement. Section 52: 28-41 allows each state to continue to exercise its riparian jurisdiction. Section 52: 28-42 provides that each state's rights in the Delaware River shall be preserved. (Heckerling-Fla)
W69-04196

LICENSING OF VESSELS.

N J Stat Ann secs 50: 3-1, 50:3-3 (1955).

Descriptors: *New Jersey, *Commercial shellfish, *Permits, *Delaware River, Legislation, Commercial fishing, Bays, Beds, Boats, State jurisdiction.

These sections pertain to the licensing of vessels for the taking of shellfish. Section 1 provides that no vessel shall be used in the catching of oysters in the Delaware River, Delaware Bay or Maurice Cove without a license for that purpose. Such license shall be issued by the Chief of the Department of Maurice River Cove, duly certified, to the captains of the vessels entitled thereto. Section 3 provides that the vessels must be owned by citizens and actual residents of this state. No vessel owned wholly or in part by a non-resident and which is licensed to take oysters in another state within the same year shall be licensed in this state. The captain of the vessel shall swear an oath as to this information. (Heckerling-Fla)
W69-04197

LEASING OF LANDS FOR SHELLFISH CULTURE.
N J Stat Ann secs 50:1-23--28, 50:1-30--33 (1955).
N J Stat Ann secs 50:1-23 (Supp 1968).

scriptors: *New Jersey, *Shellfish, *Beds, idal waters, Legislation, Commercial fishing, sters, Commercial shellfish, Agriculture, Leases, te jurisdiction, State government, Public health, rine fisheries, Mapping, Surveys, Subsurface pping.
ntifiers: *Shellfish cultures.

e Shell Fisheries Council is empowered to lease y state lands under tidal waters, the land to be d exclusively by the lessee for cultivating ters. This board's powers in this area are exclu-e. Only citizens and actual residents of the state ll be granted a license, and the Council must uire applicants to file an oath to this effect. This rd has the power to set the length of the lease, rental price, and the size of the leased ground. s board shall have the leased lands measured, rked and mapped, the expenses to be paid by the licant. This board may lease any lands that have n condemned by the state department of health. s board may make rules and regulations for the noval and distribution of shellfish from the sed land. All leases issued before July 4, 1931 continued. This law shall not prevent the ching of floating fish from tidal waters. eckerling-Fla)
9-04198

'. Nonstructural Alternatives

OOD PLAIN INFORMATION-HUTTON ANCH AND COOKS BRANCH, DALLAS UNTY, TEXAS.
rps of Engineers, Fort Worth, Tex.
primary bibliographic entry see Field 04A.
abstract, see .
9-03707

OOD PLAIN INFORMATION - VOLUME IV DENVER METROPOLITAN REGION, LORADO.
rps of Engineers, Omaha, Nebr.
primary bibliographic entry see Field 04A.
abstract, see .
9-03708

OOD PLAIN INFORMATION OF CON-REE CREEK AND SIX MILE CREEK IN XINGTON COUNTY, SOUTH CAROLINA.
rps of Engineers, Charleston, S. C.
primary bibliographic entry see Field 04A.
abstract, see .
9-03709

OOD PLAIN INFORMATION-PETERS EEK AND LICK RUN, ROANOKE, VIR-NIA.
ves, Seay, Mattern and Mattern, Roanoke, Va.
primary bibliographic entry see Field 04A.
abstract, see .
9-03710

ELIMINARY FLOOD PLAIN INFORMA-ON-CHATTAHOOCHEE RIVER, BUFORD M TO METROPOLITAN ATLANTA, GEOR-A.
rps of Engineers, Mobile, Ala.
primary bibliographic entry see Field 04A.
abstract, see .
9-03711

OOD PLAIN INFORMATION - FOUNTAIN EEK, PUEBLO, COLORADO.
rps of Engineers, Albuquerque, N. Mex.
primary bibliographic entry see Field 04A.
abstract, see .
9-03712

FLOOD PLAIN INFORMATION-OUACHITA RIVER, CAMDEN, ARKANSAS.
Corps of Engineers, Vicksburg, Miss.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03713

FLOOD PLAIN INFORMATION-CUMBERLAND RIVER AND OBEY RIVER, CELINA, TENNESSEE.
Corps of Engineers, Nashville, Tenn.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03714

FLOOD PLAIN INFORMATION, CHRISTINA RIVER, MUDDY AND BELLTOWN RUNS, NEW CASTLE COUNTY, DELAWARE.
Corps of Engineers, Philadelphia, Pa.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03715

OREGON'S WATER-MANAGEMENT DISTRICTS,
Oregon Univ., Eugene. School of Law.
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-04034

SIMULATION OF A NATIONAL FLOOD INSURANCE FUND,
Florida Univ., Gainesville; and Harvard Univ., Cambridge, Mass.
For primary bibliographic entry see Field 06A.
For abstract, see .
W69-04138

6G. Ecologic Impact of Water Development

WATER PROBLEMS IN THE NORTHEAST AND INCREASING FEDERAL REGULATION,
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-04052

07. RESOURCES DATA

7B. Data Acquisition

STAGE MEASUREMENT AT GAGING STATIONS,
Geological Survey, Washington, D. C.
Thomas J. Buchanan, and William P. Somers.
Geol Surv Tech Water Resources Invest, Book 3, Chapter A7, 1968. 28 p, 27 fig, 6 ref.

Descriptors: *Stream gages, *Instrumentation, Gaging stations, Telemetry, Water levels, Potentiometers.
Identifiers: Technical manuals, Stage measurement.

Continuous measurements of stream stage are used in determining records of stream discharge and are useful in themselves for use in designing structures affected by stream elevation or in planning the use of flood plains. Instruments and structures commonly used in obtaining a record of stream stage are described. The topics covered in detail are water-level sensors, water-stage recorders, stilling wells, instrument shelters, telemetering systems, nonrecording gages, operation of stage gages, and special-purpose gages. (Knapp-USGS)
W69-03721

INFRARED AERIAL SURVEYS IN ENVIRONMENTAL ENGINEERING,
Air Force Inst. of Tech., Wright-Patterson AFB, Ohio; and Oklahoma State Univ., Stillwater. School of Civil Engineering.
R. V. Matalucci, and M. Abel-Hady.
ASCE Proc, J Sanit Eng Div, Vol 94, No SA6, Pap 6277, pp 1071-1084, Dec 1968. 14 p, 8 fig, 19 ref.

Descriptors: *Air pollution, *Thermal pollution, *Infrared radiation, *Remote sensing, *Mapping, Environmental engineering, Temperature, Spectroscopy, Technology, Methodology.
Identifiers: *Mapping techniques, Thermal anomaly.

An illustrated review is given of the basic principles related to the nature of IR radiation and the problems associated with its atmospheric attenuation. Some of the differences between IR photography and imagery are analyzed, and illustrations are used to demonstrate techniques for locating thermal water pollution by IR sensing. Stream valleys and subsurface drainage patterns are distinctly shown by IR imagery, which can also be used for locating buried conduits and utility systems. The potential application of IR surveys for detecting and tracing air pollution is discussed. (Lang-USGS)
W69-03744

GENERAL FIELD AND OFFICE PROCEDURES FOR INDIRECT DISCHARGE MEASUREMENTS,
Geological Survey, Washington, D. C.
M. A. Benson, and Tate Dalrymple.
Geol Surv Tech Water-Resources Invest, Book 3, Chapter A1, 1967. 30 p, 7 fig, 1 tab, 7 ref.

Descriptors: *Discharge measurement, *Stage-discharge relations, Mannings equation, Peak discharge, Surveys, Profiles.
Identifiers: Technical manuals, Indirect discharge measurements.

The discharge of streams is usually measured by the current-meter method. During flood periods, however, it is frequently impossible or impractical to measure the discharges by this method when they occur. Consequently, many peak discharges must be determined after the passage of the flood by indirect methods, such as slope-area, contracted-opening, flow-over-dam, and flow-through-culvert, rather than by direct current-meter measurement. Indirect methods of determining peak discharge are based on hydraulic equations which relate the discharge to the water-surface profile and the geometry of the channel. A field survey is made after the flood to determine the location and elevation of high-water marks and the characteristics of the channel. Detailed descriptions of the general procedures used in collecting the field data and in computing the discharge are given in this report. Each of the methods requires special procedures described in subsequent chapters. (Knapp-USGS)
W69-03748

MEASUREMENT OF PEAK DISCHARGE AT WIDTH CONTRACTIONS BY INDIRECT METHODS,
Geological Survey, Washington, D. C.
Howard F. Matthai.
Geol Surv Tech Water-Resources Invest, Book 3, Chapter A4, 1967. 44 p, 34 fig, 4 ref.

Descriptors: *Discharge measurement, *Peak discharge, *Stage-discharge relations, Control, Flow around objects, Velocity, Hydraulics.
Identifiers: Technical manuals, Indirect discharge measurements, Channel width contractions.

U. S. Geological Survey procedures for measuring peak discharges using open-channel width contractions are described. Field and office procedures limited to this method are described. The discharge equation based on the continuity and energy equations between an approach cross section and the contracted section under a bridge or contraction is

given. Contractions are classified into 4 geometric types. Discharge coefficients and computation procedures are given with a complete facsimile example of computation of a contracted-opening measurement. Additional procedures are given for multiple-opening contractions.
W69-03753

THE MOVEMENT OF BEACH SAND,
University of Southern California, Los Angeles. Dept. of Geology.
For primary bibliographic entry see Field 02J.
For abstract, see .
W69-03754

GEOLOGIC ORBITAL PHOTOGRAPHY: EXPERIENCE FROM THE GEMINI PROGRAM,
National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center.
Paul D. Lowman, Jr.
Goddard Space Flight Center, Pap X-644-68-228, Greenbelt, Md, June 1968. 34 p, 10 fig, 2 tab, 44 ref.

Descriptors: *Aerial photography, *Geologic investigations, Geology, Satellites (Artificial), Photographic equipment, Photographs, Terrain, Geological surveys, *Photography, Oceanography, Terrain analysis, Geography, *Geologic mapping, Bibliographies.
Identifiers: Color film, *Color photography, Infrared photography, Photographic analysis, Space vehicles, Photointerpretation.

Most Gemini flights carried a terrain photography experiment to obtain small-scale color photographs of selected land and ocean areas with 70 mm-hand held cameras. Photographic equipment included Hasselblad 500-C and SWC cameras, and the Maurer 70 mm-Space Camera with 38-, 80-, and 250-mm focal length lenses. Most pictures were taken with Ektachrome; Ansochrome D-50 and Ektachrome infrared film was also used. Specific geologic applications of the Gemini photographs include: (1) study and remapping part of northern Baja California, Mex; (2) study of tectonics and geology at northern Chihuahua, Mex; (3) unsuccessful search for the Texas Lineament; (4) study of a regional dune-fracture pattern surrounding the Tibesti massif in Chad and Libya; and (5) study of the theory that the Arabian Sea is a sphenochasm formed by continental drift. The terrain photography experiment is described and specific applications of the Gemini pictures are presented. The experiment was highly successful, demonstrating the geologic value and feasibility of orbital photography. Major advantages and disadvantages are discussed. The most promising uses appear to be in regional geologic mapping, tectonics, sedimentation, planning of geologic and geophysical field work, and interpretation of regional geophysical surveys. (USBR)
W69-03784

THE FUTURE ROLE OF NON-DESTRUCTIVE TESTING,
Central Metallurgical Labs., Whetstone (England).
For primary bibliographic entry see Field 08G.
For abstract, see .
W69-03787

HYDRAULIC LOAD-CELL LYSIMETER, CONSTRUCTION, CALIBRATION, AND TESTS,
Wisconsin Univ., Madison.
T. A. Black, G. W. Thurtell, and C. B. Tanner.
Soil Sci Soc Amer Proc, Vol 32, No 5, pp 623-629, Sept-Oct 1968. 7 p, 6 fig, 1 tab, 13 ref.

Descriptors: *Lysimeters, *Evapotranspiration, *Evaporation, Moisture content, Percolation, Soil water, Insulation, Construction, Sands, Test procedures, Tanks (Containers), Soil temperature, Calibrations, Energy balance, Soil science, Soil moisture, Measuring instruments.
Identifiers: *Load cells, Weight loss, Thermal balance, Plastic foam, Pressure transducers.

The construction and calibration of two 35-metric ton, hydraulic load-cell lysimeters with suction drainage systems are described. The butyl-nylon load cells contain an ethylene glycol-water mixture; pressures are measured with a capacitive pressure transducer. Lysimeter sensitivity is 0.02 mm evaporation. Daily evaporation from the lysimeter and the 2 independent micrometeorological methods agreed to within 5%. Lysimeter measurements of evaporation from bare soil during summer lagged measurements using the 2 other methods by almost 1.5 hr. Differences between the lysimeter thermal regime and that in the surrounding soil accounted for the lag. By using foam plastic insulation on the tank walls, thermal regime differences were minimized. (USBR)
W69-03793

THEORY OF MEASUREMENT,
Princeton Univ., N. J.
Gerard J. Born, and Enoch J. Durbin.
Instrum Contr Syst, pp 63-67, Nov 1968. 5 p, 7 fig, 1 tab.

Descriptors: *Measurement, *Measuring instruments, *Errors, Sensors, Statistics, Sensitivity, Instrumentation, Transducers, Hysteresis.
Identifiers: Static instrumental error, Standard deviation, Validity, Resolution, Accuracy, *Metrology.

Basic metrology is reviewed and instrument elements are discussed. Measurement consists of obtaining a value of a physical quantity by comparison to a reference; a measurement system may include a comparator, a reference, a gain element, and a transducer or converter. Evaluation of a measurement technique is based upon possible error reduction. The static error precision of an instrument arises from reading, characteristic, and environmental errors. The total error may be measured by the root mean square of the component errors. Conditions for the validity of the root mean square error are discussed; when the total root mean square error is known, the most probable value of the measurement can be estimated. Instrument performance is evaluated in terms of resolution, precision, and accuracy. (USBR)
W69-03800

WATER FLUX IN MOIST SOIL: THERMAL VERSUS SUCTION GRADIENTS,
Department of Agriculture, Washington, D. C.
For primary bibliographic entry see Field 02G.
For abstract, see .
W69-03883

MEASUREMENT OF NATURAL EVAPORATION: COMPARISON OF GRAVIMETRIC AND AERODYNAMIC METHODS,
British Meteorological Office, Cambridge (England). Research Unit.
For primary bibliographic entry see Field 02D.
For abstract, see .
W69-03891

SALT PENETRATION TECHNIQUE FOR SEEPAGE MEASUREMENT,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03935

FLUOROMETRIC PROCEDURES FOR DYE TRACING,
Geological Survey, Washington, D. C.
James F. Wilson, Jr.
Geol Surv Tech Water-Resources Invest, Book 3, Chapter A12, 1968. 31 p, 15 fig, 1 tab, 28 ref.

Descriptors: *Dye releases, *Fluorometry, Tracers, Surface waters, Groundwater movement, Instrumentation, Measurement.
Identifiers: Technical manuals, Dye tracing.

The current fluorometric procedures used by the U.S. Geological Survey in surface streams for such applications as time-of-travel measurements, dispersion studies, and discharge measurements are described in a technical manual. Rhodamine B is the dye generally recommended for the time-of-travel and dispersion measurements, and Rhodamine WT for discharge measurements and groundwater applications. Pontacyl Pink is a good tracer dye, but is much more expensive than the others. A fourth dye, fluorescein, is of marginal value as a surface-water tracer. Important properties of the dyes include fluorescence, temperature effects, pH effects, fluorescence quenching, photochemical decay, physical sorption, biological effects, and spectral characteristics. The strong orange fluorescence of Rhodamine B, Rhodamine WT, and Pontacyl Pink in weak solutions is easily isolated and detected in a filter fluorometer. Fluorometer components and operation and calibration of the most commonly used fluorometers are described. Prepared standards of known dye concentration may be used to determine the linear relationship of fluorometer readings to concentration. Readings for samples containing dye must be corrected for background and temperature effects before conversion to concentration. Light scattered by turbidity of the sample often is the most troublesome component of background. Aerial photography of the visible dye cloud is a potentially useful supplement to fluorometric analysis in some studies. (USGS)
W69-03944

MEASUREMENT OF PEAK DISCHARGE AT DAMS BY INDIRECT METHODS,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02E.
For abstract, see .
W69-03945

SP LOG INTERPRETATION IN SHALY SANDS.
Koninklijke/Shell Exploratie en Produktie Laboratorium, Rijswijk (Netherlands).
L. J. M. Smits.
J Soc of Petrol Eng, Vol 8, No 2, pp 123-136, June 1968. 14 p, 9 fig, 3 tab, 18 ref.

Descriptors: *Electrical well logging, *Potentiometers, Geologic formations, Resistivity, Exploration, Logging (Recording), Porosity, Permeability, Membrane processes, Osmosis, Diffusion, Salinity.
Identifiers: SP log interpretation, Shaly sand log interpretation, Potential logging, Streaming potentials, Membrane potentials.

A theoretical equation is developed describing membrane potentials of shaly sands as a function of the cation-exchange capacity per unit pore volume of the rock and saturating water salinity. This equation is based on the same simple physical model as that employed earlier describing the electrical conductivity of shaly sands. Experiments conducted with NaCl solutions showed that the equation is obeyed, except in the case of saturated salt solutions where minor deviations were observed. A possible explanation is given for this decrepancy. As the clay content and the porosity of shales may vary appreciably, shale membrane potentials also vary. It was found that membrane potentials of shales can be calculated accurately with the aid of the same theory. Consequently, changes in membrane potentials can be accounted for by simple measurement of cation-exchange capacities per unit pore volume of both shales and shaly sands. Charts are given to facilitate interpretation of the electro-chemical part of the SP in terms of cation exchange capacities and the salinities of mud filtrate and formation water.
W69-03946

TREE-RING ANALYSIS: A TOOL FOR WATER RESOURCES RESEARCH,
Arizona Univ., Tucson. Lab. of Tree-Ring Research.
For primary bibliographic entry see Field 02A.
For abstract, see .
W69-03963

EASUREMENT OF PEAK DISCHARGE BY IE SLOPE-AREA METHOD,
eological Survey, Washington, D. C.
te Dalrymple, and M. A. Benson.
eol Surv Tech Water-Resources Invest, Book 3, apter A2, 1967. 12 p, 7 fig, 1 tab, 3 ref.

escriptors: *Discharge measurement, *Open annels, *Mannings equation, *Stage-discharge ations, Roughness (Hydraulic), Discharge 'ater).
entifiers: Technical manuals, Slope-area charge measurements.

e application of the Manning equation to mea-e peak discharge in open channels is described. eld and office procedures limited to this method discussed. Selection of reaches and cross sec-ns is detailed, discharge equations are given, and omplete facsimile example of computation of a pe-area measurement is also given. (USGS)
69-03967

OUGHNESS CHARACTERISTICS OF NATU-L CHANNELS,
ological Survey, Washington, D. C.
r primary bibliographic entry see Field 02E.
r abstract, see .
69-03978

SEARCH ON THE MORPHOLOGY OF ECIPITATION AND RUNOFF IN TEXAS,
xas A and M Univ., College Station. Water sources Inst.
r primary bibliographic entry see Field 02B.
r abstract, see .
69-04135

C. Evaluation, Processing AND Publication

OMPUTATIONAL SCHEMES FOR THE OUSSINESQ EQUATION,
lifornia Univ., Davis. Dept. of Water Science l Engineering.
orge Terzidis.
CE Proc, J Irrig and Drainage Div, Vol 94, No 4, Pap 6276, pp 381-389, Dec 1968. 9 p, 2 fig, 13 , append.

escriptors: *Equations, *Numerical analysis, roundwater, *Unsteady flow, Mathematical stu-s, Continuity equation, Digital computers, Sta-ty.
ntifiers: *Boussinesq equation, *Nonlinear dif-ential equations, Stability methods, Boundary nditions, Finite difference methods.

general analytical solution of Boussinesq's equa-n subjected to general initial and boundary con-ons has not yet been found because of its non-earity. However, numerical methods may be d to obtain an approximate solution of the ed boundary value problem of this equation. A neral computational scheme is constructed by ng a weighting factor, Theta between 0 and 1, in computational net and expanding the involved ctions in Taylor's series. The stability analysis of general computational scheme is studied and general criterion of stability as a function of the ghting factor is derived. Several nonlinear dif-ence schemes and their criteria of stability are ived for different values of the weighting factor.
69-03937

TIMAL IDENTIFICATION OF NONLINEAR DROLOGIC SYSTEM RESPONSE MODELS QUASILINEARIZATION,
lifornia Univ., Los Angeles.
r primary bibliographic entry see Field 02A.
r abstract, see .
69-03958

08. ENGINEERING WORKS

8A. Structures

GEOLOGICAL CONSIDERATIONS IN THE DESIGN OF RESERVOIR SEEPAGE CONTROL SYSTEMS,
Harry R. Cedergren.
Pap, Symp Reservoir Leakage Ground Water Constr, Ass Eng Geol Nat Meet, Seattle, Wash, 1968. 21 p, 3 fig, 5 ref.

Descriptors: *Seepage, Seepage losses, Reservoir design, Hydraulic conductivity, Permeability, *Reservoir leakage, Reservoirs, Geology, Earth dams, Geologic formations, Groundwater recharge, Embankments, Groundwater movement, *Drainage systems, Drainage wells, Drainage, Dam design, Drainage water, Engineering geology, Dam foundations.
Identifiers: *Seepage control, Geologic defects, Drain curtains, Toe drains.

Designing ground-water control systems for reservoirs is a matter of prying into the earth's secrets, using all available experience and intuition, designing systems on the basis of all available information, and following up by carefully observing the completed works. Examples illustrate the manner that variations in geologic conditions in formations under and around reservoirs can influence basic seepage patterns and the overall requirements for drainage systems to control seepage. The importance of providing adequate hydraulic conductivity in drains for estimated seepage quantities is discussed. To illustrate designing for hydraulic capacity, a drainage system design is given for a weighted buttress fill that is used to stabilize an embankment. The drainage system includes a sloping blanket drain, a line of vertical wells, and the outlet blanket. This example demonstrates the engineering and economic advantages of graded filters for drains in reservoirs and other engineering works having important seepage control requirements. (USBR)
W69-03763

PREVENTION OF VORTICES AT INTAKES,
Ministry of Technology, Wallingford (England).
H. O. Anwar.
Water Power, Vol 20, No 10, pp 393-401, Oct 1968. 9 p, 17 fig, 1 tab, 5 ref.

Descriptors: *Vortices, *Intakes, *Intake gates, Intake structures, Fluid flow, Hydraulics, Flow around objects, Flow characteristics, Air entrainment, Flow control, Models, Hydraulic models, Apparatus, Charts, Eddies, Reynolds number, Discharge coefficients, Sudden enlargements, Flow, Orifice flow, Submergence.
Identifiers: Eddy currents, Borda flow.

Theoretical and experimental results of an investigation into various types of flow occurring at an intake are presented and the prevention of swirl and vortex formation discussed. Two types of flow (radial and swirl) are examined. The formation of a vortex is shown to depend on depth of submergence and on swirl of the oncoming flow. Graphs are presented to predict vortex formation; the parameters of the graphs can be calculated or measured on models. (USBR)
W69-03788

HOTZENWALD PUMPED-STORAGE SCHEME,
E. Pfisterer.
Water Power, Vol 20, No 9 and 10, pp 349-355 and 407-413, Sept/Oct 1968. 13 p, 20 fig, 1 ref.

Descriptors: *Pumped storage, *Hydroelectric power, *Underground powerplants, Reservoirs, Dams, Intake structures, Intakes, Turbines, Hydraulic turbines, Pump turbines, Underground structures, Tailrace, Cables, Tunnels, Shafts (Excavations), Tunnel construction, Torque.
Identifiers: West Germany, Pressure shafts, *Hotzenwald Pump Stor (West Germany), Sackingen Power Sta (West Germany), Generator-motors.

The Sackingen 360-mw underground pumped-storage plant is a part of the Hotzenwald hydropower development in the Black Forest of West Germany. The plant is connected to a 2-million-cu m upper reservoir by a 400-m-high vertical pressure shaft from which branches lead to turbines and pumps. Below the machines, similar branches form the tailrace distribution lines terminating in the 2000-m-long tailrace tunnel leading to the lower reservoir on the Rhine. The turbine-alternator/motor-pump sets are described. These sets are unique in having a torque converter between the alternator/motor and the pump and an automatic coupling between the alternator/motor and the turbine. Two other planned units of the Hotzenwald hydropower scheme (the Strittmatt and Hornberg) as well as the Schluchsee scheme are discussed. (USBR)
W69-03789

NORTHFIELD MOUNTAIN PUMPED STORAGE PROJECT,
Northeast Utilities Service Co., Hartford, Conn.
S. Hale Lull, and Antonio Ferreira.
Proc Amer Soc Civ Eng, J Power Div, Vol 94, No PO2, pp 199-215, Nov 1968. 17 p, 8 fig.

Descriptors: *Pumped storage, Pump turbines, *Peak power, Powerplants, Peak loads, Peaking capacities, Pumping plants, Underground powerplants, *Hydroelectric power, Multiple-purpose reservoirs, Project planning, Tunnels, Surges, Recreation, Municipal water.
Identifiers: Pump-generators, Northfield Mountain Proj (Mass).

The Northfield Mountain Pumped Storage Project will be a source of economical peaking power for New England, as area of high transportation and fuel costs. In addition to the project's capability to hydraulically store surplus power from conventional thermal and nuclear baseload power sources, the 1,000,000-kw facility will provide assured reserve (spinning reserve) capacity at extremely short notice. Emanating from this pumped storage project are accrual flexibilities (in the form of multipurpose use) that will provide optimum utilization of this project site. Part of the storage will be retained at all times to meet possible emergencies. The operating cycle of the remaining storage is one week. A portion of the daily water releases will be pumped back into the reservoir the following night, with the remaining portion being restored over the weekend. The pressure conduit length was kept short by locating the powerhouse underground adjacent to the upper reservoir. This minimizes response time to rapid changes in system demand. Civil, electrical, and hydraulic features of the system are described. (USBR)
W69-03794

DISCHARGE FACILITIES AT HELLS CANYON DAM,
Bechtel Corp., San Francisco, Calif; and Idaho Power Co., Boise, Idaho.
Joseph T. Gilchrist, and Donald E. Barclay.
Proc Amer Soc Civ Eng, J Power Div, Vol 94, No PO2, pp 161-176, Nov 1968. 16 p, 13 fig, 2 tab.

Descriptors: Discharge (Water), *Diversion tunnels, Diversion dams, Diversion structures, *Spillways, Hydraulic models, Tunnels, *Gravity dams, *Concrete dams, Hydroelectric power, Fish handling facilities, Energy dissipation, Powerplants, Turbines, Tunnel linings, Hydraulic gates, Intake structures, Hydraulic structures.
Identifiers: Hells Canyon Dam (Idaho), Energy dissipators.

Designing Hells Canyon Dam on the Snake River for the Idaho Power Co required careful considera-

tion in arranging the diversion, power, and spillway facilities to fit within the deep narrow gorge. The arrangement of each feature is described. The dam is a straight concrete gravity structure. The 1700-ft-long diversion tunnel is concrete lined and has a 40-ft-dia horseshoe section to handle 60,000 cfs. The 3-unit powerplant, with 391,500-kw nameplate capacity, is notched into left abutment rock and overlaps the toe of the dam. Energy of 300,000-cfs discharge over the center section spillway is dissipated by a combination of concrete nappe deflectors and a submerged roller bucket. Fish trapping facilities adaptable to the 48-ft tailwater fluctuation are mounted in an aluminum barge floating in the tailrace. Hydraulic model studies were made of the spillway and the entire project to determine discharge capacities and characteristics of various features. (USBR)
W69-03795

POWERS V LAWSON (APPLICABILITY OF DAM ALTERATION STATUTE).

136 A 2d 613-616 (RI 1957).

Descriptors: *Rhode Island, Judicial decisions, Backwater, Dams, *Mill dams, Flood control, Dam construction, Mosquitoes, Water pollution, Damages, Administrative agencies, State governments, *Legislation, *Public health, Legal aspects, Mud flats, Ponds, Planning.
Identifiers: Dam removal, Dam alteration.

A Rhode Island statute authorized the Chief of Harbors and Rivers to issue an order requiring dam owners to file plans and specifications of construction or substantial alteration of a dam. The statute also provided that the court may pass an order to secure the persons interested from danger or loss from the breaking of the dam. Defendants owned an old wooden, trench dam which held back the waters of a pond. Defendants wished to demolish the dam since it was no longer being used. Upon removal of a few of the upper planks, the pond level dropped, and mudflats were exposed. Property owners complained of pollution and mosquitoes, whereupon, the Chief of Harbors and Rivers ordered defendants to submit professional plans before continuing with any alteration. Defendants refused to comply with this order, and the Attorney General filed a petition asking that defendants be ordered to comply with the Chief's order to prevent injury to life or property from the unsafe condition of the dam. The lower court granted the order, but the appellate court reversed. The court held the purpose of the statute was only to protect against dangers due to a dam breaking and excess water. The court also held that the owners of a dam are under no legal obligation to keep it in operation for the benefit of others. (Wheeler-Fla)
W69-03897

FOCAL MECHANISM OF THE EARTHQUAKE OF JULY 26, 1963, AT SKOPJE,
Ye I Shirokova.
Phys Solid Earth, No 2, pp 104-109, Feb 1968. 6 p, 8 fig, 2 tab, 8 ref.

Descriptors: *Earthquakes, *Seismology, Seismic waves, Longitudinal waves, *Faults (Geology), Geophysics, Geologic investigations, Stress analysis, Displacements, Seismic investigations, Seismic studies.
Identifiers: Epicenters, *Earthquake focus, Skopje (Yugoslavia), Yugoslavia, Earthquake theory.

The focal mechanisms of the earthquake that destroyed the city of Skopje, Yugoslavia, in July 1963 is discussed. The focal depth was approximately 3 to 5 km. In the interpretation of seismograms of the Skopje earthquake, the focus was compared with a theoretical earthquake source in the form of an instantaneous fault with displacements in the fault plane. By observing the distribution of actual body wave displacements and comparing them with displacements calculated for the theoretical source (depths of zero, 10, and 30 km) it was possible to determine the possible fault planes, the direction of motion in these planes, and the direction of the principal stress axes. Records from 46 seismograph stations were used in the analysis. Conclusions from the study were: (1) the earthquake occurred under conditions of horizontally acting tensile stress in the meridian direction, (2) the fault occurred along a plane striking WNW and dipping from 55 to 80 deg to the NNE, and (3) Skopje is located on the hanging wall of the fault which was displaced downward and to the WNW.
W69-04009

WATER PROBLEMS IN THE NORTHEAST AND INCREASING FEDERAL REGULATION,
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-04052

8B. Hydraulics

ANALYSIS OF AQUIFER TESTS IN THE PUNJAB REGION OF WEST PAKISTAN,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02F.
For abstract, see .
W69-03975

8C. Hydraulic Machinery

REDUCING CAVITATION IN VALVES,
Colorado State Univ., Fort Collins.
J. Paul Tullis, and M. M. Skinner.
Proc Amer Soc Civ Eng, J Hydraul Div, Vol 94, No HY6, pp 1475-1488, Nov 1968. 14 p, 8 fig, 9 ref, append.

Descriptors: *Butterfly valves, *Cavitation, High pressure valves, *Hydraulic valves, *Valves, Test procedures, Steady flow, Vortices, Closed conduit flow, *Closed conduits, Air, Compressed air, Hydraulic equipment, Instrumentation, Costs, Maintenance costs, Injection, *Hydraulic gates and valves.
Identifiers: *Cavitation control, Cavitation index, *Cavitation noise, Test results.

Critical cavitation indices are presented for a 12-in. ball and a 12-in. butterfly valve installed in a closed conduit with an enlarged section downstream. Tests were conducted under normal operating conditions and with air (atmospheric and pressurized) and water being injected to control cavitation. Injecting a small amount of air into the low pressure region is a very satisfactory method of controlling cavitation, whereas using water is not. The most critical factor in successfully using air is so placing the injection port that it admits air as close as practicable to the high intensity shear region between the jet and the separation zone. If the port is properly placed, atmospheric air is satisfactory for reducing cavitation. For valves where it is neither possible nor practical to locate the injection port in the optimum location, pressurized air can be used effectively to reduce cavitation. (USBR)
W69-03757

PROTOTYPE INVESTIGATIONS OF DYNAMICS OF A TRIPLE-RIB OF A PLANE GATE OF THE DAM OF THE XXII CONGRESS CPSU VOLGA HES,
M. A. Rudyk, A. R. Freishist, and A. A. Davydov.

Hydrotech Constr, No 2, pp 134-140, Feb 1968. 7 p, 9 fig, 14 ref.

Descriptors: *Hydraulic gates, *Vibrations, Frequency, Investigations, *Spillway gates, Instrumentation, Foreign research, Waves (Water), Gates, Tensiometers, Mechanical engineering, Design, Experimental data, Deformation, Characteristics, *Hydraulic gates and valves.
Identifiers: USSR, Amplitude.

This study reports on a theoretical method of deter mining dynamic characteristics of ribbed gates an how they are affected by water masses, and on th investigation of the reaction of a vibrating ga system to different dynamic disturbances such a vibration of piers, aero- and hydrodynamic impul ses, and wave loads. The experimental work con sisted of 2 stages: (1) investigating free vibration of a gate in water and in air and determining it dynamic characteristics, and (2) investigating th vibration of a gate under a head with different ga openings. Instrumentation is discussed. Results o the study show that a reverse relation exist between the pulsations of pressure and the pulsa tions of gate ribs, and that the system of a gate ex hibits a tendency toward hydroelastic autovibratio processes of natural frequency when in wate Determining inherent vibration characteristics of gate is very important in gate design. (USBR)
W69-03765

THE PLANNING, CONSTRUCTION AN OPERATION OF POWER STATIONS I LARGE INTERCONNECTED SYSTEMS--TH STRATEGY OF LARGE-AREA POWE SUPPLY,
Federal Power Station Dept. (West Germany).
K. Schroder, and E. Brunecke.
Pap, World Power Conf, Aug 1968. 28 p, 4 fig.

Descriptors: *Electric power, *Electric powe production, Reliability, Electric power deman Electric power costs, *Thermal powerplants, Co comparisons, Planning, Economics, Peak load Forecasting, Steam turbines, Foreign researc Design, Boilers, Coals, Transmission (Electrical Failure (Power).
Identifiers: *Interconnected systems, West Ge many, Fossil fuels, Base loads, Outages.

The electric power load growth studies of th Federal Republic of Germany through 1980 ar presented. The interconnection of power suppl systems to continental and intercontinental system on the scale that can be expected in the future wi create the need for new approaches in planning designing, and constructing thermal power station The design of individual plants can be selecte more specifically for a certain fuel and mode o operation. Internal reserve capacity can b reduced. These measures all contribute to reducin specific first costs. It is also important to keep kw costs at the consumer end as low as possible b skillful combination of the power sources. Subject discussed include: (1) basic concepts, (2) futur problems in power generation, (3) modern powe station technology, and (4) considerations necessa ry for the best design in power stations.
W69-03771

UNITED STATES DEVELOPMENTS IN UN DERGROUND TRANSMISSION,
Boston Edison Co., Mass.
Charles F. Avila.
Pap, World Power Conf, Aug 1968. 17 p, 7 fig, tab.

Descriptors: *Electric cables, *Transmission (Ele trical), Costs, United States, Economies, Install tion, Installation costs, Moisture, Inert gases, Co tamination, Extra high voltage, Dielectrics, He exchangers, Underground.
Identifiers: *Underground cables, Buried cable *Pipe-type cables, *Forced-cooling systems, O filled cables, Insulating oil.

Progress in underground cable technology in the S has been steady since the introduction of pre surized cable in 1926. Cable has been employe mainly to carry substantial blocks of power und heavy-duty pavements of congested streets in lar cities. These sites favor installation of a drawn- system rather than a direct buried system. In add tion, the high cost of labor increases splicing e pense, thus favoring the installation of very lo lengths. Evolution of new cable systems a modification of existing systems to meet these co

tions are traced. Developments in pulling long ngths of cable and in substantial use of forced oling methods are emphasized. Factory chniques resulting in satisfactory manufacture of mmercial lengths of cable are described. The atus of current research programs in the fields of tra high voltage, extruded dielectrics, joint simification, synthetic insulation, and environmental ntrol is summarized.
69-03773

ROJECTED TRENDS AND REQUIREMENTS THE COORDINATED GROWTH OF ELECRIC POWER SYSTEMS IN THE UNITED TATES,
deral Power Commission, Washington, D. C.
Stewart Brown, and Robert B. Boyd.
p, World Power Conf, Aug 1968. 18 p, 2 fig, 2 f.

escriptors: Extra high voltage, Extra long stance, *Electric power production, Planning, lectric power demand, Hydroelectric power, ermal power, Stability, Reliability, Failure ower), Coordination, Automation, Disturbances, lectrical networks, Transmission (Electrical).
entifiers: *Interconnected systems, Spinning serve, *Power grids, Outages, Power losses.

is paper examines trends in coordination and inrconnection of electric power systems in the U S, d reviews principal recommendations of the deral Power Commission in its report on the revention of Power Failures.' A steady increase interconnection of power systems has added to e general reliability of electric service and has ntributed to more economical construction and eration of interconnected networks. Many vere cascading failures have occurred; the best lution to such problems requires coordination of anning on a regional basis and the design, conuction, and operation of facilities that meet quirements of reliability and economy. Rapid owth in use of electricity in the U S, in combinan with diverse characteristics and conditions afcting electric utility operation, offers opportunis for using technological advances and new uipment affording improved reliability and onomy. Criteria for testing transmission network signs are discussed, the need for reliable internnection of networks is emphasized, and an inease in research effort is suggested. Progress in ducing power failures is recognized, and areas of terest concerning reliability are discussed.
69-03774

OLE OF HIGHER VOLTAGE TRANSMISSION CHANGING ASPECTS OF ENERGY TRANSORT,
ommonwealth Associates, Inc., Jackson, Mich.
B. Falls, Jr.
p, World Power Conf, Aug 1968. 23 p, 2 fig, 3 , 9 ref.

escriptors: Electric power, *Transmission (Elecal), *Energy, Oil, *Transportation, *Forecastg, Extra high voltage, Direct current, Cost comrisons, Alternating current, Economics, droelectric power, Extra long distance, Transssion lines, Converters (Electrical), Rectifiers, als, Railroads, Pipelines, Natural gas, Air pollun, Costs.
entifiers: Interconnected systems, Fossil fuels.

e author describes rapid advances taking place the field of high-voltage power transmission in e U S and notes that electric power transmission an increasingly important mode of energy transrt. Typical costs are presented for: (1) 345-, 500- nd 750-kv a-c power transmission; (2) 750-kv d-ower transmission; and (3) fuel transport by rail-y, barge, and pipeline. Conclusions and forecasts the future role of these methods of energy transrt are offered. The introduction and growing mmercial application of high-voltage direct curnt for long-distance transmission will cause sigficant changes in the field of energy transport. More remote hydroelectric developments will be brought within reach and more widespread load areas will be interconnected to exploit diversity of area energy demands, all leading to changing patterns of fuel consumption. Historical data and current factors at work in the electrical transmission field suggest that the very-high-voltage systems of tomorrow may be more economically attractive. Growing worldwide concern with environmental concepts is one of the most important factors now influencing decisions in energy transport.
W69-03775

ECONOMIC AND DESIGN CONSIDERATIONS OF THE PACIFIC NORTHWEST-PACIFIC SOUTHWEST INTERTIE,
Bureau of Reclamation, Washington, D. C.
Floyd E. Dominy.
Pap, World Power Conf, Aug 1968. 2 p, 1 fig, 2 ref.

Descriptors: *Extra high voltage, *Extra long distance, Benefits, Benefit-cost ratios, Peak power, Hydroelectric power, Thermal power, Energy, Economics, Direct current, Alternating current, Design, *Transmission lines, Transmission (Electrical), Corrosion, Stability, Converters (Electrical).
Identifiers: *Pacific Northwest-Southwest Intertie, Firm energy, *Interties, International river basin, Ground return.

The Pacific Northwest-Southwest Intertie, the largest single electrical transmission development undertaken in the U S, is described. The intertie will interconnect (directly or indirectly) major systems of the Federal Government and public and private electrical systems in 11 western states, promoting maximum electrical efficiency and benefits throughout these states. Two intertie transmission lines will be d-c lines, the first in the U S and the longest in the world. Benefits to the Pacific Northwest and Pacific Southwest areas of the U S and to the Nation as a whole will be extensive. Over a 50-yr payout period, total benefits are estimated at $2.6 billion, having a benefit-cost ratio of 2.5:1. These benefits and other economic considerations are discussed. Because the intertie represents major advances in the technology of electrical transmission, some major facets of design being considered in developing the intertie facilities are discussed.
W69-03776

MEASUREMENT OF TRANSFORMER NOISE AND ITS REDUCTION,
English Electric Power Transformers Ltd, Stafford.
G. D. Antippa.
Engl Elec J, Vol 23, No 4, pp 21-27, July-Aug 1968. 7 p, 13 fig, 8 ref.

Descriptors: *Power transformers, *Noise, *Noise reduction, Sound, Instrumentation, Microphones, Standards, Acoustics, Foreign research, Acoustic insulation, Vibrations, Design, Magnetic fields, Electrical equipment.
Identifiers: Great Britain, Foreign testing, Anechoic chambers.

The study of transformer noise over the past 10 yr has developed techniques for handling any reasonable problem. Measurements can be taken and specifications or criteria can be met. The economics of suppressing noise have not been dealt with in this paper, but considering the problem of noise at the design stage is better than waiting until complaints arrive. Techniques used to measure and control transformer noise levels to within specified limits are described. Methods used for reducing noise from transformers include: (1) barrier walls; (2) an enclosure of brick, steel, or concrete; (3) cladding of steel, lead, or lead-weighted plastics; and (4) foam lining for transformer tanks. Each of these methods is reviewed. (USBR)
W69-03790

THE ADVANTAGES OF INCLINED-AXIS HYDROELECTRIC UNITS,
Corps of Engineers, Washington, D. C.
Asa V. Shannon, and C. H. Fogg.
Pap, World Power Conf, Aug 1968. 25 p, 2 fig.

Descriptors: *Axial flow turbines, *Hydraulic turbines, Planning, Cost comparisons, Bulb turbines, Feasibility studies, Efficiencies, Thrust bearings, Hydroelectric power, Economics, Model tests, Pump turbines, Investigations.
Identifiers: *Run-of-the-river powerplant, Corps of Engineers, Low head, *Low-head hydro plants, *Inclined-axis units.

Decision processes of the Corps of Engineers in a pioneer effort in hydroelectric development are described. Details of the studies and investigations leading to the selection of inclined-axis units (in the 20,000- to 30,000-kw range) for 3 projects in the low head category are included. The inclined-axis arrangement is not without precedent. Turbine runners of 8.0-m dia are no longer unusual. Generators of the size and speed required are practically standard design. Speed changers of the capacity and efficiency needed for 2 of the projects have long been available as shipboard equipment. The pioneering consisted of acting on the belief that these components in large sizes could be adapted into an efficient whole suitable for generation (or generation and pumping). The structure for these units was estimated to cost substantially less than the structure required for conventional vertical generating units of like capacity. Equipment and other costs have corresponded well with estimated costs. Installations at 4 projects are discussed. (USBR)
W69-04010

8D. Soil Mechanics

DAMS AND RESERVOIRS IN PLEISTOCENE-EOLIAN DEPOSIT TERRANE OF NEBRASKA AND KANSAS,
Bureau of Reclamation, Denver, Colo.
William I. Gardner.
Pap, Symp Reservoir Leakage Ground Water Contr, Ass Eng Geol Nat Meet, Seattle, Wash, 1968. 23 p, 5 fig, 1 tab, 8 ref.

Descriptors: *Loess, *Dam foundations, Earth dams, Reservoirs, *Seepage losses, Dune sands, *Reservoir leakage, Granular materials, Sands, Cutoff trenches, Cutoffs, Impervious materials, Drainage wells, Settlement, Geology, Geologic formations, Pleistocene epoch, Aeolian soils, Engineering geology, Alluvial deposits.
Identifiers: Seepage control.

The general geologic situation is discussed and the leakage and foundation problems are considered at a few Bureau of Reclamation dams and reservoirs. The reservoir sites are located in Pleistocene-eolian deposits in central and western Neb and Kans and northeastern Colo. Initial pessimism on the feasibility of conservation reservoirs in permeable continental sediments of the loess and sand dune region has changed to cautious optimism through knowledge gained from construction and successful operation of many reservoirs. Loess and dune sands are moderately permeable but do not present major leakage problems. Seepage occurs mainly through Pleistocene alluvial sands and gravels and through zones of uncemented sandy beds in the Ogallala formation. Treatment confined to the area of the dam and adjacent parts of abutments and channel has been sufficient to control losses to acceptable amounts. Cutoffs and blankets of impermeable material from required excavation have been used successfully to reduce seepage. Thorough drainage at the toe of the dam is necessary; additional drainage by ditches or relief wells is needed after the reservoir starts filling when requirements can be properly determined. Seepage losses have not impaired the planned operation of the projects. (USBR)
W69-03762

DESIGN OF A SPILLWAY DAM ON SHELL PILES AND METHOD OF STATIC CALCULATION OF ITS FOUNDATION,
A. R. Berezinskii, and D. F. Gerstle.

Hydrotech Constr, No 2, pp 119-126, Feb 1968. 8 p, 4 fig, 1 tab, 2 ref.

Descriptors: *Spillways, *Pile foundations, Pile lateral loads, Piers, Foreign design practices, Dam design, Dam foundations, Bending, *Foundations, Hydraulic structures, Sheet piling, Batter piles, Bending moments, Elastic deformation.
Identifiers: Spillway piers, USSR, Dam stability, Pile caps.

This article describes the design and method of static calculation of the foundation of a medium-head spillway dam constructed on shell piles in a nonrock base. The upstream face of the dam consists of shell sheet piling and is rigidly joined with the spillway slab. Sheet piling is not directly connected with pier foundations. Load is transmitted to piers through spillway slab projections that pass freely into grooves on the piers. This design permits the assumption that the sheet piling undergoes plane bending which protects the lock joints. Pier foundations are tall grillages composed of separately standing vertical and batter shell piles, permitting a fuller utilization of the foundation-bearing capacity. A pile is regarded as a bar obeying the laws of the theory of strength of materials and undergoes bending with its lower part embedded in assumed elastic soil. The static calculation of the dam foundation can be reduced to a plane problem with forces collected within one span. The sequence used to analyze the pile foundation is illustrated by a sample problem. (USBR)
W69-03766

GROUTING OF THE LIMESTONE FOUNDATION FOR THE ARSTADDALEN DAM,
L. Bjerrum, and I. Torblaa.
Norw Geotech Inst, Publ 80, pp 33-38, 1968. 6 p, 5 fig.

Descriptors: *Grout curtains, *Grouting, *Dam foundations, Earth dams, Geology, Foundations, Foundation rocks, *Rockfill dams, Cores, Filters, Foreign construction, Geologic formations, Limestones, Rock properties, Bentonite, Permeability.
Identifiers: Grouting pressure, Grout mixes, Grout take, *Arstaddalen Dam, Norway, Seepage control, Geologic defects, Impervious layers.

The engineering-geological features of the foundation for the 60-m-high earth and rockfill Arstaddalen Dam are described, with emphasis on rock permeability and grouting to reduce leakage. The dam has an impervious core protected with filters on both sides. The outer zones are constructed of rockfill to a slope of 1.7:1. The foundation rock was a limestone with relatively serious defects due to solubility. Rock permeability ranged from 0.05 to 0.5 ft per yr. The area took part in the Caledonion upheaval, subjecting it to severe folding and intrusion of various eruptives. Under the influence of folding pressures and high temperatures from intrusions, the limestone has locally recrystallized and transformed into marble. The grout curtain consisted of 2 rows of holes bored to at least 20 m or until the water loss was less than one Lugeon. The grout used was a mixture of cement and water with an admixture of 2% bentonite by weight. In addition to curtain grouting, blanket grouting was carried out over the total area where the core was to be in contact with the rock. Blanket grouting was performed from a series of 6.4 m deep borings made by percussion drilling. Cost of the grouting work represented about 6% of the total cost of the dam. (USBR)
W69-03777

GENERAL PROCEDURE IN INVESTIGATION, DESIGN AND CONTROL DURING CONSTRUCTION OF EARTH- AND ROCK FILL DAMS IN NORWAY,
B. Kjaernsli.
Norw Geotech Inst, Publ 80, pp 1-20, 1968. 20 p, 24 fig, 2 tab, 22 ref.

Descriptors: *Dam design, *Earth dams, *Rockfill dams, *Foreign design practices, Engineering geology, Field investigations, Dam construction, Aerial photography, Geologic investigations, Laboratory tests, Climatic data, Dam foundations, Embankments, Foreign construction, Borrow areas, Seepage, Soil properties, Specifications, Grouting, Bibliographies.
Identifiers: Norway, Construction control.

The general procedure followed at the Norwegian Geotechnical Institute in consulting activities concerning earth and rockfill dams in Norway is described. Norway has been covered by ice 3 times and, as a result, the country is 60% covered by moraines. Geologic and climatic conditions are discussed and illustrated by figures. Because of the topography and storage requirements, maximum height of existing earth and rockfill dams is approximately 90 m. Blasted rock, gravel, and morainic materials are commonly used in embankments. Laboratory investigations are usually limited to testing core and filter material. Soil properties used in stability calculations are determined from laboratory tests, but properties of gravel and rockfill are usually assumed. Generally, the dam axis is curved upstream and very steep abutments are avoided, even at the cost of increased volume. The steepest abutment used has been 1:1. Cross sections and descriptions of 23 dams built in Norway in the last decade are given. Specifications are based on the method of construction and on specific end results desired. A table is given of data on foundation grouting for several Norwegian dams. (USBR)
W69-03778

GENERAL SLOPE STABILITY ANALYSIS,
Colorado State Univ., Fort Collins.
James M. Bell.
Proc Amer Soc Civ Eng, J Soil Mech Found Div, Vol 94, No SM6, pp 1253-1270, Nov 1968. 18 p, 12 fig, 1 tab, 5 ref, 3 append.

Descriptors: *Stability analysis, *Slope stability, Safety factors, Sliding, Slip-circle method, Slipping, Seismic investigations, Numerical method, Stress distribution, Cohesion, Pore pressure, Soil mechanics, Effective stress, Computer programs, Earth dams, Embankments, Slopes.
Identifiers: Seismic stability, *Computer-aided design, Earthquake loads, Failure surfaces, Bishops method, Slip surface.

A statically accurate limiting equilibrium procedure was developed for the numerical treatment of slope stability problems. The method: (1) applies to homogeneous or nonhomogeneous earth slopes, (2) contains a wide variety of loads and approximately accounts for the influence of seismic effects through inclusion of statically equivalent horizontal and vertical earthquake forces, (3) requires a normal stress distribution assumption, and (4) can be carried out either in terms of effective stress with input of effective strength parameters and excess pore pressures, or in terms of total stress with input of appropriate shearing resistances (phi - 0). A sample problem illustrates the application of the new procedure for a nonhomogeneous slope with a wide range of loads. Rapid convergence of solutions was noted for a specific normal stress distribution assumption; the stresses obtained seem appropriate. Results are compared with results obtained from other methods. Assuming the availability of a high-speed computer, the engineer is provided an additional tool for estimating the stability of complex earth slopes. (USBR)
W69-03779

CONSTRUCTION PROBLEMS EXPERIENCED WITH LOESS SOILS,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
W. J. Turnbull.
Highw Res Rec, No 212, pp 10-27, 1968. 18 p, 33 fig, 17 ref.

Descriptors: *Loess, *Cut slopes, Seepage, Gullying, Sinkholes, *Land settlement, Cavities, Soil compaction, Bibliographies, Construction, Density, Soil liquefaction, Shear strength, *Soil structure, Soil properties, Settlement, Stratification.
Identifiers: Construction methods, Piping (Erosion).

Loess deposits cover 17% of the land surface of the United States. This paper is based on the author's experiences with these soils in various types of construction, particularly in Miss and Neb. Until construction of the Central Nebraska Public Power and Irrigation Project along the North Platte River, many engineers doubted the feasibility of using loess as a construction or foundation material. The internal structure and stratification of loess and the cut slope problem are discussed and illustrated by figures. Deep cut, soil bank, and settlement problems are also reviewed. The project demonstrated that loess soils could be used safely as a construction material or as a foundation for earth dams and hydraulic structures. Compacting the loess soil to wet of optimum is the reason that all structures withstood settlement. Satisfactory behavior of steep cut bank slopes along a major project canal for 30 yr is evidence that steep backslopes should be used in loess soils. (USBR)
W69-03803

LATERAL PRESSURE OF EARTH BACKFILL,
V. Kh. Gol'tsman.
Hydrotech Constr, No 8, pp 738-742, Aug 1967. 5 p, 1 fig, 3 ref.

Descriptors: *Backfill, *Lateral forces, *Retaining walls, *Earth pressure, Displacements, Granular materials, Structures, Cohesion, Soil mechanics, Internal friction, Active pressures, Passive pressures, Horizontal loads, Elastic deformation.
Identifiers: Coulomb theory, Soil-structure interaction, At rest pressure.

Background theory and equations necessary to calculate lateral pressure of earth backfill are presented. Applying various theories for determining lateral pressure of earth backfill on retaining walls is difficult because of the necessity to reconcile discrepancies between these theories. Lateral earth pressure differs from hydrostatic pressure because of frictional and cohesive forces in the soil. These forces reduce pressure if the wall deflects away from the backfill and increases the pressure if the wall reclines on the backfill. The limiting-equilibrium theory (based on Coulomb's theory) permits determining the lower and upper limits of lateral earth pressure, irrespective of soil deformation, structural displacements, or state of the backfill. Coulomb's theory for granular materials holds true (from a practical viewpoint), and provides the extreme values of lateral earth pressure on vertical or steeply inclined rear faces of structures. Forces and moments acting on a structure are given in 8 equations. (USBR)
W69-03805

8E. Rock Mechanics AND Geology

SEISMIC RESONANCE INVESTIGATION OF A NEAR-SURFACE CAVITY IN ANCHOR RESERVOIR, WYOMING,
Geological Survey, Flagstaff, Ariz; and North Carolina Univ., Chapel Hill.
Richard H. Godson, and Joel S. Watkins.
Bull Ass Eng Geol, Vol 5, No 1, pp 27-36, 1968. 10 p, 5 fig, 2 plate, 4 ref.

Descriptors: *Cavities, *Engineering geology, *Geophysics, *Resonance, *Reservoir leakage, Sinks, Reservoirs, Reservoir surveys, Oscillation, *Seismic investigations, Seismic waves, Seismographs, Bedrock, Geologic investigations, Subsurface investigations, Frequency, Sinkholes.
Identifiers: Anchor Dam (Wyo), *Cavernous rock, Geophysical prospecting, *Resonance frequency method, *Seismic prospecting.

small part of the Anchor Reservoir area was in-
stigated by a seismic resonance method for locat-
g near-surface cavities that could develop into
rface sinks. The seismic resonance method con-
ts of exciting resonant vibrations in cavities by
arby dynamite explosions and recording these
rations (at the surface above the cavities) by a
de-band seismograph system. Initial ground mo-
n generated by an explosion in rock is attenuated
idly and may be reduced 90% about one-half
ond after the explosion. Cavity vibrations persist
ch longer and have been observed for as long as
seconds after the explosion. This resonance ex-
its a dominant time-independent frequency
tinguishable from other types of seismic energy.
e size of the cavity and seismic wave velocity in
rrounding rock determines the resonant frequen-
The exact relationship between cavity size and
onant frequency is not known, but estimates of
ity size can be made within a factor of 3 of ac-
l cavity diameters. Results of the seismic
onance field investigations at Anchor Reservoir
discussed and compared with a previous gravity
vey in that area. (USBR)
69-03759

**LOCKY AND SEAMY ROCK' IN TUNNEL-
G,**
rges Tekniske Hoegskole, Trondheim.
r L. Brekke.
ll Ass Eng Geol, Vol 5, No 1, pp 23-26, 1968. 4
4 ref.

scriptors: *Rock mechanics, *Tunnel design,
nnels, Roof supports, Underground structures,
iscontinuities, Joints (Geology), Engineering
ology, Rock properties, *Tunnel pressures, Tun-
ing, Groundwater, Foreign research, Hydro-
tic pressure, Shear strength.
ntifiers: *Tunnel supports, *Subsurface
enings, *Arching, Norway, Rock competency,
ock pressures.

sic concepts are evaluated for Terzaghi's classifi-
ion of rock conditions and estimation of rock
ds for blocky and seamy rock. The basis for Ter-
ghi's estimation of rock loads is the assumption
t blocky and seamy rock essentially has the
aracter of a dense sand with very large grains and
cohesion. However, the contact area between
k blocks is much larger than the contact area
tween sand grains, and the shear strength of
nts and seams can be mobilized over virtually the
ire area of the discontinuities. Downward move-
nt of rock-block layers in the immediate roof
ve a tunnel may mobilize horizontal thrust
oughout the layers, yielding stable downward
hes of blocks that carry only their own weight.
estigations of more than 250 underground
rks in Norway show the quite surprising stability
blocky and seamy rock in tunnels situated well
ow the water table, and directly contradicts
k-load estimates based on the sand analogy.
pport requirements in blocky and seamy rock
sed on the sand analogy often result in rather
nservative design (particularly in tunnels well
ow the ground-water table) except in areas with
h inflow conditions. (USBR)
69-03760

**ALYSIS OF WEDGE FAILURES IN
AYERED ROCKS,**
iversity of Southern California, Los Angeles.
rnard W. Pipkin.
ll Ass Eng Geol, Vol 5, No 1, pp 12-17, 1968. 6
3 fig, 2 ref.

scriptors: *Slope stability, Landslides, Stability
alysis, *Rock mechanics, *Engineering geology,
ds (Geology), Structural geology, Dips, Slopes,
ts, Slipping, Sliding, *Cut slopes, Rocks,
dges, Geometry, Retaining walls.
ntifiers: Slip planes, Strikes (Geology), *Rock
pe stability, Geologic defects.

geometric analysis is made of the stability of
ered rock oriented at an angle to the strike of an
ificial or natural slope. Slopes oriented in this manner show an apparent dip of the layered rock that is always less than the true rock dip. Slope failure in this situation involves the translation of a small rock wedge directly down dip and is called a wedge failure. Using apparent dip as a design parameter for retaining structures or slope stability analysis has no prior justification and may lead to unnecessary additional lateral slope support. The analysis assumes rock in good condition, relatively free from defects that might control sliding, and does not presume the failure of unsupported wedges determined by shear resistance along potential failure planes. Nomographs are given for determining the minimum setback for locating structures beyond the zone of wedge failure parallel to the top of cut slopes. (USBR)
W69-03761

STRENGTH AND EARTH PRESSURE OF ROCK WITH WEAK PLANES,
Tokai Univ., Tokyo (Japan).
Shigeyasu Okusa.
Soils Found, Vol 8, No 1, pp 49-79, Mar 1968. 31 p, 22 fig, 13 ref.

Descriptors: *Rock mechanics, Rock properties, *Shear strength, Rocks, Discontinuities, Joints (Geology), Foreign research, Shear failures, Failure (Mechanics), *Earth pressure, Stress analysis, Sliding, Active pressures, Passive pressures.
Identifiers: Japan, *Rankine pressures, Coulomb-Navier model, Rock slope stability, *Weakness planes, Failure surfaces, Rock pressures.

Two- and 3-dimensional analyses were made of the strength and Rankine earth pressure of rocks containing weak planes with a vertical slope. Two questions in considering shear strength of rock with weak planes are: (1) whether failure occurs along the weak planes or in the solid rock cutting the weak planes; and (2) the stress conditions for failure to occur along the weak planes. The 2-dimensional conditions for failure in the weak plane are discussed. The stable height of a vertical slope is derived from an analysis of earth pressures related to the direction of weak planes. Shear strength analyses are based on the Coulomb-Navier theory. Rock fails along weak planes before a new fracture cuts the planes if the angle between the planes and the principal stress lies within a determinable range. Active earth pressures are greater and passive earth pressures are less for rock with weak planes, compared with intact rock. The 3-dimensional problem of rock with weak planes is analyzed; failure occurs along weak planes if direction cosines of the normal to the planes with principal axes lie within a specified range. In this case, the medium principal stress plays an important role in failure along weak planes and in determining the dangerous range of direction cosines. (USBR)
W69-03768

STABILITY OF ROCK SLOPES IN NORWAY,
Laurits Bjerrum, and Finn A. Jorstad.
Norw Geotech Inst, Publ 79, pp 1-11, 1968. 11 p, 18 fig, 15 ref.

Descriptors: *Rock mechanics, Rock properties, Rocks, *Rockslides, *Landslides, *Engineering geology, Geologic investigations, Equilibrium, Foreign research, Granites, Gneisses, Slope stability, Slopes, Stability analysis, Field investigations, Joints (Geology), Bibliographies.
Identifiers: *Rockfalls, *Rock slope stability, Norway, Slope angles.

The Norwegian Geotechnical Institute has surveyed some 300 unstable areas, and other areas where rockfalls and rockslides have occurred, to study the factors determining stability of rock slopes. Experiences gained through the study are described. The behavior or rock slopes is attributed to 3 factors: (1) the way the mountain slope is exposed to rock destruction, (2) the elapsed time before a slope reaches a final stable equilibrium, and (3) the angle of inclination the slope will assume at a stable condition. Experiences clearly show that stability problems in hard Norwegian rocks cannot be solved by theoretical methods. The stability is entirely dependent upon the extent and continuity of joint systems, presence of internal residual stresses, local stress concentrations, fatigue failures, and many other indeterminate factors incapable of treatment in a conventional stability analysis. An empirical method for solving slope stability problems has been developed, based on field observation of all physical processes and significant phenomena. Although the method has not been fully developed, it is the only practical method for solving the complex problems of slope stability in hard unweathered rock.
W69-03782

THE DENVER EARTHQUAKES,
Geological Survey, Menlo Park, Calif; Institute of Geophysics and Planetary Physics, University of California, Los Angeles.
J. H. Healy, W. W. Rubey, and D. T. Griggs.
Sci, Vol 161, No 3848, pp 1301-1310, Sept 1968. 10 p, 9 fig, 2 tab, 29 ref.

Descriptors: *Earthquakes, *Seismology, Seismic waves, Geophysics, *Waste disposal, Seismic investigations, Seismic properties, Pore water pressures, Seismic studies, *Injection wells, Geologic investigations, Geology, Stress analysis, Faults (Geology), Bibliographies.
Identifiers: Epicenters, Correlation, Fluid injection, Earthquake theory, Earthquake focus, Denver, (Colo), Earthquake forecasting.

In 1961, a disposal well was completed for the U S Army at the Rocky Mountain Arsenal north of Denver, Colo, for disposing of waste fluids from chemical manufacturing operations. The well was 3,671 m deep and bottomed in Precambrian crystalline rock. Injection of fluids began in Mar 1962 and continued through Sept 1962 at an average rate of about 5.5 million gal/mo. No fluid was injected from Oct 1963 to Aug 1964. Fluid was later put into the well by gravity flow and, subsequently, put under pressure until use of the well was stopped in Feb 1966 because of the suggested connection between the well and earthquakes in the area. The article discusses the program to determine whether there was a connection between the operations of the disposal well and the earthquakes. The mechanism of the earthquakes is discussed. Most investigators working on the problem have concluded that injecting fluids into the disposal well triggered the seismic activity. (USBR)
W69-03802

LOCATION OF THE SOURCES OF SEISMOACOUSTIC PULSES,
Ya Ya Kagan.
Phys Solid Earth, No 5, pp 321-325, May 1968. 5 p, 6 fig, 7 ref.

Descriptors: Coal mines, Foreign research, *Mining engineering, *Rock mechanics, Mining, Seismic waves, Rock properties, *Engineering geology, Geologic investigations, Geophones, Seismographs, Longitudinal waves, Geophysics, *Seismic investigations, Seismic properties, Tunneling, Acoustic equipment.
Identifiers: Foreign testing, *Rock noise, *Microseisms, Rockbursts, Seismic tests, Seismic sources, USSR, Rock breakage, Rock pressures.

Seismoacoustic methods have shown that the stressed state of a rock mass is characterized by the number of seismoacoustic pulses occurring in a given period of time. Multichannel recorders were used to obtain a fuller picture of the rock destruction process and the location of the pulse sources. The object of the investigation was to improve seismoacoustic forecasting of the risk of dynamic phenomena in mining coal seams in the Donets Basin. By locating pulse sources, the observed noise level can be related to a specific zone ahead of the longwall face and thus determine the ad-

vance that will bring the face into the danger area. The equipment and operating procedures are described. Results from an investigation of pulse source distribution are discussed. (USBR)
W69-04008

8F. Concrete

CONDITION OF JOINTS IN MASSIVE CONCRETE STRUCTURES DETERMINED BY ULTRASONICS,
G. Ya. Pochtovik, A. S. Nikol'skii, and A. V. Mizonov.
Hydrotech Constr, No 3, pp 228-232, Mar 1968. 5 p, 6 fig.

Descriptors: *Construction joints, Concrete construction, Rupturing, *Concrete structures, *Concrete testing, Cracks, Ultrasonics, *Expansion joints, Sonic waves, Test procedures, Mass concrete, Materials testing, Instrumentation.
Identifiers: Concrete properties, Pulse velocity tests, USSR, Foreign testing, *Ultrasonic impulse method, *Ultrasonic tests.

Construction joints in concrete are planes of weakness that determine and control the deformation of the concrete structure. The ultrasonic pulse method for investigating the adjustment and condition of interior construction joints is described. Ultrasonic transmitter-receivers are embedded 10-15 cm from construction joints during concrete placing. Ultrasonic measurements are made at intervals as the concrete cures until the readings show that the joint has stabilized. Control readings are taken over a period of 15-20 days to establish a characteristic ultrasonic traveltime for the joint. Further readings are made during the construction period and at later ages to determine if the joint is still intact. As tension develops and the joint ruptures, the characteristic traveltime increases; the increase is more significant when rupture is accompanied by separation and formation of an air space. When the continuity of the concrete is broken between the transmitter and receiver, the resultant change in the ultrasonic wave may be used to detect cracks. Laboratory tests are described for joints under tension and compression and with artificial opening and closing of joints. (USBR)
W69-03799

FROST DAMAGE TO STONE AND CONCRETE: GEOLOGICAL CONSIDERATIONS,
Notre Dame Univ., Ind.
Erhard M. Winkler.
Eng Geol Int J, Vol 2, No 5, pp 315-323, Aug 1968. 9 p, 5 fig, 1 tab, 14 ref.

Descriptors: *Freezing, *Frost action, Frozen soils, Permafrost, Ice, Capillarity, Capillary tubes, Frost heaving, Frozen ground, Durability, Phase diagrams, Capillary water, Concretes, Rocks, Soils, Engineering geology, Porosity, Piles (Foundations), Geologic investigations, Concrete technology.
Identifiers: *Freeze-thaw durability, *Frost resistance, Ice forming, Ice lenses.

Frost damage to stone and concrete is due to expansion during freezing of water. Frost action depends not only on the expansion of ice but also on other phenomena including: (1) the process of freezing as related to the pvt diagram for ice, (2) the movement of water to the freezing zone and behavior in microcapillaria, and (3) lithologies that promote frost action. Engineering geological applications of the pvt ice diagram are: (1) the frost stability of stone if strength, climate, and capillary size are shown; (2) stability of point-bearing piles in muddy frozen sediments; and (3) geological thermometry applications in the study of felsenmeers. Frost sensitivity of soils is discussed. (USBR)
W69-03804

8G. Materials

THE FUTURE ROLE OF NON-DESTRUCTIVE TESTING,
Central Metallurgical Labs., Whetstone (England).
J. A. Derry.
Engl Elec J, Vol 23, No 3 and 4, pp 28-34 and 28-31, May-June/July-Aug, 1968. 11 p, 14 fig, 14 ref.

Descriptors: *Non-destructive tests, Inspection, Instrumentation, Measuring instruments, *Quality control, Materials control, *Materials testing, Test procedures, *Radiographic inspection, Microwaves, Infrared radiation, Thermographs, Ultrasonics.
Identifiers: Great Britain, Infrared detectors, Thermometric method, Ultrasonic imaging, *Ultrasonic tests, Radiography.

Radiography, microwave, thermography, and ultrasonic techniques for non-destructive testing are discussed. Recent developments are described and possible applications suggested. New radiographic techniques include: (1) color radiography for complex components, (2) neutron radiography for heavy materials normally beyond the range of conventional methods, (3) high-speed or flash radiography for ballistic studies, and (4) cine radiography for investigations in foundry technology. Microwaves have application with nonmetallic materials and are used to examine flaws and inclusions in composite materials, and to determine thickness, density, voids, and the state of cure in plastics. The introduction of infrared detectors or radiometers permits thermographic mapping of a component's surface for detecting defects, and appears most promising for examining bonds, spot welds, honeycomb structures, and perhaps printed circuits. In ultrasonics, new developments include recording systems, the ultrasonic camera, and modulated apparatus, leading to automated systems for high production rate inspection of sheet and bar stock forgings. (USBR)
W69-03787

8I. Fisheries Engineering

FISHWAYS AND DAMS.

Me Rev Stat Ann tit 12, secs 2202, 2203, 2205 (1965); Me Rev Stat Ann tit 12, secs 2201, 2204 (1968-69 Supp).

Descriptors: *Legislation, *Maine, *Fish passages, *Dams, Engineering structures, Fish hatcheries, Fish handling facilities, Fish migration, Fish management, Fish barriers, Streams, Rivers, Dam construction, Administrative agencies, Riparian land, Banks.
Identifiers: *Fishways, Brooks, Commissions.

This chapter deals with fishways and dams. It provides that any person who tampers, damages or pollutes a fishway shall be subject to a fine not to exceed $100. In addition, no person shall build a dam or other obstruction in rivers, streams or brooks without first filing written notice with the Commissioner. Whenever the Commissioner deems it expedient, he may require a fishway to be erected, repaired, or altered by dam owners. The Commissioner must hold a hearing after due notice to the owners. A civil action lies against any owner who refuses to comply with the Commissioner's order. Furthermore, the statute provides that anyone who tampers with any dam owned or operated by the department, including dams in a fish hatchery, shall be punished by a fine of not more than $100. Finally, the statute makes it a misdemeanor for anyone to bulldoze between the banks of a river or stream without obtaining permission from the Commissioner. (Stewart-Fla)
W69-04164

09. MANPOWER, GRANTS AND FACILITIES

9D. Grants, Contracts, AND Research Act Allotments

A HISTORY OF FEDERAL INVOLVEMENT IN THE MARINE SCIENCES: EMERGENCE OF THE NATIONAL SEA GRANT PROGRAM,
National Science Foundation, Washington, D. C.
Robert B. Abel.
Nat Resources Lawyer, Vol 1, No 3, pp 105-114, July 1968, 10 p.

Descriptors: *Legislation, *Federal government, *Grants, *Oceanography, Research facilities, Education, Colleges, Hydrography, Mapping, Exploration, Exploitation, Project purposes, Geological surveys, Allotments, Scientific personnel, Training, Legal aspects, Project planning, Marine geology.

Prior to 1960, there was little organized oceanographic research in the United States. The three federal agencies carrying on the majority of this work were the U. S. Navy, the U. S. Coast and Geodetic Survey, and the Bureau of Commercial Fisheries. Since 1960, however, congress has become increasingly involved in establishing a strong national program in the marine sciences. Congress has passed fisheries research programs, has expanded the functions and geographical limits of the Coast Guard (and of the Geodetic Survey) and has held extensive hearings and investigations on oceanographic research and technology. These have culminated in the National Sea Grant College and Program Act of 1966. Reasons, such as increased involvement on the part of scientists in governmental administrative capacity, are given to explain the congressional interest. The purpose of the National Sea Grant Act is to create a comprehensive program for assisting private and state institutions in their programs for ocean exploration and exploitation. The author encourages that most of the funds made available by the Act be utilized for support of established programs which show evidence of merit, with limited funding of new projects in undeveloped areas. (Kelly-Fla)
W69-04048

SUBJECT INDEX

CELERATION PRINCIPLE
EMPIRICAL EVIDENCE ON THE ACCELERATION PRINCIPLE COMMENT,
W69-04096 06B

CRETION
CLAUSS V BAUMGARTNER (AGREEMENT ON OWNERSHIP OF ACCRETIONS).
W69-03998 04A

ESSO STANDARD OIL CO V JONES (OWNERSHIP OF BED OF FORMER NAVIGABLE STREAM IS IN RIPARIAN OWNER).
W69-03999 04A

ID MINE WATER
CHAPMAN V BEAVER DAM COAL CO (DRAINAGE OF MINE WATER).
W69-04173 05B

MINISTRATION
WATER COMPACTS.
W69-03923 06E

MINISTRATIVE AGENCIES
WATER FRONT HARBOR FACILITIES.
W69-03810 06E

INTERNATIONAL JOINT COMMISSION - UNITED STATES AND CANADA,
W69-03815 06E

STREAM CONTROL COMMISSION - VIOLATIONS AND PENALTIES.
W69-03836 05G

DRAINAGE OF NOXIOUS OR POISONOUS SUBSTANCES INTO NATURAL WATERWAYS OR CANALS.
W69-03837 05G

STREAM CONTROL COMMISSION - POWERS AND DUTIES.
W69-03868 06E

DISPOSITION OF STATE UNDERWATER LANDS.
W69-03919 06E

CONSERVATION LAW - DEFINITIONS - GENERAL JURISDICTION OF THE COMMISSION.
W69-03988 06E

CITY OF COLD SPRING V CAMPBELL COUNTY WATER DISTRICT (RIGHT OF MUNICIPALITY TO SERVE CUSTOMERS OUTSIDE ITS CORPORATE LIMITS).
W69-04006 03D

DIRECTOR OF IRRIGATION.
W69-04167 03E

WATER RESOURCES RESEARCH INSTITUTE.
W69-04168 06E

CREATION OF WATER RESOURCES COMMISSION.
W69-04190 06E

NORTH CAROLINA STATE STREAM SANITATION AND CONSERVATION COMMITTEE.
W69-04193 05G

SORPTION
FLUID FLOW AND PORE-WALL ADSORPTION RELATIONSHIP THE EFFECT OF TENSION AGENTS (FRENCH),
W69-03973 02G

ADSORPTION OF POLY (VINYL ALCOHOL) BY NATURAL SOIL AGGREGATES,
W69-04108 02A

VANCE TREATMENT TECHNIQUES
NEW APPROACHES TO WASTEWATER TREATMENT,
W69-03746 05D

RATION
EFFECTS OF TEMPERATURE ON STREAM AERATION,
W69-03742 05G

AMMONIA NITROGEN LOSSES FROM STREAMS,
W69-03745 05B

PILOT STUDY OF DYNAMICS OF RESERVOIR DESTRATIFICATION,
W69-03960 05G

RIAL PHOTOGRAPHY
GEOLOGIC ORBITAL PHOTOGRAPHY EXPERIENCE FROM THE GEMINI PROGRAM,
W69-03784 07B

RODYNAMICS
MEASUREMENT OF NATURAL EVAPORATION COMPARISON OF GRAVIMETRIC AND AERODYNAMIC METHODS,
W69-03891 02D

RICA
CHERT AND ITS SODIUM-SILICATE PRECURSORS IN SODIUM-CARBONATE LAKES OF EAST AFRICA,
W69-03955 02H

GREGATE PRODUCTION FUNCTION
A NOTE ON HOUTHAKKER'S AGGREGATE PRODUCTION FUNCTION IN A MULTIFIRM INDUSTRY,
W69-04064 06B

GREGATES
THE LINEAR AGGREGATION COEFFICIENT AS THE DUAL OF THE LINEAR CORRELATION COEFFICIENT,
W69-04063 06D

AGRICULTURAL ECONOMICS
ALTERNATIVE WATER DEMANDS AND THE ADEQUACY OF PRESENT ARRANGEMENTS,
W69-04058 06D

AGRICULTURAL WATERSHEDS
CITY OF EAST ORANGE V TOWNSHIP OF LIVINGSTON (ASSESSMENT OF WATERSHED PROPERTY).
W69-03818 06E

NITRATE AND OTHER WATER POLLUTANTS UNDER FIELDS AND FEEDLOTS,
W69-04024 05B

AIR CIRCULATION
WIND-TUNNEL INVESTIGATION OF AIR FLOW OVER A HEXADECANOL MONOLAYER SPREAD ON A WATER SURFACE,
W69-04125 03B

AIR POLLUTION
INFRARED AERIAL SURVEYS I. ENVIRONMENTAL ENGINEERING,
W69-03744 07B

AIR AND WATER INTERSTATE C MPACTS.
W69-04047 05G

AIR POLLUTION EFFECTS
FOG,
W69-03786 02B

ALABAMA
UNUSED WELLS, CISTERNS, ETC, TO BE COVERED OR FILLED - POISONING SPRINGS, WELLS, ETC.
W69-03827 06E

CITY OF HUNTSVILLE V MILLER (MUNICIPAL WATER).
W69-04166 04C

DIRECTOR OF IRRIGATION.
W69-04167 03E

WATER RESOURCES RESEARCH INSTITUTE.
W69-04168 06E

ALCOHOLS
EVAPORATION OF WATER ITS RETARDATION BY MONOLAYERS,
W69-03884 03B

ADSORPTION OF POLY (VINYL ALCOHOL) BY NATURAL SOIL AGGREGATES,
W69-04108 02A

ALGAE
THE EFFECT OF INDUCED TURBULENCE ON THE GROWTH OF ALGAE,
W69-03730 05C

ALLUVIAL CHANNELS
RIVER ADJUSTMENT TO ALTERED HYDROLOGIC REGIMEN-MURRUMBIDGEE RIVER AND PALEOCHANNELS, AUSTRALIA,
W69-03957 02J

ALTERATION OF FLOW
SOMERS V HILL (DIVERTING OF WATER ONTO ADJOINING LAND).
W69-03833 04A

LONG V BITNER HOMES, INC. (RIGHTS OF LAND OWNER TO CHANNEL SURFACE WATER ONTO ADJACENT LAND).
W69-03907 04A

PROHIBITED DIVERSIONS.
W69-03987 04A

ALUMINUM
ALUMINUM SPECIES IN WATER,
W69-03728 02K

AMMONIA NITROGEN LOSSES
AMMONIA NITROGEN LOSSES FROM STREAMS,
W69-03745 05B

ANALYSIS
ANALYTICAL USES OF ENERGY BALANCES,
W69-03772 06B

ANALYTICAL TECHNIQUES
IDENTIFICATION OF PETROLEUM IN ESTUARINE WATERS,
W69-03738 05B

DETERMINATION OF STRONTIUM-90 IN WATER,
W69-03749 05A

DETERMINATION OF NITRATE IN ESTUARINE WATERS AUTOMATIC DETERMINATION USING A BRUCINE METHOD,
W69-04025 02L

AN ANALYTIC APPROACH TO DETERMINE IRRIGATION SPRINKLER SPACING,
W69-04121 03F

ANGLING
FISH AND GAME NON-RESIDENT FISHING.
W69-03845 06E

FISH AND GAME DELAWARE RIVER AND BAY AREAS BETWEEN NEW JERSEY AND DELAWARE.
W69-03846 06E

ANIMAL METABOLISM
THE GREAT INDIAN DESERT. PERSPECTIVES IN THE ECOLOGY AND PHYSIOLOGY OF SMALL DESERT MAMMALS,
W69-03889 02I

ANIMAL PHYSIOLOGY
THE GREAT INDIAN DESERT. PERSPECTIVES IN THE ECOLOGY AND PHYSIOLOGY OF SMALL DESERT MAMMALS,
W69-03889 02I

APPROPRIATION
ST. REGIS TRIBE OF MOHAWK INDIANS V STATE (OWNERSHIP OF ISLAND).
W69-03896 06E

SEC 40 ACQUISITION OF PROPERTY - SEC 43 EXCHANGE OF PROPERTY.
W69-03915 04C

WATER LAW, PLANNING AND POLICY CASES AND MATERIALS,
W69-04037 06E

AQUACULTURE
LEASES OF STATE OWNED UNDER WATER LANDS FOR SHELLFISH CULTIVATION.
W69-03814 06E

AQUATIC MICROBIOLOGY
MICROBIOLOGY OF OCEANS AND ESTUARIES,
W69-03752 02L

AQUATIC PLANTS
AXENIC CULTURE AND NUTRITIONAL STUDIES OF AQUATIC MACROPHYTES,
W69-04027 02H

AQUEOUS SOLUTIONS
BIOLOGICAL STUDIES OF MANGANESE SOLUTION FROM ITS DIOXIDE,
W69-03725 02H

ALUMINUM SPECIES IN WATER,
W69-03728 02K

AQUIFER CHARACTERISTICS
AVAILABILITY OF GROUND WATERS IN THE NORTHERN PART, TENMILE AND TAUNTON RIVER BASINS, SOUTHEASTERN MASSACHUSETTS,
W69-03723 02F

ANALYSIS OF AQUIFER TESTS IN THE PUNJAB REGION OF WEST PAKISTAN,
W69-03975 02F

AQUIFERS
AVAILABILITY OF GROUND WATERS IN THE NORTHERN PART, TENMILE AND TAUNTON RIVER BASINS, SOUTHEASTERN MASSACHUSETTS,
W69-03723 02F

A WATER-BALANCE EQUATION FOR THE RATHDRUM PRAIRIE GROUND-WATER RESERVOIR, NEAR SPOKANE, WASHINGTON,
W69-03740 02E

GEOHYDROLOGY OF THE SOURIS RIVER VALLEY IN THE VICINITY OF MINOT, NORTH DAKOTA,
W69-03969 02F

GEOLOGY AND GROUNDWATER OF THE SAVANNAH RIVER PLANT AND VICINITY, SOUTH CAROLINA,
W69-03970 02F

DISPERSION OF RADIOACTIVE TRACERS IN A MODEL BASIN SANDY AQUIFER,
W69-04111 02F

ARCHING
'BLOCKY AND SEAMY ROCK' IN TUNNELING,
W69-03760 08E

ARID CLIMATES
SALINITY AND ARIDITY,
W69-03751 03C

ARID LANDS
SALINITY AND ARIDITY,
W69-03751 03C

ARIZONA
WATER AND CHOICE IN THE COLORADO BASIN,
W69-03785 06D

ARKANSAS
LEE-PHILLIPS DRAIN DIST V BEAVER BAYOU DRAIN DIST (UPPER OWNER'S RIGHT TO DRAIN WATERS ACROSS LOWER LAND CONDITIONED UPON PAYMENT FOR ANY IMPROVEMENTS NEEDED TO PROVIDE FOR HIGHER THAN NATURAL FLOW).
W69-03997 04A

CLAUSS V BAUMGARTNER (AGREEMENT ON OWNERSHIP OF ACCRETIONS).
W69-03998 04A

MCKEE V GAY (BOUNDARY LIMITATION WHEN DEED CONVEYS TO THE LOW WATER MARK).
W69-04169 06E

ARSTADDALEN DAM
GROUTING OF THE LIMESTONE FOUNDATION FOR THE ARSTADDALEN DAM,
W69-03777 08D

ARTIFICIAL PRECIPITATION
A PROGRESS REPORT ON PROJECT SKYWATER THE BUREAU OF RECLAMATION'S ATMOSPHERIC WATER RESOURCES PROGRAM,
W69-03769 03B

ARTIFICIAL WATERCOURSES
PELSON V ASPEGREN (TO ENJOIN DIVERSION OF ARTIFICIAL STREA AND CREATION OF ARTIFICIAL POND).
W69-04180 04A

BURNS V GARDNER (SUIT FOR DEATH OF CHILD BY DROWNING).
W69-04192 06E

ASSESSMENTS
CITY OF EAST ORANGE V TOWNSHIP OF LIVINGSTON (ASSESSMENT OF WATERSHED PROPERTY).
W69-03818 06E

BLACK MARSH DRAINAGE DISTRICT V ROWE (TAXATION FOR IMPROVEMENT OF DRAINAGE DISTRICT).
W69-03904 04A

ATMOSPHERIC RESEARCH
A PROGRESS REPORT ON PROJECT SKYWATER THE BUREAU OF RECLAMATION'S ATMOSPHERIC WATER RESOURCES PROGRAM,
W69-03769 03B

AUSTRALIA
NITROGEN FERTILIZER AND WHEAT IN A SEMI-ARID ENVIRONMENT 4 EMPIRICAL YIELD RESPONSE MODELS AND ECONOMIC FACTORS,
W69-03877 03F

ECO-PHYSIOLOGICAL STUDIES ON PLANTS IN ARID AND SEMI-ARID REGIONS IN WESTERN AUSTRALIA. I. AUTECOLOGY OF PHAGODIA BACCATA (LABILL.) MOQ,
W69-04118 03F

AUTECOLOGY
ECO-PHYSIOLOGICAL STUDIES ON PLANTS IN ARID AND SEMI-ARID REGIONS IN WESTERN AUSTRALIA. I. AUTECOLOGY OF PHAGODIA BACCATA (LABILL.) MOQ,
W69-04118 03F

AUTOCORRELATION
A TRANSFORMATION USED TO CIRCUMVENT THE PROBLEM OF AUTOCORRELATION,
W69-04101 06B

AUTOMATION
DETERMINATION OF NITRATE IN ESTUARINE WATERS AUTOMATIC DETERMINATION USING A BRUCINE METHOD,
W69-04025 02L

AXENIC CULTURE
AXENIC CULTURE AND NUTRITIONAL STUDIES OF AQUATIC MACROPHYTES,
W69-04027 02H

AXIAL FLOW TURBINES
THE ADVANTAGES OF INCLINED-AXIS HYDROELECTRIC UNITS,
W69-04010 08C

BACKFILL
LATERAL PRESSURE OF EARTH BACKFILL,
W69-03805 08D

BACTERIA
BIOLOGICAL STUDIES OF MANGANESE SOLUTION FROM ITS DIOXIDE,
W69-03725 02H

BALANCED GROWTH
A NOTE ON THE GLOBAL STABILITY OF A SIMPLE GROWTH MODEL WIT MANY CAPITAL GOODS,
W69-04087 06B

BALLAST
UNLAWFUL DISPOSAL OR TAKING OF BALLAST.
W69-04158 05B

BEACH COMMISSION
BEACH COMMISSION.
W69-03840 06E

BEACH EROSION
CAROLINA BEACH FISHING PIER, INC V TOWN OF CAROLINA BEACH (STATE'S RIGHT TO TAKE PRIVATE BEACH LAND).
W69-03982 04A

PROJECTS TO PREVENT SHORE EROSION.
W69-04183 04D

BEACHES
THE MOVEMENT OF BEACH SAND,
W69-03754 02J

BEACH COMMISSION.
W69-03840 06E

WATER FRONT IMPROVEMENTS.
W69-03852 06E

PUBLIC PARKS ON BEACH OR OCEAN FRONT.
W69-03865 06E

BEANS
A SYSTEM FOR SHORT INTERVAL MEASUREMENT OF EVAPOTRANSPIRATION,
W69-04110 02D

BEDS

UNITED STATES V SMOOT SAND AND GRAVEL CORP (OWNER OF CONDEMNED RIPARIAN LANDS RIGHTS IN UNDERWATER GRAVEL DEPOSITS).
W69-03910 06E

SURRENDER OF GRANT.
W69-03912 06E

GRANTS OF LANDS UNDERWATER.
W69-03918 06E

DISPOSITION OF STATE UNDERWATER LANDS.
W69-03919 06E

LEASING OF LANDS FOR SHELLFISH CULTURE.
W69-04198 06E

NCH LEVELING
CONSERVATION BENCH TERRACES IN EASTERN COLORADO,
W69-03880 03F

NEFICATION
WATER RESOURCES OF THE MARQUETTE IRON RANGE AREA, MICHIGAN,
W69-03971 06D

G SANDY CREEK VALLEY
GEOLOGY AND GROUNDWATER RESOURCES OF THE BIG SANDY CREEK VALLEY, LINCOLN, CHEYENNE, AND KIOWA COUNTIES, COLORADO,
W69-03974 02F

OCHEMISTRY
BIOLOGICAL STUDIES OF MANGANESE SOLUTION FROM ITS DIOXIDE,
W69-03725 02H

ODEGRADATION
PESTICIDE OCCURRENCE, CONCENTRATION, AND DEGRADATION IN FREE WATER SYSTEMS,
W69-03962 05B

OLOGICAL TREATMENT
COLLECTION, CHARACTERIZATION, AND STUDY OF BIODEGRADABILITY AND CHEMICAL OXIDATION OF CARBON-ABSORBED MATERIALS FROM EFFLUENTS FROM SEWAGE TREATMENT PLANTS,
W69-04132 05D

ATING
OPERATING RESTRICTIONS ON WATERCRAFT.
W69-03862 06E

PUBLIC FACILITIES FOR BOATS.
W69-04157 06E

ATS
UNLAWFUL DISPOSAL OR TAKING OF BALLAST.
W69-04158 05B

ARSON.
W69-04163 06E

DIES OF WATER
HOWARD V ATLANTIC COAST LINE RR (ACTION FOR DROWNING IN ABANDONED WELL).
W69-03924 05B

PROCEEDINGS BEFORE THE COMMISSIONER (LEGAL ACTION AGAINST SOURCES OF POLLUTION).
W69-03989 05B

ENTRY BY TOWN ENGINEER ON PRIVATE LANDS.
W69-04184 06E

UNDARIES
MULTIPLE INTERESTS IN RIPARIAN LAND, SUBDIVISION PLATTING, AND THE ALLOCATION OF RIPARIAN RIGHTS.
W69-04040 06E

UNDARIES(PROPERTY)
REYNOLDS V REFUGE PLANNING CO (LAND BOUNDARIES).
W69-03821 06E

HOUGH V OHIO RIVER SAND CO (BOUNDARY LIMITATION WHEN DEED CONVEYS TO THE LOW WATER MARK).
W69-03996 04A

CLAUSS V BAUMGARTNER (AGREEMENT ON OWNERSHIP OF ACCRETIONS).
W69-03998 04A

MCKEE V GAY (BOUNDARY LIMITATION WHEN DEED CONVEYS TO THE LOW WATER MARK).
W69-04169 06E

NEW JERSEY AND DELAWARE - TERRITORIAL LIMITS AND JURISDICTION.
W69-04196 06E

UNDARY DISPUTES
CLAUSS V BAUMGARTNER (AGREEMENT ON OWNERSHIP OF ACCRETIONS).
W69-03998 04A

CITY OF COLD SPRING V CAMPBELL COUNTY WATER DISTRICT (RIGHT OF MUNICIPALITY TO SERVE CUSTOMERS OUTSIDE ITS CORPORATE LIMITS).
W69-04006 03D

THE DEVELOPMENT OF OCEAN MINERALS AND THE LAW OF THE SEA,
W69-04049 06E

OUSSINESQ EQUATION
COMPUTATIONAL SCHEMES FOR THE BOUSSINESQ EQUATION,
W69-03937 07C

BOWEN RATIO
SOME STUDIES OF SENSIBLE AND LATENT HEAT FLUXES AT WALTAIR, SOUTHEASTERN COAST OF INDIA,
W69-03887 02G

BRIBES
A NOTE ON THE SYMMETRY BETWEEN BRIBES AND CHARGES,
W69-04071 06C

BRIDGES
BRIDGES OVER CANALS OR RAILROADS.
W69-03864 06E

BRISTLECONE PINE TREES
RATES OF SLOPE DEGRADATION AS DETERMINED FROM BOTANICAL EVIDENCE, WHITE MOUNTAINS, CALIFORNIA,
W69-03943 02J

BUDGET RESTRAINT
A SIMPLE MACROECONOMIC MODEL WITH A GOVERNMENT BUDGET RESTRAINT,
W69-04069 06C

BUREAU OF RECLAMATION
ROLE OF IRRIGATION IN THE WEST'S EXPANDING ECONOMY,
W69-03940 03F

BURNING
ARSON.
W69-04163 06E

BUTTERFLY VALVES
REDUCING CAVITATION IN VALVES,
W69-03757 08C

CALIFORNIA
ABUNDANCE AND CHARACTER OF MICROSESTON IN A CALIFORNIA MOUNTAIN STREAM,
W69-04031 02E

CANALS
LEASES OR DEEDS OF RAILROAD OR CANAL PROPERTY IN MORE THAN ONE COUNTY.
W69-03861 06E

CLAIMS FOR DAMAGE GENERALLY ADJUSTMENT OF CLAIMS OF OWNERS OF PRIVATE DAMS.
W69-03913 04A

SEC 82 DEPOSIT OF REFUSE IN NAVIGABLE WATERS, SEC 81 SUPPLYING DEFICIENCIES OF WATER, SEC 83 SEIZURE OF OBSTRUCTION.
W69-03914 04A

SEC 40 ACQUISITION OF PROPERTY - SEC 43 EXCHANGE OF PROPERTY.
W69-03915 04C

GENERAL POWERS AND DUTIES OF COMMISSIONER OF TRANSPORTATION.
W69-03916 06E

CAPILLARY ACTION
FLUID FLOW AND PORE-WALL ADSORPTION RELATIONSHIP THE EFFECT OF TENSION AGENTS (FRENCH),
W69-03973 02G

CAPITAL GAINS
A NOTE ON THE GLOBAL STABILITY OF A SIMPLE GROWTH MODEL WITH MANY CAPITAL GOODS,
W69-04087 06B

CAPITAL GOODS
A NOTE ON THE GLOBAL STABILITY OF A SIMPLE GROWTH MODEL WITH MANY CAPITAL GOODS,
W69-04087 06B

AN INPUT-OUTPUT SYSTEM INVOLVING NON-TRANSFERABLE GOODS,
W69-04090 06D

CARBON RADIOISOTOPES
AGE AND COMPARATIVE DEVELOPMENT OF DESERT SOILS AT THE GARDNER SPRING RADIOCARBON SITE, NEW MEXICO,
W69-04126 02J

CATION EXCHANGE
LEACHING REQUIREMENT FOR EXCHANGEABLE-SODIUM CONTROL,
W69-04012 02G

CAVITATION
REDUCING CAVITATION IN VALVES,
W69-03757 08C

CAVITATION CONTROL
REDUCING CAVITATION IN VALVES,
W69-03757 08C

CAVITATION NOISE
REDUCING CAVITATION IN VALVES,
W69-03757 08C

CAVITIES
SEISMIC RESONANCE INVESTIGATION OF A NEAR-SURFACE CAVITY IN ANCHOR RESERVOIR, WYOMING,
W69-03759 08E

CHANNEL MORPHOLOGY
RIVER ADJUSTMENT TO ALTERED HYDROLOGIC REGIMEN-MURRUMBIDGEE RIVER AND PALEOCHANNELS, AUSTRALIA,
W69-03957 02J

CHARCOAL HORIZONS

AGE AND COMPARATIVE DEVELOPMENT OF DESERT SOILS AT THE GARDNER SPRING RADIOCARBON SITE, NEW MEXICO,
W69-04126 02J

CHARGES
A NOTE ON THE SYMMETRY BETWEEN BRIBES AND CHARGES,
W69-04071 06C

CHARLESTON HARBOR(SC)
STATISTICAL APPROACH TO ESTUARINE BEHAVIOR,
W69-03732 05B

CHEMICAL ANALYSIS
THE STRONTIUM AND BARIUM CONTENT OF SEA WATER,
W69-03726 02K

GAS CHROMATOGRAPHIC ANALYSIS OF DALAPON IN WATER,
W69-03755 05A

CHEMICAL PRECIPITATION
CHERT AND ITS SODIUM-SILICATE PRECURSORS IN SODIUM-CARBONATE LAKES OF EAST AFRICA,
W69-03955 02H

OCCURRENCE OF SELECTED MINOR ELEMENTS IN THE WATERS OF CALIFORNIA,
W69-03966 02K

CHEMISTRY OF PRECIPITATION
SODIUM-TO-CHLORINE RATIO IN HAWAIIAN RAINS AS A FUNCTION OF DISTANCE INLAND AND OF ELEVATION,
W69-03735 02B

CHERT
CHERT AND ITS SODIUM-SILICATE PRECURSORS IN SODIUM-CARBONATE LAKES OF EAST AFRICA,
W69-03955 02H

CHROMATOGRAPHY
GAS CHROMATOGRAPHIC ANALYSIS OF DALAPON IN WATER,
W69-03755 05A

CITIES
EXCHANGE OF RIPARIAN LANDS.
W69-03853 06E

CITY OF COLD SPRING V CAMPBELL COUNTY WATER DISTRICT (RIGHT OF MUNICIPALITY TO SERVE CUSTOMERS OUTSIDE ITS CORPORATE LIMITS).
W69-04006 03D

CITY PLANNING
PUBLIC WORKS AND IMPROVEMENTS.
W69-03844 06E

ALTERNATIVE WATER DEMANDS AND THE ADEQUACY OF PRESENT ARRANGEMENTS,
W69-04058 06D

CIVIL LAW
HOPSON V DOWNS (OBSTRUCTION TO NATURAL FLOW OF SURFACE WATER).
W69-04172 04A

CLASSIFICATION
FLOOD PROTECTION.
W69-03813 04A

CITY OF FORT WAYNE V MAPLEWOOD PARK UTIL (CONSTITUTIONALITY OF STATE COMBINED SEWAGE DISPOSAL AND WATER ACT).
W69-03983 05G

CLEAR-CUTTING
INCREASING WATER YIELD IN THE NORTHEAST BY MANAGEMENT OF FORESTED WATERSHEDS,
W69-03980 03B

CLIMATOLOGY
TREE-RING ANALYSIS A TOOL FOR WATER RESOURCES RESEARCH,
W69-03963 02A

CLOSED CONDUIT FLOW
OFFENHARTZ V HEINSOHN (EASEMENT TO ALLOW UNDERGROUND TRANSPORT OF WATER).
W69-03908 04B

CLOSED CONDUITS
REDUCING CAVITATION IN VALVES,
W69-03757 08C

CLOUD SEEDING
A PROGRESS REPORT ON PROJECT SKYWATER THE BUREAU OF RECLAMATION'S ATMOSPHERIC WATER RESOURCES PROGRAM,
W69-03769 03B

FOG,
W69-03786 02B

COAL MINES
MARCHETTI V LUMAGHI COAL COMPANY (SURFACE SUBSIDENCE FROM UNDERGROUND MINESHAFTS).
W69-03826 06E

COASTAL SALTBUSH
ECO-PHYSIOLOGICAL STUDIES ON PLANTS IN ARID AND SEMI-ARID REGIONS IN WESTERN AUSTRALIA. I. AUTECOLOGY OF RHAGODIA BACCATA (LABILL.) MOQ,
W69-04118 03F

COASTS
FISHERIES JURISDICTION BEYOND THE TERRITORIAL SEA - WITH SPECIAL REFERENCE TO THE POLICY OF THE UNITED STATES,
W69-04046 06E

THE DEVELOPMENT OF OCEAN MINERALS AND THE LAW OF THE SEA,
W69-04049 06E

COLLECTIVE GOODS
ON THE PRINCIPLE OF CONSUMERS' SOVEREIGNTY,
W69-04083 06B

COLLOIDS
ELECTROKINETIC MEASUREMENTS OF COLLOIDAL-LADEN FLOW THROUGH A SAND COLUMN,
W69-04112 02A

COLOR
SECULAR CHANGES IN THE TRANSPARENCY OF LAKE WATERS,
W69-04022 02H

COLOR PHOTOGRAPHY
GEOLOGIC ORBITAL PHOTOGRAPHY EXPERIENCE FROM THE GEMINI PROGRAM,
W69-03784 07B

COLORADO
GEOLOGY AND GROUNDWATER RESOURCES OF THE BIG SANDY CREEK VALLEY, LINCOLN, CHEYENNE, AND KIOWA COUNTIES, COLORADO,
W69-03974 02F

COLORADO RIVER BASIN
WATER AND CHOICE IN THE COLORADO BASIN,
W69-03785 06D

AUGMENTING COLORADO RIVER BY WEATHER MODIFICATION,
W69-03950 03B

QUALITY OF SURFACE WATERS FOR IRRIGATION, WESTERN STATES, 1963,
W69-03968 02E

COMMERCE CLAUSE
COMMENT, EMINENT DOMAIN - UNITED STATES V RANDS, 88 S CT 26 (1967),
W69-04044 06E

COMMERCIAL SHELLFISH
FISH AND GAME OYSTER FISHING.
W69-03847 06E

LICENSING OF VESSELS.
W69-04197 06E

COMMON ENEMY DOCTRINE
LAUR V CITY OF MILWAUKEE (SURFACE WATER DRAINAGE).
W69-03899 04A

COMMUNITY DEVELOPMENT
PUBLIC WORKS AND IMPROVEMENTS.
W69-03844 06E

METROPOLITAN RESOURCES IN A POLICY MATRIX,
W69-04099 06B

COMPETITION
ECONOMIC THEORY AND THE MEANING OF COMPETITION,
W69-04084 06B

COMPUTERS
THE RELATION BETWEEN RAINFALL AND RUNOFF,
W69-03890 02A

COMPUTER-AIDED DESIGN
GENERAL SLOPE STABILITY ANALYSIS,
W69-03779 08D

CONCRETE STRUCTURES
CONDITION OF JOINTS IN MASSIVE CONCRETE STRUCTURES DETERMINED BY ULTRASONICS,
W69-03799 08F

CONCRETE TESTING
CONDITION OF JOINTS IN MASSIVE CONCRETE STRUCTURES DETERMINED BY ULTRASONICS,
W69-03799 08F

CONDEMNATION
UNITED STATES V 811.92 ACRES OF LAND,
W69-03811 06E

UNITED STATES V SMOOT SAND AND GRAVEL CORP (OWNER OF CONDEMNED RIPARIAN LANDS RIGHTS IN UNDERWATER GRAVEL DEPOSITS).
W69-03910 06E

EAST BATON ROUGE PARISH COUNCIL V KOLLER (NO OFFSET AGAINST DAMAGE AWARD FOR BENEFITS CONFERRED).
W69-04000 04A

DRAINAGE OF AGRICULTURAL LANDS PROCEDURE.
W69-04185 04A

CONDEMNATION VALUE
UNITED STATES V 811.92 ACRES OF LAND,
W69-03811 06E

COMMENT, EMINENT DOMAIN - UNITED STATES V RANDS, 88 S CT 26 (1967),
W69-04044 06E

CONDENSATION
STUDIES ON DEW FORMATION UNDER SEMI-ARID CONDITIONS,

W69-04115 02A

IFINED WATER
SOIL WATER TRANSLOCATION IN A HIGH WATER TABLE AREA,
W69-04124 02G

INATE WATER
ON THE MAINTENANCE OF ANOMALOUS FLUID PRESSURES 1. THICK SEDIMENTARY SEQUENCES,
W69-03954 02J

INECTICUT
SOMERS V HILL (DIVERTING OF WATER ONTO ADJOINING LAND).
W69-03833 04A

ISERVATION
GREAT LAKES BASIN COMPACT.
W69-03925 06E

ISTITUTIONAL LAW
CITY OF FORT WAYNE V MAPLEWOOD PARK UTIL (CONSTITUTIONALITY OF STATE COMBINED SEWAGE DISPOSAL AND WATER ACT).
W69-03983 05G

ISTRAINED DEMAND
THE CONSTRAINED DEMAND FOR PUBLIC ASSISTANCE,
W69-04093 06D

ISTRUCTION JOINTS
CONDITION OF JOINTS IN MASSIVE CONCRETE STRUCTURES DETERMINED BY ULTRASONICS,
W69-03799 08F

ISUMER SOVEREIGNTY
ON THE PRINCIPLE OF CONSUMERS' SOVEREIGNTY,
W69-04083 06B

NSUMERS' SURPLUS
JULES DUPUIT AND THE EARLY THEORY OF MARGINAL COST PRICING,
W69-04085 06E

REVISITING MARSHALL'S CONSTANCY OF MARGINAL UTILITY OF MONEY,
W69-04086 06B

NSUMPTION USE
ON PERVERSE CONSUMPTION PATTERNS,
W69-04089 06D

NTAMINATION(WATER)
CORRUPTING WATERS FORBIDDEN.
W69-03863 05B

NTIGUOUS LAND
FINAL REPORT AS OF MARCH 24, 1967, OF CONCLUSIONS REACHED, LEGISLATION RECOMMENDED AND PROGRESS MADE.
W69-04105 06E

NTINENTAL SHELF
THE CONVENTION OF THE CONTINENTAL SHELF AND THE NEED FOR ITS REVISION AND SOME COMMENTS REGARDING THE REGIME FOR THE LAND BEYOND,
W69-04042 06E

THE ADMINISTRATION OF THE OUTER CONTINENTAL SHELF LANDS ACT,
W69-04043 06E

THE DEVELOPMENT OF OCEAN MINERALS AND THE LAW OF THE SEA,
W69-04049 06E

NTINUOUS
CONTINUOUS AND DISCRETE TIME APPROACHES TO A MAXIMIZATION PROBLEM,
W69-04091 06B

NTRACTS
CONTRACTS FOR PURIFICATION OF WATER AND SEWAGE - CONTRACTS FOR SEWERAGE DISPOSAL (RIGHT OF MUNICIPALITIES TO CONTRACT FOR EFFECT SEWERAGE).
W69-03992 05D

RNFIELD WASH BASIN
HYDROLOGY OF CORNFIELD WASH AREA AND EFFECTS OF LAND-TREATMENT PRACTICES, SANDOVAL COUNTY, NEW MEXISO, 1951-60,
W69-03747 04D

RRELATION ANALYSIS
THE RELATION BETWEEN RAINFALL AND RUNOFF,
W69-03890 02A

ST SHARING
LEE-PHILLIPS DRAIN DIST V BEAVER BAYOU DRAIN DIST (UPPER OWNER'S RIGHT TO DRAIN WATERS ACROSS LOWER LAND CONDITIONED UPON PAYMENT FOR ANY IMPROVEMENTS NEEDED TO PROVIDE FOR HIGHER THAN NATURAL FLOW).
W69-03997 04A

STS
AN ACT TO REPEAL SECTIONS 204.030, 204.100, AND 204.170, RSMO 1959, RELATING TO WATER POLLUTION AND TO ENACT IN LIEU THEREOF FOUR NEW SECTIONS, RELATING TO THE SAME SUBJECT, WITH PENALTY PROVISIONS.
W69-04007 05B

ECONOMIC THEORY AND THE MEANING OF COMPETITION,
W69-04084 06B

ST-BENEFIT RATIO
ROLE OF IRRIGATION IN THE WEST'S EXPANDING ECONOMY,
W69-03940 03F

AUGMENTING COLORADO RIVER BY WEATHER MODIFICATION,
W69-03950 03B

COST-BENEFIT THEORY
JULES DUPUIT AND THE EARLY THEORY OF MARGINAL COST PRICING,
W69-04085 06E

CRITERION
WHAT REDISTRIBUTION MAY ECONOMISTS DISCUSS,
W69-04076 06B

CROP RESPONSE
NITROGEN FERTILIZER AND WHEAT IN A SEMI-ARID ENVIRONMENT 4 EMPIRICAL YIELD RESPONSE MODELS AND ECONOMIC FACTORS,
W69-03877 03F

CROSS-SECTIONAL ANALYSIS
THE LONG-RUN COST FUNCTION OF WATER PRODUCTION FOR SELECTED WISCONSIN COMMUNITIES,
W69-04136 06C

CULTURAL CONTROL
INFLUENCE OF VARIOUS RANGELAND CULTURAL TREATMENTS ON RUNOFF AND SEDIMENT PRODUCTION FROM THE BIG SAGE TYPE, EASTGATE BASIN, NEVADA,
W69-03873 02G

CULTURES
AXENIC CULTURE AND NUTRITIONAL STUDIES OF AQUATIC MACROPHYTES,
W69-04027 02H

CULVERTS
NEMETH V COUNTY OF GENESEE (ACTION FOR CROP DAMAGE FROM ENLARGEMENT OF DRAINAGE DITCH).
W69-04175 04A

CITY OF MERIDIAN V NEW ORLEANS AND NORTHEASTERN RR (INADEQUATE DRAINAGE THROUGH CULVERTS).
W69-04176 04A

CUT SLOPES
CONSTRUCTION PROBLEMS EXPERIENCED WITH LOESS SOILS,
W69-03803 08D

CYANOPHYTA
HYDROCARBONS OF BLUE-GREEN ALGAE GEOCHEMICAL SIGNIFICANCE,
W69-04021 02K

CYCLING NUTRIENTS
THE ECOLOGICAL ROLE OF PHOSPHORUS IN WATERS WITH SPECIAL REFERENCE TO MICROORGANISMS,
W69-04023 05C

DALAPON
GAS CHROMATOGRAPHIC ANALYSIS OF DALAPON IN WATER,
W69-03755 05A

DAM CONSTRUCTION
BLOOD V CITY OF NEW YORK (ACTION TO RECOVER DAMAGES FROM TURBIDITY ALLEGEDLY CAUSED BY DAM).
W69-03909 05B

PUBLIC UTILITIES - WATER POWER COMPANIES.
W69-04200 03E

DAM DESIGN
GENERAL PROCEDURE IN INVESTIGATION, DESIGN AND CONTROL DURING CONSTRUCTION OF EARTH- AND ROCK FILL DAMS IN NORWAY,
W69-03778 08D

DAM FAILURE
PASHLEY V UNITED STATES (FLOOD DAMAGE THROUGH ERECTION OF DAM).
W69-03835 04A

DAM FOUNDATIONS
DAMS AND RESERVOIRS IN PLEISTOCENE-EOLIAN DEPOSIT TERRANE OF NEBRASKA AND KANSAS,
W69-03762 08D

GROUTING OF THE LIMESTONE FOUNDATION FOR THE ARSTADDALEN DAM,
W69-03777 08D

DAMAGES
MCFARLAND V DEKALK COUNTY (DAMAGES ATTRIBUTABLE TO SURFACE WATER NUISANCE).
W69-03812 04A

CLAIMS FOR DAMAGE GENERALLY ADJUSTMENT OF CLAIMS OF OWNERS OF PRIVATE DAMS.
W69-03913 04A

WASHINGTON GOLF AND COUNTRY CLUB V BRIGGS AND BRENNAN DEVELOPERS (ACTION FOR DAMAGE CAUSED BY FLOODING).
W69-03993 04A

CITY OF OXFORD V SPEARS (CITY'S LIABILITY FOR DUMPING SEWAGE INTO STREAM WHICH PASSES THROUGH PRIVATE PROPERTY).
W69-04177 05B

DAMS
CLAIMS FOR DAMAGE GENERALLY ADJUSTMENT OF CLAIMS OF OWNERS OF PRIVATE DAMS.
W69-03913 04A

LAKE BARCROFT ESTATES V MCCAW (WATER DAMAGE DUE TO FLOODGATE OPENING).
W69-03995 04A

CITIZENS UTILITIES COMPANY V FEDERAL POWER COMMISSION (FPC JURISDICTION).
W69-04002 04A

FISHWAYS AND DAMS.
W69-04164 08I

PUBLIC UTILITIES - WATER POWER COMPANIES.
W69-04200 03E

DATA COLLECTIONS
INDEX OF SURFACE-WATER RECORDS TO SEPTEMBER 30, 1967. PART 8- WESTERN GULF OF MEXICO BASINS,
W69-03942 02E

HYDROLOGIC DATA 1967 - VOLUME 1 NORTH COASTAL AREA.
W69-03951 02F

DECISION MAKING
RESOURCES RESPONSIBILITY AND COORDINATION RELATED TO THE COMPREHENSIVE STUDY OF THE SUSQUEHANNA RIVER BASIN.
W69-04032 06B

THE PLANNING-PROGRAMMING-BUILDING-BUDGETING SYSTEM,
W69-04092 06B

DECOMPOSITION
THE DECOMPOSITION OF ECONOMIC PRODUCTION SYSTEMS,
W69-04103 06B

DEEDING OF LAND
BUILDINGS AND OTHER THINGS INCLUDED IN DEEDS TO LAND.
W69-03829 06E

DELAWARE RIVER
NEW JERSEY AND DELAWARE - TERRITORIAL LIMITS AND JURISDICTION.
W69-04196 06E

LICENSING OF VESSELS.
W69-04197 06E

DELAWARE RIVER BASIN COMMISSION
WATER QUALITY MANAGEMENT IN THE DELAWARE RIVER BASIN (FEDERAL AND INTERSTATE COMPACT TO SOLVE POLLUTION PROBLEMS),
W69-04039 05G

DEMAND
ESTIMATING DEMAND EQUATIONS,
W69-04062 06D

A NOTE ON THE DIFFERENTIABILITY OF CONSUMER DEMAND FUNCTIONS,
W69-04080 06D

JULES DUPUIT AND THE EARLY THEORY OF MARGINAL COST PRICING,
W69-04085 06E

THE CONSTRAINED DEMAND FOR PUBLIC ASSISTANCE,
W69-04093 06D

DEMAND EQUATIONS
ESTIMATING DEMAND EQUATIONS,
W69-04062 06D

DENDROCHRONOLOGY
TREE-RING ANALYSIS A TOOL FOR WATER RESOURCES RESEARCH,
W69-03963 02A

DENSITY
SEASONAL PRECIPITATION AND SCALED QUAIL IN EASTERN NEW MEXICO,
W69-04120 02B

DENSITY STRATIFICATION
STATISTICAL APPROACH TO ESTUARINE BEHAVIOR,
W69-03732 05B

DESERTS
THE GREAT INDIAN DESERT. PERSPECTIVES IN THE ECOLOGY AND PHYSIOLOGY OF SMALL DESERT MAMMALS,
W69-03889 02I

DESIGN
VERTICAL ALIGNMENT OF SEWER AND DRAINAGE SYSTEMS BY DYNAMIC PROGRAMMING,
W69-04150 04A

DESIGN FLOOD
ESTIMATING DESIGN FLOODS FROM EXTREME RAINFALL,
W69-03783 02E

DETERGENTS
FLUID FLOW AND PORE-WALL ADSORPTION RELATIONSHIP THE EFFECT OF TENSION AGENTS (FRENCH),
W69-03973 02G

DIATOMS
THE SUCCESSION OF DIATOM ASSEMBLAGES IN THE RECENT SEDIMENTS OF LAKE WASHINGTON,
W69-04029 05C

DIFFERENCE EQUATIONS
CONTINUOUS AND DISCRETE TIME APPROACHES TO A MAXIMIZATION PROBLEM,
W69-04091 06B

DIFFERENTIAL EQUATIONS
CONTINUOUS AND DISCRETE TIME APPROACHES TO A MAXIMIZATION PROBLEM,
W69-04091 06B

DIRECT BENEFITS
DRAINAGE.
W69-03839 04A

DIRECTOR OF IRRIGATION
DIRECTOR OF IRRIGATION.
W69-04167 03E

DISCHARGE MEASUREMENT
GENERAL FIELD AND OFFICE PROCEDURES FOR INDIRECT DISCHARGE MEASUREMENTS,
W69-03748 07B

MEASUREMENT OF PEAK DISCHARGE AT WIDTH CONTRACTIONS BY INDIRECT METHODS,
W69-03753 07B

MEASUREMENT OF PEAK DISCHARGE AT DAMS BY INDIRECT METHODS,
W69-03945 02E

MEASUREMENT OF PEAK DISCHARGE BY THE SLOPE-AREA METHOD,
W69-03967 07B

DISCHARGE(WATER)
GROUNDWATER DISCHARGE TOWARD GREAT SALT LAKE THROUGH VALLEY FILL IN THE JORDAN VALLEY, UTAH,
W69-03739 02F

ALLOCATIONS, DIVERSIONS, AND RELEASES.
W69-03920 06E

DISCONTINUITIES
'BLOCKY AND SEAMY ROCK' IN TUNNELING,
W69-03760 08E

DISCRETE
CONTINUOUS AND DISCRETE TIME APPROACHES TO A MAXIMIZATION PROBLEM,
W69-04091 06B

DISPERSION
VELOCITY-DISTRIBUTIONS IN STRAIGHT RECTANGULAR CHANNELS,
W69-03703 02E

A DISCUSSION OF THE DISPERSIVITY TENSOR FOR A TURBULENT UNIFORM CHANNEL FLOW,
W69-03704 02E

CALCULATION OF THE DISPERSION COEFFICIENT IN STRAIGHT PRISMATIC STREAMS,
W69-03705 02E

DISPERSION OF RADIOACTIVE TRACERS IN A MODEL BASIN SANDY AQUIFER,
W69-04111 02F

DISPERSIVITY TENSORS
A DISCUSSION OF THE DISPERSIVITY TENSOR FOR A TURBULENT UNIFORM CHANNEL FLOW,
W69-03704 02E

DISSOLVED OXYGEN
PILOT STUDY OF DYNAMICS OF RESERVOIR DESTRATIFICATION,
W69-03960 05G

DISTRIBUTION PATTERNS
RESPONSE OF SPRINGFLOW TO SOME CLIMATIC VARIABLES IN SOUTHWESTERN WISCONSIN,
W69-04016 02A

DITCHES
HUNT LAND HOLDING COMPANY V SCHRAMM (PRESCRIPTIVE RIGHTS).
W69-04003 04A

MANCINI V DELILLIS (ACTION TO REQUIRE REMOVAL OF DITCH OBSTRUCTION).
W69-04194 04A

DIVERSION
MILLER V DARBY (DIVERSION OF SURFACE WATERS).
W69-03823 04A

WIESE V MIEHER (ALTERATION OF DRAINAGE).
W69-03824 04A

KEISER V MANN (DIVERSION OF SURFACE WATERS).
W69-03825 04A

ALLOCATIONS, DIVERSIONS, AND RELEASES.
W69-03920 06E

DIVERSION STRUCTURES
LONG V EITNER HOMES, INC. (RIGHTS OF LAND OWNER TO CHANNEL SURFACE WATER ONTO ADJACENT LAND).
W69-03907 04A

LICENSING DIVERSION AND USE OF WATER FOR POWER.
W69-04188 06E

DIVERSIONS
PROHIBITED DIVERSIONS.
W69-03987 04A

DOMESTIC WASTES
LITTERING AND DUMPING.
W69-04162 05B

DOWNSTREAM
BLOOD V CITY OF NEW YORK (ACTION TO RECOVER DAMAGES FROM

TURBIDITY ALLEGEDLY CAUSED BY DAM).
W69-03909 05B

RAINAGE
WIESE V MIEHER (ALTERATION OF DRAINAGE).
W69-03824 04A

HOPSON V DOWNS (OBSTRUCTION TO NATURAL FLOW OF SURFACE WATER).
W69-04172 04A

RAINAGE COMMISSION
DRAINAGE.
W69-03839 04A

RAINAGE DISTRICT
RIGHT OF ENTRY UNLAWFUL INTERFERENCE WITH DRAINAGE WORKS.
W69-03986 04A

RAINAGE DISTRICTS
DRAINAGE.
W69-03839 04A

HEITSCH V CLARK (INJUNCTION TO ENJOIN CHANGE IN LAKE LEVEL).
W69-03901 04A

BLACK MARSH DRAINAGE DISTRICT V ROWE (TAXATION FOR IMPROVEMENT OF DRAINAGE DISTRICT).
W69-03904 04A

LEE-PHILLIPS DRAIN DIST V BEAVER BAYOU DRAIN DIST (UPPER OWNER'S RIGHT TO DRAIN WATERS ACROSS LOWER LAND CONDITIONED UPON PAYMENT FOR ANY IMPROVEMENTS NEEDED TO PROVIDE FOR HIGHER THAN NATURAL FLOW).
W69-03997 04A

RAINAGE EFFECTS
SOMERS V HILL (DIVERTING OF WATER ONTO ADJOINING LAND).
W69-03833 04A

CITY OF HUNTSVILLE V MILLER (MUNICIPAL WATER).
W69-04166 04C

RAINAGE ENGINEERING
DRAINAGE OF AGRICULTURAL LAND AN ANNOTATED BIBLIOGRAPHY OF SELECTED REFERENCES, 1956-1964,
W69-03809 04A

RAINAGE PROGRAMS
RIGHT OF ENTRY UNLAWFUL INTERFERENCE WITH DRAINAGE WORKS.
W69-03986 04A

RAINAGE PROJECT
EAST BATON ROUGE PARISH COUNCIL V KOLLER (NO OFFSET AGAINST DAMAGE AWARD FOR BENEFITS CONFERRED).
W69-04000 04A

RAINAGE SYSTEMS
GEOLOGICAL CONSIDERATIONS IN THE DESIGN OF RESERVOIR SEEPAGE CONTROL SYSTEMS,
W69-03763 08A

DRAINAGE FACILITIES.
W69-03917 06E

VERTICAL ALIGNMENT OF SEWER AND DRAINAGE SYSTEMS BY DYNAMIC PROGRAMMING,
W69-04150 04A

NEMETH V COUNTY OF GENESEE (ACTION FOR CROP DAMAGE FROM ENLARGEMENT OF DRAINAGE DITCH).
W69-04175 04A

RAINAGE WATER
MCFARLAND V DEKALK COUNTY (DAMAGES ATTRIBUTABLE TO SURFACE WATER NUISANCE).
W69-03812 04A

COLLINS V WICKLAND (FLOOD DAMAGE DUE TO NATURAL DRAINAGE OBSTRUCTION).
W69-03906 04A

RAINS
PROTECTION OF WATER SUPPLY FROM POLLUTION.
W69-03855 05G

SEWERS, DRAINS - CHANGE OF COURSE OR OUTLET.
W69-03858 05F

RAUGHT RESISTANCE
ECO-PHYSIOLOGICAL STUDIES ON PLANTS IN ARID AND SEMI-ARID REGIONS IN WESTERN AUSTRALIA. 1. AUTECOLOGY OF RHAGODIA BACCATA (LABILL.) MOQ,
W69-04118 03F

RAWDOWN
SUBSURFACE DRAINAGE BY TRANSIENT-FLOW THEORY,
W69-03941 02G

REDGING
VODOPIJA V TENNESSEE GAS TRANSMISSION CO (DAMAGE TO OYSTERS).
W69-03830 06E

FISH AND GAME OYSTER FISHING.
W69-03847 06E

ROUGHT RESISTANCE
STOMATA IN RELATION TO DROUGHT RESISTANCE OF WHEAT VARIETIES,
W69-04117 03F

DROWNING
HOWARD V ATLANTIC COAST LINE RR (ACTION FOR DROWNING IN ABANDONED WELL).
W69-03924 05B

BURNS V GARDNER (SUIT FOR DEATH OF CHILD BY DROWNING).
W69-04192 06E

DUAL PROBLEM
THE DUAL IN NONLINEAR PROGRAMMING AND ITS ECONOMIC INTERPRETATION,
W69-04088 06B

DYE RELEASES
FLUOROMETRIC PROCEDURES FOR DYE TRACING,
W69-03944 07B

DYNAMIC NONSUBSTITUTION THEOREM
AN INPUT-OUTPUT SYSTEM INVOLVING NON-TRANSFERABLE GOODS,
W69-04090 06D

DYNAMIC PROGRAMMING
DYNAMIC PROGRAMMING FOR PROJECT COST-TIME CURVES,
W69-04137 06C

VERTICAL ALIGNMENT OF SEWER AND DRAINAGE SYSTEMS BY DYNAMIC PROGRAMMING,
W69-04150 04A

DYNAMICS
CONTINUOUS AND DISCRETE TIME APPROACHES TO A MAXIMIZATION PROBLEM,
W69-04091 06B

EARMARKED TAXES
EARMARKED TAXES AND MAJORITY RULE BUDGETARY PROCESS,
W69-04067 06C

EARTH DAMS
GENERAL PROCEDURE IN INVESTIGATION, DESIGN AND CONTROL DURING CONSTRUCTION OF EARTH- AND ROCK FILL DAMS IN NORWAY,
W69-03778 08D

EARTH PRESSURE
LATERAL PRESSURE OF EARTH BACKFILL,
W69-03805 08D

EARTHQUAKE FOCUS
FOCAL MECHANISM OF THE EARTHQUAKE OF JULY 26, 1963, AT SKOPJE,
W69-04009 08A

EARTHQUAKES
THE DENVER EARTHQUAKES,
W69-03802 08E

FOCAL MECHANISM OF THE EARTHQUAKE OF JULY 26, 1963, AT SKOPJE,
W69-04009 08A

EASEMENT
GOODMAN V ELLISH (IMPLIED EASEMENT ON PRIVATE LAKE).
W69-03832 06E

EASEMENTS
MASSUCCO V VERMONT COLLEGE CORP (ABANDONMENT OF WATER RIGHTS EASEMENT).
W69-03894 06E

OFFENHARTZ V HEINSOHN (EASEMENT TO ALLOW UNDERGROUND TRANSPORT OF WATER).
W69-03908 04B

RIGHT OF ENTRY UNLAWFUL INTERFERENCE WITH DRAINAGE WORKS.
W69-03986 04A

KUSHNER V PAZ CONSTR (STORM SEWER DRAINAGE).
W69-04179 04A

PETITION OF ALGONQUIN GAS TRANSMISSION CO (GRANTED RIGHTS IN RIVERBEDS).
W69-04182 06E

ECOLOGICAL DISTRIBUTION
THE TAXONOMY AND ECOLOGY OF LEECHES (HIRUDINEA) OF LAKE MENDOTA, WISCONSIN,
W69-04028 02H

ECOLOGY
THE GREAT INDIAN DESERT. PERSPECTIVES IN THE ECOLOGY AND PHYSIOLOGY OF SMALL DESERT MAMMALS,
W69-03889 02I

ECO-PHYSIOLOGICAL STUDIES ON PLANTS IN ARID AND SEMI-ARID REGIONS IN WESTERN AUSTRALIA. I. AUTECOLOGY OF RHAGODIA BACCATA (LABILL.) MOQ,
W69-04118 03F

INFLUENCE OF FATTY ALCOHOLS AND ACIDS ON THE CLARITY AND BIOTA OF IMPOUNDED RESERVOIRS,
W69-04134 05B

ECONOMETRICS
ECONOMETRICS OF JOINT PRODUCTION,
W69-04070 06B

ECONOMIC EFFICIENCY
A CAPACITY EXPANSION PLANNING MODEL FOR MUNICIPAL WATER SUPPLY SYSTEMS,
W69-04145 06D

ECONOMIC IMPACT
ROLE OF IRRIGATION IN THE WEST'S EXPANDING ECONOMY,
W69-03940 03F

ECONOMICS
THE PIAS OF LIVIATAN'S CONSISTENT ESTIMATOR IN A DISTRIBUTED LAG MODEL,
W69-04060 06B

EFFLUENTS
COLLECTION, CHARACTERIZATION, AND STUDY OF BIODEGRADABILITY AND CHEMICAL OXIDATION OF CARBON-ABSORBED MATERIALS FROM EFFLUENTS FROM SEWAGE TREATMENT PLANTS,
W69-04132 05D

ELECTRIC CABLES
UNITED STATES DEVELOPMENTS IN UNDERGROUND TRANSMISSION,
W69-03773 08C

ELECTRIC POWER
MEETING TOMORROW'S ELECTRIC POWER NEEDS--NEW METHODS, NEW CONCEPTS,
W69-03770 06D

THE PLANNING, CONSTRUCTION AND OPERATION OF POWER STATIONS IN LARGE INTERCONNECTED SYSTEMS--THE STRATEGY OF LARGE-AREA POWER SUPPLY,
W69-03771 08C

PUBLIC UTILITIES - WATER POWER COMPANIES.
W69-04200 03E

ELECTRIC POWER DEMAND
MEETING TOMORROW'S ELECTRIC POWER NEEDS--NEW METHODS, NEW CONCEPTS,
W69-03770 06D

ANALYTICAL USES OF ENERGY BALANCES,
W69-03772 06B

PROJECTED TRENDS AND REQUIREMENTS IN THE COORDINATED GROWTH OF ELECTRIC POWER SYSTEMS IN THE UNITED STATES,
W69-03774 08C

ELECTRIC POWER PRODUCTION
MEETING TOMORROW'S ELECTRIC POWER NEEDS--NEW METHODS, NEW CONCEPTS,
W69-03770 06D

THE PLANNING, CONSTRUCTION AND OPERATION OF POWER STATIONS IN LARGE INTERCONNECTED SYSTEMS--THE STRATEGY OF LARGE-AREA POWER SUPPLY,
W69-03771 08C

PROJECTED TRENDS AND REQUIREMENTS IN THE COORDINATED GROWTH OF ELECTRIC POWER SYSTEMS IN THE UNITED STATES,
W69-03774 08C

POWER GENERATION UNDER IJC REGULATION,
W69-03781 04A

ELECTRICAL WELL LOGGING
SP LOG INTERPRETATION IN SHALY SANDS,
W69-03946 07B

ELECTROGASDYNAMICS
MEETING TOMORROW'S ELECTRIC POWER NEEDS--NEW METHODS, NEW CONCEPTS,
W69-03770 06D

EMINENT DOMAIN
PASHLEY V UNITED STATES (FLOOD DAMAGE THROUGH ERECTION OF DAM).
W69-03835 04A

IN RE SHIPPINGTON FERRY CO (RIGHTS OF FERRY OWNER AGAINST STATE FOR FRANCHISE INFRINGEMENTS).
W69-03903 04C

CAROLINA BEACH FISHING PIER, INC V TOWN OF CAROLINA BEACH (STATE'S RIGHT TO TAKE PRIVATE BEACH LAND).
W69-03982 04A

COMMENT, EMINENT DOMAIN - UNITED STATES V RANDS, 88 S CT 265 (1967),
W69-04044 06E

LICENSING DIVERSION AND USE OF WATER FOR POWER.
W69-04188 06E

ENERGY
ANALYTICAL USES OF ENERGY BALANCES,
W69-03772 06B

ROLE OF HIGHER VOLTAGE TRANSMISSION IN CHANGING ASPECTS OF ENERGY TRANSPORT,
W69-03775 08C

ENERGY BALANCE
ANALYTICAL USES OF ENERGY BALANCES,
W69-03772 06B

ENGINEERING GEOLOGY
SEISMIC RESONANCE INVESTIGATION OF A NEAR-SURFACE CAVITY IN ANCHOR RESERVOIR, WYOMING,
W69-03759 08E

ANALYSIS OF WEDGE FAILURES IN LAYERED ROCKS,
W69-03761 08E

STABILITY OF ROCK SLOPES IN NORWAY,
W69-03782 08E

LOCATION OF THE SOURCES OF SEISMOACOUSTIC PULSES,
W69-04008 08E

ENGINEERS ESTIMATES
CITY OF MERIDIAN V NEW ORLEANS AND NORTHEASTERN RR (INADEQUATE DRAINAGE THROUGH CULVERTS).
W69-04176 04A

ENTRY ON LAND
ENTRY ON LAND TO MAKE SURVEYS.
W69-03867 04A

ENVIRONMENTAL SANITATION
NEW APPROACHES TO WASTEWATER TREATMENT,
W69-03746 05D

EPHEMERAL STREAMS
EVAPORATION FROM AN EPHEMERAL STREAMBED,
W69-03874 02G

EQUATIONS
COMPUTATIONAL SCHEMES FOR THE BOUSSINESQ EQUATION,
W69-03937 07C

LEACHING REQUIREENT FOR EXCHANGEABLE-SODIUM CONTROL,
W69-04012 02G

ANOTHER EVAPORATION FORMULA,
W69-04107 02D

EROSION
RATES OF SLOPE DEGRADATION AS DETERMINED FROM BOTANICAL EVIDENCE, WHITE MOUNTAINS, CALIFORNIA,
W69-03943 02J

EROSION CONTROL
HYDROLOGY OF CORNFIELD WASH AREA AND EFFECTS OF LAND-TREATMENT PRACTICES, SANDOVAL COUNTY, NEW MEXISO, 1951-60,
W69-03747 04D

PROJECTS TO PREVENT SHORE EROSION.
W69-04183 04D

ERRORS
THEORY OF MEASUREMENT,
W69-03800 07B

ESCANABA RIVER
WATER RESOURCES OF THE MARQUETTE IRON RANGE AREA, MICHIGAN,
W69-03971 06D

ESTUARIES
STATISTICAL APPROACH TO ESTUARINE BEHAVIOR,
W69-03732 05B

IDENTIFICATION OF PETROLEUM IN ESTUARINE WATERS,
W69-03738 05B

MICROBIOLOGY OF OCEANS AND ESTUARIES,
W69-03752 02L

DETERMINATION OF NITRATE IN ESTUARINE WATERS AUTOMATIC DETERMINATION USING A BRUCINE METHOD,
W69-04025 02L

DEVELOPMENT OF OPTIMIZATION - SYSTEMS ANALYSIS TECHNIQUES FOR TEXAS WATER RESOURCES,
W69-04133 05B

EUTROPHICATION
THE SUCCESSION OF DIATOM ASSEMBLAGES IN THE RECENT SEDIMENTS OF LAKE WASHINGTON,
W69-04029 05C

NITROGEN REMOVAL IN SEWAGE TREATMENT PROCESS,
W69-04030 05D

EVAPORATION
EVAPORATION STUDY AT SHARP STATION POND NEAR BATON ROUGE, LOUISIANA,
W69-03731 02D

HYDRAULIC LOAD-CELL LYSIMETER, CONSTRUCTION, CALIBRATION, AND TESTS,
W69-03793 07B

EVAPORATION FROM AN EPHEMERAL STREAMBED,
W69-03874 02G

THE EFFECTS OF EVAPORATION, POTENTIAL TRANSPIRATION AND RAINFALL ON DEPLETION OF SOIL MOISTURE BY IRRIGATED PERENNIAL PASTURE,
W69-03875 03F

MEASUREMENT OF NATURAL EVAPORATION COMPARISON OF GRAVIMETRIC AND AERODYNAMIC METHODS,
W69-03891 02D

ANOTHER EVAPORATION FORMULA,
W69-04107 02D

A METHOD OF DETERMINING HYDRAULIC CONDUCTIVITY CHARACTERISTICS FOR NON-SWELLING SOILS IN SITU, AND OF CALCULATING EVAPORATION FROM BARE SOIL,
W69-04114 02G

HYDROLOGICAL STUDIES IN MASSACHUSETTS,
W69-04131 02A

VAPORATION CONTROL
EVAPORATION RETARDED BY MONOLAYERS,
W69-03722 03B

EVAPORATION OF WATER ITS RETARDATION BY MONOLAYERS,
W69-03884 03B

VAPORATION PANS
ANOTHER EVAPORATION FORMULA,
W69-04107 02D

VAPORATIVE INDEX
THE EFFECTS OF EVAPORATION, POTENTIAL TRANSPIRATION AND RAINFALL ON DEPLETION OF SOIL MOISTURE BY IRRIGATED PERENNIAL PASTURE,
W69-03875 03F

VAPORIMETERS
THE EFFECTS OF EVAPORATION, POTENTIAL TRANSPIRATION AND RAINFALL ON DEPLETION OF SOIL MOISTURE BY IRRIGATED PERENNIAL PASTURE,
W69-03875 03F

VAPOTRANSPIRATION
EVAPORATION STUDY AT SHARP STATION POND NEAR BATON ROUGE, LOUISIANA,
W69-03731 02D

HYDRAULIC LOAD-CELL LYSIMETER, CONSTRUCTION, CALIBRATION, AND TESTS,
W69-03793 07B

A SYSTEM FOR SHORT INTERVAL MEASUREMENT OF EVAPOTRANSPIRATION,
W69-04110 02D

XCESS WATER(LEGAL ASPECTS)
KANE V VILLAGE OF RED HOOK (FIRE PROTECTION REQUIREMENTS DETERMINATIVE OF 'EXCESS WATER' OF SUPPLY CONTRACT).
W69-04005 03D

XEMPTIONS(TAX)
AN ACT CONCERNING INDUSTRIAL WASTE DISPOSAL PROPERTY...EXEMPTING FROM TAXATION CERTAIN TANGIBLE PERSONAL PROPERTY.
W69-04001 05G

XPANSION JOINTS
CONDITION OF JOINTS IN MASSIVE CONCRETE STRUCTURES DETERMINED BY ULTRASONICS,
W69-03799 08F

XPERIMENTAL WATERSHEDS
PROCEEDINGS INTERNATIONAL SYMPOSIUM ON FOREST HYDROLOGY.
W69-03806 02A

XPLOITATION
THE ADMINISTRATION OF THE OUTER CONTINENTAL SHELF LANDS ACT,
W69-04043 06E

XTERNALITIES
A NOTE ON THE SYMMETRY BETWEEN BRIBES AND CHARGES,
W69-04071 06C

XTERNALITY
A NOTE ON PUBLIC GOODS SUPPLY,
W69-04104 06B

XTRA HIGH VOLTAGE
ECONOMIC AND DESIGN CONSIDERATIONS OF THE PACIFIC NORTHWEST-PACIFIC SOUTHWEST INTERTIE,
W69-03776 08C

XTRA LONG DISTANCE
ECONOMIC AND DESIGN CONSIDERATIONS OF THE PACIFIC NORTHWEST-PACIFIC SOUTHWEST INTERTIE,
W69-03776 08C

ACTOR INPUT
NORMALLY, FACTOR INPUTS ARE NEVER GROSS SUBSTITUTES,
W69-04073 06D

ALLOWING
CONSERVATION BENCH TERRACES IN EASTERN COLORADO,
W69-03880 03F

SOIL-SALINITY CHANGES WITH FALLOW AND A STRAW MULCH ON FALLOW,
W69-04116 02I

AULTS(GEOLOGY)
FOCAL MECHANISM OF THE EARTHQUAKE OF JULY 26, 1963, AT SKOPJE,
W69-04009 08A

EDERAL GOVERNMENT
THE ADMINISTRATION OF THE OUTER CONTINENTAL SHELF LANDS ACT,
W69-04043 06E

A HISTORY OF FEDERAL INVOLVEMENT IN THE MARINE SCIENCES EMERGENCE OF THE NATIONAL SEA GRANT PROGRAM,
W69-04048 09D

EDERAL-STATE WATER RIGHTS CONFLICT
THE RELATIONSHIP BETWEEN THE LAWS GOVERNING WATER RIGHTS AND THOSE GOVERNING OTHER NATURAL RESOURCES,
W69-04041 06E

ERTILIZERS
NITROGEN FERTILIZER AND WHEAT IN A SEMI-ARID ENVIRONMENT 4
EMPIRICAL YIELD RESPONSE MODELS AND ECONOMIC FACTORS,
W69-03877 03F

FERTILIZING DRYLAND SPRING AND WINTER WHEAT IN THE BROWN SOIL ZONE,
W69-03878 03F

FINANCING
DRAINAGE.
W69-03839 04A

BEACH COMMISSION.
W69-03840 06E

WATER FRONT IMPROVEMENTS.
W69-03852 06E

FISCAL POLICY *MULTIPLIER EFFECT
A SIMPLE MACROECONOMIC MODEL WITH A GOVERNMENT BUDGET RESTRAINT,
W69-04069 06C

FISH
FISH AND GAME DELAWARE RIVER AND BAY AREAS BETWEEN NEW JERSEY AND DELAWARE.
W69-03846 06E

FISH PASSAGES
FISHWAYS AND DAMS.
W69-04164 08I

FISHING
HUDSON RIVER, NEW YORK HARBOR AND SANDY HOOK BAY (NEW).
W69-03851 06E

SHAD FISHING ON HUDSON RIVER.
W69-03866 06E

WATERS IMPOUNDED BY DAMS CONSTRUCTED FOR POWER PURPOSES IMPRESSED WITH PUBLIC INTEREST.
W69-03895 06E

FISHKILL
FISH HATCHERIES POLLUTION OF WATERS USED BY FISH HATCHERIES.
W69-03843 05C

FISHWAYS
FISHWAYS AND DAMS.
W69-04164 08I

FLEXIBLE ACCELERATION PRINCIPLE
AN INPUT-OUTPUT SYSTEM INVOLVING NON-TRANSFERABLE GOODS,
W69-04090 06D

FLOOD CONTROL
FLOOD PROTECTION.
W69-03813 04A

GENERAL DUTIES - BOARDS OF RIVER REGULATING DISTRICTS.
W69-03985 04A

FLOOD DAMAGE
FLOOD PLAIN INFORMATION-HUTTON BRANCH AND COOKS BRANCH, DALLAS COUNTY, TEXAS.
W69-03707 04A

FLOOD PLAIN INFORMATION - VOLUME IV OF DENVER METROPOLITAN REGION, COLORADO.
W69-03708 04A

FLOOD PLAIN INFORMATION OF CONGAREE CREEK AND SIX MILE CREEK IN LEXINGTON COUNTY, SOUTH CAROLINA.
W69-03709 04A

FLOOD PLAIN INFORMATION-PETERS CREEK AND LICK RUN, ROANOKE, VIRGINIA.
W69-03710 04A

PRELIMINARY FLOOD PLAIN INFORMATION-CHATTAHOOCHEE RIVER, BUFORD DAM TO METROPOLITAN ATLANTA, GEORGIA.
W69-03711 04A

FLOOD PLAIN INFORMATION - FOUNTAIN CREEK, PUEBLO, COLORADO.
W69-03712 04A

FLOOD PLAIN INFORMATION-OUACHITA RIVER, CAMDEN, ARKANSAS.
W69-03713 04A

FLOOD PLAIN INFORMATION-CUMBERLAND RIVER AND OBEY RIVER, CELINA, TENNESSEE.
W69-03714 04A

FLOOD PLAIN INFORMATION, CHRISTINA RIVER, MUDDY AND BELLTOWN RUNS, NEW CASTLE COUNTY, DELAWARE.
W69-03715 04A

STRICKLAND V STATE (DISCHARGE OF SURFACE WATER - STATE'S LIABILITY FOR NEGLIGENT INDEPENDENT CONTRACTOR).
W69-03820 04C

PASHLEY V UNITED STATES (FLOOD DAMAGE THROUGH ERECTION OF DAM).
W69-03835 04A

BRATONJA V CITY OF MILWAUKEE (ACTION TO RECOVER DAMAGES DUE TO FLOODING FROM HEAVY RAIN).
W69-03905 04A

FLOOD PLAIN INFORMATION OF LEFT-HAND CREEK, VOLUME 1, BOULDER COUNTY, COLORADO.

W69-03926 04A

FLOOD PLAIN INFORMATION, MOJAVE RIVER (VICINITY OF BARSTOW), SAN BERNARDINO COUNTY, CALIFORNIA.
W69-03927 04A

FLOOD PLAIN INFORMATION, AUGLAIZE RIVER, WAPAKONETA, OHIO.
W69-03928 04A

FLOOD PLAIN INFORMATION, ALLEGHENY RIVER, LITTLE VALLEY AND GREAT VALLEY CREEKS, SALAMANCA, NEW YORK.
W69-03929 04A

FLOOD PLAIN INFORMATION, OUACHITA RIVER, WEST MONROE, LOUISIANA.
W69-03930 04A

FLOOD PLAIN INFORMATION, CONCORD AND SHAWSHEEN RIVERS, BEDFORD, MASSACHUSETTS.
W69-03931 04A

FLOOD PLAIN INFORMATION-SOUTH FORK EEL RIVER, WEOTT TO MYERS FLAT, HUMBOLDT COUNTY, CALIFORNIA.
W69-03932 04A

WASHINGTON GOLF AND COUNTRY CLUB V BRIGGS AND BRENNAN DEVELOPERS (ACTION FOR DAMAGE CAUSED BY FLOODING).
W69-03993 04A

FLOOD FORECASTING
FLOODS IN BEECHER WEST QUADRANGLE, NORTHEASTERN ILLINOIS,
W69-03720 02E

FLOOD PLAIN INSURANCE
SIMULATION OF A NATIONAL FLOOD INSURANCE FUND,
W69-04138 06A

FLOOD PLAINS
FLOOD PROTECTION.
W69-03813 04A

FLOOD ROUTING
EFFECTS OF URBAN DEVELOPMENT ON FLOODS IN NORTHERN VIRGINIA,
W69-03706 04C

FLOODGATES
LAKE BARCROFT ESTATES V MCCAW (WATER DAMAGE DUE TO FLOODGATE OPENING).
W69-03995 04A

FLOODING
NEMETH V COUNTY OF GENESEE (ACTION FOR CROP DAMAGE FROM ENLARGEMENT OF DRAINAGE DITCH).
W69-04175 04A

CITY OF MERIDIAN V NEW ORLEANS AND NORTHEASTERN RR (INADEQUATE DRAINAGE THROUGH CULVERTS).
W69-04176 04A

FLOODS
EFFECTS OF URBAN DEVELOPMENT ON FLOODS IN NORTHERN VIRGINIA,
W69-03706 04C

FLOOD PLAIN INFORMATION-HUTTON BRANCH AND COOKS BRANCH, DALLAS COUNTY, TEXAS.
W69-03707 04A

FLOOD PLAIN INFORMATION - VOLUME IV OF DENVER METROPOLITAN REGION, COLORADO.
W69-03708 04A

FLOOD PLAIN INFORMATION OF CONGAREE CREEK AND SIX MILE CREEK IN LEXINGTON COUNTY, SOUTH CAROLINA.
W69-03709 04A

FLOOD PLAIN INFORMATION-PETERS CREEK AND LICK RUN, ROANOKE, VIRGINIA.
W69-03710 04A

PRELIMINARY FLOOD PLAIN INFORMATION-CHATTAHOOCHEE RIVER, BUFORD DAM TO METROPOLITAN ATLANTA, GEORGIA.
W69-03711 04A

FLOOD PLAIN INFORMATION - FOUNTAIN CREEK, PUEBLO, COLORADO.
W69-03712 04A

FLOOD PLAIN INFORMATION-OUACHITA RIVER, CAMDEN, ARKANSAS.
W69-03713 04A

FLOOD PLAIN INFORMATION-CUMBERLAND RIVER AND OBEY RIVER, CELINA, TENNESSEE.
W69-03714 04A

FLOOD PLAIN INFORMATION, CHRISTINA RIVER, MUDDY AND BELLTOWN RUNS, NEW CASTLE COUNTY, DELAWARE.
W69-03715 04A

FLOODS IN BEECHER WEST QUADRANGLE, NORTHEASTERN ILLINOIS,
W69-03720 02E

GLACIER OUTBURST FLOODS IN THE PACIFIC NORTHWEST,
W69-03741 02C

DRAINAGE FACILITIES.
W69-03917 06E

FLOOD PLAIN INFORMATION OF LEFT-HAND CREEK, VOLUME 1, BOULDER COUNTY, COLORADO.
W69-03926 04A

FLOOD PLAIN INFORMATION, MOJAVE RIVER (VICINITY OF BARSTOW), SAN BERNARDINO COUNTY, CALIFORNIA.
W69-03927 04A

FLOOD PLAIN INFORMATION, AUGLAIZE RIVER, WAPAKONETA, OHIO.
W69-03928 04A

FLOOD PLAIN INFORMATION, ALLEGHENY RIVER, LITTLE VALLEY AND GREAT VALLEY CREEKS, SALAMANCA, NEW YORK.
W69-03929 04A

FLOOD PLAIN INFORMATION, OUACHITA RIVER, WEST MONROE, LOUISIANA.
W69-03930 04A

FLOOD PLAIN INFORMATION, CONCORD AND SHAWSHEEN RIVERS, BEDFORD, MASSACHUSETTS.
W69-03931 04A

FLOOD PLAIN INFORMATION-SOUTH FORK EEL RIVER, WEOTT TO MYERS FLAT, HUMBOLDT COUNTY, CALIFORNIA.
W69-03932 04A

LAKE BARCROFT ESTATES V MCCAW (WATER DAMAGE DUE TO FLOODGATE OPENING).
W69-03995 04A

FLORIDA
HOWARD V ATLANTIC COAST LINE RR (ACTION FOR DROWNING IN ABANDONED WELL).
W69-03924 05B

HUNT LAND HOLDING COMPANY V SCHRAMM (PRESCRIPTIVE RIGHTS).
W69-04003 04A

FLOW CHARACTERISTICS
ANALYSIS OF AQUIFER TESTS IN THE PUNJAB REGION OF WEST PAKISTAN,
W69-03975 02F

FLOW MEASUREMENT
ELECTROKINETIC MEASUREMENTS OF COLLOIDAL-LADEN FLOW THROUGH A SAND COLUMN,
W69-04112 02A

FLUCTUATION
WATER TRANSPORT IN SOIL WITH A DAILY TEMPERATURE WAVE II ANALYSIS,
W69-03870 02G

SOME STUDIES OF SENSIBLE AND LATENT HEAT FLUXES AT WALTAIR, SOUTHEASTERN COAST OF INDIA,
W69-03887 02G

FLUID FLOW
FLUID FLOW AND PORE-WALL ADSORPTION RELATIONSHIP THE EFFECT OF TENSION AGENTS (FRENCH),
W69-03973 02G

FLUOROMETRY
FLUOROMETRIC PROCEDURES FOR DYE TRACING,
W69-03944 07B

FOG DISPERSION
FOG,
W69-03786 02B

FORCED-COOLING SYSTEMS
UNITED STATES DEVELOPMENTS IN UNDERGROUND TRANSMISSION,
W69-03773 08C

FORECASTING
ANALYTICAL USES OF ENERGY BALANCES,
W69-03772 06B

ROLE OF HIGHER VOLTAGE TRANSMISSION IN CHANGING ASPECTS OF ENERGY TRANSPORT,
W69-03775 08C

FUTURE IRRIGATION DEMAND IN THE SUSQUEHANNA BASIN,
W69-03934 03F

SIMULTANEOUS CONFIDENCE INTERVALS IN ECONOMETRIC FORECASTING,
W69-04065 06B

FOREIGN DESIGN PRACTICES
GENERAL PROCEDURE IN INVESTIGATION, DESIGN AND CONTROL DURING CONSTRUCTION OF EARTH- AND ROCK FILL DAMS IN NORWAY,
W69-03778 08D

FOREIGN WATERS
INTERNATIONAL JOINT COMMISSION - UNITED STATES AND CANADA,
W69-03815 06E

FOREST HYDROLOGY
PROCEEDINGS INTERNATIONAL SYMPOSIUM ON FOREST HYDROLOGY.
W69-03806 02A

FOREST MANAGEMENT
PROCEEDINGS INTERNATIONAL SYMPOSIUM ON FOREST HYDROLOGY.
W69-03806 02A

FORMULAE
ANOTHER EVAPORATION FORMULA,
W69-04107 02D

FOUNDATIONS
DESIGN OF A SPILLWAY DAM ON SHELL PILES AND METHOD OF STATIC CALCULATION OF ITS FOUNDATION,
W69-03766 08D

EEZE-THAW DURABILITY
FROST DAMAGE TO STONE AND CONCRETE GEOLOGICAL CONSIDERATIONS,
W69-03804 08F

EEZING
FROST DAMAGE TO STONE AND CONCRETE GEOLOGICAL CONSIDERATIONS,
W69-03804 08F

OST
RIME AND HOARFROST IN UPPER-SLOPE FORESTS OF EASTERN WASHINGTON,
W69-03807 02I

OST ACTION
FROST DAMAGE TO STONE AND CONCRETE GEOLOGICAL CONSIDERATIONS,
W69-03804 08F

OST RESISTANCE
FROST DAMAGE TO STONE AND CONCRETE GEOLOGICAL CONSIDERATIONS,
W69-03804 08F

OZEN GROUND
WINTER THAWS CAN RAISE GROUND WATER LEVELS IN DRIFTLESS AREA,
W69-04015 02F

URROW DRAINAGE
MODEL STUDY OF BOUNDARY EFFECTS ON DITCH DRAINAGE,
W69-03938 02G

ME BIRDS
SEASONAL PRECIPITATION AND SCALED QUAIL IN EASTERN NEW MEXICO,
W69-04120 02B

RBAGE DUMPS
LITTERING AND DUMPING.
W69-04162 05B

S CHROMATOGRAPHY
GAS CHROMATOGRAPHIC ANALYSIS OF DALAPON IN WATER,
W69-03755 05A

ENERAL FUNDS BUDGETING
EARMARKED TAXES AND MAJORITY RULE BUDGETARY PROCESS,
W69-04067 06C

EOCHEMISTRY
HYDROCARBONS OF BLUE-GREEN ALGAE GEOCHEMICAL SIGNIFICANCE,
W69-04021 02K

EOLOGIC INVESTIGATIONS
GEOLOGIC ORBITAL PHOTOGRAPHY EXPERIENCE FROM THE GEMINI PROGRAM,
W69-03784 07B

EOLOGIC MAPPING
GEOLOGY OF CLEMSON RESEARCH WATERSHED,
W69-04018 02G

EOPHYSICS
SEISMIC RESONANCE INVESTIGATION OF A NEAR-SURFACE CAVITY IN ANCHOR RESERVOIR, WYOMING,
W69-03759 08E

GEOPHYSICAL, ISOTOPE AND TRACER TECHNIQUES IN WATERSHED RESEARCH,
W69-04119 02A

EORGIA
MCFARLAND V DEKALB COUNTY (DAMAGES ATTRIBUTABLE TO SURFACE WATER NUISANCE).
W69-03812 04A

ERBILS
THE GREAT INDIAN DESERT. PERSPECTIVES IN THE ECOLOGY AND PHYSIOLOGY OF SMALL DESERT MAMMALS,
W69-03889 02I

ERMINATION
A MICROPSYCHROMETER TO MEASURE WATER POTENTIALS OF INTACT PLANT MATERIAL,
W69-04109 02I

GERMINATION OF WINTERFAT SEEDS UNDER DIFFERENT MOISTURE STRESSES AND TEMPERATURES,
W69-04129 02I

EYSERS
THERMAL AND SEISMIC INDICATIONS OF OLD FAITHFUL GEYSER'S INNER WORKINGS,
W69-03737 02F

LACIAL DRIFT
A WATER-BALANCE EQUATION FOR THE RATHDRUM PRAIRIE GROUND-WATER RESERVOIR, NEAR SPOKANE, WASHINGTON,
W69-03740 02E

LACIERS
GLACIER OUTBURST FLOODS IN THE PACIFIC NORTHWEST,
W69-03741 02C

OVERNMENTAL IMMUNITY
SOMERS V HILL (DIVERTING OF WATER ONTO ADJOINING LAND).
W69-03833 04A

RANTS
SURRENDER OF GRANT.
W69-03912 06E

GRANTS OF LANDS UNDERWATER.
W69-03918 06E

A HISTORY OF FEDERAL INVOLVEMENT IN THE MARINE SCIENCES EMERGENCE OF THE NATIONAL SEA GRANT PROGRAM,
W69-04048 09D

GRAVIMETRY
MEASUREMENT OF NATURAL EVAPORATION COMPARISON OF GRAVIMETRIC AND AERODYNAMIC METHODS,
W69-03891 02D

GREAT LAKES
THE GREAT LAKES WATER LEVELS PROBLEM,
W69-03947 02H

WATER POLLUTION IN THE GREAT LAKES BASIN,
W69-03948 05B

GREAT LAKES REGION
GREAT LAKES BASIN COMPACT.
W69-03925 06E

GROSS COMPLEMENTS
NORMALLY, FACTOR INPUTS ARE NEVER GROSS SUBSTITUTES,
W69-04073 06D

GROSS SUBSTITUTES
NORMALLY, FACTOR INPUTS ARE NEVER GROSS SUBSTITUTES,
W69-04073 06D

GROUNDWATER
CONTAMINANTS IN GROUNDWATERS NEAR WASTE STABILIZATION PONDS,
W69-03718 05B

AVAILABILITY OF GROUND WATERS IN THE NORTHERN PART, TENMILE AND TAUNTON RIVER BASINS, SOUTHEASTERN MASSACHUSETTS,
W69-03723 02F

COMPUTATIONAL SCHEMES FOR THE BOUSSINESQ EQUATION,
W69-03937 07C

WATER RESOURCES OF WISCONSIN, FOX-WOLF RIVER BASIN,
W69-03939 02E

HYDROLOGIC DATA 1967 - VOLUME 1 NORTH COASTAL AREA.
W69-03951 02F

GEOLOGY AND GROUND-WATER RESOURCES OF THE MURPHY AREA, NORTH CAROLINA,
W69-03959 02F

GEOLOGY AS A GUIDE TO REGIONAL ESTIMATES OF THE WATER RESOURCE,
W69-03961 02F

GEOHYDROLOGY OF THE SOURIS RIVER VALLEY IN THE VICINITY OF MINOT, NORTH DAKOTA,
W69-03969 02F

GEOLOGY AND WATER RESOURCES IN THE FRENCH PRAIRIE AREA, NORTHERN WILLAMETTE VALLEY, OREGON,
W69-03977 03F

GEOLOGY AND GROUNDWATER RESOURCES OF LARAMIE COUNTY, WYOMING,
W69-03979 03F

WINTER THAWS CAN RAISE GROUND WATER LEVELS IN DRIFTLESS AREA,
W69-04015 02F

RESPONSE OF SPRINGFLOW TO SOME CLIMATIC VARIABLES IN SOUTHWESTERN WISCONSIN,
W69-04016 02A

GROUNDWATER BASINS
INVESTIGATION OF THE KARSTIC WATER RESERVES BURIED UNDER MIOCENE, PLIOCENE, AND QUATERNARY SEDIMENTS OF THE MEDITERRANEAN BASIN (FRENCH),
W69-03972 02F

GROUND WATER AND COMPUTER SIMULATIONS,
W69-04149 02F

GROUNDWATER CONTAMINATION
CONTAMINANTS IN GROUNDWATERS NEAR WASTE STABILIZATION PONDS,
W69-03718 05B

GROUNDWATER MINING
LAND SUBSIDENCE IN PLEASANT VALLEY AREA, FRESNO COUNTY, CALIF.,
W69-03797 02F

GROUNDWATER MOVEMENT
GROUNDWATER DISCHARGE TOWARD GREAT SALT LAKE THROUGH VALLEY FILL IN THE JORDAN VALLEY, UTAH,
W69-03739 02F

GROUNDWATER RECHARGE
WINTER THAWS CAN RAISE GROUND WATER LEVELS IN DRIFTLESS AREA,
W69-04015 02F

GROUT CURTAINS
GROUTING OF THE LIMESTONE FOUNDATION FOR THE ARSTADDALEN DAM,
W69-03777 08D

GROUTING
GROUTING OF THE LIMESTONE FOUNDATION FOR THE ARSTADDALEN DAM,
W69-03777 08D

DIGIACINTO V NEW JERSEY ZINC CO (LANDOWNER'S RIGHTS TO TAKE PERCOLATING WATER).
W69-04038 04B

GROWTH RATES
THE EFFECT OF INDUCED TURBULENCE ON THE GROWTH OF ALGAE,
W69-03730 05C

ON PERVERSE CONSUMPTION PATTERNS,
W69-04089 06D

CONTINUOUS AND DISCRETE TIME APPROACHES TO A MAXIMIZATION PROBLEM,
W69-04091 06B

A CAPACITY EXPANSION PLANNING MODEL FOR MUNICIPAL WATER SUPPLY SYSTEMS,
W69-04145 06D

GYPSUM
DETERMINATION OF THE SOLUBILITY PRODUCT OF SOIL CONSTITUENTS SUCH AS GYPSUM,
W69-04127 02G

HARBOR FACILITIES
WATER FRONT HARBOR FACILITIES.
W69-03810 06E

HARBOR MASTERS
HARBOR MASTERS.
W69-04159 06E

HARBORS
WATER FRONT HARBOR FACILITIES.
W69-03810 06E

HARBOR MASTERS.
W69-04159 06E

HEAT BALANCE
SOME STUDIES OF SENSIBLE AND LATENT HEAT FLUXES AT WALTAIR, SOUTHEASTERN COAST OF INDIA,
W69-03887 02G

HEAT FLOW
WATER FLUX IN MOIST SOIL THERMAL VERSUS SUCTION GRADIENTS,
W69-03883 02G

HEAT FLUXES
SOME STUDIES OF SENSIBLE AND LATENT HEAT FLUXES AT WALTAIR, SOUTHEASTERN COAST OF INDIA,
W69-03887 02G

HEAT RESISTANCE
ECO-PHYSIOLOGICAL STUDIES ON PLANTS IN ARID AND SEMI-ARID REGIONS IN WESTERN AUSTRALIA. I. AUTECOLOGY OF RHAGODIA BACCATA (LABILL.) MOQ,
W69-04118 03F

HELE-SHAW MODELS
MODEL STUDY OF BOUNDARY EFFECTS ON DITCH DRAINAGE,
W69-03938 02G

HERBICIDES
INCREASING WATER YIELD IN THE NORTHEAST BY MANAGEMENT OF FORESTED WATERSHEDS,
W69-03980 03B

HEXADECANOL
EVAPORATION RETARDED BY MONOLAYERS,
W69-03722 03B

WIND-TUNNEL INVESTIGATION OF AIR FLOW OVER A HEXADECANOL MONOLAYER SPREAD ON A WATER SURFACE,
W69-04125 03B

INFLUENCE OF FATTY ALCOHOLS AND ACIDS ON THE CLARITY AND BIOTA OF IMPOUNDED RESERVOIRS,
W69-04134 05B

HIGH PRESSURE
ON THE MAINTENANCE OF ANOMALOUS FLUID PRESSURES 1. THICK SEDIMENTARY SEQUENCES,
W69-03954 02J

HIGH WATER MARK
MULTIPLE INTERESTS IN RIPARIAN LAND, SUBDIVISION PLATTING, AND THE ALLOCATION OF RIPARIAN RIGHTS,
W69-04040 06E

HORIZONTAL INTERCEPTION
RIME AND HOARFROST IN UPPER-SLOPE FORESTS OF EASTERN WASHINGTON,
W69-03807 02I

HOTZENWALD PUMP STOR(WEST GERMANY)
HOTZENWALD PUMPED-STORAGE SCHEME,
W69-03789 08A

HUDSON BAY
QUALITY OF SURFACE WATERS FOR IRRIGATION, WESTERN STATES, 1963,
W69-04068 02E

HUDSON RIVER
HUDSON RIVER BETWEEN NEW JERSEY AND NEW YORK.
W69-03850 06E

SHAD FISHING ON HUDSON RIVER.
W69-03866 06E

PETITION OF ALGONQUIN GAS TRANSMISSION CO (GRANTED RIGHTS IN RIVERBEDS).
W69-04182 06E

HUMIDITY
MEASURING THE RELATIVE HUMIDITY OF SOILS AT DIFFERENT MOISTURE CONTENTS BY THE GHAY HYDROCAL HYDROMETER,
W69-04130 02G

HURRICANES
RESEARCH ON THE MORPHOLOGY OF PRECIPITATION AND RUNOFF IN TEXAS,
W69-04135 02B

HYDRAULIC CONDUCTIVITY
ON THE MAINTENANCE OF ANOMALOUS FLUID PRESSURES 1. THICK SEDIMENTARY SEQUENCES,
W69-03954 02J

A METHOD OF DETERMINING HYDRAULIC CONDUCTIVITY CHARACTERISTICS FOR NON-SWELLING SOILS IN SITU, AND OF CALCULATING EVAPORATION FROM BARE SOIL,
W69-04114 02G

HYDRAULIC GATES
PROTOTYPE INVESTIGATIONS OF DYNAMICS OF A TRIPLE-RIB OF A PLANE GATE OF THE DAM OF THE XXII CONGRESS CPSU VOLGA HES,
W69-03765 08C

HYDRAULIC GATES AND VALVES
REDUCING CAVITATION IN VALVES,
W69-03757 08C

HYDRAULIC MODELS
EFFECTS OF TEMPERATURE ON STREAM AERATION,
W69-03742 05G

MODEL STUDY OF BOUNDARY EFFECTS ON DITCH DRAINAGE,
W69-03938 02G

HYDRAULIC TURBINES
THE ADVANTAGES OF INCLINED-AXIS HYDROELECTRIC UNITS,
W69-04010 08C

HYDRAULIC VALVES
REDUCING CAVITATION IN VALVES,
W69-03757 08C

HYDROCARBONS
HYDROCARBONS OF BLUE-GREEN ALGAE GEOCHEMICAL SIGNIFICANCE,
W69-04021 02K

HYDROELECTRIC POWER
LONG-RANGE HYDROELECTRIC POWER USE DESCRIBED,
W69-03780 06D

POWER GENERATION UNDER IJC REGULATION,
W69-03781 04A

HOTZENWALD PUMPED-STORAGE SCHEME,
W69-03789 08A

NORTHFIELD MOUNTAIN PUMPED STORAGE PROJECT,
W69-03794 08A

PUBLIC UTILITIES - LIGHT AND WATER SUPPLY.
W69-03856 03D

HYDROELECTRIC PROJECT LICENSING
CITIZENS UTILITIES COMPANY V FEDERAL POWER COMMISSION (FPC JURISDICTION).
W69-04002 04A

HYDROELECTRIC RESOURCES
LONG-RANGE HYDROELECTRIC POWER USE DESCRIBED,
W69-03780 06D

HYDROGEOLOGY
GEOHYDROLOGY OF THE SOURIS RIVER VALLEY IN THE VICINITY OF MINOT, NORTH DAKOTA,
W69-03969 02F

GEOLOGY AND GROUNDWATER OF THE SAVANNAH RIVER PLANT AND VICINITY, SOUTH CAROLINA,
W69-03970 02F

INVESTIGATION OF THE KARSTIC WATER RESERVES BURIED UNDER MIOCENE, PLIOCENE, AND QUATERNARY SEDIMENTS OF THE MEDITERRANEAN BASIN (FRENCH),
W69-03972 02F

HYDROLOGIC ASPECTS
PROCEEDINGS INTERNATIONAL SYMPOSIUM ON FOREST HYDROLOGY.
W69-03806 02A

ISOLATION AND CHARACTERIZATION OF HYDROLOGIC RESPONSE UNITS WITHIN AGRICULTURAL WATERSHEDS,
W69-03879 03F

HYDROLOGIC BUDGET
THE GREAT LAKES WATER LEVELS PROBLEM,
W69-03947 02H

HYDROLOGIC CYCLE
RESPONSE OF SPRINGFLOW TO SOME CLIMATIC VARIABLES IN

SOUTHWESTERN WISCONSIN,
W69-04016 02A

YDROLOGIC DATA
ISOLATION AND CHARACTERIZATION OF HYDROLOGIC RESPONSE UNITS WITHIN AGRICULTURAL WATERSHEDS,
W69-03879 03F

THE RELATION BETWEEN RAINFALL AND RUNOFF,
W69-03890 02A

POWERS AND DUTIES OF THE COMMISSION.
W69-03921 06E

GEOLOGY AND GROUND-WATER RESOURCES OF THE MURPHY AREA, NORTH CAROLINA,
W69-03959 02F

YDROLOGIC PROPERTIES
AVAILABILITY OF GROUND WATERS IN THE NORTHERN PART, TENMILE AND TAUNTON RIVER BASINS, SOUTHEASTERN MASSACHUSETTS,
W69-03723 02F

YDROLOGIC RESPONSE UNITS
ISOLATION AND CHARACTERIZATION OF HYDROLOGIC RESPONSE UNITS WITHIN AGRICULTURAL WATERSHEDS,
W69-03879 03F

YDROLOGICAL CHARACTERISTICS
COMPILATION OF THE MAXIMUM STREAMFLOWS OF SNOWMELT WATERS IN USSR RIVERS (RUSSIAN),
W69-03981 02E

YDROLOGY
COMPILATION OF THE MAXIMUM STREAMFLOWS OF SNOWMELT WATERS IN USSR RIVERS (RUSSIAN),
W69-03981 02E

YGROMETRY
A MICROPSYCHROMETER TO MEASURE WATER POTENTIALS OF INTACT PLANT MATERIAL,
W69-04109 02I

MEASURING THE RELATIVE HUMIDITY OF SOILS AT DIFFERENT MOISTURE CONTENTS BY THE GRAY HYDROCAL HYDROMETER,
W69-04130 02G

YPOTHESES
WHAT REDISTRIBUTION MAY ECONOMISTS DISCUSS,
W69-04076 06B

CE FISHING
SHREWSBURY AND NAVESINK RIVERS.
W69-03849 06E

LLINOIS
PEOPLE V METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO (CONSTITUTIONALITY OF SANITARY AUTHORITY ACT).
W69-03822 06E

WIESE V MIEHER (ALTERATION OF DRAINAGE).
W69-03824 04A

MARCHETTI V LUMAGHI COAL COMPANY (SURFACE SUBSIDENCE FROM UNDERGROUND MINESHAFTS).
W69-03826 06E

MPERVIOUS SOILS
MODEL STUDY OF BOUNDARY EFFECTS ON DITCH DRAINAGE,
W69-03938 02G

MPLIED BENEFITS
BUILDINGS AND OTHER THINGS INCLUDED IN DEEDS TO LAND.
W69-03829 06E

MPOUNDED WATERS
WATERS IMPOUNDED BY DAMS CONSTRUCTED FOR POWER PURPOSES IMPRESSED WITH PUBLIC INTEREST.
W69-03895 06E

NCLINED-AXIS UNITS
THE ADVANTAGES OF INCLINED-AXIS HYDROELECTRIC UNITS,
W69-04010 08C

NCOME DISTRIBUTION
INCOME DISTRIBUTION AND GROWTH IN A MONOPOLIST ECONOMY,
W69-04072 06C

NCOME TRANSFERS
WHAT KIND OF REDISTRIBUTION DO WE WANT,
W69-04075 06B

NDIAN DESERT
THE GREAT INDIAN DESERT. PERSPECTIVES IN THE ECOLOGY AND PHYSIOLOGY OF SMALL DESERT MAMMALS,
W69-03889 02I

NDIANA
CITY OF FORT WAYNE V MAPLEWOOD PARK UTIL (CONSTITUTIONALITY OF STATE COMBINED SEWAGE DISPOSAL AND WATER ACT).
W69-03983 05G

AN ACT CONCERNING INDUSTRIAL WASTE DISPOSAL PROPERTY...EXEMPTING FROM TAXATION CERTAIN TANGIBLE PERSONAL PROPERTY.
W69-04001 05G

NDIVIDUAL PREFERENCE FUNCTION
WHAT KIND OF REDISTRIBUTION DO WE WANT,
W69-04075 06B

INDUSTRIAL PLANTS
OIL FACTORIES IN RARITAN AND SANDY HOOK BAYS.
W69-03848 05B

INDUSTRIAL WASTES
AN ACT CONCERNING INDUSTRIAL WASTE DISPOSAL PROPERTY...EXEMPTING FROM TAXATION CERTAIN TANGIBLE PERSONAL PROPERTY.
W69-04001 05G

INDUSTRIAL WASTES ORDINANCE ENFORCEMENT HELPS ABATE POLLUTION AT CHICAGO,
W69-04053 05G

INDUSTRIAL WATER
WATER REQUIREMENTS OF THE IRON AND STEEL INDUSTRY,
W69-03965 06D

INFERIOR FACTOR
'INFERIOR FACTORS' AND THE THEORIES OF PRODUCTION AND INPUT DEMAND,
W69-04074 06D

INFILTRATION
THEORETICAL ANALYSIS OF TWO-DIMENSIONAL, TRANSIENT FLOW OF WATER IN UNSATURATED AND PARTLY UNSATURATED SOILS,
W69-03736 02G

SALT PENETRATION TECHNIQUE FOR SEEPAGE MEASUREMENT,
W69-03935 04A

SURFACE IRRIGATION HYDRAULICS-KINEMATICS,
W69-03936 03F

HYDROLOGIC CHARACTERISTICS OF SOIL TYPES,
W69-04011 02E

CONCEPTS IN HYDROLOGIC SOIL GROUPING,
W69-04013 02G

WINTER THAWS CAN RAISE GROUND WATER LEVELS IN DRIFTLESS AREA,
W69-04015 02F

INFILTRATION MODEL
CONCEPTS IN HYDROLOGIC SOIL GROUPING,
W69-04013 02G

INFRARED RADIATION
INFRARED AERIAL SURVEYS IN ENVIRONMENTAL ENGINEERING,
W69-03744 07B

INJECTION WELLS
THE DENVER EARTHQUAKES,
W69-03802 08E

INNOVATIONS
OPTIMAL TIMING OF INNOVATIONS,
W69-04081 06B

INPUT DEMAND FUNCTION
'INFERIOR FACTORS' AND THE THEORIES OF PRODUCTION AND INPUT DEMAND,
W69-04074 06D

INPUT-OUTPUT ANALYSIS
AN INPUT-OUTPUT SYSTEM INVOLVING NON-TRANSFERABLE GOODS,
W69-04090 06D

MODEL OF OPTIMAL COMBINATION OF TREATMENT AND DILUTION,
W69-04144 05D

INSTITUTIONAL ARRANGEMENTS
MAN AND HIS WATER RESOURCE,
W69-04035 06D

INSTRUMENTATION
STAGE MEASUREMENT AT GAGING STATIONS,
W69-03721 07B

A MICROPSYCHROMETER TO MEASURE WATER POTENTIALS OF INTACT PLANT MATERIAL,
W69-04109 02I

MEASURING THE RELATIVE HUMIDITY OF SOILS AT DIFFERENT MOISTURE CONTENTS BY THE GRAY HYDROCAL HYDROMETER,
W69-04130 02G

INTAKE GATES
PREVENTION OF VORTICES AT INTAKES,
W69-03788 08A

INTAKES
PREVENTION OF VORTICES AT INTAKES,
W69-03788 08A

INTERCEPTION
RIME AND HOARFROST IN UPPER-SLOPE FORESTS OF EASTERN WASHINGTON,
W69-03807 02I

INTERCONNECTED SYSTEMS
THE PLANNING, CONSTRUCTION AND OPERATION OF POWER STATIONS IN LARGE INTERCONNECTED SYSTEMS--THE STRATEGY OF LARGE-AREA POWER SUPPLY,
W69-03771 08C

PROJECTED TRENDS AND REQUIREMENTS IN THE COORDINATED GROWTH OF ELECTRIC POWER SYSTEMS IN THE UNITED STATES,
W69-03774 08C

INTEREST RATE
ON PERVERSE CONSUMPTION PATTERNS,
W69-04089 06D

INTERNATIONAL COMMISSIONS
REGULATION OF MINING IN INTERNATIONAL WATER - FOUR POSSIBILITIES FACING THE MINING INDUSTRY TODAY.
W69-03817 06E

INTERNATIONAL JOINT COMMISSION
FUNCTIONS OF THE INTERNATIONAL JOINT COMMISSION,
W69-03796 06E

INTERNATIONAL JOINT COMMISSION - UNITED STATES AND CANADA,
W69-03815 06E

INTERNATIONAL LAW
REGULATION OF MINING IN INTERNATIONAL WATER - FOUR POSSIBILITIES FACING THE MINING INDUSTRY TODAY.
W69-03817 06E

THE CONVENTION OF THE CONTINENTAL SHELF AND THE NEED FOR ITS REVISION AND SOME COMMENTS REGARDING THE REGIME FOR THE LAND BEYOND,
W69-04042 06E

FISHERIES JURISDICTION BEYOND THE TERRITORIAL SEA - WITH SPECIAL REFERENCE TO THE POLICY OF THE UNITED STATES,
W69-04046 06E

INTERNATIONAL RELATIONS
FUNCTIONS OF THE INTERNATIONAL JOINT COMMISSION,
W69-03796 06E

INTERNATIONAL WATERS
REGULATION OF MINING IN INTERNATIONAL WATER - FOUR POSSIBILITIES FACING THE MINING INDUSTRY TODAY.
W69-03817 06E

INTERSTATE COMPACT
NEW JERSEY AND DELAWARE - TERRITORIAL LIMITS AND JURISDICTION.
W69-04196 06E

INTERSTATE COMPACTS
NEW ENGLAND INTERSTATE WATER POLLUTION CONTROL COMPACT.
W69-03990 05G

AIR AND WATER INTERSTATE COMPACTS.
W69-04047 05G

INTERTIES
ECONOMIC AND DESIGN CONSIDERATIONS OF THE PACIFIC NORTHWEST-PACIFIC SOUTHWEST INTERTIE,
W69-03776 08C

INTER-AGENCY COOPERATION
RESOURCES RESPONSIBILITY AND COORDINATION RELATED TO THE COMPREHENSIVE STUDY OF THE SUSQUEHANNA RIVER BASIN.
W69-04032 06B

OREGON'S WATER-MANAGEMENT DISTRICTS,
W69-04034 06E

WATER QUALITY MANAGEMENT IN THE DELAWARE RIVER BASIN (FEDERAL AND INTERSTATE COMPACT TO SOLVE POLLUTION PROBLEMS),
W69-04039 05G

INTER-BASIN TRANSFERS
THE TEXAS WATER PLAN.
W69-03729 06B

INVESTIGATIONS
ENTRY BY TOWN ENGINEER ON PRIVATE LANDS.
W69-04184 06E

INVESTMENT BEHAVIOR
INVESTMENT BEHAVIOR AND NEO-CLASSICAL THEORY,
W69-04082 06B

IODINE RADIOISOTOPES
DISPERSION OF RADIOACTIVE TRACERS IN A MODEL BASIN SANDY AQUIFER,
W69-04111 02F

IOWA
ABOLT V CITY OF PORT MADISON (USE OF PUBLIC LAND BY PRIVATE INDIVIDUAL).
W69-04171 06E

IRON AND STEEL INDUSTRY
WATER REQUIREMENTS OF THE IRON AND STEEL INDUSTRY,
W69-03965 06D

IRRIGATED LAND
THE EFFECTS OF EVAPORATION, POTENTIAL TRANSPIRATION AND RAINFALL ON DEPLETION OF SOIL MOISTURE BY IRRIGATED PERENNIAL PASTURE,
W69-03875 03F

IRRIGATION
FUTURE IRRIGATION DEMAND IN THE SUSQUEHANNA BASIN,
W69-03934 03F

ROLE OF IRRIGATION IN THE WEST'S EXPANDING ECONOMY,
W69-03940 03F

QUALITY OF SURFACE WATERS FOR IRRIGATION, WESTERN STATES, 1963,
W69-03968 02E

IRRIGATION DISTRICTS
DIRECTOR OF IRRIGATION.
W69-04167 06F

IRRIGATION EFFICIENCY
WATER DISTRIBUTION UNDER SPRINKLER IRRIGATION,
W69-03892 03F

IRRIGATION PROGRAMS
ROLE OF IRRIGATION IN THE WEST'S EXPANDING ECONOMY,
W69-03940 03F

IRRIGATION SYSTEMS
WATER DISTRIBUTION UNDER SPRINKLER IRRIGATION,
W69-03892 03F

AN ANALYTIC APPROACH TO DETERMINE IRRIGATION SPRINKLER SPACING,
W69-04121 03F

IRRIGATION WATER
MINERAL-WEATHERING CORRECTION FOR ESTIMATING THE SODIUM HAZARD OF IRRIGATION WATERS,
W69-03791 03C

THE EFFECT OF SOIL-MINERAL WEATHERING ON THE SODIUM HAZARD OF IRRIGATION WATERS,
W69-03792 03C

LEACHING REQUIREMENT FOR EXCHANGEABLE-SODIUM CONTROL,
W69-04012 02G

TOWARDS ECONOMIC EVALUATION OF THE QUALITY OF WATER IN IRRIGATION,
W69-04059 03C

ISLANDS
ST. REGIS TRIBE OF MOHAWK INDIANS V STATE (OWNERSHIP OF ISLAND).
W69-03896 06E

JACKSON AND INDEPENDENCE COUNTIES(ARK)
WATER RESOURCES OF JACKSON AND INDEPENDENCE COUNTIES, ARKANSAS,
W69-03976 02F

JAPAN
RELATION BETWEEN DEPTH FOR MAXIMUM AMOUNT OF EXCESS OXYGEN DURING THE SUMMER STAGNATION PERIOD AND THE TRANSPARENCY OF FRESHWATER LAKES OF JAPAN,
W69-04019 02H

JOINT PRODUCTION
ECONOMETRICS OF JOINT PRODUCTION,
W69-04070 06B

JUDICIAL DECISIONS
COMMENT, EMINENT DOMAIN - UNITED STATES V RANDS, 88 S CT 265 (1967),
W69-04044 06E

CARD V NICKERSON (ACTION FOR DAMAGES FOR OBSTRUCTION OF NATURAL WATER COURSE).
W69-04151 04A

CHAPMAN V BEAVER DAM COAL CO (DRAINAGE OF MINE WATER).
W69-04173 05B

BUSBY V INTERNATIONAL PAPER COMPANY (ACTION FOR DAMAGES AND INJUNCTION DUE TO STREAM POLLUTION).
W69-04174 05B

JURISDICTION
FISHERIES JURISDICTION BEYOND THE TERRITORIAL SEA - WITH SPECIAL REFERENCE TO THE POLICY OF THE UNITED STATES,
W69-04046 06E

KARST
INVESTIGATION OF THE KARSTIC WATER RESERVES BURIED UNDER MIOCENE, PLIOCENE, AND QUATERNARY SEDIMENTS OF THE MEDITERRANEAN BASIN (FRENCH),
W69-03972 02F

KENTUCKY
UNITED STATES V 811.92 ACRES OF LAND,
W69-03811 06E

WALKER V FELMONT OIL CORP (CLAIMS TO OIL AND GAS RIGHTS UNDER OHIO RIVER).
W69-03831 06E

HOUGH V OHIO RIVER SAND CO (BOUNDARY LIMITATION WHEN DEED CONVEYS TO THE LOW WATER MARK).
W69-03996 04A

HOPSON V DOWNS (OBSTRUCTION TO NATURAL FLOW OF SURFACE WATER).
W69-04172 04A

CHAPMAN V BEAVER DAM COAL CO (DRAINAGE OF MINE WATER).
W69-04173 05B

KESSLER DEW RECORDER
STUDIES ON DEW FORMATION UNDER SEMI-ARID CONDITIONS,
W69-04115 02A

KINETICS
EFFECTS OF EXTERNAL SALT CONCENTRATIONS ON WATER RELATIONS IN PLANTS I. ABSENCE OF OSMOTIC ADJUSTMENT IN THE ROOT XYLEM,

W69-04113 02I

KUBAN' RIVER(USSR)
PLAN FOR UTILIZING THE WATER RESOURCES OF THE UPPER KUBAN',
W69-03767 03F

LABOR SUPPLY
INCOME DISTRIBUTION AND GROWTH IN A MONOPOLIST ECONOMY,
W69-04072 06C

LAKE MENDOTA(WIS)
THE TAXONOMY AND ECOLOGY OF LEECHES (HIRUDINEA) OF LAKE MENDOTA, WISCONSIN,
W69-04028 02H

LAKE WASHINGTON(WASH)
THE SUCCESSION OF DIATOM ASSEMBLAGES IN THE RECENT SEDIMENTS OF LAKE WASHINGTON,
W69-04029 05C

LAKE WINDERMERE(ENGLAND)
LIGHT PENETRATION INTO FRESH WATER,
W69-04020 02H

LAKES
BIOLOGICAL STUDIES OF MANGANESE SOLUTION FROM ITS DIOXIDE,
W69-03725 02H

GOODMAN V ELLISH (IMPLIED EASEMENT ON PRIVATE LAKE).
W69-03832 06E

CHERT AND ITS SODIUM-SILICATE PRECURSORS IN SODIUM-CARBONATE LAKES OF EAST AFRICA,
W69-03955 02H

LIGHT PENETRATION INTO FRESH WATER,
W69-04020 02H

SECULAR CHANGES IN THE TRANSPARENCY OF LAKE WATERS,
W69-04022 02H

NITROGEN FIXATION IN TWO WISCONSIN LAKES,
W69-04026 02H

BURNS V GARDNER (SUIT FOR DEATH OF CHILD BY DROWNING).
W69-04192 06E

LAND CLASSIFICATION
CITY OF EAST ORANGE V TOWNSHIP OF LIVINGSTON (ASSESSMENT OF WATERSHED PROPERTY).
W69-03818 06E

LAND FORMING
CONSERVATION BENCH TERRACES IN EASTERN COLORADO,
W69-03880 03F

LEVEL PAN CONSTRUCTION FOR DIVERTING AND SPREADING RUNOFF,
W69-03881 03F

LAND RECLAMATION
ENTRY ON LAND TO MAKE SURVEYS.
W69-03867 04A

DRAINAGE OF AGRICULTURAL LANDS PROCEDURE.
W69-04185 04A

LAND SETTLEMENT
CONSTRUCTION PROBLEMS EXPERIENCED WITH LOESS SOILS,
W69-03803 08D

LAND SUBSIDENCE
LAND SUBSIDENCE IN PLEASANT VALLEY AREA, FRESNO COUNTY, CALIF.,
W69-03797 02F

MARCHETTI V LUMAGHI COAL COMPANY (SURFACE SUBSIDENCE FROM UNDERGROUND MINESHAFTS).
W69-03826 06E

LAND TREATMENT
HYDROLOGY OF CORNFIELD WASH AREA AND EFFECTS OF LAND-TREATMENT PRACTICES, SANDOVAL COUNTY, NEW MEXICO, 1951-60,
W69-03747 04D

LAND USE
ABOLT V CITY OF FORT MADISON (USE OF PUBLIC LAND BY PRIVATE INDIVIDUAL).
W69-04171 06E

LANDFILLS
KEISER V MANN (DIVERSION OF SURFACE WATERS).
W69-03825 04A

LANDSLIDES
STABILITY OF ROCK SLOPES IN NORWAY,
W69-03782 08E

LARAMIE COUNTY
GEOLOGY AND GROUNDWATER RESOURCES OF LARAMIE COUNTY, WYOMING,
W69-03979 03F

LATENT HEAT
SOME STUDIES OF SENSIBLE AND LATENT HEAT FLUXES AT WALTAIR, SOUTHEASTERN COAST OF INDIA,
W69-03887 02G

LATERAL FORCES
LATERAL PRESSURE OF EARTH BACKFILL,
W69-03805 08D

LAW OF THE SEA
THE DEVELOPMENT OF OCEAN MINERALS AND THE LAW OF THE SEA,
W69-04049 06E

LEACHING
MINERAL-WATER INTERACTION DURING THE CHEMICAL WEATHERING OF SILICATES,
W69-03724 02K

LEACHING REQUIREMENT FOR EXCHANGEABLE-SODIUM CONTROL,
W69-04012 02G

LEACHING REQUIREMENT
LEACHING REQUIREMENT FOR EXCHANGEABLE-SODIUM CONTROL,
W69-04012 02G

LEASES
LEASES OF STATE OWNED UNDER WATER LANDS FOR SHELLFISH CULTIVATION.
W69-03814 06E

WALKER V FELMONT OIL CORP (CLAIMS TO OIL AND GAS RIGHTS UNDER OHIO RIVER).
W69-03831 06E

LEASE OF OCEAN FRONT PROPERTY.
W69-03854 06E

LEECHES
THE TAXONOMY AND ECOLOGY OF LEECHES (HIRUDINEA) OF LAKE MENDOTA, WISCONSIN,
W69-04028 02H

LEGAL ASPECTS
LAW OF THE RIVER,
W69-03801 06E

PEOPLE V METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO (CONSTITUTIONALITY OF SANITARY AUTHORITY ACT).
W69-03822 06E

IN RE SHIPPINGTON FERRY CO (RIGHTS OF FERRY OWNER AGAINST STATE FOR FRANCHISE INFRINGEMENTS).
W69-03903 04C

THE LAW OF WATER IN NEW JERSEY,
W69-04055 04A

LEGISLATION
PEOPLE V METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO (CONSTITUTIONALITY OF SANITARY AUTHORITY ACT).
W69-03822 06E

GENERAL AND REGULATORY POWERS (POWER OF CITIES TO REGULATE SWIMMING).
W69-03841 06E

FISH HATCHERIES POLLUTION OF WATERS USED BY FISH HATCHERIES.
W69-03843 05C

PUBLIC WORKS AND IMPROVEMENTS.
W69-03844 06E

FISH AND GAME NON-RESIDENT FISHING.
W69-03845 06E

FISH AND GAME DELAWARE RIVER AND BAY AREAS BETWEEN NEW JERSEY AND DELAWARE.
W69-03846 06E

FISH AND GAME OYSTER FISHING.
W69-03847 06E

OIL FACTORIES IN RARITAN AND SANDY HOOK BAYS.
W69-03848 05B

SHREWSBURY AND NAVESINK RIVERS.
W69-03849 06E

HUDSON RIVER BETWEEN NEW JERSEY AND NEW YORK.
W69-03850 06E

HUDSON RIVER, NEW YORK HARBOR AND SANDY HOOK BAY (NEW).
W69-03851 06E

EXCHANGE OF RIPARIAN LANDS.
W69-03853 06E

STREETS AND PUBLIC PLACES - STREETS ALONG STREAMS.
W69-03857 06E

LINES ALONG HIGHWAY AND ACROSS WATERS.
W69-03860 06E

LEASES OR DEEDS OF RAILROAD OR CANAL PROPERTY IN MORE THAN ONE COUNTY.
W69-03861 06E

OPERATING RESTRICTIONS ON WATERCRAFT.
W69-03862 06E

CORRUPTING WATERS FORBIDDEN.
W69-03863 05B

BRIDGES OVER CANALS OR RAILROADS.
W69-03864 06E

SHAD FISHING ON HUDSON RIVER.
W69-03866 06E

POWERS V LAWSON (APPLICABILITY OF DAM ALTERATION STATUTE).
W69-03897 08A

HEITSCH V CLARK (INJUNCTION TO ENJOIN CHANGE IN LAKE LEVEL).
W69-03901 04A

CITY OF FOND DU LAC V TOWN OF EMPIRE (VALIDITY OF MUNICIPAL ORDINANCE REGULATING THE DRILLING OF WELLS).
W69-03902 02F

CITY OF FORT WAYNE V MAPLEWOOD PARK UTIL (CONSTITUTIONALITY OF STATE COMBINED SEWAGE DISPOSAL AND WATER ACT).
W69-03983 05G

CONSERVATION LAW - DEFINITIONS - GENERAL JURISDICTION OF THE COMMISSION.
W69-03988 06E

CONTRACTS FOR PURIFICATION OF WATER AND SEWAGE - CONTRACTS FOR SEWERAGE DISPOSAL (RIGHT OF MUNICIPALITIES TO CONTRACT FOR EFFECT SEWERAGE).
W69-03992 05D

THE ADMINISTRATION OF THE OUTER CONTINENTAL SHELF LANDS ACT,
W69-04043 06E

A HISTORY OF FEDERAL INVOLVEMENT IN THE MARINE SCIENCES EMERGENCE OF THE NATIONAL SEA GRANT PROGRAM,
W69-04048 09D

POLLUTION.
W69-04050 06E

ALTERNATIVE WATER DEMANDS AND THE ADEQUACY OF PRESENT ARRANGEMENTS,
W69-04058 06D

INTERSTATE WATER POLLUTION CONTROL ACT.
W69-04154 05G

ARTICLE ONE, SUBCHAPTER TWO, NEW ENGLAND INTERSTATE WATER POLLUTION CONTROL COMPACT (DETAILS OF THE COMPACT).
W69-04155 05G

ARTICLE TWO SUBCHAPTER TWO NEW ENGLAND INTERSTATE WATER POLLUTION CONTROL COMPACT.
W69-04156 05G

PUBLIC FACILITIES FOR BOATS.
W69-04157 06E

UNLAWFUL DISPOSAL OR TAKING OF BALLAST.
W69-04158 05B

HARBOR MASTERS.
W69-04159 06E

FISHWAYS AND DAMS.
W69-04164 08I

COMMERCE AND TRADE MINING BUREAU.
W69-04165 03F

ENTRY BY TOWN ENGINEER ON PRIVATE LANDS.
W69-04184 06E

RESERVATION OF STATE CONTROL OVER WATER POWER.
W69-04189 06E

NORTH CAROLINA STATE STREAM SANITATION AND CONSERVATION COMMITTEE.
W69-04193 05G

ACTIONS TO DETERMINE TITLE TO RIPARIAN LANDS AND LANDS UNDER WATER.
W69-04195 06E

LEISURE
MEGALOPOLIZATION AND LEISURE A COMMENT,
W69-04100 06B

LEVEES
REYNOLDS V REFUGE PLANNING CO (LAND BOUNDARIES).
W69-03821 06E

LEVEL PANS
LEVEL PAN CONSTRUCTION FOR DIVERTING AND SPREADING RUNOFF,
W69-03881 03F

LIGHT PENETRATION
RELATION BETWEEN DEPTH FOR MAXIMUM AMOUNT OF EXCESS OXYGEN DURING THE SUMMER STAGNATION PERIOD AND THE TRANSPARENCY OF FRESHWATER LAKES OF JAPAN,
W69-04019 02H

LIGHT PENETRATION INTO FRESH WATER,
W69-04020 02H

SECULAR CHANGES IN THE TRANSPARENCY OF LAKE WATERS,
W69-04022 02H

LIMITED ACCESS
ENTRY ON LAND TO MAKE SURVEYS.
W69-03867 04A

LIMNOLOGY
RELATION BETWEEN DEPTH FOR MAXIMUM AMOUNT OF EXCESS OXYGEN DURING THE SUMMER STAGNATION PERIOD AND THE TRANSPARENCY OF FRESHWATER LAKES OF JAPAN,
W69-04019 02H

LIGHT PENETRATION INTO FRESH WATER,
W69-04020 02H

LINEAR AGGREGATION COEFFICIENT
THE LINEAR AGGREGATION COEFFICIENT AS THE DUAL OF THE LINEAR CORRELATION COEFFICIENT,
W69-04063 06D

LINEAR CORRELATION COEFFICIENT
THE LINEAR AGGREGATION COEFFICIENT AS THE DUAL OF THE LINEAR CORRELATION COEFFICIENT,
W69-04063 06D

LINEAR PROGRAMMING
THE DUAL IN NONLINEAR PROGRAMMING AND ITS ECONOMIC INTERPRETATION,
W69-04088 06B

OPTIMAL WATER QUALITY MANAGEMENT AND MULTI-COMPONENT EFFLUENT CONTROL BY MEANS OF LINEAR PROGRAMMING,
W69-04147 05D

LOAD CELLS
HYDRAULIC LOAD-CELL LYSIMETER, CONSTRUCTION, CALIBRATION, AND TESTS,
W69-03793 07B

LOCAL GOVERNMENTS
LUNTER V LAUDEMAN (PIER CONSTRUCTION PERMIT).
W69-03819 06E

PROJECTS RELATING TO THE USE OF ATMOSPHERIC WATER RESOURCES.
W69-03828 06E

WATER FRONT IMPROVEMENTS.
W69-03842 06E

WATERFRONT RENEWAL.
W69-04033 04C

LOCATION PRINCIPLES
A NOTE ON A LOCATION PRINCIPLE,
W69-04095 06C

LOESS
DAMS AND RESERVOIRS IN PLEISTOCENE-EOLIAN DEPOSIT TERRANE OF NEBRASKA AND KANSAS,
W69-03762 08D

CONSTRUCTION PROBLEMS EXPERIENCED WITH LOESS SOILS,
W69-03803 08D

LOGGING(RECORDING)
STUDIES ON DEW FORMATION UNDER SEMI-ARID CONDITIONS,
W69-04115 02A

LONG-TERM PLANNING
LONG-RANGE HYDROELECTRIC POWER USE DESCRIBED,
W69-03780 06D

LOUISIANA
VODOPIJA V TENNESSEE GAS TRANSMISSION CO (DAMAGE TO OYSTERS).
W69-03830 06E

STREAM CONTROL COMMISSION - VIOLATIONS AND PENALTIES.
W69-03836 05G

DRAINAGE OF NOXIOUS OR POISONOUS SUBSTANCES INTO NATURAL WATERWAYS OR CANALS.
W69-03837 05G

STREAM CONTROL COMMISSION - POWERS AND DUTIES.
W69-03868 06E

ESSO STANDARD OIL CO V JONES (OWNERSHIP OF BED OF FORMER NAVIGABLE STREAM IS IN RIPARIAN OWNER).
W69-03999 04A

EAST BATON ROUGE PARISH COUNCIL V KOLLER (NO OFFSET AGAINST DAMAGE AWARD FOR BENEFITS CONFERRED).
W69-04000 04A

BUSBY V INTERNATIONAL PAPER COMPANY (ACTION FOR DAMAGES AND INJUNCTION DUE TO STREAM POLLUTION).
W69-04174 05B

LOW WATER MARK
HOUGH V OHIO RIVER SAND CO (BOUNDARY LIMITATION WHEN DEED CONVEYS TO THE LOW WATER MARK).
W69-03996 04A

MCKEE V GAY (BOUNDARY LIMITATION WHEN DEED CONVEYS TO THE LOW WATER MARK).
W69-04169 06E

LOW-FLOW AUGMENTATION
MODEL OF OPTIMAL COMBINATION OF TREATMENT AND DILUTION,
W69-04144 05D

LOW-HEAD HYDRO PLANTS
THE ADVANTAGES OF INCLINED-AXIS HYDROELECTRIC UNITS,
W69-04010 08C

LUMBER
FLOATING TIMBER.
W69-04153 06E

LUMBERING
FLOATING TIMBER.
W69-04153 06E

SIMETERS
HYDRAULIC LOAD-CELL LYSIMETER, CONSTRUCTION, CALIBRATION, AND TESTS,
W69-03793 07B

INE
LINES ALONG HIGHWAY AND ACROSS WATERS.
W69-03860 06E

OPERATING RESTRICTIONS ON WATERCRAFT.
W69-03862 06E

CORRUPTING WATERS FORBIDDEN.
W69-03863 05B

BRIDGES OVER CANALS OR RAILROADS.
W69-03864 06E

CARD V NICKERSON (ACTION FOR DAMAGES FOR OBSTRUCTION OF NATURAL WATER COURSE).
W69-04151 04A

KENNEBUNK WATER DIST V MAINE TURNPIKE AUTH (RIPARIAN RIGHTS AND USES).
W69-04152 06E

FLOATING TIMBER.
W69-04153 06E

INTERSTATE WATER POLLUTION CONTROL ACT.
W69-04154 05G

ARTICLE ONE, SUBCHAPTER TWO, NEW ENGLAND INTERSTATE WATER POLLUTION CONTROL COMPACT (DETAILS OF THE COMPACT).
W69-04155 05G

ARTICLE TWO SUBCHAPTER TWO NEW ENGLAND INTERSTATE WATER POLLUTION CONTROL COMPACT.
W69-04156 05G

PUBLIC FACILITIES FOR BOATS.
W69-04157 06E

UNLAWFUL DISPOSAL OR TAKING OF BALLAST.
W69-04158 05B

HARBOR MASTERS.
W69-04159 06E

PUBLIC UTILITIES COMMISSION.
W69-04160 04A

PARTICULAR NUISANCES.
W69-04161 04A

LITTERING AND DUMPING.
W69-04162 05B

ARSON.
W69-04163 06E

FISHWAYS AND DAMS.
W69-04164 08I

COMMERCE AND TRADE MINING BUREAU.
W69-04165 03P

MMALS
THE GREAT INDIAN DESERT. PERSPECTIVES IN THE ECOLOGY AND PHYSIOLOGY OF SMALL DESERT MAMMALS,
W69-03889 02I

NGANESE
BIOLOGICAL STUDIES OF MANGANESE SOLUTION FROM ITS DIOXIDE,
W69-03725 02H

NNINGS EQUATION
MEASUREMENT OF PEAK DISCHARGE BY THE SLOPE-AREA METHOD,
W69-03967 07B

APPING
INFRARED AERIAL SURVEYS IN ENVIRONMENTAL ENGINEERING,
W69-03744 07B

APPING TECHNIQUES
INFRARED AERIAL SURVEYS IN ENVIRONMENTAL ENGINEERING,
W69-03744 07B

ARGINAL COST PRICING
JULES DUPUIT AND THE EARLY THEORY OF MARGINAL COST PRICING,
W69-04085 06E

ARGINAL PRODUCTIVITY
NORMALLY, FACTOR INPUTS ARE NEVER GROSS SUBSTITUTES,
W69-04073 06D

ARGINAL UTILITY
REVISITING MARSHALL'S CONSTANCY OF MARGINAL UTILITY OF MONEY,
W69-04086 06B

ARINE MICROORGANISMS
MICROBIOLOGY OF OCEANS AND ESTUARIES,
W69-03752 02L

ARKET STRUCTURE PRODUCTION TECHNIQUES
ECONOMIC THEORY AND THE MEANING OF COMPETITION,
W69-04084 06B

ARKING TECHNIQUES
THE MOVEMENT OF BEACH SAND,
W69-03754 02J

MARQUETTE IRON RANGE AREA
WATER RESOURCES OF THE MARQUETTE IRON RANGE AREA, MICHIGAN,
W69-03971 06D

MARYLAND
LUNTER V LAUDEMAN (PIER CONSTRUCTION PERMIT).
W69-03819 06E

RESOURCES RESPONSIBILITY AND COORDINATION RELATED TO THE COMPREHENSIVE STUDY OF THE SUSQUEHANNA RIVER BASIN.
W69-04032 06B

MASS TRANSFER
EVAPORATION STUDY AT SHARP STATION POND NEAR BATON ROUGE, LOUISIANA,
W69-03731 02D

MASSACHUSETTS
PETERS V AUBIN (ACTION TO RESTORE WATERCOURSE).
W69-03816 04A

MILLER V DARBY (DIVERSION OF SURFACE WATERS).
W69-03823 04A

MATERIALS TESTING
THE FUTURE ROLE OF NON-DESTRUCTIVE TESTING,
W69-03787 08G

MATHEMATICAL MODELS
OPTIMAL IDENTIFICATION OF NONLINEAR HYDROLOGIC SYSTEM RESPONSE MODELS BY QUASILINEARIZATION,
W69-03958 02A

DEVELOPMENT AND APPLICATION OF A RATIONAL WATER QUALITY PLANNING MODEL,
W69-04017 05B

AN EXAMINATION OF NON-TREATMENT PLANT ALTERNATIVES IN WATER POLLUTION CONTROL,
W69-04142 05D

A CAPACITY EXPANSION PLANNING MODEL FOR MUNICIPAL WATER SUPPLY SYSTEMS,
W69-04145 06D

MATHEMATICAL STUDIES
SUBSURFACE DRAINAGE BY TRANSIENT-FLOW THEORY,
W69-03941 02G

MAXIMUM PROBABLE FLOOD
COMPILATION OF THE MAXIMUM STREAMFLOWS OF SNOWMELT WATERS IN USSR RIVERS (RUSSIAN),
W69-03981 02E

MEASUREMENT
THEORY OF MEASUREMENT,
W69-03800 07B

MEASUREMENT OF NATURAL EVAPORATION COMPARISON OF GRAVIMETRIC AND AERODYNAMIC METHODS,
W69-03891 02D

RATES OF SLOPE DEGRADATION AS DETERMINED FROM BOTANICAL EVIDENCE, WHITE MOUNTAINS, CALIFORNIA,
W69-03943 02J

A MICROPSYCHROMETER TO MEASURE WATER POTENTIALS OF INTACT PLANT MATERIAL,
W69-04109 02I

A SYSTEM FOR SHORT INTERVAL MEASUREMENT OF EVAPOTRANSPIRATION,
W69-04110 02D

MEASUREMENTS
A METHOD OF DETERMINING HYDRAULIC CONDUCTIVITY CHARACTERISTICS FOR NON-SWELLING SOILS IN SITU, AND OF CALCULATING EVAPORATION FROM BARE SOIL,
W69-04114 02G

MEASURING INSTRUMENTS
THEORY OF MEASUREMENT,
W69-03800 07B

MELT WATER
GLACIER OUTBURST FLOODS IN THE PACIFIC NORTHWEST,
W69-03741 02C

METEOROLOGY
FOG,
W69-03786 02B

METHODOLOGY
RESOURCES RESPONSIBILITY AND COORDINATION RELATED TO THE COMPREHENSIVE STUDY OF THE SUSQUEHANNA RIVER BASIN.
W69-04032 06B

WATERFRONT RENEWAL.
W69-04033 04C

METORIC WATER
PROJECTS RELATING TO THE USE OF ATMOSPHERIC WATER RESOURCES.
W69-03628 06E

METROLOGY
THEORY OF MEASUREMENT,
W69-03800 07B

MEXICO
WATER REUSE IN MONTERREY, MEXICO,
W69-03717 05D

MICHIGAN
KERLEY V WOLFE (NAVIGABILITY OF LAKES).
W69-03900 04A

HEITSCH V CLARK (INJUNCTION TO ENJOIN CHANGE IN LAKE LEVEL).
W69-03901 04A

BLACK MARSH DRAINAGE DISTRICT V HOWE (TAXATION FOR IMPROVEMENT OF DRAINAGE DISTRICT).
W69-03904 04A

NEMETH V COUNTY OF GENESEE (ACTION FOR CROP DAMAGE FROM ENLARGEMENT OF DRAINAGE DITCH).
W69-04175 04A

MICROBIOLOGY
MICROBIOLOGY OF OCEANS AND ESTUARIES,
W69-03752 02L

MICROMETEOROLOGY
RAINFALL DISTRIBUTION OVER DISSECTED TERRAIN IN SOUTHWESTERN WISCONSIN,
W69-04014 02B

MICROORGANISMS
THE ECOLOGICAL ROLE OF PHOSPHORUS IN WATERS WITH SPECIAL REFERENCE TO MICROORGANISMS,
W69-04023 05C

MICROSEISMS
LOCATION OF THE SOURCES OF SEISMOACOUSTIC PULSES,
W69-04008 08E

MICROSESTON
ABUNDANCE AND CHARACTER OF MICROSESTON IN A CALIFORNIA MOUNTAIN STREAM,
W69-04031 02E

MILL DAMS
POWERS V LAWSON (APPLICABILITY OF DAM ALTERATION STATUTE).
W69-03897 08A

MINERAL WATER
MINERAL SPRINGS OF THE DAYLESFORD DISTRICT,
W69-03933 02K

MINING
REGULATION OF MINING IN INTERNATIONAL WATER - FOUR POSSIBILITIES FACING THE MINING INDUSTRY TODAY.
W69-03817 06E

DIGIACINTO V NEW JERSEY ZINC CO (LANDOWNER'S RIGHTS TO TAKE PERCOLATING WATER).
W69-04038 04B

COMMERCE AND TRADE MINING BUREAU.
W69-04165 03F

MINING ENGINEERING
LOCATION OF THE SOURCES OF SEISMOACOUSTIC PULSES,
W69-04008 08E

MINNESOTA
COLLINS V WICKLAND (FLOOD DAMAGE DUE TO NATURAL DRAINAGE OBSTRUCTION).
W69-03906 04A

MINOR ELEMENT OCCURRENCE
OCCURRENCE OF SELECTED MINOR ELEMENTS IN THE WATERS OF CALIFORNIA,
W69-03966 02K

MINOT AQUIFER
GEOHYDROLOGY OF THE SOURIS RIVER VALLEY IN THE VICINITY OF MINOT, NORTH DAKOTA,
W69-03969 02F

MISSISSIPPI
REYNOLDS V REFUGE PLANNING CO (LAND BOUNDARIES).
W69-03821 06E

GROVE LABORATORIES V FLOWOOD CORP (WELL WATER RIGHTS CONTRACT INTERPRETATION).
W69-03911 06E

WARREN PETROLEUM CORP V LEE (ACTION TO RECOVER DAMAGES FOR POLLUTION OF CREEK).
W69-04170 05B

CITY OF MERIDIAN V NEW ORLEANS AND NORTHEASTERN RR (INADEQUATE DRAINAGE THROUGH CULVERTS).
W69-04176 04A

CITY OF OXFORD V SPEARS (CITY'S LIABILITY FOR DUMPING SEWAGE INTO STREAM WHICH PASSES THROUGH PRIVATE PROPERTY).
W69-04177 05B

MISSISSIPPI RIVER BASIN
QUALITY OF SURFACE WATERS FOR IRRIGATION, WESTERN STATES, 1963,
W69-03968 02E

MISSOURI
AN ACT TO REPEAL SECTIONS 204.030, 204.100, AND 204.170, RSMO 1959, RELATING TO WATER POLLUTION AND TO ENACT IN LIEU THEREOF FOUR NEW SECTIONS, RELATING TO THE SAME SUBJECT, WITH PENALTY PROVISIONS.
W69-04007 05B

MIXING
PILOT STUDY OF DYNAMICS OF RESERVOIR DESTRATIFICATION,
W69-03960 05G

MOISTURE CONTENT
WATER TRANSPORT IN SOIL WITH A DAILY TEMPERATURE WAVE I THEORY AND EXPERIMENT,
W69-03869 02G

A METHOD OF DETERMINING HYDRAULIC CONDUCTIVITY CHARACTERISTICS FOR NON-SWELLING SOILS IN SITU, AND OF CALCULATING EVAPORATION FROM BARE SOIL,
W69-04114 02G

MEASURING THE RELATIVE HUMIDITY OF SOILS AT DIFFERENT MOISTURE CONTENTS BY THE GRAY HYDROCAL HYDROMETER,
W69-04130 02G

MOISTURE DEFICIT
THE EFFECTS OF EVAPORATION, POTENTIAL TRANSPIRATION AND RAINFALL ON DEPLETION OF SOIL MOISTURE BY IRRIGATED PERENNIAL PASTURE,
W69-03875 03F

MOISTURE STRESS
STOMATA IN RELATION TO DROUGHT RESISTANCE OF WHEAT VARIETIES,
W69-04117 03F

GERMINATION OF WINTERFAT SEEDS UNDER DIFFERENT MOISTURE STRESSES AND TEMPERATURES,
W69-04129 02I

MONEY
REVISITING MARSHALL'S CONSTANCY OF MARGINAL UTILITY OF MONEY,
W69-04086 06B

MONOLAYERS
EVAPORATION RETARDED BY MONOLAYERS,
W69-03722 03B

MONOMOLECULAR FILMS
EVAPORATION OF WATER ITS RETARDATION BY MONOLAYERS,
W69-03884 03B

WIND-TUNNEL INVESTIGATION OF AIR FLOW OVER A HEXADECANOL MONOLAYER SPREAD ON A WATER SURFACE,
W69-04125 03B

MONOPOLY
ECONOMIC THEORY AND THE MEANING OF COMPETITION,
W69-04084 06B

CONTINUOUS AND DISCRETE TIME APPROACHES TO A MAXIMIZATION PROBLEM,
W69-04091 06B

MOUNTAIN FORESTS
RIME AND HOARFROST IN UPPER-SLOPE FORESTS OF EASTERN WASHINGTON,
W69-03807 02I

MOUNTAINS
RATES OF SLOPE DEGRADATION AS DETERMINED FROM BOTANICAL EVIDENCE, WHITE MOUNTAINS, CALIFORNIA,
W69-03943 02J

MULCHING
SOIL-SALINITY CHANGES WITH FALLOW AND A STRAW MULCH ON FALLOW,
W69-04116 02I

MULTIPLE OBJECTIVES
RESTRICTED BARGAINING FOR ORGANIZATION WITH MULTIPLE OBJECTIVES,
W69-04061 06B

MULTIPLE-PURPOSE PROJECTS
LONG-RANGE HYDROELECTRIC POWER USE DESCRIBED,
W69-03780 06D

ROLE OF IRRIGATION IN THE WEST'S EXPANDING ECONOMY,
W69-03940 03F

MUNICIPAL WATER
CITY OF FOND DU LAC V TOWN OF EMPIRE (VALIDITY OF MUNICIPAL ORDINANCE REGULATING THE DRILLING OF WELLS).
W69-03902 02F

CITY OF HUNTSVILLE V MILLER (MUNICIPAL WATER).
W69-04166 04C

MURPHY AREA(N C)
GEOLOGY AND GROUND-WATER RESOURCES OF THE MURPHY AREA, NORTH CAROLINA,
W69-03959 02F

NATURAL CHANNELS
ROUGHNESS CHARACTERISTICS OF NATURAL CHANNELS,
W69-03978 02E

NATURAL FLOW
PETERS V AUBIN (ACTION TO RESTORE WATERCOURSE).
W69-03816 04A

YENCHKO V GRONTKOWSKI (ACTION FOR DAMAGE DUE TO INTERFERENCE WITH NATURAL FLOW OF SURFACE WATERS).
W69-03834 04A

COLLINS V WICKLAND (FLOOD DAMAGE DUE TO NATURAL DRAINAGE OBSTRUCTION).
W69-03906 04A

LONG V BITNER HOMES, INC. (RIGHTS OF LAND OWNER TO CHANNEL SURFACE WATER ONTO ADJACENT LAND).
W69-03907 04A

KOSSOFF V RATHGEB-WALSH (ACTION FOR DAMAGE CAUSED BY SURFACE WATER FLOW).
W69-04181 04A

NATURAL FLOW DOCTRINE
SOMERS V HILL (DIVERTING OF WATER ONTO ADJOINING LAND).
W69-03833 04A

JONES V HOME BUILDING AND LOAN ASS'N OF THOMASVILLE (LOWER OWNER'S OBSTRUCTION OF UNDERGROUND FLOW).
W69-04004 04A

HOPSON V DOWNS (OBSTRUCTION TO NATURAL FLOW OF SURFACE WATER).
W69-04172 04A

NATURAL RESOURCES
THE CONVENTION OF THE CONTINENTAL SHELF AND THE NEED FOR ITS REVISION AND SOME COMMENTS REGARDING THE REGIME FOR THE LAND BEYOND,
W69-04042 06E

MEGALOPOLIS RESOURCE CONSERVER OR RESOURCE WASTER,
W69-04098 06B

NAVIGABLE RIVERS
CITIZENS UTILITIES COMPANY V FEDERAL POWER COMMISSION (FPC JURISDICTION).
W69-04002 04A

NAVIGABLE WATERS
KERLEY V WOLFF (NAVIGABILITY OF LAKES).
W69-03900 04A

PROTECTION OF NAVIGABLE WATERS AND STREAMS EXCAVATION OR FILL DAMS AND DOCKS PERMIT.
W69-03984 04A

COMMENT, EMINENT DOMAIN - UNITED STATES V RANDS, 88 S CT 265 (1967),
W69-04044 06E

NAVIGATION
POWER GENERATION UNDER IJC REGULATION,
W69-03781 04A

GENERAL POWERS AND DUTIES OF COMMISSIONER OF TRANSPORTATION.
W69-03916 06E

NAVIGATIONAL SERVITUDE
COMMENT, EMINENT DOMAIN - UNITED STATES V RANDS, 88 S CT 265 (1967),
W69-04044 06E

NEO-CLASSICAL THEORY
INVESTMENT BEHAVIOR AND NEO-CLASSICAL THEORY,
W69-04082 06B

NETWORKS
AN ANALYTIC APPROACH TO DETERMINE IRRIGATION SPRINKLER SPACING,
W69-04121 03F

NEVADA
INFLUENCE OF VARIOUS RANGELAND CULTURAL TREATMENTS ON RUNOFF AND SEDIMENT PRODUCTION FROM THE BIG SAGE TYPE, EASTGATE BASIN, NEVADA,
W69-03873 02G

NEW ENGLAND
NEW ENGLAND INTERSTATE WATER POLLUTION CONTROL COMPACT.
W69-03990 05G

NEW ENGLAND INTERSTATE WPS COMPACT
INTERSTATE WATER POLLUTION CONTROL ACT.
W69-04154 05G

ARTICLE ONE, SUBCHAPTER TWO, NEW ENGLAND INTERSTATE WATER POLLUTION CONTROL COMPACT (DETAILS OF THE COMPACT).
W69-04155 05G

ARTICLE TWO SUBCHAPTER TWO NEW ENGLAND INTERSTATE WATER POLLUTION CONTROL COMPACT.
W69-04156 05G

NEW HAMPSHIRE
AN ACT RELATIVE TO EXPANDED STATE ACTIVITY IN THE FIELD OF WATER POLLUTION CONTROL.
W69-04178 05G

NEW JERSEY
WATER FRONT HARBOR FACILITIES.
W69-03810 06E

CITY OF EAST ORANGE V TOWNSHIP OF LIVINGSTON (ASSESSMENT OF WATERSHED PROPERTY).
W69-03818 06E

BUILDINGS AND OTHER THINGS INCLUDED IN DEEDS TO LAND.
W69-03829 06E

DRAINAGE.
W69-03839 04A

BEACH COMMISSION.
W69-03840 06E

GENERAL AND REGULATORY POWERS (POWER OF CITIES TO REGULATE SWIMMING).
W69-03841 06E

WATER FRONT IMPROVEMENTS.
W69-03842 06E

FISH HATCHERIES POLLUTION OF WATERS USED BY FISH HATCHERIES.
W69-03843 05C

PUBLIC WORKS AND IMPROVEMENTS.
W69-03844 06E

FISH AND GAME NON-RESIDENT FISHING.
W69-03845 06E

FISH AND GAME DELAWARE RIVER AND BAY AREAS BETWEEN NEW JERSEY AND DELAWARE.
W69-03846 06E

FISH AND GAME OYSTER FISHING.
W69-03847 06E

OIL FACTORIES IN RARITAN AND SANDY HOOK BAYS.
W69-03848 05B

SHREWSBURY AND NAVESINK RIVERS.
W69-03849 06E

HUDSON RIVER BETWEEN NEW JERSEY AND NEW YORK.
W69-03850 06E

HUDSON RIVER, NEW YORK HARBOR AND SANDY HOOK BAY (NEW).
W69-03851 06E

WATER FRONT IMPROVEMENTS.
W69-03852 06E

EXCHANGE OF RIPARIAN LANDS.
W69-03853 06E

LEASE OF OCEAN FRONT PROPERTY.
W69-03854 06E

PROTECTION OF WATER SUPPLY FROM POLLUTION.
W69-03855 05G

PUBLIC UTILITIES - LIGHT AND WATER SUPPLY.
W69-03856 03D

STREETS AND PUBLIC PLACES - STREETS ALONG STREAMS.
W69-03857 06E

SEWERS, DRAINS - CHANGE OF COURSE OR OUTLET.
W69-03858 05F

SURFACE DRAINAGE.
W69-03859 04A

LEASES OR DEEDS OF RAILROAD OR CANAL PROPERTY IN MORE THAN ONE COUNTY.
W69-03861 06E

PUBLIC PARKS ON BEACH OR OCEAN FRONT.
W69-03865 06E

SHAD FISHING ON HUDSON RIVER.
W69-03866 06E

ENTRY ON LAND TO MAKE SURVEYS.
W69-03867 04A

BAKER V NORMANOCH ASS'N, INC (OWNERSHIP OF LAKE BED).
W69-03898 04A

GEOLOGY AS A GUIDE TO REGIONAL ESTIMATES OF THE WATER RESOURCE,
W69-03961 02F

THE LAW OF WATER IN NEW JERSEY,
W69-04055 04A

MANCINI V DELILLIS (ACTION TO REQUIRE REMOVAL OF DITCH OBSTRUCTION).
W69-04194 04A

ACTIONS TO DETERMINE TITLE TO RIPARIAN LANDS AND LANDS UNDER WATER.
W69-04195 06E

NEW JERSEY AND DELAWARE - TERRITORIAL LIMITS AND JURISDICTION.
W69-04196 06E

LICENSING OF VESSELS.
W69-04197 06E

LEASING OF LANDS FOR SHELLFISH CULTURE.
W69-04198 06E

PUBLIC UTILITIES - POWERS AND DUTIES.
W69-04199 03E

PUBLIC UTILITIES - WATER POWER COMPANIES.
W69-04200 03E

NEW MEXICO
SEASONAL PRECIPITATION AND SCALED QUAIL IN EASTERN NEW MEXICO,
W69-04120 02B

AGE AND COMPARATIVE DEVELOPMENT OF DESERT SOILS AT THE GARDNER SPRING RADIOCARBON SITE, NEW MEXICO,
W69-04126 02J

NEW YORK
FLOOD PROTECTION.
W69-03813 04A

LEASES OF STATE OWNED UNDER WATER LANDS FOR SHELLFISH CULTIVATION.
W69-03814 06E

STRICKLAND V STATE (DISCHARGE OF SURFACE WATER - STATE'S LIABILITY FOR NEGLIGENT INDEPENDENT CONTRACTOR).
W69-03820 04C

PROJECTS RELATING TO THE USE OF ATMOSPHERIC WATER RESOURCES.
W69-03828 06E

GOODMAN V ELLISH (IMPLIED EASEMENT ON PRIVATE LAKE).
W69-03832 06E

HUDSON RIVER BETWEEN NEW JERSEY AND NEW YORK.
W69-03850 06E

HUDSON RIVER, NEW YORK HARBOR AND SANDY HOOK BAY (NEW).
W69-03851 06E

WATERS IMPOUNDED BY DAMS CONSTRUCTED FOR POWER PURPOSES IMPRESSED WITH PUBLIC INTEREST.
W69-03895 06E

ST. REGIS TRIBE OF MOHAWK INDIANS V STATE (OWNERSHIP OF ISLAND).
W69-03896 06E

BLOOD V CITY OF NEW YORK (ACTION TO RECOVER DAMAGES FROM TURBIDITY ALLEGEDLY CAUSED BY DAM).
W69-03909 05B

SURRENDER OF GRANT.
W69-03912 06E

CLAIMS FOR DAMAGE GENERALLY ADJUSTMENT OF CLAIMS OF OWNERS OF PRIVATE DAMS.
W69-03913 04A

SEC 82 DEPOSIT OF REFUSE IN NAVIGABLE WATERS, SEC 81 SUPPLYING DEFICIENCIES OF WATER, SEC 83 SEIZURE OF OBSTRUCTION.
W69-03914 04A

SEC 40 ACQUISITION OF PROPERTY - SEC 43 EXCHANGE OF PROPERTY.
W69-03915 04C

GENERAL POWERS AND DUTIES OF COMMISSIONER OF TRANSPORTATION.
W69-03916 06E

DRAINAGE FACILITIES.
W69-03917 06E

GRANTS OF LANDS UNDERWATER.
W69-03918 06E

DISPOSITION OF STATE UNDERWATER LANDS.
W69-03919 06E

ALLOCATIONS, DIVERSIONS, AND RELEASES.
W69-03920 06E

POWERS AND DUTIES OF THE COMMISSION.
W69-03921 06E

SUSQUEHANNA RIVER BASIN COMPACT - PREAMBLE.
W69-03922 06E

WATER COMPACTS.
W69-03923 06E

GREAT LAKES BASIN COMPACT.
W69-03925 06E

PROTECTION OF NAVIGABLE WATERS AND STREAMS EXCAVATION OR FILL DAMS AND DOCKS PERMIT.
W69-03984 04A

GENERAL DUTIES - BOARDS OF RIVER REGULATING DISTRICTS.
W69-03985 04A

RIGHT OF ENTRY UNLAWFUL INTERFERENCE WITH DRAINAGE WORKS.
W69-03986 04A

PROHIBITED DIVERSIONS.
W69-03987 04A

CONSERVATION LAW - DEFINITIONS - GENERAL JURISDICTION OF THE COMMISSION.
W69-03988 06E

PROCEEDINGS BEFORE THE COMMISSIONER (LEGAL ACTION AGAINST SOURCES OF POLLUTION).
W69-03989 05B

NEW ENGLAND INTERSTATE WATER POLLUTION CONTROL COMPACT.
W69-03990 05G

VIOLATION INJUNCTION AND ABATEMENT (WATER POLLUTION SOURCES).
W69-03991 05B

CONTRACTS FOR PURIFICATION OF WATER AND SEWAGE - CONTRACTS FOR SEWERAGE DISPOSAL (RIGHT OF MUNICIPALITIES TO CONTRACT FOR EFFECT SEWERAGE).
W69-03992 05D

RESOURCES RESPONSIBILITY AND COORDINATION RELATED TO THE COMPREHENSIVE STUDY OF THE SUSQUEHANNA RIVER BASIN.
W69-04032 06B

ACQUISITION OF RIPARIAN RIGHTS IN NEW YORK,
W69-04051 06E

N Y COMMON LAW AND STATUTORY RIGHTS PROTECTING THE INTERESTS OF THE INDIVIDUAL RIPARIAN OWNER IN THE RECREATIONAL AND AESTHETIC VALUES OF HIS ENVIRONMENT,
W69-04054 06E

FINAL REPORT AS OF MARCH 24, 1967, OF CONCLUSIONS REACHED, LEGISLATION RECOMMENDED AND PROGRESS MADE.
W69-04105 06E

A STUDY OF SELECTED ASPECTS OF THE POWERS OF NEW YORK STATE OVER THE WATERS OF THE STATE.
W69-04106 06E

KUSHNER V PAZ CONSTR (STORM SEWER DRAINAGE).
W69-04179 04A

FELSON V ASPEGREN (TO ENJOIN DIVERSION OF ARTIFICIAL STREA AND CREATION OF ARTIFICIAL POND).
W69-04180 04A

KOSSOFF V RATHGEB-WALSH (ACTION FOR DAMAGE CAUSED BY SURFACE WATER FLOW).
W69-04181 04A

PETITION OF ALGONQUIN GAS TRANSMISSION CO (GRANTED RIGHTS IN RIVERBEDS).
W69-04182 06E

PROJECTS TO PREVENT SHORE EROSION.
W69-04183 04D

ENTRY BY TOWN ENGINEER ON PRIVATE LANDS.
W69-04184 06E

DRAINAGE OF AGRICULTURAL LANDS PROCEDURE.
W69-04185 04A

RIVER REGULATION BY STORAGE RESERVOIRS - DEFINITIONS AND CONSTRUCTION.
W69-04186 04A

CREATION OF RIVER REGULATION DISTRICTS.
W69-04187 04A

LICENSING DIVERSION AND USE OF WATER FOR POWER.
W69-04188 06E

RESERVATION OF STATE CONTROL OVER WATER POWER.
W69-04189 06E

CREATION OF WATER RESOURCES COMMISSION.
W69-04190 06E

WATER RESOURCES - LEGISLATIVE FINDINGS.
W69-04191 06E

NEW YORK STATE BARGE CANAL SYSTEM
SEC 40 ACQUISITION OF PROPERTY - SEC 43 EXCHANGE OF PROPERTY.
W69-03915 04C

NITRATE
NITRATE AND OTHER WATER POLLUTANTS UNDER FIELDS AND FEEDLOTS,
W69-04024 05B

NITRATE DETERMINATION
DETERMINATION OF NITRATE IN ESTUARINE WATERS AUTOMATIC DETERMINATION USING A BRUCINE METHOD,
W69-04025 02L

NITROGEN
NITROGEN FERTILIZER AND WHEAT IN A SEMI-ARID ENVIRONMENT 4 EMPIRICAL YIELD RESPONSE MODELS AND ECONOMIC FACTORS,
W69-03877 03F

NITROGEN COMPOUNDS
FERTILIZING DRYLAND SPRING AND WINTER WHEAT IN THE BROWN SOIL ZONE,
W69-03878 03F

NITROGEN REMOVAL IN SEWAGE TREATMENT PROCESS,
W69-04030 05D

NITROGEN CYCLE
AMMONIA NITROGEN LOSSES FROM STREAMS,
W69-03745 05B

NITROGEN FIXATION
NITROGEN FIXATION IN TWO WISCONSIN LAKES,
W69-04026 02H

NOISE

MEASUREMENT OF TRANSFORMER NOISE AND ITS REDUCTION,
W69-03790 08C

ISE REDUCTION
MEASUREMENT OF TRANSFORMER NOISE AND ITS REDUCTION,
W69-03790 08C

NLINEAR DIFFERENTIAL EQUATIONS
COMPUTATIONAL SCHEMES FOR THE BOUSSINESQ EQUATION,
W69-03937 07C

NLINEAR PROGRAMMING
THE DUAL IN NONLINEAR PROGRAMMING AND ITS ECONOMIC INTERPRETATION,
W69-04088 06B

N-DESTRUCTIVE TESTS
THE FUTURE ROLE OF NON-DESTRUCTIVE TESTING,
W69-03787 08G

N-RECIPROCAL
A NOTE ON PUBLIC GOODS SUPPLY,
W69-04104 06B

RMATIVE
WHAT REDISTRIBUTION MAY ECONOMISTS DISCUSS,
W69-04076 06B

RTH CAROLINA
GEOLOGY AND GROUND-WATER RESOURCES OF THE MURPHY AREA, NORTH CAROLINA,
W69-03959 02F

CAROLINA BEACH FISHING PIER, INC V TOWN OF CAROLINA BEACH (STATE'S RIGHT TO TAKE PRIVATE BEACH LAND).
W69-03982 04A

BURNS V GARDNER (SUIT FOR DEATH OF CHILD BY DROWNING).
W69-04192 06E

NORTH CAROLINA STATE STREAM SANITATION AND CONSERVATION COMMITTEE.
W69-04193 05G

RTHEASTERN ILLINOIS
FLOODS IN BEECHER WEST QUADRANGLE, NORTHEASTERN ILLINOIS,
W69-03720 02E

RTHERN WILLAMETTE VALLEY
GEOLOGY AND WATER RESOURCES IN THE FRENCH PRAIRIE AREA, NORTHERN WILLAMETTE VALLEY, OREGON,
W69-03977 03F

ISANCE
PARTICULAR NUISANCES.
W69-04161 04A

MERICAL ANALYSIS
COMPUTATIONAL SCHEMES FOR THE BOUSSINESQ EQUATION,
W69-03937 07C

TRIENT REQUIREMENTS
AXENIC CULTURE AND NUTRITIONAL STUDIES OF AQUATIC MACROPHYTES,
W69-04027 02H

TRIENTS
A SYSTEM FOR SHORT INTERVAL MEASUREMENT OF EVAPOTRANSPIRATION,
W69-04110 02D

STRUCTION TO FLOW
PETERS V AUBIN (ACTION TO RESTORE WATERCOURSE).
W69-03816 04A

YENCHKO V GRONTKOWSKI (ACTION FOR DAMAGE DUE TO INTERFERENCE WITH NATURAL FLOW OF SURFACE WATERS).
W69-03834 04A

PROTECTION OF NAVIGABLE WATERS AND STREAMS EXCAVATION OR FILL DAMS AND DOCKS PERMIT.
W69-03984 04A

JONES V HOME BUILDING AND LOAN ASS'N OF THOMASVILLE (LOWER OWNER'S OBSTRUCTION OF UNDERGROUND FLOW).
W69-04004 04A

CARD V NICKERSON (ACTION FOR DAMAGES FOR OBSTRUCTION OF NATURAL WATER COURSE).
W69-04151 04A

KUSHNER V PAZ CONSTR (STORM SEWER DRAINAGE).
W69-04179 04A

MANCINI V DELILLIS (ACTION TO REQUIRE REMOVAL OF DITCH OBSTRUCTION).
W69-04194 04A

EANOGRAPHY
A HISTORY OF FEDERAL INVOLVEMENT IN THE MARINE SCIENCES EMERGENCE OF THE NATIONAL SEA GRANT PROGRAM,
W69-04048 09D

EANS
LEASE OF OCEAN FRONT PROPERTY.
W69-03854 06E

THE CONVENTION OF THE CONTINENTAL SHELF AND THE NEED FOR ITS REVISION AND SOME COMMENTS REGARDING THE REGIME FOR THE LAND BEYOND,
W69-04042 06E

FISHERIES JURISDICTION BEYOND THE TERRITORIAL SEA - WITH SPECIAL REFERENCE TO THE POLICY OF THE UNITED STATES,
W69-04046 06E

OCTADECANOL
INFLUENCE OF FATTY ALCOHOLS AND ACIDS ON THE CLARITY AND BIOTA OF IMPOUNDED RESERVOIRS,
W69-04134 05B

OHIO
KEISER V MANN (DIVERSION OF SURFACE WATERS).
W69-03825 04A

OHIO RIVER
WALKER V FELMONT OIL CORP (CLAIMS TO OIL AND GAS RIGHTS UNDER OHIO RIVER).
W69-03831 06E

IN RE SHIPPINGTON FERRY CO (RIGHTS OF FERRY OWNER AGAINST STATE FOR FRANCHISE INFRINGEMENTS)
W69-03903 04C

OIL INDUSTRY
OIL FACTORIES IN RARITAN AND SANDY HOOK BAYS.
W69-03848 05B

WARREN PETROLEUM CORP V LEE (ACTION TO RECOVER DAMAGES FOR POLLUTION OF CREEK).
W69-04170 05B

ON-SITE TESTS
SALT PENETRATION TECHNIQUE FOR SEEPAGE MEASUREMENT,
W69-03935 04A

OPEN CHANNEL FLOW
VELOCITY-DISTRIBUTIONS IN STRAIGHT RECTANGULAR CHANNELS,
W69-03703 02E

A DISCUSSION OF THE DISPERSIVITY TENSOR FOR A TURBULENT UNIFORM CHANNEL FLOW,
W69-03704 02F

CALCULATION OF THE DISPERSION COEFFICIENT IN STRAIGHT PRISMATIC STREAMS,
W69-03705 02E

SALT PENETRATION TECHNIQUE FOR SEEPAGE MEASUREMENT,
W69-03935 04A

OPEN CHANNELS
MEASUREMENT OF PEAK DISCHARGE BY THE SLOPE-AREA METHOD,
W69-03967 07B

OPERATING CRITERIA
POWER GENERATION UNDER IJC REGULATION,
W69-03781 04A

OPTICAL PROPERTIES
SECULAR CHANGES IN THE TRANSPARENCY OF LAKE WATERS,
W69-04022 02H

OPTIMAL TIMING
OPTIMAL TIMING OF INNOVATIONS,
W69-04081 06B

OPTIMIZATION
DEVELOPMENT OF OPTIMIZATION - SYSTEMS ANALYSIS TECHNIQUES FOR TEXAS WATER RESOURCES,
W69-04133 05B

MODEL OF OPTIMAL COMBINATION OF TREATMENT AND DILUTION,
W69-04144 05D

OPTIMUM SIZE
MEGALOPOLIS RESOURCE CONSERVER OR RESOURCE WASTER,
W69-04098 06B

OREGON
OREGON'S WATER-MANAGEMENT DISTRICTS,
W69-04034 06E

ORGANIC WASTES
DEVELOPMENT AND APPLICATION OF A RATIONAL WATER QUALITY PLANNING MODEL,
W69-04017 05B

OSMOTIC PRESSURE
EFFECTS OF EXTERNAL SALT CONCENTRATIONS ON WATER RELATIONS IN PLANTS I. ABSENCE OF OSMOTIC ADJUSTMENT IN THE ROOT XYLEM,
W69-04113 02I

OUTLET WORKS
SEWERS, DRAINS - CHANGE OF COURSE OR OUTLET.
W69-03858 05F

OVERDRAFT
LAND SUBSIDENCE IN PLEASANT VALLEY AREA, FRESNO COUNTY, CALIF.,
W69-03797 02F

OWNERSHIP OF BEDS
BUILDINGS AND OTHER THINGS INCLUDED IN DEEDS TO LAND.
W69-03829 06E

WALKER V FELMONT OIL CORP (CLAIMS TO OIL AND GAS RIGHTS UNDER OHIO RIVER).
W69-03831 06E

BAKER V NORMANOCH ASS'N, INC (OWNERSHIP OF LAKE BED).

W69-03898 04A

HOUGH V OHIO RIVER SAND CO (BOUNDARY LIMITATION WHEN DEED CONVEYS TO THE LOW WATER MARK).
W69-03996 04A

ESSO STANDARD OIL CO V JONES (OWNERSHIP OF BED OF FORMER NAVIGABLE STREAM IS IN RIPARIAN OWNER).
W69-03999 04A

A STUDY OF SELECTED ASPECTS OF THE POWERS OF NEW YORK STATE OVER THE WATERS OF THE STATE.
W69-04106 06E

MCKEE V GAY (BOUNDARY LIMITATION WHEN DEED CONVEYS TO THE LOW WATER MARK).
W69-04169 06E

ACTIONS TO DETERMINE TITLE TO RIPARIAN LANDS AND LANDS UNDER WATER.
W69-04195 06E

OXYGEN DIFFUSION
INFLUENCE OF FATTY ALCOHOLS AND ACIDS ON THE CLARITY AND BIOTA OF IMPOUNDED RESERVOIRS,
W69-04134 05B

OYSTERS
VODOPIJA V TENNESSEE GAS TRANSMISSION CO (DAMAGE TO OYSTERS).
W69-03830 06E

PACIFIC NORTHWEST-SOUTHWEST INTERTIE
ECONOMIC AND DESIGN CONSIDERATIONS OF THE PACIFIC NORTHWEST-PACIFIC SOUTHWEST INTERTIE,
W69-03776 08C

PACIFIC OCEAN
OCCURRENCE OF SELECTED MINOR ELEMENTS IN THE WATERS OF CALIFORNIA,
W69-03966 02K

PALEOHYDROLOGY
RIVER ADJUSTMENT TO ALTERED HYDROLOGIC REGIMEN-MURRUMBIDGEE RIVER AND PALEOCHANNELS, AUSTRALIA,
W69-03957 02J

PALEOSOLS
AGE AND COMPARATIVE DEVELOPMENT OF DESERT SOILS AT THE GARDNER SPRING RADIOCARBON SITE, NEW MEXICO,
W69-04126 02J

PARETO OPTIMALITY
A NOTE ON PUBLIC GOODS SUPPLY,
W69-04104 06B

PARKING SPACE
MEGALOPOLIS RESOURCE CONSERVER OR RESOURCE WASTER,
W69-04098 06B

PASTURES
THE EFFECTS OF EVAPORATION, POTENTIAL TRANSPIRATION AND RAINFALL ON DEPLETION OF SOIL MOISTURE BY IRRIGATED PERENNIAL PASTURE,
W69-03875 03F

PATH OF POLLUTANTS
CONTAMINANTS IN GROUNDWATERS NEAR WASTE STABILIZATION PONDS,
W69-03718 05B

RADIOACTIVE WASTE DILUTION IN THE CLINCH RIVER, EASTERN TENNESSEE,
W69-03956 05A

PEAK DISCHARGE
MEASUREMENT OF PEAK DISCHARGE AT WIDTH CONTRACTIONS BY INDIRECT METHODS,
W69-03753 07B

PEAK POWER
NORTHFIELD MOUNTAIN PUMPED STORAGE PROJECT,
W69-03794 08A

PENALTIES
STREAM CONTROL COMMISSION - VIOLATIONS AND PENALTIES.
W69-03836 05G

PENALTIES(CRIMINAL)
ARSON.
W69-04163 06E

PENNSYLVANIA
YENCHKO V GRONTKOWSKI (ACTION FOR DAMAGE DUE TO INTERFERENCE WITH NATURAL FLOW OF SURFACE WATERS).
W69-03834 04A

IN RE SHIPPINGTON FERRY CO (RIGHTS OF FERRY OWNER AGAINST STATE FOR FRANCHISE INFRINGEMENTS).
W69-03903 04C

LONG V EITNER HOMES, INC. (RIGHTS OF LAND OWNER TO CHANNEL SURFACE WATER ONTO ADJACENT LAND).
W69-03907 04A

RESOURCES RESPONSIBILITY AND COORDINATION RELATED TO THE COMPREHENSIVE STUDY OF THE SUSQUEHANNA RIVER BASIN.
W69-04032 06B

DIGIACINTO V NEW JERSEY ZINC CO (LANDOWNER'S RIGHTS TO TAKE PERCOLATING WATER).
W69-04048 04B

PERCOLATING WATER
DIGIACINTO V NEW JERSEY ZINC CO (LANDOWNER'S RIGHTS TO TAKE PERCOLATING WATER).
W69-04038 04B

PERCOLATING WATERS
JONES V HOMP BUILDING AND LOAN ASS'N OF THOMASVILLE (LOWER OWNER'S OBSTRUCTION OF UNDERGROUND FLOW).
W69-04004 04A

PERMEABILITY
GROUNDWATER CONDITIONS AND GEOLOGIC RECONNAISSANCE IN THE UPPER SEVIER RIVER BASIN, UTAH,
W69-03750 02F

PERMITS
WATER FRONT HARBOR FACILITIES.
W69-03810 06E

WATER FRONT IMPROVEMENTS.
W69-03842 06E

FISH AND GAME NON-RESIDENT FISHING.
W69-03845 06E

DISPOSITION OF STATE UNDERWATER LANDS.
W69-03919 06E

PROTECTION OF NAVIGABLE WATERS AND STREAMS EXCAVATION OR FILL DAMS AND DOCKS PERMIT.
W69-03984 04A

DARGAN V RICHARDSON (STATE REGULATION JURISDICTION OVER PRIVATE, MAN-MADE PONDS).
W69-03994 06E

LICENSING DIVERSION AND USE OF WATER FOR POWER.
W69-04188 06E

LICENSING OF VESSELS.
W69-04197 06E

PESTICIDE RESIDUES
GAS CHROMATOGRAPHIC ANALYSIS OF DALAPON IN WATER,
W69-03755 05A

PESTICIDE OCCURRENCE, CONCENTRATION, AND DEGRADATION IN FREE WATER SYSTEMS,
W69-03962 05B

PHOSPHORUS
THE ECOLOGICAL ROLE OF PHOSPHORUS IN WATERS WITH SPECIAL REFERENCE TO MICROORGANISMS,
W69-04023 05C

PHOTOGRAPHY
ROUGHNESS CHARACTERISTICS OF NATURAL CHANNELS,
W69-03978 02E

PHOTOHYDROLOGY
ROUGHNESS CHARACTERISTICS OF NATURAL CHANNELS,
W69-03978 02E

PHOTOSYNTHESIS
THE EFFECT OF INDUCED TURBULENCE ON THE GROWTH OF ALGAE,
W69-03730 05C

ECO-PHYSIOLOGICAL STUDIES ON PLANTS IN ARID AND SEMI-ARID REGIONS IN WESTERN AUSTRALIA. I. AUTECOLOGY OF RHAGODIA BACCATA (LABILL.) MOQ,
W69-04118 03F

PHOTOSYNTHETIC OXYGEN
RELATION BETWEEN DEPTH FOR MAXIMUM AMOUNT OF EXCESS OXYGEN DURING THE SUMMER STAGNATION PERIOD AND THE TRANSPARENCY OF FRESHWATER LAKES OF JAPAN,
W69-04019 02H

PHYTOPLANKTON
LIGHT PENETRATION INTO FRESH WATER,
W69-04020 02H

PIERS
LUNTER V LAUDEMAN (PIER CONSTRUCTION PERMIT).
W69-03819 06E

PILE FOUNDATIONS
DESIGN OF A SPILLWAY DAM ON SHELL PILES AND METHOD OF STATIC CALCULATION OF ITS FOUNDATION,
W69-03766 08D

PILOT PLANTS
NEW APPROACHES TO WASTEWATER TREATMENT,
W69-03746 05D

PINE BLUFF-CARPENTER AREA
GEOLOGY AND GROUNDWATER RESOURCES OF LARAMIE COUNTY, WYOMING,
W69-03979 03F

PIPE-TYPE CABLES
UNITED STATES DEVELOPMENTS IN UNDERGROUND TRANSMISSION,
W69-03773 08C

PLANNING
THE TEXAS WATER PLAN.
W69-03729 06B

WATER DEVELOPMENT AND WATER PLANNING IN THE SOUTHWESTERN UNITED STATES,

W69-03949 06B

THE PLANNING-PROGRAMMING-BUILDING-BUDGETING SYSTEM,
W69-04092 06B

A CAPACITY EXPANSION PLANNING MODEL FOR MUNICIPAL WATER SUPPLY SYSTEMS,
W69-04145 06D

ANNING-PROGRAMMING-BUDGETING SYSTEM
THE PLANNING-PROGRAMMING-BUILDING-BUDGETING SYSTEM,
W69-04092 06B

ANT PHYSIOLOGY
ECO-PHYSIOLOGICAL STUDIES ON PLANTS IN ARID AND SEMI-ARID REGIONS IN WESTERN AUSTRALIA. I. AUTECOLOGY OF RHAGODIA BACCATA (LABILL.) MOQ,
W69-04118 03F

ANTS
PESTICIDE OCCURRENCE, CONCENTRATION, AND DEGRADATION IN FREE WATER SYSTEMS,
W69-03962 05B

ATS
MULTIPLE INTERESTS IN RIPARIAN LAND, SUBDIVISION PLATTING, AND THE ALLOCATION OF RIPARIAN RIGHTS,
W69-04040 06E

ISON
UNUSED WELLS, CISTERNS, ETC, TO BE COVERED OR FILLED - POISONING SPRINGS, WELLS, ETC.
W69-03827 06E

ISONOUS SUBSTANCES
FISH HATCHERIES POLLUTION OF WATERS USED BY FISH HATCHERIES.
W69-03843 05C

LIC POWER
A STUDY OF SELECTED ASPECTS OF THE POWERS OF NEW YORK STATE OVER THE WATERS OF THE STATE.
W69-04106 06E

LLUTANT IDENTIFICATION
IDENTIFICATION OF PETROLEUM IN ESTUARINE WATERS,
W69-03738 05B

LLUTANTS
NITRATE AND OTHER WATER POLLUTANTS UNDER FIELDS AND FEEDLOTS,
W69-04024 05B

LLUTION ABATEMENT
INDUSTRIAL WASTES ORDINANCE ENFORCEMENT HELPS ABATE POLLUTION AT CHICAGO,
W69-04053 05G

LLUTION CONTROL
MAN AND HIS WATER RESOURCE,
W69-04035 06D

LYMERS
ADSORPTION OF POLY (VINYL ALCOHOL) BY NATURAL SOIL AGGREGATES,
W69-04108 02A

LYVINYL ALCOHOL
ADSORPTION OF POLY (VINYL ALCOHOL) BY NATURAL SOIL AGGREGATES,
W69-04108 02A

NDS
DARGAN V RICHARDSON (STATE REGULATION JURISDICTION OVER PRIVATE, MAN-MADE PONDS).
W69-03994 06E

FFELSON V ASPEGREN (TO ENJOIN DIVERSION OF ARTIFICIAL STREAM AND CREATION OF ARTIFICIAL POND).
W69-04180 04A

OLING
POOLING OF TIME SERIES AND CROSS SECTION DATA,
W69-04066 06D

PULATION
MEGALOPOLIS RESOURCE CONSERVER OR RESOURCE WASTER,
W69-04098 06B

RES
STOMATA IN RELATION TO DROUGHT RESISTANCE OF WHEAT VARIETIES,
W69-04117 03F

ROUS MEDIA
ON THE MAINTENANCE OF ANOMALOUS FLUID PRESSURES 1. THICK SEDIMENTARY SEQUENCES,
W69-03954 02J

ELECTROKINETIC MEASUREMENTS OF COLLOIDAL-LADEN FLOW THROUGH A SAND COLUMN,
W69-04112 02A

RT AUTHORITIES
LUNTER V LAUDEMAN (PIER CONSTRUCTION PERMIT).
W69-03819 06E

HARBOR MASTERS.
W69-04159 06E

OTABLE WATER
VIOLATION INJUNCTION AND ABATEMENT (WATER POLLUTION SOURCES).
W69-03991 05B

POTENTIOMETERS
SP LOG INTERPRETATION IN SHALY SANDS,
W69-03946 07B

POUROUS MEDIA
FLUID FLOW AND PORE-WALL ADSORPTION RELATIONSHIP THE EFFECT OF TENSION AGENTS (FRENCH),
W69-03973 02G

POWER GRIDS
PROJECTED TRENDS AND REQUIREMENTS IN THE COORDINATED GROWTH OF ELECTRIC POWER SYSTEMS IN THE UNITED STATES,
W69-03774 08C

POWER TRANSFORMERS
MEASUREMENT OF TRANSFORMER NOISE AND ITS REDUCTION,
W69-03790 08C

PRECIPITATION(ATMOSPHERIC)
SODIUM-TO-CHLORINE RATIO IN HAWAIIAN RAINS AS A FUNCTION OF DISTANCE INLAND AND OF ELEVATION,
W69-03735 02B

ESTIMATING DESIGN FLOODS FROM EXTREME RAINFALL,
W69-03783 02E

RAINFALL DISTRIBUTION OVER DISSECTED TERRAIN IN SOUTHWESTERN WISCONSIN,
W69-04014 02B

RESPONSE OF SPRINGFLOW TO SOME CLIMATIC VARIABLES IN SOUTHWESTERN WISCONSIN,
W69-04016 02A

SEASONAL PRECIPITATION AND SCALED QUAIL IN EASTERN NEW MEXICO,
W69-04120 02B

PRESCRIPTIVE RIGHTS
HUNT LAND HOLDING COMPANY V SCHRAMM (PRESCRIPTIVE RIGHTS).
W69-04003 04A

PRICING
JULES DUPUIT AND THE EARLY THEORY OF MARGINAL COST PRICING,
W69-04085 06E

A NOTE ON A LOCATION PRINCIPLE,
W69-04095 06C

PRIOR APPROPRIATION
THE RELATIONSHIP BETWEEN THE LAWS GOVERNING WATER RIGHTS AND THOSE GOVERNING OTHER NATURAL RESOURCES,
W69-04041 06E

PRIVATE LAKE
GOODMAN V ELLISH (IMPLIED EASEMENT ON PRIVATE LAKE).
W69-03832 06E

PRODUCTION SYSTEMS
THE DECOMPOSITION OF ECONOMIC PRODUCTION SYSTEMS,
W69-04103 06B

PROJECT BENEFITS
EAST BATON ROUGE PARISH COUNCIL V KOLLER (NO OFFSET AGAINST DAMAGE AWARD FOR BENEFITS CONFERRED).
W69-04000 04A

PROJECT PLANNING
DYNAMIC PROGRAMMING FOR PROJECT COST-TIME CURVES,
W69-04137 06C

PUBLIC UTILITIES COMMISSION.
W69-04160 04A

PROJECT SKYWATER
A PROGRESS REPORT ON PROJECT SKYWATER THE BUREAU OF RECLAMATION'S ATMOSPHERIC WATER RESOURCES PROGRAM,
W69-03769 03B

PROPERTY VALUES
UNITED STATES V 811.92 ACRES OF LAND,
W69-03811 06E

PROPOSED LEGISLATION
FINAL REPORT AS OF MARCH 24, 1967, OF CONCLUSIONS REACHED, LEGISLATION RECOMMENDED AND PROGRESS MADE.
W69-04105 06E

PROPRIETARY POWER
A STUDY OF SELECTED ASPECTS OF THE POWERS OF NEW YORK STATE OVER THE WATERS OF THE STATE.
W69-04106 06E

KENNEBUNK WATER DIST V MAINE TURNPIKE AUTH (RIPARIAN RIGHTS AND USES).
W69-04152 06E

PUBLIC ASSISTANCE
THE CONSTRAINED DEMAND FOR PUBLIC ASSISTANCE,
W69-04093 06D

PUBLIC BENEFITS
PUBLIC UTILITIES - LIGHT AND WATER SUPPLY.
W69-03856 03D

PUBLIC HEALTH
PROTECTION OF WATER SUPPLY FROM POLLUTION.

W69-03855 05G

POWERS V LAWSON (APPLICABILITY OF DAM ALTERATION STATUTE).
W69-03897 08A

BLACK MARSH DRAINAGE DISTRICT V ROWE (TAXATION FOR IMPROVEMENT OF DRAINAGE DISTRICT).
W69-03904 04A

ECONOMIC AND SOCIAL BENEFITS FROM IMPROVING HEALTH BY PROVISION OF SAFE DRINKING WATER SUPPLIES,
W69-04056 06B

CREATION OF RIVER REGULATION DISTRICTS.
W69-04187 04A

PUBLIC LANDS
PUBLIC PARKS ON BEACH OR OCEAN FRONT.
W69-03865 06E

ABOLT V CITY OF FORT MADISON (USE OF PUBLIC LAND BY PRIVATE INDIVIDUAL).
W69-04171 06E

PUBLIC NUISANCE
PARTICULAR NUISANCES.
W69-04161 04A

PUBLIC RIGHTS
BAKER V NORMANOCH ASS'N, INC (OWNERSHIP OF LAKE BED).
W69-03898 04A

KERLEY V WOLFE (NAVIGABILITY OF LAKES).
W69-03900 04A

A STUDY OF SELECTED ASPECTS OF THE POWERS OF NEW YORK STATE OVER THE WATERS OF THE STATE.
W69-04106 06E

ABOLT V CITY OF FORT MADISON (USE OF PUBLIC LAND BY PRIVATE INDIVIDUAL).
W69-04171 06E

PUBLIC TRUSTEE DOCTRINE
A STUDY OF SELECTED ASPECTS OF THE POWERS OF NEW YORK STATE OVER THE WATERS OF THE STATE.
W69-04106 06E

PUBLIC UTILITIES
CITY OF FORT WAYNE V MAPLEWOOD PARK UTIL (CONSTITUTIONALITY OF STATE COMBINED SEWAGE DISPOSAL AND WATER ACT).
W69-03983 05G

PUBLIC UTILITIES COMMISSION.
W69-04160 04A

PUBLIC UTILITIES - POWERS AND DUTIES.
W69-04199 03E

PULP WASTES
BUSBY V INTERNATIONAL PAPER COMPANY (ACTION FOR DAMAGES AND INJUNCTION DUE TO STREAM POLLUTION).
W69-04174 05B

PUMPED STORAGE
HOTZENWALD PUMPED-STORAGE SCHEME,
W69-03789 08A

NORTHFIELD MOUNTAIN PUMPED STORAGE PROJECT,
W69-03794 08A

PUMPING
GROUNDWATER CONDITIONS AND GEOLOGIC RECONNAISSANCE IN THE UPPER SEVIER RIVER BASIN, UTAH,
W69-03750 02F

ANALYSIS OF AQUIFER TESTS IN THE PUNJAB REGION OF WEST PAKISTAN,
W69-03975 02F

PUMPING PLANTS
PUBLIC UTILITIES - LIGHT AND WATER SUPPLY.
W69-03856 03D

QUAIL
SEASONAL PRECIPITATION AND SCALED QUAIL IN EASTERN NEW MEXICO,
W69-04120 02B

QUALITY CONTROL
THE FUTURE ROLE OF NON-DESTRUCTIVE TESTING,
W69-03787 08G

QUASI-CONSTANCY
REVISITING MARSHALL'S CONSTANCY OF MARGINAL UTILITY OF MONEY,
W69-04086 06B

RADIATION
SOME STUDIES OF SENSIBLE AND LATENT HEAT FLUXES AT WALTAIR, SOUTHEASTERN COAST OF INDIA,
W69-03887 02G

RADIOACTIVE WASTE DISPOSAL
DEACTIVATION OF WASTE WATERS FROM RADIOCHEMICAL LABORATORIES AND ATOMIC REACTORS (RUSSIAN),
W69-03964 05D

RADIOACTIVE WASTES
RADIOACTIVE WASTE DILUTION IN THE CLINCH RIVER, EASTERN TENNESSEE,
W69-03956 05A

RADIOCHEMICAL ANALYSIS
DETERMINATION OF STRONTIUM-90 IN WATER,
W69-03749 05A

RADIOCHEMICAL LABORATORIES
DEACTIVATION OF WASTE WATERS FROM RADIOCHEMICAL LABORATORIE AND ATOMIC REACTORS (RUSSIAN),
W69-03964 05D

RADIOGRAPHIC INSPECTION
THE FUTURE ROLE OF NON-DESTRUCTIVE TESTING,
W69-03787 08G

RADIOISOTOPES
GEOPHYSICAL, ISOTOPE AND TRACER TECHNIQUES IN WATERSHED RESEARCH,
W69-04119 02A

RAIN WATER
BRATONJA V CITY OF MILWAUKEE (ACTION TO RECOVER DAMAGES DUE TO FLOODING FROM HEAVY RAIN).
W69-03905 04A

RAINFALL
ESTIMATING DESIGN FLOODS FROM EXTREME RAINFALL,
W69-03783 02E

RAINFALL-RUNOFF RELATIONSHIPS
LEVEL PAN CONSTRUCTION FOR DIVERTING AND SPREADING RUNOFF,
W69-03881 03F

THE RELATION BETWEEN RAINFALL AND RUNOFF,
W69-03890 02A

OPTIMAL IDENTIFICATION OF NONLINEAR HYDROLOGIC SYSTEM RESPONSE MODELS BY QUASILINEARIZATION,
W69-03958 02A

RESEARCH ON THE MORPHOLOGY OF PRECIPITATION AND RUNOFF IN TEXAS,
W69-04135 02B

RANKINE PRESSURES
STRENGTH AND EARTH PRESSURE OF ROCK WITH WEAK PLANES,
W69-03768 08E

RARITAN BAY
OIL FACTORIES IN RARITAN AND SANDY HOOK BAYS.
W69-03848 05B

REAL ESTATE
RIVER REGULATION BY STORAGE RESERVOIRS - DEFINITIONS AND CONSTRUCTION.
W69-04186 04A

REASONABLE USE
FINAL REPORT AS OF MARCH 24, 1967, OF CONCLUSIONS REACHED, LEGISLATION RECOMMENDED AND PROGRESS MADE.
W69-04105 06E

KOSSOFF V RATHGEB-WALSH (ACTION FOR DAMAGE CAUSED BY SURFACE WATER FLOW).
W69-04181 04A

RECREATION
N Y COMMON LAW AND STATUTORY RIGHTS PROTECTING THE INTEREST OF THE INDIVIDUAL RIPARIAN OWNER IN THE RECREATIONAL AND AESTHETIC VALUES OF HIS ENVIRONMENT,
W69-04054 06E

RECREATION FACILITIES
WATER FRONT IMPROVEMENTS.
W69-03852 06E

PUBLIC PARKS ON BEACH OR OCEAN FRONT.
W69-03865 06E

PUBLIC FACILITIES FOR BOATS.
W69-04157 06E

REGIONAL PLANNING
WATER AND CHOICE IN THE COLORADO BASIN,
W69-03785 06D

REGULATED FLOW
RIVER REGULATION BY STORAGE RESERVOIRS - DEFINITIONS AND CONSTRUCTION.
W69-04186 04A

REGULATION
STREAM CONTROL COMMISSION - VIOLATIONS AND PENALTIES.
W69-03836 05G

DRAINAGE OF NOXIOUS OR POISONOUS SUBSTANCES INTO NATURAL WATERWAYS OR CANALS.
W69-03837 05G

WATER FRONT IMPROVEMENTS.
W69-03842 06E

STREAM CONTROL COMMISSION - POWERS AND DUTIES.
W69-03868 06E

RESERVATION OF STATE CONTROL OVER WATER POWER.
W69-04189 06E

REMOTE SENSING
INFRARED AERIAL SURVEYS IN ENVIRONMENTAL ENGINEERING,
W69-03744 07B

LSION
UR V CITY OF MILWAUKEE (SURFACE WATER DRAINAGE).
9-03899 04A

ARCH AND DEVELOPMENT
W APPROACHES TO WASTEWATER TREATMENT,
9-03746 05D

N AND HIS WATER RESOURCE,
9-04035 06D

ARCH FACILITIES
W APPROACHES TO WASTEWATER TREATMENT,
9-03746 05D

TER RESOURCES RESEARCH INSTITUTE.
9-04168 06E

RVOIR LEAKAGE
ISMIC RESONANCE INVESTIGATION OF A NEAR-SURFACE CAVITY IN
CHOR RESERVOIR, WYOMING,
9-03759 08E

MS AND RESERVOIRS IN PLEISTOCENE-EOLIAN DEPOSIT TERRANE OF
BRASKA AND KANSAS,
9-03762 08D

OLOGICAL CONSIDERATIONS IN THE DESIGN OF RESERVOIR SEEPAGE
NTROL SYSTEMS,
9-03763 08A

RVOIR OPERATION
EATION OF RIVER REGULATION DISTRICTS.
9-04187 04A

RVOIR SITES
NERAL DUTIES - BOARDS OF RIVER REGULATING DISTRICTS.
9-03985 04A

RVOIR STORAGE
VER REGULATION BY STORAGE RESERVOIRS - DEFINITIONS AND
NSTRUCTION.
9-04186 04A

RVOIRS
LOT STUDY OF DYNAMICS OF RESERVOIR DESTRATIFICATION,
9-03960 05G

STANCE
APORATION OF WATER ITS RETARDATION BY MONOLAYERS,
9-03884 03B

NANCE
ISMIC RESONANCE INVESTIGATION OF A NEAR-SURFACE CAVITY IN
CHOR RESERVOIR, WYOMING,
9-03759 08E

URCE ALLOCATION
AT REDISTRIBUTION MAY ECONOMISTS DISCUSS,
9-04076 06B

URCE INPUTS
NOTE ON PUBLIC GOODS SUPPLY,
9-04104 06B

RICTED BARGAINING
STRICTED BARGAINING FOR ORGANIZATION WITH MULTIPLE
JECTIVES,
9-04061 06B

ITCHING
PERVERSE CONSUMPTION PATTERNS,
9-04089 06D

INING WALLS
TERAL PRESSURE OF EARTH BACKFILL,
9-03805 08D

E ISLAND
VERS V LAWSON (APPLICABILITY OF DAM ALTERATION STATUTE).
9-03897 08A

ANCE(LEGAL ASPECTS)
C-PHILLIPS DRAIN DIST V BEAVER BAYOU DRAIN DIST (UPPER
NER'S RIGHT TO DRAIN WATERS ACROSS LOWER LAND CONDITIONED
ON PAYMENT FOR ANY IMPROVEMENTS NEEDED TO PROVIDE FOR
GHER THAN NATURAL FLOW).
9-03997 04A

TO DRAIN LAND
TRY ON LAND TO MAKE SURVEYS.
9-03867 04A

ES OF INTERESTED PERSONS
TRY ON LAND TO MAKE SURVEYS.
9-03867 04A

IF AND HOARFROST IN UPPER-SLOPE FORESTS OF EASTERN
SHINGTON,
9-03807 02I

RIAN LAND
NAL REPORT AS OF MARCH 24, 1967, OF CONCLUSIONS REACHED,
GISLATION RECOMMENDED AND PROGRESS MADE.
9-04105 06E

CIONS TO DETERMINE TITLE TO RIPARIAN LANDS AND LANDS UNDER
TER.
9-04195 06E

RIPARIAN LANDS
EXCHANGE OF RIPARIAN LANDS.
W69-03853 06E

RIPARIAN RIGHTS
KERLEY V WOLFE (NAVIGABILITY OF LAKES).
W69-03900 04A

UNITED STATES V SMOOT SAND AND GRAVEL CORP (OWNER OF CONDEMNED RIPARIAN LANDS RIGHTS IN UNDERWATER GRAVEL DEPOSITS).
W69-03910 06E

ESSO STANDARD OIL CO V JONES (OWNERSHIP OF BED OF FORMER NAVIGABLE STREAM IS IN RIPARIAN OWNER).
W69-03999 04A

WATER LAW, PLANNING AND POLICY CASES AND MATERIALS,
W69-04037 06E

MULTIPLE INTERESTS IN RIPARIAN LAND, SUBDIVISION PLATTING, AND THE ALLOCATION OF RIPARIAN RIGHTS,
W69-04040 06E

THE RELATIONSHIP BETWEEN THE LAWS GOVERNING WATER RIGHTS AND THOSE GOVERNING OTHER NATURAL RESOURCES,
W69-04041 06E

ACQUISITION OF RIPARIAN RIGHTS IN NEW YORK,
W69-04051 06E

N Y COMMON LAW AND STATUTORY RIGHTS PROTECTING THE INTERESTS OF THE INDIVIDUAL RIPARIAN OWNER IN THE RECREATIONAL AND AESTHETIC VALUES OF HIS ENVIRONMENT,
W69-04054 06E

THE LAW OF WATER IN NEW JERSEY,
W69-04055 04A

ALTERNATIVE WATER DEMANDS AND THE ADEQUACY OF PRESENT ARRANGEMENTS,
W69-04058 06D

FINAL REPORT AS OF MARCH 24, 1967, OF CONCLUSIONS REACHED, LEGISLATION RECOMMENDED AND PROGRESS MADE.
W69-04105 06E

KENNEBUNK WATER DIST V MAINE TURNPIKE AUTH (RIPARIAN RIGHTS AND USES).
W69-04152 06E

BUSBY V INTERNATIONAL PAPER COMPANY (ACTION FOR DAMAGES AND INJUNCTION DUE TO STREAM POLLUTION).
W69-04174 05B

FELSON V ASPEGREN (TO ENJOIN DIVERSION OF ARTIFICIAL STREAM AND CREATION OF ARTIFICIAL POND).
W69-04180 04A

RIPARIAN RIGHTS TRANSFER
FINAL REPORT AS OF MARCH 24, 1967, OF CONCLUSIONS REACHED, LEGISLATION RECOMMENDED AND PROGRESS MADE.
W69-04105 06E

RISKS
COMPETITIVE EQUILIBRIUM UNDER UNCERTAINTY,
W69-04078 06D

SOME EFFECTS OF TAXES ON RISK TAKING,
W69-04097 06B

RIVER BASIN
SUSQUEHANNA RIVER BASIN COMPACT - PREAMBLE.
W69-03922 06E

RIVER BEDS
PETITION OF ALGONQUIN GAS TRANSMISSION CO (GRANTED RIGHTS IN RIVERBEDS).
W69-04182 06E

RIVER FLOW
CITIZENS UTILITIES COMPANY V FEDERAL POWER COMMISSION (FPC JURISDICTION).
W69-04002 04A

RIVER FORECASTING
RESEARCH ON THE MORPHOLOGY OF PRECIPITATION AND RUNOFF IN TEXAS,
W69-04135 02B

RIVER REGULATING DISTRICTS
CREATION OF RIVER REGULATION DISTRICTS.
W69-04187 04A

RIVER REGULATION
POWER GENERATION UNDER IJC REGULATION,
W69-03781 04A

GENERAL DUTIES - BOARDS OF RIVER REGULATING DISTRICTS.
W69-03985 04A

RIVER REGULATION BY STORAGE RESERVOIRS - DEFINITIONS AND CONSTRUCTION.
W69-04186 04A

CREATION OF RIVER REGULATION DISTRICTS.
W69-04187 04A

RIVER SYSTEMS
COMPILATION OF THE MAXIMUM STREAMFLOWS OF SNOWMELT WATERS IN

USSR RIVERS (RUSSIAN),
W69-03981 02E

RIVERS
CREEKS, BROOKS AND RIVERS IN ROCKLAND COUNTY, NEW YORK AND THEIR RELATION TO PLANNING FOR THE FUTURE,
W69-04036 06D

ROAD CONSTRUCTION
STRICKLAND V STATE (DISCHARGE OF SURFACE WATER - STATE'S LIABILITY FOR NEGLIGENT INDEPENDENT CONTRACTOR).
W69-03820 04C

STREETS AND PUBLIC PLACES - STREETS ALONG STREAMS.
W69-03857 06E

ROADS
SURFACE DRAINAGE.
W69-03859 04A

ROCK MECHANICS
'BLOCKY AND SEAMY ROCK' IN TUNNELING,
W69-03760 08E

ANALYSIS OF WEDGE FAILURES IN LAYERED ROCKS,
W69-03761 08E

STRENGTH AND EARTH PRESSURE OF ROCK WITH WEAK PLANES,
W69-03768 08E

STABILITY OF ROCK SLOPES IN NORWAY,
W69-03782 08E

LOCATION OF THE SOURCES OF SEISMOACOUSTIC PULSES,
W69-04008 08E

ROCK NOISE
LOCATION OF THE SOURCES OF SEISMOACOUSTIC PULSES,
W69-04008 08E

ROCK PRESSURES
'BLOCKY AND SEAMY ROCK' IN TUNNELING,
W69-03760 08E

ROCK SLOPE STABILITY
STABILITY OF ROCK SLOPES IN NORWAY,
W69-03782 08E

ROCKFALLS
STABILITY OF ROCK SLOPES IN NORWAY,
W69-03782 08E

ROCKFILL DAMS
GROUTING OF THE LIMESTONE FOUNDATION FOR THE ARSTADDALEN DAM,
W69-03777 08D

GENERAL PROCEDURE IN INVESTIGATION, DESIGN AND CONTROL DURING CONSTRUCTION OF EARTH- AND ROCK FILL DAMS IN NORWAY,
W69-03778 08D

ROCKSLIDES
STABILITY OF ROCK SLOPES IN NORWAY,
W69-03782 08E

ROOT SYSTEMS
EFFECTS OF EXTERNAL SALT CONCENTRATIONS ON WATER RELATIONS IN PLANTS I. ABSENCE OF OSMOTIC ADJUSTMENT IN THE ROOT XYLEM,
W69-04113 02I

ROUGHNESS COEFFICIENT
ROUGHNESS CHARACTERISTICS OF NATURAL CHANNELS,
W69-03978 02E

ROUGHNESS(HYDRAULIC)
ROUGHNESS CHARACTERISTICS OF NATURAL CHANNELS,
W69-03978 02E

RUNOFF
MINERAL-WATER INTERACTION DURING THE CHEMICAL WEATHERING OF SILICATES,
W69-03724 02K

MOISTURE STORAGE AND SPRING WHEAT YIELDS ON LEVEL-BENCH TERRACES AS INFLUENCED BY CONTRIBUTING AREA COVER AND EVAPORATION CONTROL,
W69-03871 03F

INFLUENCE OF VARIOUS RANGELAND CULTURAL TREATMENTS ON RUNOFF AND SEDIMENT PRODUCTION FROM THE BIG SAGE TYPE, EASTGATE BASIN, NEVADA,
W69-03873 02G

LEVEL PAN CONSTRUCTION FOR DIVERTING AND SPREADING RUNOFF,
W69-03881 03F

RUNOFF FORECASTING
THE RELATION BETWEEN RAINFALL AND RUNOFF,
W69-03890 02A

RUN-OF-THE-RIVER POWERPLANT
THE ADVANTAGES OF INCLINED-AXIS HYDROELECTRIC UNITS,
W69-04010 08C

SAGEBRUSH
INFLUENCE OF VARIOUS RANGELAND CULTURAL TREATMENTS ON RUNOFF AND SEDIMENT PRODUCTION FROM THE BIG SAGE TYPE, EASTGATE BASIN, NEVADA,
W69-03873 02G

SALINE SOILS
SALINITY AND ARIDITY,
W69-03751 03C

SOIL-SALINITY CHANGES WITH FALLOW AND A STRAW MULCH ON FALLOW,
W69-04116 02I

SALINE WATER INTRUSION
WARREN PETROLEUM CORP V LEE (ACTION TO RECOVER DAMAGES FOR POLLUTION OF CREEK).
W69-04170 05B

SALINE WATER SYSTEMS
TOWARDS ECONOMIC EVALUATION OF THE QUALITY OF WATER IN IRRIGATION,
W69-04059 03C

SALT TOLERANCE
SALINITY AND ARIDITY,
W69-03751 03C

SALTS
EFFECTS OF EXTERNAL SALT CONCENTRATIONS ON WATER RELATIONS IN PLANTS I. ABSENCE OF OSMOTIC ADJUSTMENT IN THE ROOT XYLEM,
W69-04113 02I

SANDS
THE MOVEMENT OF BEACH SAND,
W69-03754 02J

EVAPORATION FROM AN EPHEMERAL STREAMBED,
W69-03874 02G

A SYSTEM FOR SHORT INTERVAL MEASUREMENT OF EVAPOTRANSPIRATION,
W69-04110 02D

DISPERSION OF RADIOACTIVE TRACERS IN A MODEL BASIN SANDY AQUIFER,
W69-04111 02F

ELECTROKINETIC MEASUREMENTS OF COLLOIDAL-LADEN FLOW THROUG A SAND COLUMN,
W69-04112 02A

SANDY HOOK BAY
OIL FACTORIES IN RARITAN AND SANDY HOOK BAYS.
W69-03848 05B

SANITARY ENGINEERING
ULTIMATE DISPOSAL OF WASTE WATER CONCENTRATES TO THE ENVIRONMENT,
W69-03798 05E

SAVANNAH RIVER NUCLEAR PROCESSING PLANT
GEOLOGY AND GROUNDWATER OF THE SAVANNAH RIVER PLANT AND VICINITY, SOUTH CAROLINA,
W69-03970 02F

SAVING
SAVING AND UNCERTAINTY THE PRECAUTIONARY DEMAND FOR SAVING,
W69-04077 06D

SCALED QUAIL
SEASONAL PRECIPITATION AND SCALED QUAIL IN EASTERN NEW MEXICO,
W69-04120 02B

SEA WATER
THE STRONTIUM AND BARIUM CONTENT OF SEA WATER,
W69-03726 02K

NEUTRON ACTIVATION ANALYSIS OF LANTHANIDE ELEMENTS IN SEA WATER,
W69-03727 02K

SEASIDE ASSOCIATIONS
PUBLIC WORKS AND IMPROVEMENTS.
W69-03844 06E

SEASONAL
SEASONAL PRECIPITATION AND SCALED QUAIL IN EASTERN NEW MEXICO,
W69-04120 02B

SECULAR CHANGES
SECULAR CHANGES IN THE TRANSPARENCY OF LAKE WATERS,
W69-04022 02H

SEDIMENT DISCHARGE
INFLUENCE OF VARIOUS RANGELAND CULTURAL TREATMENTS ON RUN AND SEDIMENT PRODUCTION FROM THE BIG SAGE TYPE, EASTGATE BASIN, NEVADA,
W69-03873 02G

SEDIMENT TRANSPORT
THE MOVEMENT OF BEACH SAND,
W69-03754 02J

SEDIMENTATION
RIVER ADJUSTMENT TO ALTERED HYDROLOGIC REGIMEN-MURRUMBIDG RIVER AND PALEOCHANNELS, AUSTRALIA,
W69-03957 02J

SEDIMENTS
THE SUCCESSION OF DIATOM ASSEMBLAGES IN THE RECENT SEDIME OF LAKE WASHINGTON,
W69-04029 05C

TDS
MICROPSYCHROMETER TO MEASURE WATER POTENTIALS OF INTACT PLANT MATERIAL,
W69-04109 02I

GERMINATION OF WINTERFAT SEEDS UNDER DIFFERENT MOISTURE STRESSES AND TEMPERATURES,
W69-04129 02I

SEPAGE
GEOLOGICAL CONSIDERATIONS IN THE DESIGN OF RESERVOIR SEEPAGE CONTROL SYSTEMS,
W69-03763 08A

SALT PENETRATION TECHNIQUE FOR SEEPAGE MEASUREMENT,
W69-03935 04A

SEPAGE CONTROL
GEOLOGICAL CONSIDERATIONS IN THE DESIGN OF RESERVOIR SEEPAGE CONTROL SYSTEMS,
W69-03763 08A

SEPAGE LOSSES
DAMS AND RESERVOIRS IN PLEISTOCENE-EOLIAN DEPOSIT TERRANE OF NEBRASKA AND KANSAS,
W69-03762 08D

SEISMIC INVESTIGATIONS
SEISMIC RESONANCE INVESTIGATION OF A NEAR-SURFACE CAVITY IN ANCHOR RESERVOIR, WYOMING,
W69-03759 08E

LOCATION OF THE SOURCES OF SEISMOACOUSTIC PULSES,
W69-04008 08E

SEISMOLOGY
THE DENVER EARTHQUAKES,
W69-03802 08E

LOCAL MECHANISM OF THE EARTHQUAKE OF JULY 26, 1963, AT KOPJE,
W69-04009 08A

SEMIARID CLIMATES
NITROGEN FERTILIZER AND WHEAT IN A SEMI-ARID ENVIRONMENT 4 EMPIRICAL YIELD RESPONSE MODELS AND ECONOMIC FACTORS,
W69-03877 03F

SENSIBLE HEAT
SOME STUDIES OF SENSIBLE AND LATENT HEAT FLUXES AT WALTAIR, SOUTHEASTERN COAST OF INDIA,
W69-03887 02G

SEPARATION TECHNIQUES
GAS CHROMATOGRAPHIC ANALYSIS OF DALAPON IN WATER,
W69-03755 05A

SESTON
ABUNDANCE AND CHARACTER OF MICROSESTON IN A CALIFORNIA MOUNTAIN STREAM,
W69-04031 02E

SEVIER RIVER BASIN
GROUNDWATER CONDITIONS AND GEOLOGIC RECONNAISSANCE IN THE UPPER SEVIER RIVER BASIN, UTAH,
W69-03750 02F

SEWAGE
CONTRACTS FOR PURIFICATION OF WATER AND SEWAGE - CONTRACTS FOR SEWERAGE DISPOSAL (RIGHT OF MUNICIPALITIES TO CONTRACT FOR EFFECT SEWERAGE).
W69-03992 05D

SEWAGE DISPOSAL
ULTIMATE DISPOSAL OF WASTE WATER CONCENTRATES TO THE ENVIRONMENT,
W69-03798 05E

PROCEEDINGS BEFORE THE COMMISSIONER (LEGAL ACTION AGAINST SOURCES OF POLLUTION).
W69-03989 05B

AN ACT RELATIVE TO EXPANDED STATE ACTIVITY IN THE FIELD OF WATER POLLUTION CONTROL.
W69-04178 05G

SEWAGE DISTRICTS
PEOPLE V METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO (CONSTITUTIONALITY OF SANITARY AUTHORITY ACT).
W69-03822 06E

SEWAGE SLUDGE
ULTIMATE DISPOSAL OF WASTE WATER CONCENTRATES TO THE ENVIRONMENT,
W69-03798 05E

SEWAGE TREATMENT
ULTIMATE DISPOSAL OF WASTE WATER CONCENTRATES TO THE ENVIRONMENT,
W69-03798 05E

NITROGEN REMOVAL IN SEWAGE TREATMENT PROCESS,
W69-04030 05D

SEWERS
PARATONJA V CITY OF MILWAUKEE (ACTION TO RECOVER DAMAGES DUE TO FLOODING FROM HEAVY RAIN).
W69-03905 04A

SHAD FISHING ON HUDSON RIVER.
W69-03866 06E

SHADOW PRICES
THE DUAL IN NONLINEAR PROGRAMMING AND ITS ECONOMIC INTERPRETATION,
W69-04088 06B

SHALLOW WELLS
HOWARD V ATLANTIC COAST LINE RR (ACTION FOR DROWNING IN ABANDONED WELL).
W69-03924 05B

SHEAR STRENGTH
STRENGTH AND EARTH PRESSURE OF ROCK WITH WEAK PLANES,
W69-03768 08E

SHELLFISH
LEASES OF STATE OWNED UNDER WATER LANDS FOR SHELLFISH CULTIVATION.
W69-03814 06E

LEASING OF LANDS FOR SHELLFISH CULTURE.
W69-04198 06E

SHELLFISH CULTURES
LEASING OF LANDS FOR SHELLFISH CULTURE.
W69-04198 06E

SHIPS
POLLUTION.
W69-04050 06E

SHORE PROTECTION
PROJECTS TO PREVENT SHORE EROSION.
W69-04183 04D

SHORES
LEASE OF OCEAN FRONT PROPERTY.
W69-03854 06E

SIEROZEMS
AGE AND COMPARATIVE DEVELOPMENT OF DESERT SOILS AT THE GARDNER SPRING RADIOCARBON SITE, NEW MEXICO,
W69-04126 02J

SILICATES
CHERT AND ITS SODIUM-SILICATE PRECURSORS IN SODIUM-CARBONATE LAKES OF EAST AFRICA,
W69-03955 02H

SIMULATION ANALYSIS
THE BIAS OF LIVIATAN'S CONSISTENT ESTIMATOR IN A DISTRIBUTED LAG MODEL,
W69-04060 06B

SIMULATION OF A NATIONAL FLOOD INSURANCE FUND,
W69-04138 06A

GROUND WATER AND COMPUTER SIMULATIONS,
W69-04149 02F

SIMULATION-ANALYSIS
DEVELOPMENT AND APPLICATION OF A RATIONAL WATER QUALITY PLANNING MODEL,
W69-04017 05B

SITES
A NOTE ON A LOCATION PRINCIPLE,
W69-04095 06C

SLOPE STABILITY
ANALYSIS OF WEDGE FAILURES IN LAYERED ROCKS,
W69-03761 08E

GENERAL SLOPE STABILITY ANALYSIS,
W69-03779 08D

SMOG
FOG,
W69-03786 02B

SNOWMELT
COMPILATION OF THE MAXIMUM STREAMFLOWS OF SNOWMELT WATERS IN USSR RIVERS (RUSSIAN),
W69-03981 02E

SOCIAL ASPECTS
PEOPLE AND WATER,
W69-03953 04C

ECONOMIC AND SOCIAL BENEFITS FROM IMPROVING HEALTH BY PROVISION OF SAFE DRINKING WATER SUPPLIES,
W69-04056 06B

SODIUM
MINERAL-WEATHERING CORRECTION FOR ESTIMATING THE SODIUM HAZARD OF IRRIGATION WATERS,
W69-03791 03C

THE EFFECT OF SOIL-MINERAL WEATHERING ON THE SODIUM HAZARD OF IRRIGATION WATERS,
W69-03792 03C

LEACHING REQUIREMENT FOR EXCHANGEABLE-SODIUM CONTROL,
W69-04012 02G

SODIUM ADSORPTION RATIO
MINERAL-WEATHERING CORRECTION FOR ESTIMATING THE SODIUM HAZARD OF IRRIGATION WATERS,
W69-03791 03C

THE EFFECT OF SOIL-MINERAL WEATHERING ON THE SODIUM HAZARD OF IRRIGATION WATERS,
W69-03792 03C

SOIL AGGREGATES
ADSORPTION OF POLY (VINYL ALCOHOL) BY NATURAL SOIL AGGREGATES,
W69-04108 02A

SOIL CHEMICAL PROPERTIES
MINERAL-WEATHERING CORRECTION FOR ESTIMATING THE SODIUM HAZARD OF IRRIGATION WATERS,
W69-03791 03C

THE EFFECT OF SOIL-MINERAL WEATHERING ON THE SODIUM HAZARD OF IRRIGATION WATERS,
W69-03792 03C

SOIL GROUPS
ISOLATION AND CHARACTERIZATION OF HYDROLOGIC RESPONSE UNITS WITHIN AGRICULTURAL WATERSHEDS,
W69-03879 03P

CONCEPTS IN HYDROLOGIC SOIL GROUPING,
W69-04013 02G

SOIL MOISTURE
THE EFFECTS OF EVAPORATION, POTENTIAL TRANSPIRATION AND RAINFALL ON DEPLETION OF SOIL MOISTURE BY IRRIGATED PERENNIAL PASTURE,
W69-03875 03F

WATER FLUX IN MOIST SOIL THERMAL VERSUS SUCTION GRADIENTS,
W69-03883 02G

MEASURING THE RELATIVE HUMIDITY OF SOILS AT DIFFERENT MOISTURE CONTENTS BY THE GRAY HYDROCAL HYDROMETER,
W69-04130 02G

SOIL PROFILES
WATER TRANSPORT IN SOIL WITH A DAILY TEMPERATURE WAVE II ANALYSIS,
W69-03870 02G

SOIL PROPERTIES
MINERAL-WEATHERING CORRECTION FOR ESTIMATING THE SODIUM HAZARD OF IRRIGATION WATERS,
W69-03791 03C

THE EFFECT OF SOIL-MINERAL WEATHERING ON THE SODIUM HAZARD OF IRRIGATION WATERS,
W69-03792 03C

SOIL STRUCTURE
CONSTRUCTION PROBLEMS EXPERIENCED WITH LOESS SOILS,
W69-03803 08D

SOIL TEMPERATURE
WATER TRANSPORT IN SOIL WITH A DAILY TEMPERATURE WAVE I THEORY AND EXPERIMENT,
W69-03869 02G

WATER TRANSPORT IN SOIL WITH A DAILY TEMPERATURE WAVE II ANALYSIS,
W69-03870 02G

SOIL WATER TRANSLOCATION IN A HIGH WATER TABLE AREA,
W69-04124 02G

SOIL TYPES
HYDROLOGIC CHARACTERISTICS OF SOIL TYPES,
W69-04011 02E

SOIL WATER
A METHOD OF DETERMINING HYDRAULIC CONDUCTIVITY CHARACTERISTICS FOR NON-SWELLING SOILS IN SITU, AND OF CALCULATING EVAPORATION FROM BARE SOIL,
W69-04114 02G

SOIL WATER TRANSLOCATION IN A HIGH WATER TABLE AREA,
W69-04124 02G

SOIL WATER MOVEMENT
WATER TRANSPORT IN SOIL WITH A DAILY TEMPERATURE WAVE I THEORY AND EXPERIMENT,
W69-03869 02G

SOILS
THEORETICAL ANALYSIS OF TWO-DIMENSIONAL, TRANSIENT FLOW OF WATER IN UNSATURATED AND PARTLY UNSATURATED SOILS,
W69-03736 02G

PESTICIDE OCCURRENCE, CONCENTRATION, AND DEGRADATION IN FREE WATER SYSTEMS,
W69-03962 05B

SOLUBILITY
DETERMINATION OF THE SOLUBILITY PRODUCT OF SOIL CONSTITUENTS SUCH AS GYPSUM,
W69-04127 02G

SOLUBILITY PRODUCT
DETERMINATION OF THE SOLUBILITY PRODUCT OF SOIL CONSTITUENTS SUCH AS GYPSUM,
W69-04127 02G

SOUTH AFRICA
STUDIES ON DEW FORMATION UNDER SEMI-ARID CONDITIONS,
W69-04115 02A

SOUTH CAROLINA
STATISTICAL APPROACH TO ESTUARINE BEHAVIOR,
W69-03732 05B

DARGAN V RICHARDSON (STATE REGULATION JURISDICTION OVER PRIVATE, MAN-MADE PONDS).
W69-03994 06E

SOUTHEASTERN MASSACHUSETTS
AVAILABILITY OF GROUND WATERS IN THE NORTHERN PART, TENMILE AND TAUNTON RIVER BASINS, SOUTHEASTERN MASSACHUSETTS,
W69-03723 02F

SOUTHWEST U
LAW OF THE RIVER,
W69-03801 06E

WATER DEVELOPMENT AND WATER PLANNING IN THE SOUTHWESTERN UNITED STATES,
W69-03949 06B

SPATIAL DISTRIBUTION
AN ANALYTIC APPROACH TO DETERMINE IRRIGATION SPRINKLER SPACING,
W69-04121 03F

SPECTROSCOPY
OCCURRENCE OF SELECTED MINOR ELEMENTS IN THE WATERS OF CALIFORNIA,
W69-03966 02K

SPILLWAY GATES
PROTOTYPE INVESTIGATIONS OF DYNAMICS OF A TRIPLE-RIB OF A PLANE GATE OF THE DAM OF THE XXII CONGRESS CPSU VOLGA HES,
W69-03765 08C

SPILLWAYS
DESIGN OF A SPILLWAY DAM ON SHELL PILES AND METHOD OF STAT CALCULATION OF ITS FOUNDATION,
W69-03766 08D

SPOIL BANKS
VODOPIJA V TENNESSEE GAS TRANSMISSION CO (DAMAGE TO OYSTERS).
W69-03830 06E

SPRING WATERS
MINERAL SPRINGS OF THE DAYLESFORD DISTRICT,
W69-03933 02K

SPRINGS
MASSUCCO V VERMONT COLLEGE CORP (ABANDONMENT OF WATER RIGH EASEMENT).
W69-03894 06E

WINTER THAWS CAN RAISE GROUND WATER LEVELS IN DRIFTLESS AREA,
W69-04015 02F

RESPONSE OF SPRINGFLOW TO SOME CLIMATIC VARIABLES IN SOUTHWESTERN WISCONSIN,
W69-04016 02A

SPRINKLER IRRIGATION
WATER DISTRIBUTION UNDER SPRINKLER IRRIGATION,
W69-03892 03F

AN ANALYTIC APPROACH TO DETERMINE IRRIGATION SPRINKLER SPACING,
W69-04121 03F

STABILITY
A NOTE ON THE GLOBAL STABILITY OF A SIMPLE GROWTH MODEL WI MANY CAPITAL GOODS,
W69-04087 06B

CONTINUOUS AND DISCRETE TIME APPROACHES TO A MAXIMIZATION PROBLEM,
W69-04091 06B

STABILITY ANALYSIS
GENERAL SLOPE STABILITY ANALYSIS,
W69-03779 08D

STAGE-DISCHARGE RELATIONS
GENERAL FIELD AND OFFICE PROCEDURES FOR INDIRECT DISCHARGE MEASUREMENTS,
W69-03748 07B

MEASUREMENT OF PEAK DISCHARGE AT WIDTH CONTRACTIONS BY INDIRECT METHODS,
W69-03753 07B

MEASUREMENT OF PEAK DISCHARGE AT DAMS BY INDIRECT METHODS
W69-03945 02E

MEASUREMENT OF PEAK DISCHARGE BY THE SLOPE-AREA METHOD,
W69-03967 07B

STATE JURISDICTION
DARGAN V RICHARDSON (STATE REGULATION JURISDICTION OVER PRIVATE, MAN-MADE PONDS).
W69-03994 06E

STATE SUBMERGED LAND
LEASES OF STATE OWNED UNDER WATER LANDS FOR SHELLFISH CULTIVATION.
W69-03814 06E

STATISTICAL METHODS
STATISTICAL APPROACH TO ESTUARINE BEHAVIOR,

W69-03732 05B

THE LONG-RUN COST FUNCTION OF WATER PRODUCTION FOR SELECTED WISCONSIN COMMUNITIES,
W69-04136 06C

TATISTICAL MODELS
THE BIAS OF LIVIATAN'S CONSISTENT ESTIMATOR IN A DISTRIBUTED LAG MODEL,
W69-04060 06B

TEADY GROWTH STATE
INCOME DISTRIBUTION AND GROWTH IN A MONOPOLIST ECONOMY,
W69-04072 06C

TEADY STATE
ON PERVERSE CONSUMPTION PATTERNS,
W69-04089 06D

TOCHASTIC PROCESSES
RESEARCH ON THE MORPHOLOGY OF PRECIPITATION AND RUNOFF IN TEXAS,
W69-04135 02B

TOMATA
STOMATA IN RELATION TO DROUGHT RESISTANCE OF WHEAT VARIETIES,
W69-04117 03F

TORAGE COEFFICIENT
GEOLOGY AND GROUNDWATER OF THE SAVANNAH RIVER PLANT AND VICINITY, SOUTH CAROLINA,
W69-03970 02F

TORAGE-YIELD RELATIONS
HYDROLOGICAL STUDIES IN MASSACHUSETTS,
W69-04131 02A

TORM DRAINS
KUSHNER V PAZ CONSTR (STORM SEWER DRAINAGE).
W69-04179 04A

TORMS
RAINFALL DISTRIBUTION OVER DISSECTED TERRAIN IN SOUTHWESTERN WISCONSIN,
W69-04014 02B

TRATIFICATION
RELATION BETWEEN DEPTH FOR MAXIMUM AMOUNT OF EXCESS OXYGEN DURING THE SUMMER STAGNATION PERIOD AND THE TRANSPARENCY OF FRESHWATER LAKES OF JAPAN,
W69-04019 02H

TRATIGRAPHY
GEOLOGY AND WATER RESOURCES IN THE FRENCH PRAIRIE AREA, NORTHERN WILLAMETTE VALLEY, OREGON,
W69-03977 03F

TRAW
SOIL-SALINITY CHANGES WITH FALLOW AND A STRAW MULCH ON FALLOW,
W69-04116 02I

SOIL WATER TRANSLOCATION IN A HIGH WATER TABLE AREA,
W69-04124 02G

TREAM FLOW
PROCEEDINGS INTERNATIONAL SYMPOSIUM ON FOREST HYDROLOGY.
W69-03806 02A

TREAM GAGES
STAGE MEASUREMENT AT GAGING STATIONS,
W69-03721 07B

MEASUREMENT OF PEAK DISCHARGE AT DAMS BY INDIRECT METHODS,
W69-03945 02E

TREAM TURBULENCE
AMMONIA NITROGEN LOSSES FROM STREAMS,
W69-03745 05B

TREAMBEDS
EVAPORATION FROM AN EPHEMERAL STREAMBED,
W69-03874 02G

TREAMS
EFFECTS OF TEMPERATURE ON STREAM AERATION,
W69-03742 05G

AMMONIA NITROGEN LOSSES FROM STREAMS,
W69-03745 05B

RIVER ADJUSTMENT TO ALTERED HYDROLOGIC REGIMEN-MURRUMBIDGEE RIVER AND PALEOCHANNELS, AUSTRALIA,
W69-03957 02J

ABUNDANCE AND CHARACTER OF MICROSESTON IN A CALIFORNIA MOUNTAIN STREAM,
W69-04031 02E

CREEKS, BROOKS AND RIVERS IN ROCKLAND COUNTY, NEW YORK AND THEIR RELATION TO PLANNING FOR THE FUTURE,
W69-04036 06D

TRIP MINES
CHAPMAN V BEAVER DAM COAL CO (DRAINAGE OF MINE WATER).
W69-04173 05B

TRONTIUM-90 ANALYSIS
DETERMINATION OF STRONTIUM-90 IN WATER,
W69-03749 05A

STURGEON
HUDSON RIVER, NEW YORK HARBOR AND SANDY HOOK BAY (NEW).
W69-03851 06E

SUBSIDENCE
LAND SUBSIDENCE IN PLEASANT VALLEY AREA, FRESNO COUNTY, CALIF.,
W69-03797 02F

SUBSIDIES
JULES DUPUIT AND THE EARLY THEORY OF MARGINAL COST PRICING,
W69-04085 06E

SUBSTITUTES
WATER AND CHOICE IN THE COLORADO BASIN,
W69-03785 06D

SUBSURFACE DRAINAGE
SEWERS, DRAINS - CHANGE OF COURSE OR OUTLET.
W69-03858 05F

MODEL STUDY OF BOUNDARY EFFECTS ON DITCH DRAINAGE,
W69-03938 02G

SUBSURFACE DRAINAGE BY TRANSIENT-FLOW THEORY,
W69-03941 02G

SUBSURFACE OPENINGS
'BLOCKY AND SEAMY ROCK' IN TUNNELING,
W69-03760 08E

SUPPLY
KANE V VILLAGE OF RED HOOK (FIRE PROTECTION REQUIREMENTS DETERMINATIVE OF 'EXCESS WATER' OF SUPPLY CONTRACT).
W69-04005 03D

SUPPLY CONTRACTS
KANE V VILLAGE OF RED HOOK (FIRE PROTECTION REQUIREMENTS DETERMINATIVE OF 'EXCESS WATER' OF SUPPLY CONTRACT).
W69-04005 03D

SURFACE DRAINAGE
MILLER V DARBY (DIVERSION OF SURFACE WATERS).
W69-03823 04A

WIESE V MIEHER (ALTERATION OF DRAINAGE).
W69-03824 04A

KEISER V MANN (DIVERSION OF SURFACE WATERS).
W69-03825 04A

SURFACE DRAINAGE.
W69-03859 04A

ENTRY ON LAND TO MAKE SURVEYS.
W69-03867 04A

LONG V RITNER HOMES, INC. (RIGHTS OF LAND OWNER TO CHANNEL SURFACE WATER ONTO ADJACENT LAND).
W69-03907 04A

HUNT LAND HOLDING COMPANY V SCHRAMM (PRESCRIPTIVE RIGHTS).
W69-04003 04A

SURFACE GROUNDWATER RELATIONSHIPS
WATER RESOURCES OF THE MARQUETTE IRON RANGE AREA, MICHIGAN,
W69-03971 06D

SURFACE IRRIGATION
SURFACE IRRIGATION HYDRAULICS-KINEMATICS,
W69-03936 03F

SURFACE RUNOFF
MCFARLAND V DEKALK COUNTY (DAMAGES ATTRIBUTABLE TO SURFACE WATER NUISANCE).
W69-03812 04A

YENCHKO V GRONTKOWSKI (ACTION FOR DAMAGE DUE TO INTERFERENCE WITH NATURAL FLOW OF SURFACE WATERS).
W69-03834 04A

MANCINI V DELILLIS (ACTION TO REQUIRE REMOVAL OF DITCH OBSTRUCTION).
W69-04194 04A

SURFACE TENSION
FLUID FLOW AND PORE-WALL ADSORPTION RELATIONSHIP THE EFFECT OF TENSION AGENTS (FRENCH),
W69-03973 02G

SURFACE WATER
SURFACE DRAINAGE.
W69-03859 04A

SURFACE WATERS
STRICKLAND V STATE (DISCHARGE OF SURFACE WATER - STATE'S LIABILITY FOR NEGLIGENT INDEPENDENT CONTRACTOR).
W69-03820 04C

MILLER V DARBY (DIVERSION OF SURFACE WATERS).
W69-03823 04A

LAUR V CITY OF MILWAUKEE (SURFACE WATER DRAINAGE).
W69-03899 04A

WATER RESOURCES OF WISCONSIN, FOX-WOLF RIVER BASIN,
W69-03939 02E

HYDROLOGIC DATA 1967 - VOLUME 1 NORTH COASTAL AREA.
W69-03951 02F

QUALITY OF SURFACE WATERS FOR IRRIGATION, WESTERN STATES, 1963,
W69-03968 02E

GEOLOGY AND WATER RESOURCES IN THE FRENCH PRAIRIE AREA, NORTHERN WILLAMETTE VALLEY, OREGON,
W69-03977 03F

GEOLOGY AND GROUNDWATER RESOURCES OF LARAMIE COUNTY, WYOMING,
W69-03979 03F

WASHINGTON GOLF AND COUNTRY CLUB V BRIGGS AND BRENNAN DEVELOPERS (ACTION FOR DAMAGE CAUSED BY FLOODING).
W69-03993 04A

CITY OF HUNTSVILLE V MILLER (MUNICIPAL WATER).
W69-04166 04C

AN ACT RELATIVE TO EXPANDED STATE ACTIVITY IN THE FIELD OF WATER POLLUTION CONTROL.
W69-04178 05G

KOSSOFF V RATHGEB-WALSH (ACTION FOR DAMAGE CAUSED BY SURFACE WATER FLOW).
W69-04181 04A

SURFACE-GROUNDWATER RELATIONSHIPS
GROUNDWATER CONDITIONS AND GEOLOGIC RECONNAISSANCE IN THE UPPER SEVIER RIVER BASIN, UTAH,
W69-03750 02F

SURPLUS WATER
KANE V VILLAGE OF RED HOOK (FIRE PROTECTION REQUIREMENTS DETERMINATIVE OF 'EXCESS WATER' OF SUPPLY CONTRACT).
W69-04005 03D

SURVEYS
ENTRY ON LAND TO MAKE SURVEYS.
W69-03867 04A

SWAMPS
DRAINAGE OF AGRICULTURAL LANDS PROCEDURE.
W69-04185 04A

SWIMMING
GENERAL AND REGULATORY POWERS (POWER OF CITIES TO REGULATE SWIMMING).
W69-03841 06E

SYMMETRY
A NOTE ON THE SYMMETRY BETWEEN BRIBES AND CHARGES,
W69-04071 06C

SYSTEMATICS
THE TAXONOMY AND ECOLOGY OF LEECHES (HIRUDINEA) OF LAKE MENDOTA, WISCONSIN,
W69-04028 02H

SYSTEMS ANALYSIS
EFFECTIVE WATER RESOURCE MANAGEMENT.
W69-03702 06A

TAX RATE
A SIMPLE MACROECONOMIC MODEL WITH A GOVERNMENT BUDGET RESTRAINT,
W69-04069 06C

TAXES
AN ACT CONCERNING INDUSTRIAL WASTE DISPOSAL PROPERTY...EXEMPTING FROM TAXATION CERTAIN TANGIBLE PERSONAL PROPERTY.
W69-04001 05G

EARMARKED TAXES AND MAJORITY RULE BUDGETARY PROCESS,
W69-04067 06C

WHAT KIND OF REDISTRIBUTION DO WE WANT,
W69-04075 06B

SOME EFFECTS OF TAXES ON RISK TAKING,
W69-04097 06B

TEMPERATURE
EFFECTS OF TEMPERATURE ON STREAM AERATION,
W69-03742 05G

GERMINATION OF WINTERFAT SEEDS UNDER DIFFERENT MOISTURE STRESSES AND TEMPERATURES,
W69-04129 02I

TENESSEE VALLEY AUTHORITY PROJECT
TRIBUTARY AREA DEVELOPMENT TVA'S APPROACH TO SUB-REGIONAL DEVELOPMENT,
W69-04057 06B

TENNESSEE RIVER
RADIOACTIVE WASTE DILUTION IN THE CLINCH RIVER, EASTERN TENNESSEE,
W69-03956 05A

TENSION AGENTS EFFECT
FLUID FLOW AND PORE-WALL ADSORPTION RELATIONSHIP THE EFFECT OF TENSION AGENTS (FRENCH),
W69-03973 02G

TERRACING
CONSERVATION BENCH TERRACES IN EASTERN COLORADO,
W69-04080 03F

TEXAS
THE TEXAS WATER PLAN.
W69-03729 06E

THERMAL POLLUTION
INFRARED AERIAL SURVEYS IN ENVIRONMENTAL ENGINEERING,
W69-03744 07B

WATER REQUIREMENTS OF THE IRON AND STEEL INDUSTRY,
W69-03965 06D

THERMAL POWERPLANTS
THE PLANNING, CONSTRUCTION AND OPERATION OF POWER STATIONS IN LARGE INTERCONNECTED SYSTEMS--THE STRATEGY OF LARGE-AREA POWER SUPPLY,
W69-03771 08C

THERMAL PROPERTIES
WATER FLUX IN MOIST SOIL THERMAL VERSUS SUCTION GRADIENTS,
W69-03883 02G

THERMAL STRATIFICATION
PILOT STUDY OF DYNAMICS OF RESERVOIR DESTRATIFICATION,
W69-03960 05G

THERMAL WASTES
DEVELOPMENT AND APPLICATION OF A RATIONAL WATER QUALITY PLANNING MODEL,
W69-04017 05B

THERMOCLINE
WATER TRANSPORT IN SOIL WITH A DAILY TEMPERATURE WAVE I THEORY AND EXPERIMENT,
W69-03869 02G

WATER TRANSPORT IN SOIL WITH A DAILY TEMPERATURE WAVE II ANALYSIS,
W69-03870 02G

THERMOELECTRIC GENERATORS
MEETING TOMORROW'S ELECTRIC POWER NEEDS--NEW METHODS, NEW CONCEPTS,
W69-03770 06D

TIDAL WATERS
BAKER V NORMANOCH ASS'N, INC (OWNERSHIP OF LAKE BED).
W69-03898 04A

LEASING OF LANDS FOR SHELLFISH CULTURE.
W69-04198 06E

TIME
CONTINUOUS AND DISCRETE TIME APPROACHES TO A MAXIMIZATION PROBLEM,
W69-04091 06B

TIME SERIES ANALYSIS
STATISTICAL APPROACH TO ESTUARINE BEHAVIOR,
W69-03732 05B

PARAMETERS AND RELATIONS OF STOCHASTICALLY LAGGED AND DISAGGREGATIVE TIME SERIES,
W69-04102 06B

TOPOGRAPHY
RAINFALL DISTRIBUTION OVER DISSECTED TERRAIN IN SOUTHWESTERN WISCONSIN,
W69-04014 02B

TRACE ELEMENTS
THE STRONTIUM AND BARIUM CONTENT OF SEA WATER,
W69-03726 02K

NEUTRON ACTIVATION ANALYSIS OF LANTHANIDE ELEMENTS IN SEA WATER,
W69-03727 02K

TRACERS
THE MOVEMENT OF BEACH SAND,
W69-03754 02J

SALT PENETRATION TECHNIQUE FOR SEEPAGE MEASUREMENT,
W69-03935 04A

DISPERSION OF RADIOACTIVE TRACERS IN A MODEL BASIN SANDY AQUIFER,
W69-04111 02F

GEOPHYSICAL, ISOTOPE AND TRACER TECHNIQUES IN WATERSHED RESEARCH,
W69-04119 02A

TRACKING TECHNIQUES
GEOPHYSICAL, ISOTOPE AND TRACER TECHNIQUES IN WATERSHED RESEARCH,
W69-04119 02A

TRAFFIC
MEGALOPOLIS RESOURCE CONSERVER OR RESOURCE WASTER,
W69-04098 06B

TRANSLOCATION
SOIL WATER TRANSLOCATION IN A HIGH WATER TABLE AREA,
W69-04124 02G

TRANSMISSION LINES
ECONOMIC AND DESIGN CONSIDERATIONS OF THE PACIFIC NORTHWEST-PACIFIC SOUTHWEST INTERTIE,
W69-03776 08C

LINES ALONG HIGHWAY AND ACROSS WATERS.

W69-03860 06E

ANSMISSION(ELECTRICAL)
UNITED STATES DEVELOPMENTS IN UNDERGROUND TRANSMISSION,
W69-03773 08C

ROLE OF HIGHER VOLTAGE TRANSMISSION IN CHANGING ASPECTS OF ENERGY TRANSPORT,
W69-03775 08C

ANSPARENCY
RELATION BETWEEN DEPTH FOR MAXIMUM AMOUNT OF EXCESS OXYGEN DURING THE SUMMER STAGNATION PERIOD AND THE TRANSPARENCY OF FRESHWATER LAKES OF JAPAN,
W69-04019 02H

SECULAR CHANGES IN THE TRANSPARENCY OF LAKE WATERS,
W69-04022 02H

ANSPORTATION
ROLE OF HIGHER VOLTAGE TRANSMISSION IN CHANGING ASPECTS OF ENERGY TRANSPORT,
W69-03775 08C

GENERAL POWERS AND DUTIES OF COMMISSIONER OF TRANSPORTATION.
W69-03916 06E

FATIFS
INTERNATIONAL JOINT COMMISSION - UNITED STATES AND CANADA,
W69-03815 06E

EATMENT FACILITIES
AN ACT CONCERNING INDUSTRIAL WASTE DISPOSAL PROPERTY...EXEMPTING FROM TAXATION CERTAIN TANGIBLE PERSONAL PROPERTY.
W69-04001 05G

IBUTARY AREA DEVELOPMENT
TRIBUTARY AREA DEVELOPMENT TVA'S APPROACH TO SUB-REGIONAL DEVELOPMENT,
W69-04057 06B

CSON(ARIZONA)
EVAPORATION FROM AN EPHEMERAL STREAMBED,
W69-03874 02G

NNEL DESIGN
'BLOCKY AND SEAMY ROCK' IN TUNNELING,
W69-03760 08E

NNEL SUPPORTS
'BLOCKY AND SEAMY ROCK' IN TUNNELING,
W69-03760 08E

NNELS
WIND-TUNNEL INVESTIGATION OF AIR FLOW OVER A HEXADECANOL MONOLAYER SPREAD ON A WATER SURFACE,
W69-04125 03B

RBIDITY
BLOOD V CITY OF NEW YORK (ACTION TO RECOVER DAMAGES FROM TURBIDITY ALLEGEDLY CAUSED BY DAM).
W69-03909 05B

RBULENCE
THE EFFECT OF INDUCED TURBULENCE ON THE GROWTH OF ALGAE,
W69-03730 05C

RBULENT FLOW
AMMONIA NITROGEN LOSSES FROM STREAMS,
W69-03745 05B

RNPIKE AUTHORITY
KENNEBUNK WATER DIST V MAINE TURNPIKE AUTH (RIPARIAN RIGHTS AND USES).
W69-04152 06E

TRASONIC IMPULSE METHOD
CONDITION OF JOINTS IN MASSIVE CONCRETE STRUCTURES DETERMINED BY ULTRASONICS,
W69-03799 08F

TRASONIC TESTS
THE FUTURE ROLE OF NON-DESTRUCTIVE TESTING,
W69-03787 08G

CONDITION OF JOINTS IN MASSIVE CONCRETE STRUCTURES DETERMINED BY ULTRASONICS,
W69-03799 08F

NDERFLOW
A WATER-BALANCE EQUATION FOR THE RATHDRUM PRAIRIE GROUND-WATER RESERVOIR, NEAR SPOKANE, WASHINGTON,
W69-03740 02E

NDERGROUND CABLES
UNITED STATES DEVELOPMENTS IN UNDERGROUND TRANSMISSION,
W69-03773 08C

NDERGROUND POWERPLANTS
HOTZENWALD PUMPED-STORAGE SCHEME,
W69-03789 08A

NDERGROUND STREAMS
JONES V HOME BUILDING AND LOAN ASS'N OF THOMASVILLE (LOWER OWNER'S OBSTRUCTION OF UNDERGROUND FLOW).
W69-04004 04A

NIFORMITY COEFFICIENT
WATER DISTRIBUTION UNDER SPRINKLER IRRIGATION,
W69-03892 03F

UNSATURATED FLOW
THEORETICAL ANALYSIS OF TWO-DIMENSIONAL, TRANSIENT FLOW OF WATER IN UNSATURATED AND PARTLY UNSATURATED SOILS,
W69-03736 02G

WATER FLUX IN MOIST SOIL THERMAL VERSUS SUCTION GRADIENTS,
W69-03883 02G

UNSTEADY FLOW
COMPUTATIONAL SCHEMES FOR THE BOUSSINESQ EQUATION,
W69-03937 07C

SUBSURFACE DRAINAGE BY TRANSIENT-FLOW THEORY,
W69-03941 02G

ON THE MAINTENANCE OF ANOMALOUS FLUID PRESSURES 1. THICK SEDIMENTARY SEQUENCES,
W69-03954 02J

URBAN SOCIOLOGY
PEOPLE AND WATER,
W69-03953 04C

URBAN WATERFRONT RENEWAL
WATERFRONT RENEWAL.
W69-04033 04C

URBANIZATION
EFFECTS OF URBAN DEVELOPMENT ON FLOODS IN NORTHERN VIRGINIA,
W69-03706 04C

MEGALOPOLIZATION AND LEISURE A COMMENT,
W69-04100 06B

USSR
LONG-RANGE HYDROELECTRIC POWER USE DESCRIBED,
W69-03780 06D

VALVES
REDUCING CAVITATION IN VALVES,
W69-03757 08C

VARIABILITY
SOME STUDIES OF SENSIBLE AND LATENT HEAT FLUXES AT WALTAIR, SOUTHEASTERN COAST OF INDIA,
W69-03887 02G

VEGETATION
LIGHT PENETRATION INTO FRESH WATER,
W69-04020 02H

VERMONT
MASSUCCO V VERMONT COLLEGE CORP (ABANDONMENT OF WATER RIGHTS EASEMENT).
W69-03894 06E

VIBRATIONS
PROTOTYPE INVESTIGATIONS OF DYNAMICS OF A TRIPLE-RIB OF A PLANE GATE OF THE DAM OF THE XXII CONGRESS CPSU VOLGA HES,
W69-03765 08C

VIRGINIA
EFFECTS OF URBAN DEVELOPMENT ON FLOODS IN NORTHERN VIRGINIA,
W69-03706 04C

UNITED STATES V SMOOT SAND AND GRAVEL CORP (OWNER OF CONDEMNED RIPARIAN LANDS RIGHTS IN UNDERWATER GRAVEL DEPOSITS).
W69-03910 06E

WASHINGTON GOLF AND COUNTRY CLUB V BRIGGS AND BRENNAN DEVELOPERS (ACTION FOR DAMAGE CAUSED BY FLOODING).
W69-03993 04A

LAKE BARCROFT ESTATES V MCCAW (WATER DAMAGE DUE TO FLOODGATE OPENING).
W69-03995 04A

VORTICES
PREVENTION OF VORTICES AT INTAKES,
W69-03788 08A

WAGES
INCOME DISTRIBUTION AND GROWTH IN A MONOPOLIST ECONOMY,
W69-04072 06C

WASTE DILUTION
RADIOACTIVE WASTE DILUTION IN THE CLINCH RIVER, EASTERN TENNESSEE,
W69-03956 05A

WASTE DISPOSAL
THE DENVER EARTHQUAKES,
W69-03802 08E

LITTERING AND DUMPING.
W69-04162 05B

WASTE STREAMS
NEW APPROACHES TO WASTEWATER TREATMENT,
W69-03746 05D

WASTE WATER
ULTIMATE DISPOSAL OF WASTE WATER CONCENTRATES TO THE ENVIRONMENT,
W69-03798 05E

WASTE WATER DISPOSAL
ULTIMATE DISPOSAL OF WASTE WATER CONCENTRATES TO THE ENVIRONMENT,

W69-03798 05E

WASTE WATER TREATMENT
NEW APPROACHES TO WASTEWATER TREATMENT,
W69-03746 05D

ULTIMATE DISPOSAL OF WASTE WATER CONCENTRATES TO THE ENVIRONMENT,
W69-03798 05E

DEACTIVATION OF WASTE WATERS FROM RADIOCHEMICAL LABORATORIES AND ATOMIC REACTORS (RUSSIAN),
W69-03964 05D

AN EXAMINATION OF NON-TREATMENT PLANT ALTERNATIVES IN WATER POLLUTION CONTROL,
W69-04142 05D

MODEL OF OPTIMAL COMBINATION OF TREATMENT AND DILUTION,
W69-04144 05D

WASTES
SEC 82 DEPOSIT OF REFUSE IN NAVIGABLE WATERS, SEC 81 SUPPLYING DEFICIENCIES OF WATER, SEC 83 SEIZURE OF OBSTRUCTION.
W69-03914 04A

WATER
WATER AND CHOICE IN THE COLORADO BASIN,
W69-03785 06D

PESTICIDE OCCURRENCE, CONCENTRATION, AND DEGRADATION IN FREE WATER SYSTEMS,
W69-03962 05B

WATER ALLOCATION(POLICY)
ALLOCATIONS, DIVERSIONS, AND RELEASES.
W69-03920 06E

POWERS AND DUTIES OF THE COMMISSION.
W69-03921 06E

WATER ANALYSIS
OCCURRENCE OF SELECTED MINOR ELEMENTS IN THE WATERS OF CALIFORNIA,
W69-03966 02K

WATER BALANCE
A WATER-BALANCE EQUATION FOR THE RATHDRUM PRAIRIE GROUND-WATER RESERVOIR, NEAR SPOKANE, WASHINGTON,
W69-03740 02E

WATER CHEMISTRY
MINERAL-WATER INTERACTION DURING THE CHEMICAL WEATHERING OF SILICATES,
W69-03724 02K

WATER CIRCULATION
WATER FLUX IN MOIST SOIL THERMAL VERSUS SUCTION GRADIENTS,
W69-03883 02G

WATER CONSERVATION
WATER RESOURCES - LEGISLATIVE FINDINGS.
W69-04191 06E

WATER CONTRACTS
GROVE LABORATORIES V FLOWOOD CORP (WELL WATER RIGHTS CONTRACT INTERPRETATION).
W69-03911 06E

WATER CONVEYANCE
OFFENHARTZ V HEINSOHN (EASEMENT TO ALLOW UNDERGROUND TRANSPORT OF WATER).
W69-03908 04B

WATER DEMAND
TOWARDS ECONOMIC EVALUATION OF THE QUALITY OF WATER IN IRRIGATION,
W69-04059 03C

WATER DISTRIBUTION(APPLIED)
WATER DISTRIPUTION UNDER SPRINKLER IRRIGATION,
W69-03892 03F

WATER DISTRICTS
CITY OF COLD SPRING V CAMPBELL COUNTY WATER DISTRICT (RIGHT OF MUNICIPALITY TO SERVE CUSTOMERS OUTSIDE ITS CORPORATE LIMITS).
W69-04006 03D

OREGON'S WATER-MANAGEMENT DISTRICTS,
W69-04034 06E

WATER EQUIVALENT
RIME AND HOARFROST IN UPPER-SLOPE FORESTS OF EASTERN WASHINGTON,
W69-03807 02I

WATER FLOW DILUTION
EFFECTS OF TEMPERATURE ON STREAM AERATION,
W69-03742 05G

WATER FRONT IMPROVEMENTS
WATER FRONT IMPROVEMENTS.
W69-03842 06E

WATER LAW
LAW OF THE RIVER,
W69-03801 06E

CAROLINA BEACH FISHING PIER, INC V TOWN OF CAROLINA BEACH (STATE'S RIGHT TO TAKE PRIVATE BEACH LAND).
W69-03982 04A

WATER LAW, PLANNING AND POLICY CASES AND MATERIALS,
W69-04037 06E

ACQUISITION OF RIPARIAN RIGHTS IN NEW YORK,
W69-04051 06E

WATER LEVEL FLUCTUATIONS
THE GREAT LAKES WATER LEVELS PROBLEM,
W69-03947 02H

WATER LEVEL REGULATION
THE GREAT LAKES WATER LEVELS PROBLEM,
W69-03947 02H

WATER LEVELS
HEITSCH V CLARK (INJUNCTION TO ENJOIN CHANGE IN LAKE LEVEL).
W69-03901 04A

WATER LOSS
EVAPORATION FROM AN EPHEMERAL STREAMBED,
W69-03874 02G

EVAPORATION OF WATER ITS RETARDATION BY MONOLAYERS,
W69-03884 03B

WATER MANAGEMENT
WATER PROBLEMS IN THE NORTHEAST AND INCREASING FEDERAL REGULATION,
W69-04052 06E

WATER MANAGEMENT(APPLIED)
EFFECTIVE WATER RESOURCE MANAGEMENT.
W69-03702 06A

WATER AND CHOICE IN THE COLORADO BASIN,
W69-03785 06D

GEOLOGY AND GROUNDWATER RESOURCES OF THE BIG SANDY CREEK VALLEY, LINCOLN, CHEYENNE, AND KIOWA COUNTIES, COLORADO,
W69-03974 02F

GEOLOGY AND WATER RESOURCES IN THE FRENCH PRAIRIE AREA, NORTHERN WILLAMETTE VALLEY, OREGON,
W69-03977 03F

WATER LAW, PLANNING AND POLICY CASES AND MATERIALS,
W69-04037 06E

WATER POLICY
POWERS AND DUTIES OF THE COMMISSION.
W69-03921 06E

SUSQUEHANNA RIVER BASIN COMPACT - PREAMBLE.
W69-03922 06E

WATER COMPACTS.
W69-03923 06E

MAN AND HIS WATER RESOURCE,
W69-04035 06D

CREATION OF WATER RESOURCES COMMISSION.
W69-04190 06E

WATER POLLUTION
IDENTIFICATION OF PETROLEUM IN ESTUARINE WATERS,
W69-03738 05B

PROTECTION OF WATER SUPPLY FROM POLLUTION.
W69-03855 05G

CORRUPTING WATERS FORBIDDEN.
W69-03863 05B

WATER POLLUTION IN THE GREAT LAKES BASIN,
W69-03948 05B

NEW ENGLAND INTERSTATE WATER POLLUTION CONTROL COMPACT.
W69-03990 05G

VIOLATION INJUNCTION AND ABATEMENT (WATER POLLUTION SOURCES).
W69-03991 05B

AN ACT TO REPEAL SECTIONS 204.030, 204.100, AND 204.170, RSMO 1959, RELATING TO WATER POLLUTION AND TO ENACT IN LIEU THEREOF FOUR NEW SECTIONS, RELATING TO THE SAME SUBJECT, WITH PENALTY PROVISIONS.
W69-04007 05B

AIR AND WATER INTERSTATE COMPACTS.
W69-04047 05G

PARTICULAR NUISANCES.
W69-04161 04A

BUSBY V INTERNATIONAL PAPER COMPANY (ACTION FOR DAMAGES AND INJUNCTION DUE TO STREAM POLLUTION).
W69-04174 05B

CITY OF OXFORD V SPEARS (CITY'S LIABILITY FOR DUMPING SEWAG INTO STREAM WHICH PASSES THROUGH PRIVATE PROPERTY).
W69-04177 05B

WATER POLLUTION CONTROL
STREAM CONTROL COMMISSION - VIOLATIONS AND PENALTIES.
W69-03836 05G

DRAINAGE OF NOXIOUS OR POISONOUS SUBSTANCES INTO NATURAL WATERWAYS OR CANALS.
W69-03837 05G

STREAM CONTROL COMMISSION - POWERS AND DUTIES.
W69-03868 06E

WATER POLLUTION IN THE GREAT LAKES BASIN,
W69-03948 05B

AN ACT TO REPEAL SECTIONS 204.030, 204.100, AND 204.170, RSMO 1959, RELATING TO WATER POLLUTION AND TO ENACT IN LIEU THEREOF FOUR NEW SECTIONS, RELATING TO THE SAME SUBJECT, WITH PENALTY PROVISIONS.
W69-04007 05B

NITROGEN REMOVAL IN SEWAGE TREATMENT PROCESS,
W69-04030 05D

WATER QUALITY MANAGEMENT IN THE DELAWARE RIVER BASIN (FEDERAL AND INTERSTATE COMPACT TO SOLVE POLLUTION PROBLEMS),
W69-04039 05G

AN EXAMINATION OF NON-TREATMENT PLANT ALTERNATIVES IN WATER POLLUTION CONTROL,
W69-04142 05D

MODEL OF OPTIMAL COMBINATION OF TREATMENT AND DILUTION,
W69-04144 05D

INTERSTATE WATER POLLUTION CONTROL ACT.
W69-04154 05G

ARTICLE ONE, SUBCHAPTER TWO, NEW ENGLAND INTERSTATE WATER POLLUTION CONTROL COMPACT (DETAILS OF THE COMPACT).
W69-04155 05G

ARTICLE TWO SUBCHAPTER TWO NEW ENGLAND INTERSTATE WATER POLLUTION CONTROL COMPACT.
W69-04156 05G

WATER RESOURCES - LEGISLATIVE FINDINGS.
W69-04191 06E

NORTH CAROLINA STATE STREAM SANITATION AND CONSERVATION COMMITTEE.
W69-04193 05G

TER POLLUTION EFFECTS
FISH HATCHERIES POLLUTION OF WATERS USED BY FISH HATCHERIES.
W69-03843 05C

WARREN PETROLEUM CORP V LEE (ACTION TO RECOVER DAMAGES FOR POLLUTION OF CREEK).
W69-04170 05B

TER POLLUTION SOURCES
PROCEEDINGS BEFORE THE COMMISSIONER (LEGAL ACTION AGAINST SOURCES OF POLLUTION).
W69-03989 05B

NITROGEN REMOVAL IN SEWAGE TREATMENT PROCESS,
W69-04030 05D

TER POTENTIAL
A MICROPSYCHROMETER TO MEASURE WATER POTENTIALS OF INTACT PLANT MATERIAL,
W69-04109 02I

TER QUALITY
MINERAL SPRINGS OF THE DAYLESFORD DISTRICT,
W69-03933 02K

HYDROLOGIC DATA 1967 - VOLUME 1 NORTH COASTAL AREA.
W69-03951 02F

QUALITY OF SURFACE WATERS FOR IRRIGATION, WESTERN STATES, 1963,
W69-03968 02E

GEOLOGY AND GROUNDWATER OF THE SAVANNAH RIVER PLANT AND VICINITY, SOUTH CAROLINA,
W69-03970 02F

GEOLOGY AND GROUNDWATER RESOURCES OF LARAMIE COUNTY, WYOMING,
W69-03979 03F

CREEKS, BROOKS AND RIVERS IN ROCKLAND COUNTY, NEW YORK AND THEIR RELATION TO PLANNING FOR THE FUTURE,
W69-04036 06D

ECONOMIC AND SOCIAL BENEFITS FROM IMPROVING HEALTH BY PROVISION OF SAFE DRINKING WATER SUPPLIES,
W69-04056 06B

DEVELOPMENT OF OPTIMIZATION - SYSTEMS ANALYSIS TECHNIQUES FOR TEXAS WATER RESOURCES,
W69-04133 05B

TER QUALITY CONTROL
DEVELOPMENT AND APPLICATION OF A RATIONAL WATER QUALITY PLANNING MODEL,
W69-04017 05B

WATER QUALITY MANAGEMENT IN THE DELAWARE RIVER BASIN (FEDERAL AND INTERSTATE COMPACT TO SOLVE POLLUTION PROBLEMS),
W69-04039 05G

POLLUTION.
W69-04050 06E

TOWARDS ECONOMIC EVALUATION OF THE QUALITY OF WATER IN IRRIGATION,
W69-04059 03C

OPTIMAL WATER QUALITY MANAGEMENT AND MULTI-COMPONENT EFFLUENT CONTROL BY MEANS OF LINEAR PROGRAMMING,
W69-04147 05D

WATER REQUIREMENTS
PEOPLE AND WATER,
W69-03953 04C

WATER REQUIREMENTS OF THE IRON AND STEEL INDUSTRY,
W69-03965 06D

WATER RESOURCES
WATER AVAILABILITY OF GENEVA COUNTY, ALABAMA,
W69-03733 02E

WATER AVAILABILITY OF BUTLER COUNTY, ALABAMA,
W69-03734 02E

WATER AND CHOICE IN THE COLORADO BASIN,
W69-03785 06D

FUNCTIONS OF THE INTERNATIONAL JOINT COMMISSION,
W69-03796 06E

WATER RESOURCES OF WISCONSIN, FOX-WOLF RIVER BASIN,
W69-03939 02E

MINERAL AND WATER RESOURCES OF BARBOUR COUNTY, ALABAMA,
W69-03952 02E

GEOLOGY AND GROUND-WATER RESOURCES OF THE MURPHY AREA, NORTH CAROLINA,
W69-03959 02F

GEOLOGY AS A GUIDE TO REGIONAL ESTIMATES OF THE WATER RESOURCE,
W69-03961 02F

INVESTIGATION OF THE KARSTIC WATER RESERVES BURIED UNDER MIOCENE, PLIOCENE, AND QUATERNARY SEDIMENTS OF THE MEDITERRANEAN BASIN (FRENCH),
W69-03972 02F

CONSERVATION LAW - DEFINITIONS - GENERAL JURISDICTION OF THE COMMISSION.
W69-03988 06E

CREATION OF WATER RESOURCES COMMISSION.
W69-04190 06E

WATER RESOURCES DEVELOPMENT
EFFECTIVE WATER RESOURCE MANAGEMENT.
W69-03702 06A

THE TEXAS WATER PLAN.
W69-03729 06B

PLAN FOR UTILIZING THE WATER RESOURCES OF THE UPPER KUBAN',
W69-03767 03F

A PROGRESS REPORT ON PROJECT SKYWATER THE BUREAU OF RECLAMATION'S ATMOSPHERIC WATER RESOURCES PROGRAM,
W69-03769 03B

PROJECTS RELATING TO THE USE OF ATMOSPHERIC WATER RESOURCES.
W69-03828 06E

SUSQUEHANNA RIVER BASIN COMPACT - PREAMBLE.
W69-03922 06E

WATER COMPACTS.
W69-03923 06E

GREAT LAKES BASIN COMPACT.
W69-03925 06E

WATER DEVELOPMENT AND WATER PLANNING IN THE SOUTHWESTERN UNITED STATES,
W69-03949 06B

PEOPLE AND WATER,
W69-03953 04C

WATER RESOURCES OF THE MARQUETTE IRON RANGE AREA, MICHIGAN,
W69-03971 06D

INVESTIGATION OF THE KARSTIC WATER RESERVES BURIED UNDER MIOCENE, PLIOCENE, AND QUATERNARY SEDIMENTS OF THE MEDITERRANEAN BASIN (FRENCH),
W69-03972 02F

WATER RESOURCES OF JACKSON AND INDEPENDENCE COUNTIES, ARKANSAS,
W69-03976 02F

MAN AND HIS WATER RESOURCE,
W69-04035 06D

PUBLIC UTILITIES COMMISSION.
W69-04160 04A

WATER RESOURCES - LEGISLATIVE FINDINGS.
W69-04191 06E

WATER RESOURCES MANAGEMENT
WATER AND CHOICE IN THE COLORADO BASIN,
W69-03785 06D

WATER RESOURCES RESEARCH INST
WATER RESOURCES RESEARCH INSTITUTE.
W69-04168 06E

WATER REUSE
WASTEWATER REUSE,
W69-03716 05D

WATER REUSE IN MONTERREY, MEXICO,
W69-03717 05D

WASTEWATER REUSE--HAS IT 'ARRIVED,'
W69-03719 05D

DEACTIVATION OF WASTE WATERS FROM RADIOCHEMICAL LABORATORIES AND ATOMIC REACTORS (RUSSIAN),
W69-03964 05D

WATER RIGHTS
BUILDINGS AND OTHER THINGS INCLUDED IN DEEDS TO LAND.
W69-03829 06E

MASSUCCO V VERMONT COLLEGE CORP (ABANDONMENT OF WATER RIGHTS EASEMENT).
W69-03894 06E

GROVE LABORATORIES V FLOWOOD CORP (WELL WATER RIGHTS CONTRACT INTERPRETATION).
W69-03911 06E

MULTIPLE INTERESTS IN RIPARIAN LAND, SUBDIVISION PLATTING, AND THE ALLOCATION OF RIPARIAN RIGHTS,
W69-04040 06E

THE RELATIONSHIP BETWEEN THE LAWS GOVERNING WATER RIGHTS AND THOSE GOVERNING OTHER NATURAL RESOURCES,
W69-04041 06E

THE LAW OF WATER IN NEW JERSEY,
W69-04055 04A

COMMERCE AND TRADE MINING BUREAU.
W69-04165 03F

RESERVATION OF STATE CONTROL OVER WATER POWER.
W69-04189 06E

WATER SHORTAGE
WATER AND CHOICE IN THE COLORADO BASIN,
W69-03785 06D

SEC 82 DEPOSIT OF REFUSE IN NAVIGABLE WATERS, SEC 81 SUPPLYING DEFICIENCIES OF WATER, SEC 83 SEIZURE OF OBSTRUCTION.
W69-03914 04A

WATER PROBLEMS IN THE NORTHEAST AND INCREASING FEDERAL REGULATION,
W69-04052 06E

WATER SPREADING
LEVEL PAN CONSTRUCTION FOR DIVERTING AND SPREADING RUNOFF,
W69-03881 03F

WATER STORAGE
MOISTURE STORAGE AND SPRING WHEAT YIELDS ON LEVEL-BENCH TERRACES AS INFLUENCED BY CONTRIBUTING AREA COVER AND EVAPORATION CONTROL,
W69-03871 03F

CONSERVATION BENCH TERRACES IN EASTERN COLORADO,
W69-03880 03F

WATER SUPPLY
AUGMENTING COLORADO RIVER BY WEATHER MODIFICATION,
W69-03950 03B

CREEKS, BROOKS AND RIVERS IN ROCKLAND COUNTY, NEW YORK AND THEIR RELATION TO PLANNING FOR THE FUTURE,
W69-04036 06D

WATER PROBLEMS IN THE NORTHEAST AND INCREASING FEDERAL REGULATION,
W69-04052 06E

TOWARDS ECONOMIC EVALUATION OF THE QUALITY OF WATER IN IRRIGATION,
W69-04059 03C

A CAPACITY EXPANSION PLANNING MODEL FOR MUNICIPAL WATER SUPPLY SYSTEMS,
W69-04145 06D

GROUND WATER AND COMPUTER SIMULATIONS,
W69-04149 02F

KENNEBUNK WATER DIST V MAINE TURNPIKE AUTH (RIPARIAN RIGHTS AND USES).
W69-04152 06E

PUBLIC UTILITIES - POWERS AND DUTIES.
W69-04199 03E

WATER TABLE
SOIL-SALINITY CHANGES WITH FALLOW AND A STRAW MULCH ON FALLOW,
W69-04116 02I

SOIL WATER TRANSLOCATION IN A HIGH WATER TABLE AREA,
W69-04124 02G

WATER TRANSFER
WATER TRANSPORT IN SOIL WITH A DAILY TEMPERATURE WAVE I THEORY AND EXPERIMENT,
W69-03869 02G

WATER TRANSPORT IN SOIL WITH A DAILY TEMPERATURE WAVE II ANALYSIS,
W69-03870 02G

WATER TREATMENT
OCCURRENCE OF SELECTED MINOR ELEMENTS IN THE WATERS OF CALIFORNIA,
W69-03966 02K

WATER UTILIZATION
FUTURE IRRIGATION DEMAND IN THE SUSQUEHANNA BASIN,
W69-03934 03F

WATER RESOURCES OF JACKSON AND INDEPENDENCE COUNTIES, ARKANSAS,
W69-03976 02F

WATER PROBLEMS IN THE NORTHEAST AND INCREASING FEDERAL REGULATION,
W69-04052 06E

N Y COMMON LAW AND STATUTORY RIGHTS PROTECTING THE INTEREST OF THE INDIVIDUAL RIPARIAN OWNER IN THE RECREATIONAL AND AESTHETIC VALUES OF HIS ENVIRONMENT,
W69-04054 06E

WATER WELLS
GROVE LABORATORIES V FLOWOOD CORP (WELL WATER RIGHTS CONTRACT INTERPRETATION).
W69-03911 06E

WATER YIELD IMPROVEMENT
INCREASING WATER YIELD IN THE NORTHEAST BY MANAGEMENT OF FORESTED WATERSHEDS,
W69-03980 03B

WATERCOURSES
BUILDINGS AND OTHER THINGS INCLUDED IN DEEDS TO LAND.
W69-03829 06E

WATERCOURSES(LEGAL)
PETERS V AUBIN (ACTION TO RESTORE WATERCOURSE).
W69-03816 04A

COLLINS V WICKLAND (FLOOD DAMAGE DUE TO NATURAL DRAINAGE OBSTRUCTION).
W69-03906 04A

WATERCOURSE(LEGAL)
CARD V NICKERSON (ACTION FOR DAMAGES FOR OBSTRUCTION OF NATURAL WATER COURSE).
W69-04151 04A

WATERFRONT DETERIORATION
WATERFRONT RENEWAL.
W69-04033 04C

WATERSHED MANAGEMENT
PROCEEDINGS INTERNATIONAL SYMPOSIUM ON FOREST HYDROLOGY.
W69-03806 02A

INCREASING WATER YIELD IN THE NORTHEAST BY MANAGEMENT OF FORESTED WATERSHEDS,
W69-03980 03B

WATERSHEDS(BASINS)
ISOLATION AND CHARACTERIZATION OF HYDROLOGIC RESPONSE UNIT WITHIN AGRICULTURAL WATERSHEDS,
W69-03879 03F

GEOPHYSICAL, ISOTOPE AND TRACER TECHNIQUES IN WATERSHED RESEARCH,
W69-04119 02A

WATER-FRONT FACILITIES
WATER FRONT HARBOR FACILITIES.
W69-03810 06E

WEAKNESS PLANES
STRENGTH AND EARTH PRESSURE OF ROCK WITH WEAK PLANES,
W69-03768 08E

WEATHER MODIFICATION
A PROGRESS REPORT ON PROJECT SKYWATER THE BUREAU OF RECLAMATION'S ATMOSPHERIC WATER RESOURCES PROGRAM,
W69-03769 03B

AUGMENTING COLORADO RIVER BY WEATHER MODIFICATION,
W69-03950 03B

WEATHERING
THE EFFECT OF SOIL-MINERAL WEATHERING ON THE SODIUM HAZARD OF IRRIGATION WATERS,
W69-03792 03C

WEIRS
MEASUREMENT OF PEAK DISCHARGE AT DAMS BY INDIRECT METHODS.
W69-03945 02E

WELL REGULATIONS
UNUSED WELLS, CISTERNS, ETC, TO BE COVERED OR FILLED -

POISONING SPRINGS, WELLS, ETC.
W69-03827 06E

CITY OF FOND DU LAC V TOWN OF EMPIRE (VALIDITY OF MUNICIPAL ORDINANCE REGULATING THE DRILLING OF WELLS).
W69-03902 02F

LLS
PARTICULAR NUISANCES.
W69-04161 04A

ST PAKISTAN
ANALYSIS OF AQUIFER TESTS IN THE PUNJAB REGION OF WEST PAKISTAN,
W69-03975 02F

STOMATA IN RELATION TO DROUGHT RESISTANCE OF WHEAT VARIETIES,
W69-04117 03F

EAT
MOISTURE STORAGE AND SPRING WHEAT YIELDS ON LEVEL-BENCH TERRACES AS INFLUENCED BY CONTRIBUTING AREA COVER AND EVAPORATION CONTROL,
W69-03871 03F

NITROGEN FERTILIZER AND WHEAT IN A SEMI-ARID ENVIRONMENT 4 EMPIRICAL YIELD RESPONSE MODELS AND ECONOMIC FACTORS,
W69-03877 03F

STOMATA IN RELATION TO DROUGHT RESISTANCE OF WHEAT VARIETIES,
W69-04117 03F

D VELOCITY
RAINFALL DISTRIBUTION OVER DISSECTED TERRAIN IN SOUTHWESTERN WISCONSIN,
W69-04014 02B

DS
WIND-TUNNEL INVESTIGATION OF AIR FLOW OVER A HEXADECANOL MONOLAYER SPREAD ON A WATER SURFACE,
W69-04125 03B

TER
TIME AND HOARFROST IN UPPER-SLOPE FORESTS OF EASTERN WASHINGTON,
W69-03807 02I

WINTERFAT SEEDS
GERMINATION OF WINTERFAT SEEDS UNDER DIFFERENT MOISTURE STRESSES AND TEMPERATURES,
W69-04129 02I

WISCONSIN
LAUP V CITY OF MILWAUKEE (SURFACE WATER DRAINAGE).
W69-03899 04A

CITY OF FOND DU LAC V TOWN OF EMPIRE (VALIDITY OF MUNICIPAL ORDINANCE REGULATING THE DRILLING OF WELLS).
W69-03902 02F

BRATONJA V CITY OF MILWAUKEE (ACTION TO RECOVER DAMAGES DUE TO FLOODING FROM HEAVY RAIN).
W69-03905 04A

WATER RESOURCES OF WISCONSIN, FOX-WOLF RIVER BASIN,
W69-03939 02E

NITROGEN FIXATION IN TWO WISCONSIN LAKES,
W69-04026 02H

THE TAXONOMY AND ECOLOGY OF LEECHES (HIRUDINEA) OF LAKE MENDOTA, WISCONSIN,
W69-04028 02H

WATERFRONT RENEWAL.
W69-04033 04C

THE LONG-RUN COST FUNCTION OF WATER PRODUCTION FOR SELECTED WISCONSIN COMMUNITIES,
W69-04136 06C

XYLEM
EFFECTS OF EXTERNAL SALT CONCENTRATIONS ON WATER RELATIONS IN PLANTS I. ABSENCE OF OSMOTIC ADJUSTMENT IN THE ROOT XYLEM,
W69-04113 02I

ZETA POTENTIAL
ELECTROKINETIC MEASUREMENTS OF COLLOIDAL-LADEN FLOW THROUGH A SAND COLUMN,
W69-04112 02A

AUTHOR INDEX

BEL-HADY, M.
INFRARED AERIAL SURVEYS IN ENVIRONMENTAL ENGINEERING,
W69-03744 07B

BEL, ROBERT B.
A HISTORY OF FEDERAL INVOLVEMENT IN THE MARINE SCIENCES EMERGENCE OF THE NATIONAL SEA GRANT PROGRAM,
W69-04048 09D

LAM, KHURSHID
STOMATA IN RELATION TO DROUGHT RESISTANCE OF WHEAT VARIETIES,
W69-04117 03F

LBIN, DONALD R.
WATER RESOURCES OF JACKSON AND INDEPENDENCE COUNTIES, ARKANSAS,
W69-03976 02F

LBIN, PETER S.
THE CONSTRAINED DEMAND FOR PUBLIC ASSISTANCE,
W69-04093 06D

LI, SABIR
ANALYSIS OF AQUIFER TESTS IN THE PUNJAB REGION OF WEST PAKISTAN,
W69-03975 02F

LLEN, HOWARD E.
FLOODS IN BEECHER WEST QUADRANGLE, NORTHEASTERN ILLINOIS,
W69-03720 02E

LLRED, E. R.
AN ANALYTIC APPROACH TO DETERMINE IRRIGATION SPRINKLER SPACING,
W69-04121 03F

LVERSON, R. M.
MINERAL AND WATER RESOURCES OF BARBOUR COUNTY, ALABAMA,
W69-03952 02E

NDERSON, DANIEL G.
EFFECTS OF URBAN DEVELOPMENT ON FLOODS IN NORTHERN VIRGINIA,
W69-03706 04C

NDERSON, NEIL R.
THE STRONTIUM AND BARIUM CONTENT OF SEA WATER,
W69-03726 02K

NTIPPA, G. D.
MEASUREMENT OF TRANSFORMER NOISE AND ITS REDUCTION,
W69-03790 08C

NWAR, H. O.
PREVENTION OF VORTICES AT INTAKES,
W69-03788 08A

RMANGAU, CHRISTIAN
FLUID FLOW AND PORE-WALL ADSORPTION RELATIONSHIP THE EFFECT OF TENSION AGENTS (FRENCH),
W69-03973 02G

TSUMI, HIROSHI
INCOME DISTRIBUTION AND GROWTH IN A MONOPOLIST ECONOMY,
W69-04072 06C

VIAS, JACQUES
INVESTIGATION OF THE KARSTIC WATER RESERVES BURIED UNDER MIOCENE, PLIOCENE, AND QUATERNARY SEDIMENTS OF THE MEDITERRANEAN BASIN (FRENCH),
W69-03972 02F

FLUID FLOW AND PORE-WALL ADSORPTION RELATIONSHIP THE EFFECT OF TENSION AGENTS (FRENCH),
W69-03973 02G

VILA, CHARLES F.
UNITED STATES DEVELOPMENTS IN UNDERGROUND TRANSMISSION,
W69-03773 08C

VRETT, J. B.
WATER AVAILABILITY OF GENEVA COUNTY, ALABAMA,
W69-03733 02E

WATER AVAILABILITY OF BUTLER COUNTY, ALABAMA,
W69-03734 02E

AYER, GORDON R.
CREEKS, BROOKS AND RIVERS IN ROCKLAND COUNTY, NEW YORK AND THEIR RELATION TO PLANNING FOR THE FUTURE,
W69-04036 06D

BAIER, W.
STUDIES ON DEW FORMATION UNDER SEMI-ARID CONDITIONS,
W69-04115 02A

BALINSKI, M. L.
THE DUAL IN NONLINEAR PROGRAMMING AND ITS ECONOMIC INTERPRETATION,
W69-04088 06B

BARCLAY, DONALD E.
DISCHARGE FACILITIES AT HELLS CANYON DAM,
W69-03795 08A

BARNES, HARRY H., JR.
ROUGHNESS CHARACTERISTICS OF NATURAL CHANNELS,
W69-03978 02E

BARRY, FRANK J.
THE ADMINISTRATION OF THE OUTER CONTINENTAL SHELF LANDS ACT,
W69-04043 06E

BARTELS, L. F.
THE EFFECTS OF EVAPORATION, POTENTIAL TRANSPIRATION AND RAINFALL ON DEPLETION OF SOIL MOISTURE BY IRRIGATED PERENNIAL PASTURE,
W69-03875 03F

BARTEN, A. P.
ESTIMATING DEMAND EQUATIONS,
W69-04062 06D

BARZEL, YORAM
OPTIMAL TIMING OF INNOVATIONS,
W69-04081 06B

BASSETT, DAY L.
SURFACE IRRIGATION HYDRAULICS-KINEMATICS,
W69-03936 03F

BAUMOL, W. J.
THE DUAL IN NONLINEAR PROGRAMMING AND ITS ECONOMIC INTERPRETATION,
W69-04088 06B

BELL, FREDERICK C.
ESTIMATING DESIGN FLOODS FROM EXTREME RAINFALL,
W69-03783 02E

BELL, JAMES M.
GENERAL SLOPE STABILITY ANALYSIS,
W69-03779 08D

BENISHAY, HASKEL
PARAMETERS AND RELATIONS OF STOCHASTICALLY LAGGED AND DISAGGREGATIVE TIME SERIES,
W69-04102 06B

BENNETT, GORDON D.
ANALYSIS OF AQUIFER TESTS IN THE PUNJAB REGION OF WEST PAKISTAN,
W69-03975 02F

BENSON, M. A.
GENERAL FIELD AND OFFICE PROCEDURES FOR INDIRECT DISCHARGE MEASUREMENTS,
W69-03748 07B

MEASUREMENT OF PEAK DISCHARGE BY THE SLOPE-AREA METHOD,
W69-03967 07B

BENSON, WOODRUFF W.
THE SUCCESSION OF DIATOM ASSEMBLAGES IN THE RECENT SEDIMENTS OF LAKE WASHINGTON,
W69-04029 05C

BENZ, L. C.
SOIL-SALINITY CHANGES WITH FALLOW AND A STRAW MULCH ON FALLOW,
W69-04116 02I

SOIL WATER TRANSLOCATION IN A HIGH WATER TABLE AREA,
W69-04124 02G

BEREZINSKII, A. R.
DESIGN OF A SPILLWAY DAM ON SHELL PILES AND METHOD OF STATIC CALCULATION OF ITS FOUNDATION,
W69-03766 08D

BERNDT, H. W.
RIME AND HOARFROST IN UPPER-SLOPE FORESTS OF EASTERN WASHINGTON,
W69-03807 02I

BERRY, GEORGE T.
POWER GENERATION UNDER IJC REGULATION,
W69-03781 04A

BESCHINSKIY, A. A.
LONG-RANGE HYDROELECTRIC POWER USE DESCRIBED,
W69-03780 06D

BIRKHEAD, P. K.
GEOLOGY OF CLEMSON RESEARCH WATERSHED,
W69-04018 02G

BJERRUM, LAURITS
STABILITY OF ROCK SLOPES IN NORWAY,
W69-03782 08E

BJERRUM, L.
GROUTING OF THE LIMESTONE FOUNDATION FOR THE ARSTADDALEN DAM,
W69-03777 08D

BJORKLUND, L. J.
GROUNDWATER CONDITIONS AND GEOLOGIC RECONNAISSANCE IN THE UPPER SEVIER RIVER BASIN, UTAH,
W69-03750 02F

BLACKWELL, M. J.
MEASUREMENT OF NATURAL EVAPORATION COMPARISON OF GRAVIMETRIC AND AERODYNAMIC METHODS,

W69-03891 02D

BLACK, T. A.
HYDRAULIC LOAD-CELL LYSIMETER, CONSTRUCTION, CALIBRATION, AND TESTS,
W69-03793 07B

BOATWRIGHT, G. O.
MOISTURE STORAGE AND SPRING WHEAT YIELDS ON LEVEL-BENCH TERRACES AS INFLUENCED BY CONTRIBUTING AREA COVER AND EVAPORATION CONTROL,
W69-03871 03F

BORN, GERARD J.
THEORY OF MEASUREMENT,
W69-03800 07B

BOROVOY, A. A.
LONG-RANGE HYDROELECTRIC POWER USE DESCRIBED,
W69-03780 06D

BOUWER, HERMAN
SALT PENETRATION TECHNIQUE FOR SEEPAGE MEASUREMENT,
W69-03935 04A

BOUYOUCOS, GEORGE J.
MEASURING THE RELATIVE HUMIDITY OF SOILS AT DIFFERENT MOISTURE CONTENTS BY THE GRAY HYDROCAL HYDROMETER,
W69-04130 02G

BOWEN, VAUGHAN T.
NEUTRON ACTIVATION ANALYSIS OF LANTHANIDE ELEMENTS IN SEA WATER,
W69-03727 02K

BOYD, ROBERT B.
PROJECTED TRENDS AND REQUIREMENTS IN THE COORDINATED GROWTH OF ELECTRIC POWER SYSTEMS IN THE UNITED STATES,
W69-03774 08C

BOYKO, H.
SALINITY AND ARIDITY,
W69-03751 03C

BREDEHOEFT, J. D.
ON THE MAINTENANCE OF ANOMALOUS FLUID PRESSURES 1. THICK SEDIMENTARY SEQUENCES,
W69-03954 02J

BREKKE, TOR L.
'BLOCKY AND SEAMY ROCK' IN TUNNELING,
W69-03760 08E

BRENZENSKI, FRANCIS T.
DETERMINATION OF NITRATE IN ESTUARINE WATERS AUTOMATIC DETERMINATION USING A BRUCINE METHOD,
W69-04025 02L

BRICKER, OWEN P.
MINERAL-WATER INTERACTION DURING THE CHEMICAL WEATHERING OF SILICATES,
W69-03724 02K

BROWN, F. STEWART
PROJECTED TRENDS AND REQUIREMENTS IN THE COORDINATED GROWTH OF ELECTRIC POWER SYSTEMS IN THE UNITED STATES,
W69-03774 08C

BROWN, PAUL L.
FERTILIZING DRYLAND SPRING AND WINTER WHEAT IN THE BROWN SOIL ZONE,
W69-03878 03F

BROWN, RICHARD E.
TRIBUTARY AREA DEVELOPMENT TVA'S APPROACH TO SUB-REGIONAL DEVELOPMENT,
W69-04057 06B

BRUNECKE, F.
THE PLANNING, CONSTRUCTION AND OPERATION OF POWER STATIONS IN LARGE INTERCONNECTED SYSTEMS--THE STRATEGY OF LARGE-AREA POWER SUPPLY,
W69-03771 08C

BUCHANAN, JAMES M.
WHAT KIND OF REDISTRIBUTION DO WE WANT,
W69-04075 06B

A NOTE ON PUBLIC GOODS SUPPLY,
W69-04104 06B

BUCHANAN, THOMAS J.
STAGE MEASUREMENT AT GAGING STATIONS,
W69-03721 07B

BURKE, WILLIAM
LAW OF THE RIVER,
W69-03801 06E

BURNHAM, D. E.
HYDROLOGY OF CORNFIELD WASH AREA AND EFFECTS OF LAND-TREATMENT PRACTICES, SANDOVAL COUNTY, NEW MEXICO, 1951-60,
W69-03747 04D

BURMEISTER, EDWIN
A NOTE ON THE GLOBAL STABILITY OF A SIMPLE GROWTH MODEL WITH MANY CAPITAL GOODS,
W69-04087 06B

BUTCHER, WILLIAM S.
DYNAMIC PROGRAMMING FOR PROJECT COST-TIME CURVES,
W69-04137 06C

CAMPBELL, HOWARD
SEASONAL PRECIPITATION AND SCALED QUAIL IN EASTERN NEW MEXICO,
W69-04120 02B

CAMPBELL, RALPH E.
FERTILIZING DRYLAND SPRING AND WINTER WHEAT IN THE BROWN SOIL ZONE,
W69-03878 03F

CARBY, JOHN P.
OPTIMAL WATER QUALITY MANAGEMENT AND MULTI-COMPONENT EFFLUENT CONTROL BY MEANS OF LINEAR PROGRAMMING,
W69-04147 05D

CARPENTER, C. H.
GROUNDWATER CONDITIONS AND GEOLOGIC RECONNAISSANCE IN THE UPPER SEVIER RIVER BASIN, UTAH,
W69-03750 02F

CARRIGAN, P. H., JR.
RADIOACTIVE WASTE DILUTION IN THE CLINCH RIVER, EASTERN TENNESSEE,
W69-03956 05A

CARY, J. W.
WATER FLUX IN MOIST SOIL THERMAL VERSUS SUCTION GRADIENTS,
W69-03883 02G

CEDERGREN, HARRY R.
GEOLOGICAL CONSIDERATIONS IN THE DESIGN OF RESERVOIR SEEPAGE CONTROL SYSTEMS,
W69-03763 08A

CHETTY, V. K.
POOLING OF TIME SERIES AND CROSS SECTION DATA,
W69-04066 06D

CHRIST, CARL F.
A SIMPLE MACROECONOMIC MODEL WITH A GOVERNMENT BUDGET RESTRAINT,
W69-04069 06C

CLARK, ROBERT A.
RESEARCH ON THE MORPHOLOGY OF PRECIPITATION AND RUNOFF IN TEXAS,
W69-04135 02B

CLEAVES, EMERY T.
MINERAL-WATER INTERACTION DURING THE CHEMICAL WEATHERING OF SILICATES,
W69-03724 02K

COFFIN, DONALD L.
GEOLOGY AND GROUNDWATER RESOURCES OF THE BIG SANDY CREEK VALLEY, LINCOLN, CHEYENNE, AND KIOWA COUNTIES, COLORADO,
W69-03974 02F

CONTINI, BRUNO
RESTRICTED BARGAINING FOR ORGANIZATION WITH MULTIPLE OBJECTIVES,
W69-04061 06B

CONVERY, J. J.
NEW APPROACHES TO WASTEWATER TREATMENT,
W69-03746 05D

COOK, RAY L.
MEASURING THE RELATIVE HUMIDITY OF SOILS AT DIFFERENT MOISTURE CONTENTS BY THE GRAY HYDROCAL HYDROMETER,
W69-04130 02G

CRIST, MARVIN A.
GEOLOGY AND GROUNDWATER RESOURCES OF LARAMIE COUNTY, WYOMING,
W69-03979 03F

CROOK, CHARLES B.
DRAINAGE OF AGRICULTURAL LAND AN ANNOTATED BIBLIOGRAPHY OF SELECTED REFERENCES, 1956-1964,
W69-03809 04A

CROW, F. R.
WIND-TUNNEL INVESTIGATION OF AIR FLOW OVER A HEXADECANOL MONOLAYER SPREAD ON A WATER SURFACE,
W69-04125 03B

CURTIS, WILLIE R.
RESPONSE OF SPRINGFLOW TO SOME CLIMATIC VARIABLES IN SOUTHWESTERN WISCONSIN,
W69-04016 02A

DAGAN, G.
A DISCUSSION OF THE DISPERSIVITY TENSOR FOR A TURBULENT UNIFORM CHANNEL FLOW,
W69-03704 02E

DALRYMPLE, TATE
GENERAL FIELD AND OFFICE PROCEDURES FOR INDIRECT DISCHARGE MEASUREMENTS,
W69-03748 07B

MEASUREMENT OF PEAK DISCHARGE BY THE SLOPE-AREA METHOD,
W69-03967 07B

DAVEY, B. G.
DETERMINATION OF THE SOLUBILITY PRODUCT OF SOIL CONSTITUENTS SUCH AS GYPSUM,
W69-04127 02G

DAVIS, WILLIAM B.
INFLUENCE OF FATTY ALCOHOLS AND ACIDS ON THE CLARITY AND BIOTA OF IMPOUNDED RESERVOIRS,
W69-04134 05B

DAVYDOV, A. A.
PROTOTYPE INVESTIGATIONS OF DYNAMICS OF A TRIPLE-RIB OF A PLANE GATE OF THE DAM OF THE XXII CONGRESS CPSU VOLGA HES,
W69-03765 08C

DEAN, ROBERT B.
ULTIMATE DISPOSAL OF WASTE WATER CONCENTRATES TO THE ENVIRONMENT,
W69-03798 05E

DECOOKE, BEN G.
THE GREAT LAKES WATER LEVELS PROBLEM,
W69-03947 02H

DEDEURWAERDER, CHARLES A.
PEOPLE AND WATER,
W69-03953 04C

DEMINT, R. J.
GAS CHROMATOGRAPHIC ANALYSIS OF DALAPON IN WATER,
W69-03755 05A

DERRY, J. A.
THE FUTURE ROLE OF NON-DESTRUCTIVE TESTING,
W69-03787 08G

DOBELL, RODNEY
A NOTE ON THE GLOBAL STABILITY OF A SIMPLE GROWTH MODEL WITH MANY CAPITAL GOODS,
W69-04087 06B

DODSON, CHESTER L.
GEOLOGY AND GROUND-WATER RESOURCES OF THE MURPHY AREA, NORTH CAROLINA,
W69-03959 02F

DOMINY, FLOYD E.
ECONOMIC AND DESIGN CONSIDERATIONS OF THE PACIFIC NORTHWEST-PACIFIC SOUTHWEST INTERTIE,
W69-03776 08C

ROLE OF IRRIGATION IN THE WEST'S EXPANDING ECONOMY,
W69-03940 03F

DUCE, ROBERT A.
SODIUM-TO-CHLORINE RATIO IN HAWAIIAN RAINS AS A FUNCTION OF DISTANCE INLAND AND OF ELEVATION,
W69-03735 02B

DUFFER, WILLIAM R.
PILOT STUDY OF DYNAMICS OF RESERVOIR DESTRATIFICATION,
W69-03960 05G

DUMM, LEE D.
SUBSURFACE DRAINAGE BY TRANSIENT-FLOW THEORY,
W69-03941 02G

DURBIN, ENOCH J.
THEORY OF MEASUREMENT,
W69-03800 07B

DYSART, BENJAMIN C., III
DEVELOPMENT AND APPLICATION OF A RATIONAL WATER QUALITY PLANNING MODEL,
W69-04017 05B

EDWARDS, D. M.
ELECTROKINETIC MEASUREMENTS OF COLLOIDAL-LADEN FLOW THROUGH A SAND COLUMN,
W69-04112 02A

EDWARDS, K. W.
DETERMINATION OF STRONTIUM-90 IN WATER,
W69-03749 05A

EISENHUTH, H. P.
INDEX OF SURFACE-WATER RECORDS TO SEPTEMBER 30, 1967. PART 8- WESTERN GULF OF MEXICO BASINS,
W69-03942 02E

EISNER, ROBERT
INVESTMENT BEHAVIOR AND NEO-CLASSICAL THEORY,
W69-04082 06B

EKELUND, R. B., JR.
JULES DUPUIT AND THE EARLY THEORY OF MARGINAL COST PRICING,
W69-04085 06E

ELATA, C.
CALCULATION OF THE DISPERSION COEFFICIENT IN STRAIGHT PRISMATIC STREAMS,
W69-03705 02E

ELY, NORTHCUTT
THE RELATIONSHIP BETWEEN THE LAWS GOVERNING WATER RIGHTS AND THOSE GOVERNING OTHER NATURAL RESOURCES,
W69-04041 06E

ENGINON, MINE E.
BIOLOGICAL STUDIES OF MANGANESE SOLUTION FROM ITS DIOXIDE,
W69-03725 02H

ENGLAND, CHARLES B.
HYDROLOGIC CHARACTERISTICS OF SOIL TYPES,
W69-04011 02E

CONCEPTS IN HYDROLOGIC SOIL GROUPING,
W69-04013 02G

ENGLAND, C. B.
ISOLATION AND CHARACTERIZATION OF HYDROLOGIC RESPONSE UNITS WITHIN AGRICULTURAL WATERSHEDS,
W69-03879 03F

FALLS, O. B., JR.
ROLE OF HIGHER VOLTAGE TRANSMISSION IN CHANGING ASPECTS OF ENERGY TRANSPORT,
W69-03775 08C

FARNHAM, WILLIAM H.
N Y COMMON LAW AND STATUTORY RIGHTS PROTECTING THE INTERESTS OF THE INDIVIDUAL RIPARIAN OWNER IN THE RECREATIONAL AND AESTHETIC VALUES OF HIS ENVIRONMENT,
W69-04054 06E

FELDSTEIN, M. S.
ON THE MEASURE OF RISK AVERSION,
W69-04094 06D

FERGUSON, C. E.
'INFERIOR FACTORS' AND THE THEORIES OF PRODUCTION AND INPUT DEMAND,
W69-04074 06D

FERREIRA, ANTONIO
NORTHFIELD MOUNTAIN PUMPED STORAGE PROJECT,
W69-03794 08A

FIERING, MYRON B.
SIMULATION OF A NATIONAL FLOOD INSURANCE FUND,
W69-04138 06A

FOGG, C. H.
THE ADVANTAGES OF INCLINED-AXIS HYDROELECTRIC UNITS,
W69-04010 08C

FOWLER, W. B.
RIME AND HOARFROST IN UPPER-SLOPE FORESTS OF EASTERN WASHINGTON,
W69-03807 02I

FRANKEL, M. L.
GROUND WATER AND COMPUTER SIMULATIONS,
W69-04149 02F

FRANK, P. A.
GAS CHROMATOGRAPHIC ANALYSIS OF DALAPON IN WATER,
W69-03755 05A

FREISHIST, A. R.
PROTOTYPE INVESTIGATIONS OF DYNAMICS OF A TRIPLE-RIB OF A PLANE GATE OF THE DAM OF THE XXII CONGRESS CPSU VOLGA HES,
W69-03765 08C

FRITTS, HAROLD C.
TREE-RING ANALYSIS A TOOL FOR WATER RESOURCES RESEARCH,
W69-03963 02A

GARDNER, WILLIAM I.
DAMS AND RESERVOIRS IN PLEISTOCENE-EOLIAN DEPOSIT TERRANE OF NEBRASKA AND KANSAS,
W69-03762 08D

GEORGESCU-ROEGEN, NICHOLAS
REVISITING MARSHALL'S CONSTANCY OF MARGINAL UTILITY OF MONEY,
W69-04086 06B

GERDES, ROBERT H.
MEETING TOMORROW'S ELECTRIC POWER NEEDS--NEW METHODS, NEW CONCEPTS,
W69-03770 06D

GERSTLE, D. F.
DESIGN OF A SPILLWAY DAM ON SHELL PILES AND METHOD OF STATIC CALCULATION OF ITS FOUNDATION,
W69-03766 08D

GIFFORD, GERALD F.
INFLUENCE OF VARIOUS RANGELAND CULTURAL TREATMENTS ON RUNOFF AND SEDIMENT PRODUCTION FROM THE BIG SAGE TYPE, EASTGATE BASIN, NEVADA,
W69-03873 02G

GILCHRIST, JOSEPH T.
DISCHARGE FACILITIES AT HELLS CANYON DAM,
W69-03795 08A

GILE, L. H.
AGE AND COMPARATIVE DEVELOPMENT OF DESERT SOILS AT THE GARDNER SPRING RADIOCARBON SITE, NEW MEXICO,
W69-04126 02J

GIRGIS, R. K.
DISPERSION OF RADIOACTIVE TRACERS IN A MODEL BASIN SANDY AQUIFER,
W69-04111 02F

GODFREY, ANDREW E.
MINERAL-WATER INTERACTION DURING THE CHEMICAL WEATHERING OF SILICATES,
W69-03724 02K

GODSON, RICHARD H.
SEISMIC RESONANCE INVESTIGATION OF A NEAR-SURFACE CAVITY IN ANCHOR RESERVOIR, WYOMING,

W69-03759 08E

GOERING, JOHN J.
NITROGEN FIXATION IN TWO WISCONSIN LAKES,
W69-04026 02H

GOETZ, CHARLES J.
FARMARKED TAXES AND MAJORITY RULE BUDGETARY PROCESS,
W69-04067 06C

GOLDEN, H. G.
WATER AVAILABILITY OF GENEVA COUNTY, ALABAMA,
W69-03733 02E

WATER AVAILABILITY OF BUTLER COUNTY, ALABAMA,
W69-03734 02E

GOL'TSMAN, V. KH.
LATERAL PRESSURE OF EARTH BACKFILL,
W69-03805 08D

GOMEZ, R. J.
WATER REUSE IN MONTERREY, MEXICO,
W69-03717 05D

GRAVES, R. L.
CONTINUOUS AND DISCRETE TIME APPROACHES TO A MAXIMIZATION PROBLEM,
W69-04091 06B

GREENBERG, ARNOLD E.
IDENTIFICATION OF PETROLEUM IN ESTUARINE WATERS,
W69-03738 05B

GREENLAND, D. J.
ADSORPTION OF POLY (VINYL ALCOHOL) BY NATURAL SOIL AGGREGATES,
W69-04108 02A

GRIFFITHS, J. F.
ANOTHER EVAPORATION FORMULA,
W69-04107 02D

GRIGGS, D. T.
THE DENVER EARTHQUAKES,
W69-03802 08E

GUNNER, H. B.
PESTICIDE OCCURRENCE, CONCENTRATION, AND DEGRADATION IN FREE WATER SYSTEMS,
W69-03962 05B

GUPTA, Y. P.
THE BIAS OF LIVIATAN'S CONSISTENT ESTIMATOR IN A DISTRIBUTED LAG MODEL,
W69-04060 06B

HAAS, H. J.
MOISTURE STORAGE AND SPRING WHEAT YIELDS ON LEVEL-BENCH TERRACES AS INFLUENCED BY CONTRIBUTING AREA COVER AND EVAPORATION CONTROL,
W69-03871 03F

HAITH, DOUGLAS ALBERT
VERTICAL ALIGNMENT OF SEWER AND DRAINAGE SYSTEMS BY DYNAMIC PROGRAMMING,
W69-04150 04A

HALLMARK, WILLIAM L.
OREGON'S WATER-MANAGEMENT DISTRICTS,
W69-04034 06E

HANKS, EVA MORREALE
THE LAW OF WATER IN NEW JERSEY,
W69-04055 04A

HANN, ROY W., JR.
DEVELOPMENT OF OPTIMIZATION - SYSTEMS ANALYSIS TECHNIQUES FOR TEXAS WATER RESOURCES,
W69-04133 05B

HANSHAW, B. B.
ON THE MAINTENANCE OF ANOMALOUS FLUID PRESSURES 1. THICK SEDIMENTARY SEQUENCES,
W69-03954 02J

HARLIN, CURTIS C., JR.
PILOT STUDY OF DYNAMICS OF RESERVOIR DESTRATIFICATION,
W69-03960 05G

HART, WILLIAM E.
SURFACE IRRIGATION HYDRAULICS-KINEMATICS,
W69-03936 03F

HAWLEY, J. W.
AGE AND COMPARATIVE DEVELOPMENT OF DESERT SOILS AT THE GARDNER SPRING RADIOCARBON SITE, NEW MEXICO,
W69-04126 02J

HAY, RICHARD L.
CHERT AND ITS SODIUM-SILICATE PRECURSORS IN SODIUM-CARBONATE LAKES OF EAST AFRICA,
W69-03955 02H

HAZZAA, I. B.
DISPERSION OF RADIOACTIVE TRACERS IN A MODEL BASIN SANDY AQUIFER,
W69-04111 02F

HEALY, J. H.
THE DENVER EARTHQUAKES,
W69-03802 08E

HEALY, THOMAS W.
EVAPORATION OF WATER ITS RETARDATION BY MONOLAYERS,
W69-03884 03E

HEATH, MILSON S., JR.
ALTERNATIVE WATER DEMANDS AND THE ADEQUACY OF PRESENT ARRANGEMENTS,
W69-04058 06D

HELLMUTH, ERHART O.
ECO-PHYSIOLOGICAL STUDIES ON PLANTS IN ARID AND SEMI-ARID REGIONS IN WESTERN AUSTRALIA. I. AUTECOLOGY OF EHAGODIA BACCATA (LABILL.) MOQ,
W69-04118 03F

HEM, JOHN D.
ALUMINUM SPECIES IN WATER,
W69-03728 02K

HIGGINS, GEORGE R.
HYDROLOGICAL STUDIES IN MASSACHUSETTS,
W69-04131 02A

HINES, A. G.
EMPIRICAL EVIDENCE ON THE ACCELERATION PRINCIPLE A COMMENT,
W69-04096 06B

HINES, LAWRENCE G.
THE LONG-RUN COST FUNCTION OF WATER PRODUCTION FOR SELECTED WISCONSIN COMMUNITIES,
W69-04136 06C

HINES, MARION S.
WATER RESOURCES OF JACKSON AND INDEPENDENCE COUNTIES, ARKANSAS,
W69-03976 02F

HINES, WILLIAM W.
DEVELOPMENT AND APPLICATION OF A RATIONAL WATER QUALITY PLANNING MODEL,
W69-04017 05B

HOGDAHL, OVE T.
NEUTRON ACTIVATION ANALYSIS OF LANTHANIDE ELEMENTS IN SEA WATER,
W69-03727 02K

HOGG, THOMAS C.
PEOPLE AND WATER,
W69-03953 04C

HOLTAN, H. N.
HYDROLOGIC CHARACTERISTICS OF SOIL TYPES,
W69-04011 02E

CONCEPTS IN HYDROLOGIC SOIL GROUPING,
W69-04013 02G

HORR, ALBERT C.
GEOLOGY AND GROUNDWATER RESOURCES OF THE BIG SANDY CREEK VALLEY, LINCOLN, CHEYENNE, AND KIOWA COUNTIES, COLORADO,
W69-03974 02F

HUGHES, PAUL W.
ECONOMIC AND SOCIAL BENEFITS FROM IMPROVING HEALTH BY PROVISION OF SAFE DRINKING WATER SUPPLIES,
W69-04056 06B

HULSING, HARRY
MEASUREMENT OF PEAK DISCHARGE AT DAMS BY INDIRECT METHODS,
W69-03945 02E

HUME, DAVID N.
THE STRONTIUM AND BARIUM CONTENT OF SEA WATER,
W69-03726 02K

HUMLUM, JOHANNES
WATER DEVELOPMENT AND WATER PLANNING IN THE SOUTHWESTERN UNITED STATES,
W69-03949 06B

HURLEY, PATRICK A.
AUGMENTING COLORADO RIVER BY WEATHER MODIFICATION,
W69-03950 03B

HUTCHINSON, G. L.
NITRATE AND OTHER WATER POLLUTANTS UNDER FIELDS AND FEEDLOTS,
W69-04024 05B

HYMANS, SAUL H.
SIMULTANEOUS CONFIDENCE INTERVALS IN ECONOMETRIC FORECASTING,
W69-04065 06B

IJIRI, YUJI
THE LINEAR AGGREGATION COEFFICIENT AS THE DUAL OF THE LINEAR CORRELATION COEFFICIENT,
W69-04063 06D

INGLE, JAMES C., JR.
THE MOVEMENT OF BEACH SAND,
W69-03754 02J

INGOLS, ROBERT S.
BIOLOGICAL STUDIES OF MANGANESE SOLUTION FROM ITS DIOXIDE,
W69-03725 02H

OHNSON, J. O.
DETERMINATION OF STRONTIUM-90 IN WATER,
W69-03749 05A

OHNSON, R. L.
COLLECTION, CHARACTERIZATION, AND STUDY OF BIODEGRADABILITY AND CHEMICAL OXIDATION OF CARBON-ABSORBED MATERIALS FROM EFFLUENTS FROM SEWAGE TREATMENT PLANTS,
W69-04132 05D

ORSTAD, FINN A.
STABILITY OF ROCK SLOPES IN NORWAY,
W69-03782 08E

ADIYALA, KOTESWARA RAO
A TRANSFORMATION USED TO CIRCUMVENT THE PROBLEM OF AUTOCORRELATION,
W69-04101 06B

AFOGLIS, MILTON Z.
A NOTE ON PUBLIC GOODS SUPPLY,
W69-04104 06B

AGAN, YA YA
LOCATION OF THE SOURCES OF SEISMOACOUSTIC PULSES,
W69-04008 08E

AHAN, ARCHIE M.
A PROGRESS REPORT ON PROJECT SKYWATER THE BUREAU OF RECLAMATION'S ATMOSPHERIC WATER RESOURCES PROGRAM,
W69-03769 03B

AHN, LLOYD
DETERMINATION OF NITRATE IN ESTUARINE WATERS AUTOMATIC DETERMINATION USING A BRUCINE METHOD,
W69-04025 02L

ALISH, RICHARD J.
METROPOLITAN RESOURCES IN A POLICY MATRIX,
W69-04099 06B

ALMAN, PETER JASON
THEORY OF CONSUMER BEHAVIOR WHEN PRICES ENTER THE UTILITY FUNCTION,
W69-04079 06D

ATZNER, DONALD W.
A NOTE ON THE DIFFERENTIABILITY OF CONSUMER DEMAND FUNCTIONS,
W69-04080 06D

EENE, K. L.
COMMENT, EMINENT DOMAIN - UNITED STATES V RANDS, 88 S CT 265 (1967),
W69-04044 06E

EMPER, W. D.
NITRATE AND OTHER WATER POLLUTANTS UNDER FIELDS AND FEEDLOTS,
W69-04024 05B

HONIKEVICH, A. A.
DEACTIVATION OF WASTE WATERS FROM RADIOCHEMICAL LABORATORIES AND ATOMIC REACTORS (RUSSIAN),
W69-03964 05D

IAERNSLI, B.
GENERAL PROCEDURE IN INVESTIGATION, DESIGN AND CONTROL DURING CONSTRUCTION OF EARTH- AND ROCK FILL DAMS IN NORWAY,
W69-03778 08D

LAPPHOLZ, KURT
WHAT REDISTRIBUTION MAY ECONOMISTS DISCUSS,
W69-04076 06B

ONVIZ, V. S.
PLAN FOR UTILIZING THE WATER RESOURCES OF THE UPPER KUBAN',
W69-03767 03F

RISHNAN, A.
A METHOD OF DETERMINING HYDRAULIC CONDUCTIVITY CHARACTERISTICS FOR NON-SWELLING SOILS IN SITU, AND OF CALCULATING EVAPORATION FROM BARE SOIL,
W69-04114 02G

RIZ, GEORGE J.
MODEL STUDY OF BOUNDARY EFFECTS ON DITCH DRAINAGE,
W69-03938 02G

RUEGER, D. B.
THE EFFECT OF SOIL-MINERAL WEATHERING ON THE SODIUM HAZARD OF IRRIGATION WATERS,
W69-03792 03C

RUEGER, R. B.
THE CONVENTION OF THE CONTINENTAL SHELF AND THE NEED FOR ITS REVISION AND SOME COMMENTS REGARDING THE REGIME FOR THE LAND BEYOND,
W69-04042 06E

JGA, KIYOSHI
A NOTE ON THE GLOBAL STABILITY OF A SIMPLE GROWTH MODEL WITH MANY CAPITAL GOODS,
W69-04087 06B

ABADIE, JOHN WOODSON
OPTIMAL IDENTIFICATION OF NONLINEAR HYDROLOGIC SYSTEM RESPONSE MODELS BY QUASILINEARIZATION,
W69-03958 02A

AMARCHE, VALMORE C., JR.
RATES OF SLOPE DEGRADATION AS DETERMINED FROM BOTANICAL EVIDENCE, WHITE MOUNTAINS, CALIFORNIA,
W69-03943 02J

LAMBERT, J. R.
GEOLOGY OF CLEMSON RESEARCH WATERSHED,
W69-04018 02G

LAMER, VICTOR K.
EVAPORATION OF WATER ITS RETARDATION BY MONOLAYERS,
W69-03884 03B

LAMOREAUX, P. E.
MINERAL AND WATER RESOURCES OF BARBOUR COUNTY, ALABAMA,
W69-03952 02E

LANEY, R. L.
GEOLOGY AND GROUND-WATER RESOURCES OF THE MURPHY AREA, NORTH CAROLINA,
W69-03959 02F

LAVIN, ALLEN S.
INDUSTRIAL WASTES ORDINANCE ENFORCEMENT HELPS ABATE POLLUTION AT CHICAGO,
W69-04053 05G

LEACH, LOWELL E.
PILOT STUDY OF DYNAMICS OF RESERVOIR DESTRATIFICATION,
W69-03960 05G

LEE, FRED N.
EVAPORATION STUDY AT SHARP STATION POND NEAR BATON ROUGE, LOUISIANA,
W69-03731 02D

LEE, THEODORE R.
ACQUISITION OF RIPARIAN RIGHTS IN NEW YORK,
W69-04051 06E

LELAND, HAYNE E.
SAVING AND UNCERTAINTY THE PRECAUTIONARY DEMAND FOR SAVING,
W69-04077 06D

LEVHARI, DAVID
A NOTE ON HOUTHAKKER'S AGGREGATE PRODUCTION FUNCTION IN A MULTIFIRM INDUSTRY,
W69-04064 06B

LEWIS, DAVID C.
GEOPHYSICAL, ISOTOPE AND TRACER TECHNIQUES IN WATERSHED RESEARCH,
W69-04119 02A

LINSLEY, RAY K.
THE RELATION BETWEEN RAINFALL AND RUNOFF,
W69-03890 02A

LONG, WILLIAM N.
ECONOMIC AND SOCIAL BENEFITS FROM IMPROVING HEALTH BY PROVISION OF SAFE DRINKING WATER SUPPLIES,
W69-04056 06B

LOVE, S. K.
QUALITY OF SURFACE WATERS FOR IRRIGATION, WESTERN STATES, 1963,
W69-03968 02E

LOWMAN, PAUL D., JR.
GEOLOGIC ORBITAL PHOTOGRAPHY EXPERIENCE FROM THE GEMINI PROGRAM,
W69-03784 07B

LOWRY, MARLIN E.
GEOLOGY AND GROUNDWATER RESOURCES OF LARAMIE COUNTY, WYOMING,
W69-03979 03F

LUCP, CHARLES F.
THE DEVELOPMENT OF OCEAN MINERALS AND THE LAW OF THE SEA,
W69-04049 06E

LULL, HOWARD W.
PROCEEDINGS INTERNATIONAL SYMPOSIUM ON FOREST HYDROLOGY.
W69-03806 02A

INCREASING WATER YIELD IN THE NORTHEAST BY MANAGEMENT OF FORESTED WATERSHEDS,
W69-03980 03B

LULL, S. HALE
NORTHFIELD MOUNTAIN PUMPED STORAGE PROJECT,
W69-03794 08A

MACIOLEK, J. A.
ABUNDANCE AND CHARACTER OF MICROSESTON IN A CALIFORNIA MOUNTAIN STREAM,
W69-04031 02E

MACRITCHIE, F.
EVAPORATION RETARDED BY MONOLAYERS,
W69-03722 03B

MACUMBER, JENNIFER J.
MINERAL SPRINGS OF THE DAYLESFORD DISTRICT,
W69-03933 02K

MAEHLER, CLAUDE Z.
IDENTIFICATION OF PETROLEUM IN ESTUARINE WATERS,
W69-03738 05B

MAGLEBY, DAVID C.
LAND SUBSIDENCE IN PLEASANT VALLEY AREA, FRESNO COUNTY, CALIF.,
W69-03797 02F

MALONEY, FRANK E.
MULTIPLE INTERESTS IN RIPARIAN LAND, SUBDIVISION PLATTING, AND THE ALLOCATION OF RIPARIAN RIGHTS,
W69-04040 06E

MANIATIS, GEORGE C.
QUANTITATIVE VS. QUALITATIVE STANDARDS FOR EVALUATING MANAGERIAL EFFICIENCY IN PUBLIC UNDERTAKINGS,
W69-04068 06B

MANOHAR, MAN SINGH
A MICROPSYCHROMETER TO MEASURE WATER POTENTIALS OF INTACT PLANT MATERIAL,
W69-04109 02I

MATALUCCI, R. V.
INFRARED AERIAL SURVEYS IN ENVIRONMENTAL ENGINEERING,
W69-03744 07B

MATLOCK, WILLIAM G.
EVAPORATION FROM AN EPHEMERAL STREAMBED,
W69-03874 02G

MATTHAI, HOWARD F.
MEASUREMENT OF PEAK DISCHARGE AT WIDTH CONTRACTIONS BY INDIRECT METHODS,
W69-03753 07B

MCGREGOR, DON L.
AXENIC CULTURE AND NUTRITIONAL STUDIES OF AQUATIC MACROPHYTES,
W69-04027 02H

MCLAUGHLIN, R. J. W.
MINERAL SPRINGS OF THE DAYLESFORD DISTRICT,
W69-03933 02K

MCNULTY, PAUL J.
ECONOMIC THEORY AND THE MEANING OF COMPETITION,
W69-04084 06B

MELSOM, SIGURD
NEUTRON ACTIVATION ANALYSIS OF LANTHANIDE ELEMENTS IN SEA WATER,
W69-03727 02K

MESTELMAN, STUART
A NOTE ON THE SYMMETRY BETWEEN BRIBES AND CHARGES,
W69-04071 06C

METZGER, IVAN
EFFECTS OF TEMPERATURE ON STREAM AERATION,
W69-03742 05G

MICKELSON, ROME H.
CONSERVATION BENCH TERRACES IN EASTERN COLORADO,
W69-03880 03F

LEVEL PAN CONSTRUCTION FOR DIVERTING AND SPREADING RUNOFF,
W69-03881 03F

MICKELSON, R. H.
SOIL WATER TRANSLOCATION IN A HIGH WATER TABLE AREA,
W69-04124 02G

MIELKE, L. N.
A SYSTEM FOR SHORT INTERVAL MEASUREMENT OF EVAPOTRANSPIRATION,
W69-04110 02D

MILLER, C. W.
PESTICIDE OCCURRENCE, CONCENTRATION, AND DEGRADATION IN FREE WATER SYSTEMS,
W69-03962 05B

MILLER, HOWARD
FUTURE IRRIGATION DEMAND IN THE SUSQUEHANNA BASIN,
W69-03934 03F

MIZONOV, A. V.
CONDITION OF JOINTS IN MASSIVE CONCRETE STRUCTURES DETERMINED BY ULTRASONICS,
W69-03799 08F

MONKE, E. J.
ELECTROKINETIC MEASUREMENTS OF COLLOIDAL-LADEN FLOW THROUGH A SAND COLUMN,
W69-04112 02A

MORISHIMA, MICHIO
AN INPUT-OUTPUT SYSTEM INVOLVING NON-TRANSFERABLE GOODS,
W69-04090 06D

MOWER, R. W.
GROUNDWATER DISCHARGE TOWARD GREAT SALT LAKE THROUGH VALLEY FILL IN THE JORDAN VALLEY, UTAH,
W69-03739 02F

MURATA, YASUO
AN INPUT-OUTPUT SYSTEM INVOLVING NON-TRANSFERABLE GOODS,
W69-04090 06D

MYERS, JOEL N.
PSG,
W69-03786 02B

NADIRI, M. I.
INVESTMENT BEHAVIOR AND NEO-CLASSICAL THEORY,
W69-04082 06B

NAGAR, A. L.
THE BIAS OF LIVIATAN'S CONSISTENT ESTIMATOR IN A DISTRIBUTED LAG MODEL,
W69-04060 06B

NASLUND, B.
SOME EFFECTS OF TAXES ON RISK TAKING,
W69-04097 06B

NEESS, JOHN C.
NITROGEN FIXATION IN TWO WISCONSIN LAKES,
W69-04026 02H

NELSON, DEWITT
PEOPLE AND WATER,
W69-03953 04C

NELSON, ROBERT Y.
MODEL OF OPTIMAL COMBINATION OF TREATMENT AND DILUTION,
W69-04144 05D

NEWPORT, T. G.
WATER RESOURCES OF THE MARQUETTE IRON RANGE AREA, MICHIGAN,
W69-03971 06D

NEWTON, J. G.
MINERAL AND WATER RESOURCES OF BARBOUR COUNTY, ALABAMA,
W69-03952 02E

NIKAIDO, HUKUKANE
INCOME DISTRIBUTION AND GROWTH IN A MONOPOLIST ECONOMY,
W69-04072 06C

NIKOL'SKII, A. S.
CONDITION OF JOINTS IN MASSIVE CONCRETE STRUCTURES DETERMINED BY ULTRASONICS,
W69-03799 08F

NOMURA, LEWIS H.
FISHERIES JURISDICTION BEYOND THE TERRITORIAL SEA - WITH SPECIAL REFERENCE TO THE POLICY OF THE UNITED STATES,
W69-04046 06E

OERTLI, J. J.
EFFECTS OF EXTERNAL SALT CONCENTRATIONS ON WATER RELATIONS IN PLANTS I. ABSENCE OF OSMOTIC ADJUSTMENT IN THE ROOT XYLEM,
W69-04113 02I

OKUSA, SHIGEYASU
STRENGTH AND EARTH PRESSURE OF ROCK WITH WEAK PLANES,
W69-03768 08E

OLCOTT, PERRY G.
WATER RESOURCES OF WISCONSIN, FOX-WOLF RIVER BASIN,
W69-03939 02E

OLINGER, LAWRENCE W.
THE EFFECT OF INDUCED TURBULENCE ON THE GROWTH OF ALGAE,
W69-03730 05C

ONSTAD, C. A.
ISOLATION AND CHARACTERIZATION OF HYDROLOGIC RESPONSE UNITS WITHIN AGRICULTURAL WATERSHEDS,
W69-03879 03F

ORTOLANO, LEONARD
AN EXAMINATION OF NON-TREATMENT PLANT ALTERNATIVES IN WATER POLLUTION CONTROL,
W69-04142 05D

OTTS, LOUIS E., JR.
WATER REQUIREMENTS OF THE IRON AND STEEL INDUSTRY,
W69-03965 06D

PAIR, CLAUDE H.
WATER DISTRIBUTION UNDER SPRINKLER IRRIGATION,
W69-03892 03F

PARKER, P. L.
HYDROCARBONS OF BLUE-GREEN ALGAE GEOCHEMICAL SIGNIFICANCE,
W69-04021 02K

PAUSZEK, F. H.
CREEKS, BROOKS AND RIVERS IN ROCKLAND COUNTY, NEW YORK AND THEIR RELATION TO PLANNING FOR THE FUTURE,
W69-04036 06D

PEARSALL, W. H.
LIGHT PENETRATION INTO FRESH WATER,
W69-04020 02H

PECK, N. H.
A SYSTEM FOR SHORT INTERVAL MEASUREMENT OF EVAPOTRANSPIRATION,
W69-04110 02D

PETERSON, DEAN F.
MAN AND HIS WATER RESOURCE,
W69-04035 06D

PETTYJOHN, WAYNE A.
GEOHYDROLOGY OF THE SOURIS RIVER VALLEY IN THE VICINITY OF MINOT, NORTH DAKOTA,
W69-03969 02F

PFISTERER, E.

HOTZENWALD PUMPED-STORAGE SCHEME,
W69-03789 08A

PHILLIPS, JOHN E.
THE ECOLOGICAL ROLE OF PHOSPHORUS IN WATERS WITH SPECIAL REFERENCE TO MICROORGANISMS,
W69-04023 05C

PIPKIN, BERNARD W.
ANALYSIS OF WEDGE FAILURES IN LAYERED ROCKS,
W69-03761 08E

PLAGER, SHELDON
MULTIPLE INTERESTS IN RIPARIAN LAND, SUBDIVISION PLATTING, AND THE ALLOCATION OF RIPARIAN RIGHTS,
W69-04040 06E

PLOTT, CHARLES R.
A NOTE ON THE SYMMETRY BETWEEN BRIBES AND CHARGES,
W69-04071 06C

PLUHOWSKI, E. J.
A WATER-BALANCE EQUATION FOR THE RATHDRUM PRAIRIE GROUND-WATER RESERVOIR, NEAR SPOKANE, WASHINGTON,
W69-03740 02E

POCHTOVIK, G. YA.
CONDITION OF JOINTS IN MASSIVE CONCRETE STRUCTURES DETERMINED BY ULTRASONICS,
W69-03799 08F

POLAVARAPU, R. J.
SOME STUDIES OF SENSIBLE AND LATENT HEAT FLUXES AT WALTAIR, SOUTHEASTERN COAST OF INDIA,
W69-03887 02G

PORGES, RALPH
WATER QUALITY MANAGEMENT IN THE DELAWARE RIVER BASIN (FEDERAL AND INTERSTATE COMPACT TO SOLVE POLLUTION PROBLEMS),
W69-04039 05G

POSTON, H. W.
WATER POLLUTION IN THE GREAT LAKES BASIN,
W69-03948 05B

POWELL, W. J.
MINERAL AND WATER RESOURCES OF BARBOUR COUNTY, ALABAMA,
W69-03952 02E

PREUL, H. C.
CONTAMINANTS IN GROUNDWATERS NEAR WASTE STABILIZATION PONDS,
W69-03718 05B

PRICE, DON
GEOLOGY AND WATER RESOURCES IN THE FRENCH PRAIRIE AREA, NORTHERN WILLAMETTE VALLEY, OREGON,
W69-03977 03F

PROKOPOVICH, NIKOLA P.
LAND SUBSIDENCE IN PLEASANT VALLEY AREA, FRESNO COUNTY, CALIF.,
W69-03797 02F

PUROHIT, K. G.
THE GREAT INDIAN DESERT. PERSPECTIVES IN THE ECOLOGY AND PHYSIOLOGY OF SMALL DESERT MAMMALS,
W69-03889 02I

QUIRK, J. P.
ADSORPTION OF POLY (VINYL ALCOHOL) BY NATURAL SOIL AGGREGATES,
W69-04108 02A

RADER, TROUT
NORMALLY, FACTOR INPUTS ARE NEVER GROSS SUBSTITUTES,
W69-04073 06D

RADNER, ROY
COMPETITIVE EQUILIBRIUM UNDER UNCERTAINTY,
W69-04078 06D

RANCE, JOAN M.
DETERMINATION OF THE SOLUBILITY PRODUCT OF SOIL CONSTITUENTS SUCH AS GYPSUM,
W69-04127 02G

REEB, DONALD J.
METROPOLITAN RESOURCES IN A POLICY MATRIX,
W69-04099 06B

REED, M. J.
THE EFFECT OF SOIL-MINERAL WEATHERING ON THE SODIUM HAZARD OF IRRIGATION WATERS,
W69-03792 03C

REED, P. C.
WATER AVAILABILITY OF BUTLER COUNTY, ALABAMA,
W69-03734 02E

REFAEI, S. M.
DISPERSION OF RADIOACTIVE TRACERS IN A MODEL BASIN SANDY AQUIFER,
W69-04111 02F

REHMAN, ATA-UR-
ANALYSIS OF AQUIFER TESTS IN THE PUNJAB REGION OF WEST PAKISTAN,
W69-03975 02F

REID, GEORGE W.
MODEL OF OPTIMAL COMBINATION OF TREATMENT AND DILUTION,
W69-04144 05D

REINHART, KENNETH G.
INCREASING WATER YIELD IN THE NORTHEAST BY MANAGEMENT OF FORESTED WATERSHEDS,
W69-03980 03B

REYNOLDS, TOM D.
INFLUENCE OF FATTY ALCOHOLS AND ACIDS ON THE CLARITY AND BIOTA OF IMPOUNDED RESERVOIRS,
W69-04134 05B

RHOADES, J. D.
MINERAL-WEATHERING CORRECTION FOR ESTIMATING THE SODIUM HAZARD OF IRRIGATION WATERS,
W69-03791 03C

THE EFFECT OF SOIL-MINERAL WEATHERING ON THE SODIUM HAZARD OF IRRIGATION WATERS,
W69-03792 03C

LEACHING REQUIREMENT FOR EXCHANGEABLE-SODIUM CONTROL,
W69-04012 02G

RICE, R. C.
SALT PENETRATION TECHNIQUE FOR SEEPAGE MEASUREMENT,
W69-03935 04A

RICHARDSON, DONALD
GLACIER OUTBURST FLOODS IN THE PACIFIC NORTHWEST,
W69-03741 02C

RINEHART, JOHN S.
THERMAL AND SEISMIC INDICATIONS OF OLD FAITHFUL GEYSER'S INNER WORKINGS,
W69-03737 02F

ROBINSON, G. B., JR.
GROUNDWATER CONDITIONS AND GEOLOGIC RECONNAISSANCE IN THE UPPER SEVIER RIVER BASIN, UTAH,
W69-03750 02F

ROCHESTER, EUGENE W.
MODEL STUDY OF BOUNDARY EFFECTS ON DITCH DRAINAGE,
W69-03938 02G

ROSE, C. W.
WATER TRANSPORT IN SOIL WITH A DAILY TEMPERATURE WAVE I THEORY AND EXPERIMENT,
W69-03869 02G

WATER TRANSPORT IN SOIL WITH A DAILY TEMPERATURE WAVE II ANALYSIS,
W69-03870 02G

A METHOD OF DETERMINING HYDRAULIC CONDUCTIVITY CHARACTERISTICS FOR NON-SWELLING SOILS IN SITU, AND OF CALCULATING EVAPORATION FROM BARE SOIL,
W69-04114 02G

RUBEY, W. W.
THE DENVER EARTHQUAKES,
W69-03802 08E

RUBIN, J.
THEORETICAL ANALYSIS OF TWO-DIMENSIONAL, TRANSIENT FLOW OF WATER IN UNSATURATED AND PARTLY UNSATURATED SOILS,
W69-03736 02G

RUDYK, M. A.
PROTOTYPE INVESTIGATIONS OF DYNAMICS OF A TRIPLE-RIB OF A PLANE GATE OF THE DAM OF THE XXII CONGRESS CPSU VOLGA HES,
W69-03765 08C

RUSSELL, J. S.
NITROGEN FERTILIZER AND WHEAT IN A SEMI-ARID ENVIRONMENT 4 EMPIRICAL YIELD RESPONSE MODELS AND ECONOMIC FACTORS,
W69-03877 03F

RYDELL, PETER C.
A NOTE ON A LOCATION PRINCIPLE,
W69-04095 06C

SANDOVAL, F. M.
SOIL-SALINITY CHANGES WITH FALLOW AND A STRAW MULCH ON FALLOW,
W69-04116 02I

SOIL WATER TRANSLOCATION IN A HIGH WATER TABLE AREA,
W69-04124 02G

SAPKAREV, J. A.
THE TAXONOMY AND ECOLOGY OF LEECHES (HIRUDINEA) OF LAKE MENDOTA, WISCONSIN,
W69-04028 02H

SARTZ, RICHARD S.
RAINFALL DISTRIBUTION OVER DISSECTED TERRAIN IN SOUTHWESTERN WISCONSIN,
W69-04014 02B

WINTER THAWS CAN RAISE GROUND WATER LEVELS IN DRIFTLESS AREA,
W69-04015 02F

SAX, JOSEPH L.
WATER LAW, PLANNING AND POLICY CASES AND MATERIALS,
W69-04037 06E

SCHAAKE, JOHN C., JR.

SIMULATION OF A NATIONAL FLOOD INSURANCE FUND,
W69-04138 06A

SCHRODER, K.
THE PLANNING, CONSTRUCTION AND OPERATION OF POWER STATIONS IN LARGE INTERCONNECTED SYSTEMS--THE STRATEGY OF LARGE-AREA POWER SUPPLY,
W69-03771 08C

SCHUMM, S. A.
RIVER ADJUSTMENT TO ALTERED HYDROLOGIC REGIMEN-MURRUMBIDGEE RIVER AND PALEOCHANNELS, AUSTRALIA,
W69-03957 02J

SCHWIESOW, W. F.
WIND-TUNNEL INVESTIGATION OF AIR FLOW OVER A HEXADECANOL MONOLAYER SPREAD ON A WATER SURFACE,
W69-04125 03B

SCITOVSKY, TIBOR
ON THE PRINCIPLE OF CONSUMERS' SOVEREIGNTY,
W69-04083 06B

SCOTT, J. C.
WATER AVAILABILITY OF GENEVA COUNTY, ALABAMA,
W69-03733 02E

WATER AVAILABILITY OF BUTLER COUNTY, ALABAMA,
W69-03734 02E

SETO, YUK-BON
SODIUM-TO-CHLORINE RATIO IN HAWAIIAN RAINS AS A FUNCTION OF DISTANCE INLAND AND OF ELEVATION,
W69-03735 02B

SHANHOLTZ, VERNON O.
CONCEPTS IN HYDROLOGIC SOIL GROUPING,
W69-04013 02G

SHANNON, ASA V.
THE ADVANTAGES OF INCLINED-AXIS HYDROELECTRIC UNITS,
W69-04010 08C

SHEIKH, IJAZ AHMED
ANALYSIS OF AQUIFER TESTS IN THE PUNJAB REGION OF WEST PAKISTAN,
W69-03975 02F

SHIROKOVA, YE I
FOCAL MECHANISM OF THE EARTHQUAKE OF JULY 26, 1963, AT SKOPJE,
W69-04009 08A

SHU, TUNG CHU
AN ANALYTIC APPROACH TO DETERMINE IRRIGATION SPRINKLER SPACING,
W69-04121 03F

SILVEY, WILLIAM D.
OCCURRENCE OF SELECTED MINOR ELEMENTS IN THE WATERS OF CALIFORNIA,
W69-03966 02K

SIPLE, GEORGE E.
GEOLOGY AND GROUNDWATER OF THE SAVANNAH RIVER PLANT AND VICINITY, SOUTH CAROLINA,
W69-03970 02F

SKAU, C. M.
INFLUENCE OF VARIOUS RANGELAND CULTURAL TREATMENTS ON RUNOFF AND SEDIMENT PRODUCTION FROM THE BIG SAGE TYPE, EASTGATE BASIN, NEVADA,
W69-03873 02G

SKINNER, E. L.
WATER RESOURCES OF THE MARQUETTE IRON RANGE AREA, MICHIGAN,
W69-03971 06D

SKINNER, M. M.
REDUCING CAVITATION IN VALVES,
W69-03757 08C

SMITHIES, ARTHUR
THE PLANNING-PROGRAMMING-BUILDING-BUDGETING SYSTEM,
W69-04092 06B

SMITH, W. E.
MINERAL AND WATER RESOURCES OF BARBOUR COUNTY, ALABAMA,
W69-03952 02E

SMITS, L. J. M.
SP LOG INTERPRETATION IN SHALY SANDS,
W69-03946 07B

SOKOLOV, A. A.
COMPILATION OF THE MAXIMUM STREAMFLOWS OF SNOWMELT WATERS IN USSR RIVERS (RUSSIAN),
W69-03981 02E

SOMERS, WILLIAM P.
STAGE MEASUREMENT AT GAGING STATIONS,
W69-03721 07B

SOPPER, WILLIAM E.
PROCEEDINGS INTERNATIONAL SYMPOSIUM ON FOREST HYDROLOGY.
W69-03806 02A

SORBY, MICHAEL L.
EVAPORATION FROM AN EPHEMERAL STREAMBED,
W69-03874 02G

SPENGLER, JOSEPH J.
MEGALOPOLIS RESOURCE CONSERVER OR RESOURCE WASTER,
W69-04098 06B

SPRINGFIELD, H. W.
GERMINATION OF WINTERFAT SEEDS UNDER DIFFERENT MOISTURE STRESSES AND TEMPERATURES,
W69-04129 02I

STEIN, BRUNO
THE CONSTRAINED DEMAND FOR PUBLIC ASSISTANCE,
W69-04093 06D

STENBURG, R. L.
NEW APPROACHES TO WASTEWATER TREATMENT,
W69-03746 05D

STEPHAN, D. G.
WASTEWATER REUSE--HAS IT 'ARRIVED,'
W69-03719 05D

STEPHENS, J. W.
WATER RESOURCES OF JACKSON AND INDEPENDENCE COUNTIES, ARKANSAS,
W69-03976 02F

STEVENS, D. B.
WASTEWATER REUSE,
W69-03716 05D

STEWART, B. A.
NITRATE AND OTHER WATER POLLUTANTS UNDER FIELDS AND FEEDLOTS,
W69-04024 05B

STOCKNER, JOHN G.
THE SUCCESSION OF DIATOM ASSEMBLAGES IN THE RECENT SEDIMENTS OF LAKE WASHINGTON,
W69-04029 05C

STRATTON, FRANK E.
AMMONIA NITROGEN LOSSES FROM STREAMS,
W69-03745 05B

STREEBIN, LEALE E.
MODEL OF OPTIMAL COMBINATION OF TREATMENT AND DILUTION,
W69-04144 05D

STRELKOFF, THEODOR
SURFACE IRRIGATION HYDRAULICS-KINEMATICS,
W69-03936 03F

SWANSON, C. L.
NEW APPROACHES TO WASTEWATER TREATMENT,
W69-03746 05D

TANNER, C. B.
HYDRAULIC LOAD-CELL LYSIMETER, CONSTRUCTION, CALIBRATION, AND TESTS,
W69-03793 07B

TAYLOR, FLOYD B.
ECONOMIC AND SOCIAL BENEFITS FROM IMPROVING HEALTH BY PROVISION OF SAFE DRINKING WATER SUPPLIES,
W69-04056 06B

TELSER, L. G.
CONTINUOUS AND DISCRETE TIME APPROACHES TO A MAXIMIZATION PROBLEM,
W69-04091 06B

TERZIDIS, GEORGE
COMPUTATIONAL SCHEMES FOR THE BOUSSINESQ EQUATION,
W69-03937 07C

THOMAS, C. A.
A WATER-BALANCE EQUATION FOR THE RATHDRUM PRAIRIE GROUND-WATER RESERVOIR, NEAR SPOKANE, WASHINGTON,
W69-03740 02E

THOMAS, HAROLD A., JR.
AN EXAMINATION OF NON-TREATMENT PLANT ALTERNATIVES IN WATER POLLUTION CONTROL,
W69-04142 05D

THURTELL, G. W.
HYDRAULIC LOAD-CELL LYSIMETER, CONSTRUCTION, CALIBRATION, AND TESTS,
W69-03793 07B

TORBLAA, I.
GROUTING OF THE LIMESTONE FOUNDATION FOR THE ARSTADDALEN DAM,
W69-03777 08D

TREZZA, BRUNO
ON PERVERSE CONSUMPTION PATTERNS,
W69-04089 06D

TULLIS, J. PAUL
REDUCING CAVITATION IN VALVES,
W69-03757 08C

TURNBULL, W. J.
CONSTRUCTION PROBLEMS EXPERIENCED WITH LOESS SOILS,
W69-03803 08D

TYLDESLEY, J. B.
MEASUREMENT OF NATURAL EVAPORATION COMPARISON OF GRAVIMETRIC AND AERODYNAMIC METHODS,
W69-03891 02D

LYOTT, PHILIP
LIGHT PENETRATION INTO FRESH WATER,
W69-04020 02H

N BAALEN, CHASE
HYDROCARBONS OF BLUE-GREEN ALGAE GEOCHEMICAL SIGNIFICANCE,
W69-04021 02K

N SLYKE, R. M.
OPTIMAL WATER QUALITY MANAGEMENT AND MULTI-COMPONENT
EFFLUENT CONTROL BY MEANS OF LINEAR PROGRAMMING,
W69-04147 05D

RS, RAYMOND C.
PEOPLE AND WATER,
W69-03953 04C

ETS, F. G., JR.
NITRATE AND OTHER WATER POLLUTANTS UNDER FIELDS AND
FEEDLOTS,
W69-04024 05B

NOD, H. D.
ECONOMETRICS OF JOINT PRODUCTION,
W69-04070 06B

TTUM, M. T.
A SYSTEM FOR SHORT INTERVAL MEASUREMENT OF
EVAPOTRANSPIRATION,
W69-04110 02D

GELY, WILLIAM A.
ANALYTICAL USES OF ENERGY BALANCES,
W69-03772 06B

N STARCK, ERNEST R.
WATER PROBLEMS IN THE NORTHEAST AND INCREASING FEDERAL
REGULATION,
W69-04052 06E

SS, JUSTIN
MEGALOPOLIZATION AND LEISURE A COMMENT,
W69-04100 06B

LLING, FAULKNER B.
WATER REQUIREMENTS OF THE IRON AND STEEL INDUSTRY,
W69-03965 06D

LTER, CARL M.
STATISTICAL APPROACH TO ESTUARINE BEHAVIOR,
W69-03732 05B

STLER, T. A.
STATISTICAL APPROACH TO ESTUARINE BEHAVIOR,
W69-03732 05B

TKINS, JOEL S.
SEISMIC RESONANCE INVESTIGATION OF A NEAR-SURFACE CAVITY IN
ANCHOR RESERVOIR, WYOMING,
W69-03759 08E

BER, EUGENE W.
FUNCTIONS OF THE INTERNATIONAL JOINT COMMISSION,
W69-03796 06E

BER, GLEN D.
TRIBUTARY AREA DEVELOPMENT TVA'S APPROACH TO SUB-REGIONAL
DEVELOPMENT,
W69-04057 06B

IL, ROMAN L., JR.
THE DECOMPOSITION OF ECONOMIC PRODUCTION SYSTEMS,
W69-04103 06B

INBERGER, L. W.
WASTEWATER REUSE--HAS IT 'ARRIVED,'
W69-03719 05D

LSH, MATTHEW
INTERNATIONAL JOINT COMMISSION - UNITED STATES AND CANADA,
W69-03815 06E

STLING, ARNOLD M.
PEOPLE AND WATER,
W69-03953 04C

TZEL, ROBERT G.
AXENIC CULTURE AND NUTRITIONAL STUDIES OF AQUATIC
MACROPHYTES,
W69-04027 02H

HELAN, D. E.
HYDROLOGIC CHARACTERISTICS OF SOIL TYPES,
W69-04011 02E

HITE, GILBERT F.
WATER AND CHOICE IN THE COLORADO BASIN,
W69-03785 06D

WIDMER, KEMBLE
GEOLOGY AS A GUIDE TO REGIONAL ESTIMATES OF THE WATER
RESOURCE,
W69-03961 02F

WIITALA, S. W.
WATER RESOURCES OF THE MARQUETTE IRON RANGE AREA, MICHIGAN,
W69-03971 06D

WILLIAMS, B. G.
ADSORPTION OF POLY (VINYL ALCOHOL) BY NATURAL SOIL
AGGREGATES,
W69-04108 02A

WILLIAMS, JOHN R.
AVAILABILITY OF GROUND WATERS IN THE NORTHERN PART, TENMILE
AND TAUNTON RIVER BASINS, SOUTHEASTERN MASSACHUSETTS,
W69-03723 02F

WILLIS, W. O.
MOISTURE STORAGE AND SPRING WHEAT YIELDS ON LEVEL-BENCH
TERRACES AS INFLUENCED BY CONTRIBUTING AREA COVER AND
EVAPORATION CONTROL,
W69-03871 03F

SOIL-SALINITY CHANGES WITH FALLOW AND A STRAW MULCH ON
FALLOW,
W69-04116 02I

SOIL WATER TRANSLOCATION IN A HIGH WATER TABLE AREA,
W69-04124 02G

WILSON, JAMES F., JR.
FLUOROMETRIC PROCEDURES FOR DYE TRACING,
W69-03944 07B

WILSON, T. V.
GEOLOGY OF CLEMSON RESEARCH WATERSHED,
W69-04018 02G

WINKLER, ERHARD M.
FROST DAMAGE TO STONE AND CONCRETE GEOLOGICAL
CONSIDERATIONS,
W69-03804 08F

WINTERS, KENNETH
HYDROCARBONS OF BLUE-GREEN ALGAE GEOCHEMICAL SIGNIFICANCE,
W69-04021 02K

WOODCOCK, ALFRED H.
SODIUM-TO-CHLORINE RATIO IN HAWAIIAN RAINS AS A FUNCTION OF
DISTANCE INLAND AND OF ELEVATION,
W69-03735 02B

WOOD, E. J. F.
MICROBIOLOGY OF OCEANS AND ESTUARIES,
W69-03752 02L

WUHRMANN, K.
NITROGEN REMOVAL IN SEWAGE TREATMENT PROCESS,
W69-04030 05D

YARON, DAN
TOWARDS ECONOMIC EVALUATION OF THE QUALITY OF WATER IN
IRRIGATION,
W69-04059 03C

YEN, CHIN-LIEN
VELOCITY-DISTRIBUTIONS IN STRAIGHT RECTANGULAR CHANNELS,
W69-03703 02E

YEN, C. L.
CALCULATION OF THE DISPERSION COEFFICIENT IN STRAIGHT
PRISMATIC STREAMS,
W69-03705 02E

YOSHIMURA, SHINKICHI
RELATION BETWEEN DEPTH FOR MAXIMUM AMOUNT OF EXCESS OXYGEN
DURING THE SUMMER STAGNATION PERIOD AND THE TRANSPARENCY OF
FRESHWATER LAKES OF JAPAN,
W69-04019 02H

SECULAR CHANGES IN THE TRANSPARENCY OF LAKE WATERS,
W69-04022 02H

YUSUF, MUHAMMAD
STOMATA IN RELATION TO DROUGHT RESISTANCE OF WHEAT
VARIETIES,
W69-04117 03F

ZIONTS, STANLEY
RESTRICTED BARGAINING FOR ORGANIZATION WITH MULTIPLE
OBJECTIVES,
W69-04061 06B

ZUCKERMAN, B. M.
PESTICIDE OCCURRENCE, CONCENTRATION, AND DEGRADATION IN FREE
WATER SYSTEMS,
W69-03962 05B

ORGANIZATIONAL INDEX

ARHUS UNIV. (DENMARK). INST. OF ECONOMIC AND APPLIED GEOGRAPHY.
WATER DEVELOPMENT AND WATER PLANNING IN THE SOUTHWESTERN UNITED STATES,
W69-03949 06B

ADELAIDE UNIV. (AUSTRALIA). WAITE INST.
ADSORPTION OF POLY (VINYL ALCOHOL) BY NATURAL SOIL AGGREGATES,
W69-04108 02A

AGRICULTURAL RESEARCH SERVICE, AKRON, COLO. SOIL AND WATER CONSERVATION RESEARCH DIV.
CONSERVATION BENCH TERRACES IN EASTERN COLORADO,
W69-03880 03F

LEVEL PAN CONSTRUCTION FOR DIVERTING AND SPREADING RUNOFF,
W69-03881 03F

AGRICULTURAL RESEARCH SERVICE, BELTSVILLE, MD. SOIL AND WATER CONSERVATION RESEARCH DIV.
ISOLATION AND CHARACTERIZATION OF HYDROLOGIC RESPONSE UNITS WITHIN AGRICULTURAL WATERSHEDS,
W69-03879 03F

HYDROLOGIC CHARACTERISTICS OF SOIL TYPES,
W69-04011 02E

CONCEPTS IN HYDROLOGIC SOIL GROUPING,
W69-04013 02G

AGRICULTURAL RESEARCH SERVICE, BOZEMAN, MONT. AND AGRICULTURAL RESEARCH SERVICE, HUNTLEY, MONT.
FERTILIZING DRYLAND SPRING AND WINTER WHEAT IN THE BROWN SOIL ZONE,
W69-03878 03F

AGRICULTURAL RESEARCH SERVICE, DENVER, COLO. AND BUREAU OF RECLAMATION, DENVER, COLO.
GAS CHROMATOGRAPHIC ANALYSIS OF DALAPON IN WATER,
W69-03755 05A

AGRICULTURAL RESEARCH SERVICE, FORT COLLINS, COLO. SOIL AND WATER CONSERVATION RESEARCH DIV.
NITRATE AND OTHER WATER POLLUTANTS UNDER FIELDS AND FEEDLOTS,
W69-04024 05B

AGRICULTURAL RESEARCH SERVICE, GRAND FORKS, N. DAK. AND ARGICULTURAL RESEARCH SERVICE, MANDAN, N. DAK.
SOIL-SALINITY CHANGES WITH FALLOW AND A STRAW MULCH ON FALLOW,
W69-04116 02I

AGRICULTURAL RESEARCH SERVICE, KIMBERLY, IDAHO. SNAKE RIVER RESEARCH CENTER.
WATER DISTRIBUTION UNDER SPRINKLER IRRIGATION,
W69-03892 03F

AGRICULTURAL RESEARCH SERVICE, MANDAN, N. DAK.
MOISTURE STORAGE AND SPRING WHEAT YIELDS ON LEVEL-BENCH TERRACES AS INFLUENCED BY CONTRIBUTING AREA COVER AND EVAPORATION CONTROL,
W69-03871 03F

SOIL WATER TRANSLOCATION IN A HIGH WATER TABLE AREA,
W69-04124 02G

AGRICULTURAL RESEARCH SERVICE, PHOENIX, ARIZ. WATER CONSERVATION LAB.
SALT PENETRATION TECHNIQUE FOR SEEPAGE MEASUREMENT,
W69-03935 04A

AGRICULTURAL RESEARCH SERVICE, RIVERSIDE, CALIF. SALINITY LAB.
MINERAL-WEATHERING CORRECTION FOR ESTIMATING THE SODIUM HAZARD OF IRRIGATION WATERS,
W69-03791 03C

THE EFFECT OF SOIL-MINERAL WEATHERING ON THE SODIUM HAZARD OF IRRIGATION WATERS,
W69-03792 03C

LEACHING REQUIREMENT FOR EXCHANGEABLE-SODIUM CONTROL,
W69-04012 02G

AIR FORCE INST. OF TECH., WRIGHT-PATTERSON AFB, OHIO AND OKLAHOMA STATE UNIV., STILLWATER. SCHOOL OF CIVIL ENGINEERING.
INFRARED AERIAL SURVEYS IN ENVIRONMENTAL ENGINEERING,
W69-03744 07B

ALABAMA GEOLOGICAL SURVEY, UNIVERSITY AND GEOLOGICAL SURVEY, WASHINGTON, D. C.
MINERAL AND WATER RESOURCES OF BARBOUR COUNTY, ALABAMA,
W69-03952 02E

ARIZONA UNIV., TUCSON. LAB. OF TREE-RING RESEARCH.
TREE-RING ANALYSIS A TOOL FOR WATER RESOURCES RESEARCH,
W69-03963 02A

ARMY ENGINEER WATERWAYS EXPERIMENT STATION, VICKSBURG, MISS.
CONSTRUCTION PROBLEMS EXPERIENCED WITH LOESS SOILS,
W69-03803 08D

BECHTEL CORP., SAN FRANCISCO, CALIF AND IDAHO POWER CO., BOISE, IDAHO.
DISCHARGE FACILITIES AT HELLS CANYON DAM,
W69-03795 08A

BOSTON EDISON CO., MASS.
UNITED STATES DEVELOPMENTS IN UNDERGROUND TRANSMISSION,
W69-03773 08C

BRITISH METEOROLOGICAL OFFICE, CAMBRIDGE (ENGLAND). RESEARCH UNIT.
MEASUREMENT OF NATURAL EVAPORATION COMPARISON OF GRAVIMETRIC AND AERODYNAMIC METHODS,
W69-03891 02D

BUREAU OF MINES, WASHINGTON, D. C.
ANALYTICAL USES OF ENERGY BALANCES,
W69-03772 06B

BUREAU OF RECLAMATION, DENVER, COLO.
DAMS AND RESERVOIRS IN PLEISTOCENE-ZOLIAN DEPOSIT TERRANE OF NEBRASKA AND KANSAS,
W69-03762 08D

A PROGRESS REPORT ON PROJECT SKYWATER THE BUREAU OF RECLAMATION'S ATMOSPHERIC WATER RESOURCES PROGRAM,
W69-03769 03B

SUBSURFACE DRAINAGE BY TRANSIENT-FLOW THEORY,
W69-03941 02G

AUGMENTING COLORADO RIVER BY WEATHER MODIFICATION,
W69-03950 03B

BUREAU OF RECLAMATION, SACRAMENTO, CALIF.
LAND SUBSIDENCE IN PLEASANT VALLEY AREA, FRESNO COUNTY, CALIF.,
W69-03797 02F

BUREAU OF RECLAMATION, WASHINGTON, D. C.
ECONOMIC AND DESIGN CONSIDERATIONS OF THE PACIFIC NORTHWEST-PACIFIC SOUTHWEST INTERTIE,
W69-03776 08C

ROLE OF IRRIGATION IN THE WEST'S EXPANDING ECONOMY,
W69-03940 03F

BUREAU OF SPORT FISHERIES AND WILDLIFE, BISHOP, CALIF.
ABUNDANCE AND CHARACTER OF MICROSESTON IN A CALIFORNIA MOUNTAIN STREAM,
W69-04031 02E

CALIFORNIA STATE DEPT. OF PUBLIC HEALTH, BERKELEY.
IDENTIFICATION OF PETROLEUM IN ESTUARINE WATERS,
W69-03738 05B

CALIFORNIA STATE DEPT. OF WATER RESOURCES, SACRAMENTO.
HYDROLOGIC DATA 1967 - VOLUME 1 NORTH COASTAL AREA.
W69-03951 02F

CALIFORNIA UNIV., BERKELEY.
COMPETITIVE EQUILIBRIUM UNDER UNCERTAINTY,
W69-04078 06D

ON THE PRINCIPLE OF CONSUMERS' SOVEREIGNTY,
W69-04083 06B

CALIFORNIA UNIV., BERKELEY. DEPT. OF GEOLOGY AND GEOPHYSICS.
CHERT AND ITS SODIUM-SILICATE PRECURSORS IN SODIUM-CARBONATE LAKES OF EAST AFRICA,
W69-03955 02H

CALIFORNIA UNIV., DAVIS. DEPT. OF WATER SCIENCE AND ENGINEERING AND WASHINGTON STATE UNIV., PULLMAN. DEPT. OF AGRICULTURAL ENGINEERING.
SURFACE IRRIGATION HYDRAULICS-KINEMATICS,
W69-03936 03F

CALIFORNIA UNIV., DAVIS. DEPT. OF WATER SCIENCE AND ENGINEERING.
COMPUTATIONAL SCHEMES FOR THE BOUSSINESQ EQUATION,
W69-03937 07C

GEOPHYSICAL, ISOTOPE AND TRACER TECHNIQUES IN WATERSHED RESEARCH,
W69-04119 02A

CALIFORNIA UNIV., LOS ANGELES.
OPTIMAL IDENTIFICATION OF NONLINEAR HYDROLOGIC SYSTEM RESPONSE MODELS BY QUASILINEARIZATION,
W69-03958 02A

DYNAMIC PROGRAMMING FOR PROJECT COST-TIME CURVES,
W69-04137 06C

CALIFORNIA UNIV., RIVERSIDE. CITRUS EXPERIMENT STATION.
EFFECTS OF EXTERNAL SALT CONCENTRATIONS ON WATER RELATIONS IN PLANTS I. ABSENCE OF OSMOTIC ADJUSTMENT IN THE ROOT XYLEM,
W69-04113 02I

CARNEGIE-MELLON UNIV., PITTSBURGH, PA.
THE LINEAR AGGREGATION COEFFICIENT AS THE DUAL OF THE LINEAR CORRELATION COEFFICIENT,
W69-04063 06D

CELULOSA Y DERIVADOS S. A., MONTERREY (MEXICO). COPROPIEDAD GRUPO QUIMICO.

WATER REUSE IN MONTERREY, MEXICO,
W69-03717 05D

CENTRAL INST. FOR INDUSTRIAL RESEARCH, OSLO (NORWAY) AND WOODS HOLE OCEANOGRAPHIC INSTITUTION, MASS.
NEUTRON ACTIVATION ANALYSIS OF LANTHANIDE ELEMENTS IN SEA WATER,
W69-03727 02K

CENTRAL METALLURGICAL LABS., WHETSTONE (ENGLAND).
THE FUTURE ROLE OF NON-DESTRUCTIVE TESTING,
W69-03787 08G

CHESAPEAKE BAY-SUSQUEHANNA RIVERS BASINS PROJECT, SUSQUEHANNA FIELD STATION.
FUTURE IRRIGATION DEMAND IN THE SUSQUEHANNA BASIN,
W69-03934 03F

CHICAGO UNIV., ILL.
CONTINUOUS AND DISCRETE TIME APPROACHES TO A MAXIMIZATION PROBLEM,
W69-04091 06B

CHICAGO UNIV., ILL. SCHOOL OF BUSINESS.
THE DECOMPOSITION OF ECONOMIC PRODUCTION SYSTEMS,
W69-04103 06B

CINCINNATI UNIV., OHIO. DEPT. OF CIVIL ENGINEERING.
CONTAMINANTS IN GROUNDWATERS NEAR WASTE STABILIZATION PONDS,
W69-03718 05B

CITY UNIV. OF NEW YORK AND PRINCETON UNIV., N. J.
THE DUAL IN NONLINEAR PROGRAMMING AND ITS ECONOMIC INTERPRETATION,
W69-04088 06B

CLEMSON UNIV., S. C.
DEVELOPMENT AND APPLICATION OF A RATIONAL WATER QUALITY PLANNING MODEL,
W69-04017 05B

GEOLOGY OF CLEMSON RESEARCH WATERSHED,
W69-04018 02G

COLLEGE OF LITERATURE AND SCIENCE, TOKYO (JAPAN). GEOGRAPHICAL INST.
SECULAR CHANGES IN THE TRANSPARENCY OF LAKE WATERS,
W69-04022 02H

COLLEGE OF SCIENCE AND LITERATURE, TOKYO (JAPAN). GEOGRAPHICAL INST.
RELATION BETWEEN DEPTH FOR MAXIMUM AMOUNT OF EXCESS OXYGEN DURING THE SUMMER STAGNATION PERIOD AND THE TRANSPARENCY OF FRESHWATER LAKES OF JAPAN,
W69-04019 02H

COLORADO STATE UNIV., FORT COLLINS AND NEW SOUTH WALES UNIV., KENSINGTON (AUSTRALIA).
ESTIMATING DESIGN FLOODS FROM EXTREME RAINFALL,
W69-03783 02E

COLORADO STATE UNIV., FORT COLLINS.
REDUCING CAVITATION IN VALVES,
W69-03757 08C

GENERAL SLOPE STABILITY ANALYSIS,
W69-03779 08D

COLUMBIA UNIV., NEW YORK.
POOLING OF TIME SERIES AND CROSS SECTION DATA,
W69-04066 06D

ECONOMIC THEORY AND THE MEANING OF COMPETITION,
W69-04084 06B

COLUMBIA UNIV., NEW YORK. DEPT. OF MINERAL TECHNOLOGY AND CALIF. UNIV., BERKELEY. DEPT. OF MINERAL TECHNOLOGY.
EVAPORATION OF WATER ITS RETARDATION BY MONOLAYERS,
W69-03884 03B

COMMONWEALTH ASSOCIATES, INC., JACKSON, MICH.
ROLE OF HIGHER VOLTAGE TRANSMISSION IN CHANGING ASPECTS OF ENERGY TRANSPORT,
W69-03775 08C

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, NORTH RYDE (AUSTRALIA). WHEAT RESEARCH UNIT.
EVAPORATION RETARDED BY MONOLAYERS,
W69-03722 03B

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, CANBERRA (AUSTRALIA). DIV. OF LAND RESEARCH.
WATER TRANSPORT IN SOIL WITH A DAILY TEMPERATURE WAVE I THEORY AND EXPERIMENT,
W69-03869 02G

WATER TRANSPORT IN SOIL WITH A DAILY TEMPERATURE WAVE II ANALYSIS,
W69-03870 02G

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, CANBERRA (AUSTRALIA). DIV. OF LAND RESEARCH AND CENTRAL ARID ZONE RESEARCH INST., JODHPUR (INDIA).
A METHOD OF DETERMINING HYDRAULIC CONDUCTIVITY CHARACTERISTICS FOR NON-SWELLING SOILS IN SITU, AND OF CALCULATING EVAPORATION FROM BARE SOIL,
W69-04114 02G

CONSOLIDATED EDISON CO. OF NEW YORK, INC. NEW YORK.
THE DEVELOPMENT OF OCEAN MINERALS AND THE LAW OF THE SEA,
W69-04049 06E

CORNELL UNIV., ITHACA, N. Y. CENTER FOR WATER RESOURCES AND MARINE SCIENCES.
N Y COMMON LAW AND STATUTORY RIGHTS PROTECTING THE INTERESTS OF THE INDIVIDUAL RIPARIAN OWNER IN THE RECREATIONAL AND AESTHETIC VALUES OF HIS ENVIRONMENT,
W69-04054 06E

FINAL REPORT AS OF MARCH 24, 1967, OF CONCLUSIONS REACHED, LEGISLATION RECOMMENDED AND PROGRESS MADE.
W69-04105 06E

A STUDY OF SELECTED ASPECTS OF THE POWERS OF NEW YORK STATE OVER THE WATERS OF THE STATE.
W69-04106 06E

CORPS OF ENGINEERS, ALBUQUERQUE, N. MEX.
FLOOD PLAIN INFORMATION - FOUNTAIN CREEK, PUEBLO, COLORADO
W69-03712 04A

CORPS OF ENGINEERS, CHARLESTON, S. C.
FLOOD PLAIN INFORMATION OF CONGAREE CREEK AND SIX MILE CRE IN LEXINGTON COUNTY, SOUTH CAROLINA.
W69-03709 04A

CORPS OF ENGINEERS, DETROIT, MICH.
FLOOD PLAIN INFORMATION, AUGLAIZE RIVER, WAPAKONETA, OHIO.
W69-03928 04A

CORPS OF ENGINEERS, FORT WORTH, TEX.
FLOOD PLAIN INFORMATION-HUTTON BRANCH AND COOKS BRANCH, DALLAS COUNTY, TEXAS.
W69-03707 04A

CORPS OF ENGINEERS, LOS ANGELES, CALIF.
FLOOD PLAIN INFORMATION, MOJAVE RIVER (VICINITY OF BARSTOW SAN BERNARDINO COUNTY, CALIFORNIA.
W69-03927 04A

CORPS OF ENGINEERS, MOBILE, ALA.
PRELIMINARY FLOOD PLAIN INFORMATION-CHATTAHOOCHEE RIVER, BUFORD DAM TO METROPOLITAN ATLANTA, GEORGIA.
W69-03711 04A

CORPS OF ENGINEERS, NASHVILLE, TENN.
FLOOD PLAIN INFORMATION-CUMBERLAND RIVER AND OBEY RIVER, CELINA, TENNESSEE.
W69-03714 04A

CORPS OF ENGINEERS, OMAHA, NEBR.
FLOOD PLAIN INFORMATION - VOLUME IV OF DENVER METROPOLITAN REGION, COLORADO.
W69-03708 04A

FLOOD PLAIN INFORMATION OF LEFT-HAND CREEK, VOLUME 1, BOULDER COUNTY, COLORADO.
W69-03926 04A

CORPS OF ENGINEERS, PHILADELPHIA, PA.
FLOOD PLAIN INFORMATION, CHRISTINA RIVER, MUDDY AND BELLTO RUNS, NEW CASTLE COUNTY, DELAWARE.
W69-03715 04A

CORPS OF ENGINEERS, PITTSBURGH, PA.
FLOOD PLAIN INFORMATION, ALLEGHENY RIVER, LITTLE VALLEY AN GREAT VALLEY CREEKS, SALAMANCA, NEW YORK.
W69-03929 04A

CORPS OF ENGINEERS, SAN FRANCISCO, CALIF.
FLOOD PLAIN INFORMATION-SOUTH FORK EEL RIVER, WEOTT TO MYE FLAT, HUMBOLDT COUNTY, CALIFORNIA.
W69-03932 04A

CORPS OF ENGINEERS, VICKSBURG, MISS.
FLOOD PLAIN INFORMATION-OUACHITA RIVER, CAMDEN, ARKANSAS.
W69-03713 04A

FLOOD PLAIN INFORMATION, OUACHITA RIVER, WEST MONROE, LOUISIANA.
W69-03930 04A

CORPS OF ENGINEERS, WALTHAM, MASS.
FLOOD PLAIN INFORMATION, CONCORD AND SHAWSHEEN RIVERS, BEDFORD, MASSACHUSETTS.
W69-03931 04A

CORPS OF ENGINEERS, WASHINGTON, D. C.
THE ADVANTAGES OF INCLINED-AXIS HYDROELECTRIC UNITS,
W69-04010 08C

CUNNINGHAM LAB., BRISBANE (AUSTRALIA).
NITROGEN FERTILIZER AND WHEAT IN A SEMI-ARID ENVIRONMENT EMPIRICAL YIELD RESPONSE MODELS AND ECONOMIC FACTORS,
W69-03877 03F

DALHOUSIE UNIV., HALIFAX (NOVA SCOTIA). DEPT. OF BIOLOGY.
THE ECOLOGICAL ROLE OF PHOSPHORUS IN WATERS WITH SPECIAL REFERENCE TO MICROORGANISMS,
W69-04023 05C

DARTMOUTH COLL., HANOVER, N. H.
THE LONG-RUN COST FUNCTION OF WATER PRODUCTION FOR SELECTE WISCONSIN COMMUNITIES,
W69-04136 06C

DELAWARE RIVER BASIN COMMISSION, TRENTON, N. J.
WATER QUALITY MANAGEMENT IN THE DELAWARE RIVER BASIN (FEDERAL AND INTERSTATE COMPACT TO SOLVE POLLUTION PROBLEMS),
W69-04039 05G

HI UNIV., (INDIA).
HE BIAS OF LIVIATAN'S CONSISTENT ESTIMATOR IN A DISTRIBUTED AG MODEL,
69-04060 06B

ARTMENT OF AGRICULTURE, WASHINGTON, D. C.
ATER FLUX IN MOIST SOIL THERMAL VERSUS SUCTION GRADIENTS,
69-03883 02G

ARTMENT OF INTERIOR, WASHINGTON, D. C.
NTERNATIONAL JOINT COMMISSION - UNITED STATES AND CANADA,
69-03815 06E

ARTMENT OF THE INTERIOR, WASHINGTON, D. C. OFFICE OF THE ICITOR.
HE ADMINISTRATION OF THE OUTER CONTINENTAL SHELF LANDS ACT,
69-04043 06E

ECTORATE OF AGRICULTURAL RESEARCH, POTCHEFSTROOM (SOUTH ICA). DEPT. OF AGRICULTURAL TECHNICAL SERVICES.
TUDIES ON DEW FORMATION UNDER SEMI-ARID CONDITIONS,
69-04115 02A

E UNIV., DURHAM, N. C.
EGALOPOLIS RESOURCE CONSERVER OR RESOURCE WASTER,
69-04098 06B

GENOESSISCHE ANSTALT FUER WASSERVERSORGUNG, ASSERREINIGUNG UND GEWAESSERSCHUTZ, ZURICH (SWITZERLAND).
ITROGEN REMOVAL IN SEWAGE TREATMENT PROCESS,
69-04030 05D

LISH ELECTRIC POWER TRANSFORMERS LTD, STAFFORD.
EASUREMENT OF TRANSFORMER NOISE AND ITS REDUCTION,
69-03790 08C

IRONMENTAL SCIENCE SERVICES ADMINISTRATION, BOULDER, O. RESEARCH LABS.
HERMAL AND SEISMIC INDICATIONS OF OLD FAITHFUL GEYSER'S NNER WORKINGS,
69-03737 02F

ERAL POWER COMMISSION, WASHINGTON, D. C.
ROJECTED TRENDS AND REQUIREMENTS IN THE COORDINATED GROWTH F ELECTRIC POWER SYSTEMS IN THE UNITED STATES,
69-03774 08C

ERAL POWER STATION DEPT. (WEST GERMANY).
HE PLANNING, CONSTRUCTION AND OPERATION OF POWER STATIONS N LARGE INTERCONNECTED SYSTEMS--THE STRATEGY OF LARGE-AREA OWER SUPPLY,
69-03771 08C

ERAL WATER POLLUTION CONTROL ADMINISTRATION, CINCINNATI, O.
LTIMATE DISPOSAL OF WASTE WATER CONCENTRATES TO THE NVIRONMENT,
69-03798 05E

ERAL WATER POLLUTION CONTROL ADMINISTRATION, GREAT LAKES ION, CHICAGO, ILL.
ATER POLLUTION IN THE GREAT LAKES BASIN,
69-03948 05B

ERAL WATER POLLUTION CONTROL ADMINISTRATION, METUCHEN, N.

ETERMINATION OF NITRATE IN ESTUARINE WATERS AUTOMATIC ETERMINATION USING A BRUCINE METHOD,
69-04025 02L

ERAL WATER POLLUTION CONTROL ADMINISTRATION, WASHINGTON, C.
ASTEWATER REUSE--HAS IT 'ARRIVED,'
69-03719 05D

ERAL WATER POLLUTION CONTROL ADMINISTRATION, WASHINGTON, C. AND KANSAS CITY, MO.
TATISTICAL APPROACH TO ESTUARINE BEHAVIOR,
69-03732 05B

RIDA UNIV., GAINESVILLE AND HARVARD UNIV., CAMBRIDGE, S.
IMULATION OF A NATIONAL FLOOD INSURANCE FUND,
69-04138 06A

DAZIONE L'EINAUDI, TURIN (ITALY) AND STATE UNIV. OF NEW K, BUFFALO.
ESTRICTED BARGAINING FOR ORGANIZATION WITH MULTIPLE BJECTIVES,
69-04061 06B

EST SERVICE (USDA) ST. PAUL, MINN. NORTH CENTRAL FOREST ERIMENT STATION.
ESPONSE OF SPRINGFLOW TO SOME CLIMATIC VARIABLES IN OUTHWESTERN WISCONSIN,
69-04016 02A

EST SERVICE (USDA) WENATCHEE, WASH. PACIFIC NORTHWEST EST AND RANGE EXPERIMENT STATION.
IME AND HOARFROST IN UPPER-SLOPE FORESTS OF EASTERN ASHINGTON,
69-03807 02I

EST SERVICE (USDA), ALBUQUERQUE, N. MEX. ROCKY MOUNTAIN EST AND RANGE EXPERIMENT STATION.
ERMINATION OF WINTERFAT SEEDS UNDER DIFFERENT MOISTURE TRESSES AND TEMPERATURES,
69-04129 02I

EST SERVICE (USDA), ST. PAUL, MINN. NORTH CENTRAL FOREST ERIMENT STATION.
RAINFALL DISTRIBUTION OVER DISSECTED TERRAIN IN SOUTHWESTERN WISCONSIN,
W69-04014 02B

WINTER THAWS CAN RAISE GROUND WATER LEVELS IN DRIFTLESS AREA,
W69-04015 02F

FOREST SERVICE (USDA), UPPER DARBY, PA. NORTHEASTERN FOREST EXPERIMENT STATION AND FOREST SERVICE (USDA), PARSONS, W. VA. NORTHEASTERN FOREST EXPERIMENT STATION.
INCREASING WATER YIELD IN THE NORTHEAST BY MANAGEMENT OF FORESTED WATERSHEDS,
W69-03980 03B

GEOLOGICAL SURVEY, BATON ROUGE, LA.
EVAPORATION STUDY AT SHARP STATION POND NEAR BATON ROUGE, LOUISIANA,
W69-03731 02D

GEOLOGICAL SURVEY, DENVER, COLO. WATER RESOURCES DIV. AND ARIZONA UNIV., TUCSON. DEPT. OF AGRICULTURAL ENGINEERING.
EVAPORATION FROM AN EPHEMERAL STREAMBED,
W69-03874 02G

GEOLOGICAL SURVEY, FLAGSTAFF, ARIZ AND NORTH CAROLINA UNIV., CHAPEL HILL.
SEISMIC RESONANCE INVESTIGATION OF A NEAR-SURFACE CAVITY IN ANCHOR RESERVOIR, WYOMING,
W69-03759 08E

GEOLOGICAL SURVEY, MENLO PARK, CALIF INSTITUTE OF GEOPHYSICS AND PLANETARY PHYSICS, UNIVERSITY OF CALIFORNIA, LOS ANGELES.
THE DENVER EARTHQUAKES,
W69-03802 08E

GEOLOGICAL SURVEY, MENLO PARK, CALIF.
ALUMINUM SPECIES IN WATER,
W69-03728 02K

THEORETICAL ANALYSIS OF TWO-DIMENSIONAL, TRANSIENT FLOW OF WATER IN UNSATURATED AND PARTLY UNSATURATED SOILS,
W69-03736 02G

GEOLOGICAL SURVEY, RALEIGH, N. C.
GEOLOGY AND GROUND-WATER RESOURCES OF THE MURPHY AREA, NORTH CAROLINA,
W69-03959 02F

GEOLOGICAL SURVEY, RICHMOND, VA.
EFFECTS OF URBAN DEVELOPMENT ON FLOODS IN NORTHERN VIRGINIA,
W69-03706 04C

GEOLOGICAL SURVEY, SALT LAKE CITY, UTAH.
GROUNDWATER DISCHARGE TOWARD GREAT SALT LAKE THROUGH VALLEY FILL IN THE JORDAN VALLEY, UTAH,
W69-03739 02F

GEOLOGICAL SURVEY, TACOMA, WASH.
GLACIER OUTBURST FLOODS IN THE PACIFIC NORTHWEST,
W69-03741 02C

GEOLOGICAL SURVEY, UNIVERSITY, ALA.
WATER AVAILABILITY OF GENEVA COUNTY, ALABAMA,
W69-03733 02E

WATER AVAILABILITY OF BUTLER COUNTY, ALABAMA,
W69-03734 02E

GEOLOGICAL SURVEY, WASHINGTON, D. C.
FLOODS IN BEECHER WEST QUADRANGLE, NORTHEASTERN ILLINOIS,
W69-03720 02E

STAGE MEASUREMENT AT GAGING STATIONS,
W69-03721 07B

AVAILABILITY OF GROUND WATERS IN THE NORTHERN PART, TENMILE AND TAUNTON RIVER BASINS, SOUTHEASTERN MASSACHUSETTS,
W69-03723 02F

HYDROLOGY OF CORNFIELD WASH AREA AND EFFECTS OF LAND-TREATMENT PRACTICES, SANDOVAL COUNTY, NEW MEXISO, 1951-60,
W69-03747 04D

GENERAL FIELD AND OFFICE PROCEDURES FOR INDIRECT DISCHARGE MEASUREMENTS,
W69-03748 07B

DETERMINATION OF STRONTIUM-90 IN WATER,
W69-03749 05A

GROUNDWATER CONDITIONS AND GEOLOGIC RECONNAISSANCE IN THE UPPER SEVIER RIVER BASIN, UTAH,
W69-03750 02F

MEASUREMENT OF PEAK DISCHARGE AT WIDTH CONTRACTIONS BY INDIRECT METHODS,
W69-03753 07B

WATER RESOURCES OF WISCONSIN, FOX-WOLF RIVER BASIN,
W69-03939 02E

INDEX OF SURFACE-WATER RECORDS TO SEPTEMBER 30, 1967. PART 8- WESTERN GULF OF MEXICO BASINS,
W69-03942 02E

RATES OF SLOPE DEGRADATION AS DETERMINED FROM BOTANICAL EVIDENCE, WHITE MOUNTAINS, CALIFORNIA,
W69-03943 02J

FLUOROMETRIC PROCEDURES FOR DYE TRACING,
W69-03944 07B

MEASUREMENT OF PEAK DISCHARGE AT DAMS BY INDIRECT METHODS,
W69-03945 02E

ON THE MAINTENANCE OF ANOMALOUS FLUID PRESSURES 1. THICK SEDIMENTARY SEQUENCES,
W69-03954 02J

RADIOACTIVE WASTE DILUTION IN THE CLINCH RIVER, EASTERN TENNESSEE,
W69-03956 05A

RIVER ADJUSTMENT TO ALTERED HYDROLOGIC REGIMEN-MURRUMBIDGEE RIVER AND PALEOCHANNELS, AUSTRALIA,
W69-03957 02J

WATER REQUIREMENTS OF THE IRON AND STEEL INDUSTRY,
W69-03965 06D

OCCURRENCE OF SELECTED MINOR ELEMENTS IN THE WATERS OF CALIFORNIA,
W69-03966 02K

MEASUREMENT OF PEAK DISCHARGE BY THE SLOPE-AREA METHOD,
W69-03967 07B

QUALITY OF SURFACE WATERS FOR IRRIGATION, WESTERN STATES, 1963,
W69-03968 02E

GEOHYDROLOGY OF THE SOURIS RIVER VALLEY IN THE VICINITY OF MINOT, NORTH DAKOTA,
W69-03969 02F

GEOLOGY AND GROUNDWATER OF THE SAVANNAH RIVER PLANT AND VICINITY, SOUTH CAROLINA,
W69-03970 02F

WATER RESOURCES OF THE MARQUETTE IRON RANGE AREA, MICHIGAN,
W69-03971 06D

GEOLOGY AND GROUNDWATER RESOURCES OF THE BIG SANDY CREEK VALLEY, LINCOLN, CHEYENNE, AND KIOWA COUNTIES, COLORADO,
W69-03974 02F

ANALYSIS OF AQUIFER TESTS IN THE PUNJAB REGION OF WEST PAKISTAN,
W69-03975 02F

WATER RESOURCES OF JACKSON AND INDEPENDENCE COUNTIES, ARKANSAS,
W69-03976 02F

GEOLOGY AND WATER RESOURCES IN THE FRENCH PRAIRIE AREA, NORTHERN WILLAMETTE VALLEY, OREGON,
W69-03977 03F

ROUGHNESS CHARACTERISTICS OF NATURAL CHANNELS,
W69-03978 02E

GEOLOGY AND GROUNDWATER RESOURCES OF LARAMIE COUNTY, WYOMING,
W69-03979 03F

CREEKS, BROOKS AND RIVERS IN ROCKLAND COUNTY, NEW YORK AND THEIR RELATION TO PLANNING FOR THE FUTURE,
W69-04036 06D

GEOLOGICAL SURVEY, WASHINGTON, D. C. AND GEOLOGICAL SURVEY, BOISE, IDAHO.
A WATER-BALANCE EQUATION FOR THE RATHDRUM PRAIRIE GROUND-WATER RESERVOIR, NEAR SPOKANE, WASHINGTON,
W69-03740 02E

GEORGE WASHINGTON UNIV., WASHINGTON, D. C.
MEGALOPOLIZATION AND LEISURE A COMMENT,
W69-04100 06B

GEORGIA INST. OF TECH., ATLANTA. ENGINEERING EXPERIMENT STATION.
BIOLOGICAL STUDIES OF MANGANESE SOLUTION FROM ITS DIOXIDE,
W69-03725 02H

GEORGIA INST. OF TECH., ATLANTA. SCHOOL OF ENGINEERING AND GEORGIA INST. OF TECH., ATLANTA. WATER RESOURCES CENTER.
THE EFFECT OF INDUCED TURBULENCE ON THE GROWTH OF ALGAE,
W69-03730 05C

GULF OIL CORP., PHILADELPHIA, PA.
AIR AND WATER INTERSTATE COMPACTS.
W69-04047 05G

HARVARD UNIV., CAMBRIDGE, MASS AND STANFORD UNIV., PALO ALTO, CALIF.
SAVING AND UNCERTAINTY THE PRECAUTIONARY DEMAND FOR SAVING,
W69-04077 06D

HARVARD UNIV., CAMBRIDGE, MASS.
THE PLANNING-PROGRAMMING-BUILDING-BUDGETING SYSTEM,
W69-04092 06B

ON THE MEASURE OF RISK AVERSION,
W69-04094 06D

AN EXAMINATION OF NON-TREATMENT PLANT ALTERNATIVES IN WATER POLLUTION CONTROL,
W69-04142 05D

A CAPACITY EXPANSION PLANNING MODEL FOR MUNICIPAL WATER SUPPLY SYSTEMS,
W69-04145 06D

HAWAII UNIV., HONOLULU. DEPT. OF CHEMISTRY AND HAWAII INSTITUTE OF GEOPHYSICS, HONOLULU.
SODIUM-TO-CHLORINE RATIO IN HAWAIIAN RAINS AS A FUNCTION OF DISTANCE INLAND AND OF ELEVATION,
W69-03735 02E

HAYES, SEAY, MATTERN AND MATTERN, ROANOKE, VA.
FLOOD PLAIN INFORMATION-PETERS CREEK AND LICK RUN, ROANOKE, VIRGINIA.
W69-03710 04A

HEBREW UNIV., JERUSALEM (ISRAEL).
TOWARDS ECONOMIC EVALUATION OF THE QUALITY OF WATER IN IRRIGATION,
W69-04059 03C

HUNTER COLLEGE, NEW YORK.
A NOTE ON A LOCATION PRINCIPLE,
W69-04095 06C

HYDRONAUTICS, INC., LAUREL, MD.
VELOCITY-DISTRIBUTIONS IN STRAIGHT RECTANGULAR CHANNELS,
W69-03703 02E

A DISCUSSION OF THE DISPERSIVITY TENSOR FOR A TURBULENT UNIFORM CHANNEL FLOW,
W69-03704 02E

CALCULATION OF THE DISPERSION COEFFICIENT IN STRAIGHT PRISMATIC STREAMS,
W69-03705 02E

ILLINOIS UNIV., CHICAGO AND FLORIDA UNIV., GAINESVILLE. COLL. OF LAW.
MULTIPLE INTERESTS IN RIPARIAN LAND, SUBDIVISION PLATTING, AND THE ALLOCATION OF RIPARIAN RIGHTS,
W69-04040 06E

ILLINOIS UNIV., URBANA AND WASHINGTON UNIV., ST. LOUIS, MO.
NORMALLY, FACTOR INPUTS ARE NEVER GROSS SUBSTITUTES,
W69-04073 06D

INTERNATIONAL JOINT COMMISSION, WASHINGTON, D. C.
FUNCTIONS OF THE INTERNATIONAL JOINT COMMISSION,
W69-03796 06E

INTERSTATE ADVISORY COMMITTEE ON THE SUSQUEHANNA RIVER BASIN.
RESOURCES RESPONSIBILITY AND COORDINATION RELATED TO THE COMPREHENSIVE STUDY OF THE SUSQUEHANNA RIVER BASIN.
W69-04032 06B

IOWA STATE UNIV., AMES. DEPT OF CIVIL ENGINEERING.
COLLECTION, CHARACTERIZATION, AND STUDY OF BIODEGRADABILITY AND CHEMICAL OXIDATION OF CARBON-ABSORBED MATERIALS FROM EFFLUENTS FROM SEWAGE TREATMENT PLANTS,
W69-04132 05D

JOHNS HOPKINS UNIV., BALTIMORE, MD.
A SIMPLE MACROECONOMIC MODEL WITH A GOVERNMENT BUDGET RESTRAINT,
W69-04069 06C

JOHNS HOPKINS UNIV., BALTIMORE, MD. DEPT. OF GEOGRAPHY JOHNS HOPKINS UNIV., BALTIMORE, MD. DEPT. OF GEOLOGY AND MARYLAND GEOLOGICAL SURVEY, BALTIMORE.
MINERAL-WATER INTERACTION DURING THE CHEMICAL WEATHERING OF SILICATES,
W69-03724 02K

KONINKLIJKE/SHELL EXPLORATIE EN PRODUKTIE LABORATORIUM, RIJSWIJK (NETHERLANDS).
SP LOG INTERPRETATION IN SHALY SANDS,
W69-03946 07B

LONDON SCHOOL OF ECONOMICS AND POLITICAL SCIENCE (ENGLAND) AND VIRGINIA UNIV., CHARLOTTESVILLE.
WHAT KIND OF REDISTRIBUTION DO WE WANT,
W69-04075 06B

LONDON SCHOOL OF ECONOMICS AND POLITICAL SCIENCE (ENGLAND).
WHAT REDISTRIBUTION MAY ECONOMISTS DISCUSS,
W69-04076 06B

LOUVAIN UNIV. (BELGIUM).
ESTIMATING DEMAND EQUATIONS,
W69-04062 06D

MARYLAND UNIV., COLLEGE PARK AND OKLAHOMA STATE UNIV., STILLWATER.
WIND-TUNNEL INVESTIGATION OF AIR FLOW OVER A HEXADECANOL MONOLAYER SPREAD ON A WATER SURFACE,
W69-04125 03B

MASSACHUSETTS INST. OF TECH., CAMBRIDGE, MASS.
VERTICAL ALIGNMENT OF SEWER AND DRAINAGE SYSTEMS BY DYNAMI PROGRAMMING,
W69-04150 04A

MASSACHUSETTS INST. OF TECH., CAMBRIDGE AND HEBREW UNIV., JERUSALEM (ISREAL).
A NOTE ON HOUTHAKKER'S AGGREGATE PRODUCTION FUNCTION IN A MULTIFIRM INDUSTRY,
W69-04064 06B

MASSACHUSETTS UNIV., AMHERST.
PESTICIDE OCCURRENCE, CONCENTRATION, AND DEGRADATION IN FR

WATER SYSTEMS,
W69-03962 05B

SSACHUSETTS UNIV., AMHERST. DEPT. OF CIVIL ENGINEERING.
HYDROLOGICAL STUDIES IN MASSACHUSETTS,
W69-04131 02A

LBOURNE UNIV., PARKVILLE (AUSTRALIA). DEPT. OF GEOLOGY.
MINERAL SPRINGS OF THE DAYLESFORD DISTRICT,
W69-03933 02K

TEOROLOGICAL SERVICE OF CANADA, TORONTO (ONTARIO).
SOME STUDIES OF SENSIBLE AND LATENT HEAT FLUXES AT WALTAIR,
SOUTHEASTERN COAST OF INDIA,
W69-03887 02G

AMI UNIV., FLA. INST. OF MARINE SCIENCE.
MICROBIOLOGY OF OCEANS AND ESTUARIES,
W69-03752 02L

CHIGAN STATE UNIV., EAST LANSING, MICH.
'INFERIOR FACTORS' AND THE THEORIES OF PRODUCTION AND INPUT
DEMAND,
W69-04074 06D

CHIGAN STATE UNIV., EAST LANSING.
MEASURING THE RELATIVE HUMIDITY OF SOILS AT DIFFERENT
MOISTURE CONTENTS BY THE GRAY HYDROCAL HYDROMETER,
W69-04130 02G

CHIGAN STATE UNIV., HICKORY CORNERS. W. K. KELLOGG
OLOGICAL STATION.
AXENIC CULTURE AND NUTRITIONAL STUDIES OF AQUATIC
MACROPHYTES,
W69-04027 02H

CHIGAN UNIV., ANN ARBOR.
WATER LAW, PLANNING AND POLICY CASES AND MATERIALS,
W69-04037 06E

SIMULTANEOUS CONFIDENCE INTERVALS IN ECONOMETRIC
FORECASTING,
W69-04065 06B

DDLE EASTERN REGIONAL RADIOISOTOPE CENTRE FOR THE ARAB
UNTRIES, CAIRO (EGYPT).
DISPERSION OF RADIOACTIVE TRACERS IN A MODEL BASIN SANDY
AQUIFER,
W69-04111 02F

NISTRY OF TECHNOLOGY, WALLINGFORD (ENGLAND).
PREVENTION OF VORTICES AT INTAKES,
W69-03788 08A

NNESOTA UNIV., ST. PAUL.
AN ANALYTIC APPROACH TO DETERMINE IRRIGATION SPRINKLER
SPACING,
W69-04121 03F

NTPELLIER UNIV. (FRANCE).
INVESTIGATION OF THE KARSTIC WATER RESERVES BURIED UNDER
MIOCENE, PLIOCENE, AND QUATERNARY SEDIMENTS OF THE
MEDITERRANEAN BASIN (FRENCH),
W69-03972 02F

NTPELLIER UNIV. (FRANCE. INST. OF GEOLOGY.
FLUID FLOW AND PORE-WALL ADSORPTION RELATIONSHIP THE
EFFECT OF TENSION AGENTS (FRENCH),
W69-03973 02G

TIONAL ACADEMY OF SCIENCES-NATIONAL RESEARCH COUNCIL,
SHINGTON, D. C. COMMITTEE ON WATER.
WATER AND CHOICE IN THE COLORADO BASIN,
W69-03785 06D

TIONAL AERONAUTICS AND SPACE ADMINISTRATION, GREENBELT,
. GODDARD SPACE FLIGHT CENTER.
GEOLOGIC ORBITAL PHOTOGRAPHY EXPERIENCE FROM THE GEMINI
PROGRAM,
W69-03784 07B

TIONAL AGRICULTURAL LIBRARY, WASHINGTON, D. C. AND
RICULTURAL RESEARCH SERVICE, BELTSVILLE, MD. SOIL AND
TER CONSERVATION RESEARCH DIV.
DRAINAGE OF AGRICULTURAL LAND AN ANNOTATED BIBLIOGRAPHY OF
SELECTED REFERENCES, 1956-1964,
W69-03809 04A

TIONAL SCIENCE FOUNDATION, WASHINGTON, D. C.
PROCEEDINGS INTERNATIONAL SYMPOSIUM ON FOREST HYDROLOGY.
W69-03806 02A

A HISTORY OF FEDERAL INVOLVEMENT IN THE MARINE SCIENCES
EMERGENCE OF THE NATIONAL SEA GRANT PROGRAM,
W69-04048 09D

VAL OCEANOGRAPHIC OFFICE, WASHINGTON, D. C. AND
SSACHUSETTS INST. OF TECH., CAMBRIDGE.
THE STRONTIUM AND BARIUM CONTENT OF SEA WATER,
W69-03726 02K

VADA UNIV., RENO. RENEWABLE RESOURCE CENTER.
INFLUENCE OF VARIOUS RANGELAND CULTURAL TREATMENTS ON RUNOFF
AND SEDIMENT PRODUCTION FROM THE BIG SAGE TYPE, EASTGATE
BASIN, NEVADA,
W69-03873 02G

W JERSEY GEOLOGICAL SURVEY, TRENTON. DEPT. OF
NSERVATION AND ECONOMIC DEVELOPMENT.
GEOLOGY AS A GUIDE TO REGIONAL ESTIMATES OF THE WATER
RESOURCE,
W69-03961 02F

NEW MEXICO DEPT. OF GAME AND FISH, ALBUQUERQUE.
SEASONAL PRECIPITATION AND SCALED QUAIL IN EASTERN NEW
MEXICO,
W69-04120 02B

NEW YORK STATE AGRICULTURAL EXPERIMENT STATION, GENEVA.
A SYSTEM FOR SHORT INTERVAL MEASUREMENT OF
EVAPOTRANSPIRATION,
W69-04110 02D

NEW YORK STATE DEPT. OF HEALTH, ALBANY. ENVIRONMENTAL
HEALTH SERVICES RESEARCH UNIT.
WASTEWATER REUSE,
W69-03716 05D

NEW YORK STATE POWER AUTHORITY, NIAGARA FALLS.
POWER GENERATION UNDER IJC REGULATION,
W69-03781 04A

NEW YORK UNIV., N. Y.
THE CONSTRAINED DEMAND FOR PUBLIC ASSISTANCE,
W69-04093 06D

NEWARK COLLEGE OF ENGINEERING, N. J. DEPT. OF CIVIL
ENGINEERING.
EFFECTS OF TEMPERATURE ON STREAM AERATION,
W69-03742 05G

NORGES TEKNISKE HOEGSKOLE, TRONDHEIM.
'BLOCKY AND SEAMY ROCK' IN TUNNELING,
W69-03760 08E

NORTH CAROLINA STATE UNIV., RALEIGH. DEPT. OF BIOLOGICAL
AND AGRICULTURAL ENGINEERING.
MODEL STUDY OF BOUNDARY EFFECTS ON DITCH DRAINAGE,
W69-03938 02G

NORTH CAROLINA UNIV., CHAPEL HILL. INST. OF GOVERNMENT.
ALTERNATIVE WATER DEMANDS AND THE ADEQUACY OF PRESENT
ARRANGEMENTS,
W69-04058 06D

NORTHEAST UTILITIES SERVICE CO., HARTFORD, CONN.
NORTHFIELD MOUNTAIN PUMPED STORAGE PROJECT,
W69-03794 08A

NORTHWESTERN UNIV., EVANSTON, ILL.
PARAMETERS AND RELATIONS OF STOCHASTICALLY LAGGED AND
DISAGGREGATIVE TIME SERIES,
W69-04102 06B

NORTHWESTERN UNIV., EVANSTON, ILL. AND NATIONAL BUREAU OF
ECONOMIC RESEARCH, NEW YORK.
INVESTMENT BEHAVIOR AND NEO-CLASSICAL THEORY,
W69-04082 06B

NOTRE DAME UNIV., IND.
FROST DAMAGE TO STONE AND CONCRETE GEOLOGICAL
CONSIDERATIONS,
W69-03804 08F

NOTTINGHAM UNIV. (ENGLAND). DEPT. OF HORTICULTURE.
A MICROPSYCHROMETER TO MEASURE WATER POTENTIALS OF INTACT
PLANT MATERIAL,
W69-04109 02I

OKLAHOMA UNIV., NORMAN.
MODEL OF OPTIMAL COMBINATION OF TREATMENT AND DILUTION,
W69-04144 05D

OREGON STATE UNIV., CORVALLIS, OREG. WATER RESOURCES INST.
PEOPLE AND WATER,
W69-03953 04C

OREGON UNIV., EUGENE. SCHOOL OF LAW.
OREGON'S WATER-MANAGEMENT DISTRICTS,
W69-04034 06E

OSAKA UNIV. (JAPAN) AND KOBE UNIV. (JAPAN).
AN INPUT-OUTPUT SYSTEM INVOLVING NON-TRANSFERABLE GOODS,
W69-04090 06D

OSAKA UNIV., (JAPAN).
INCOME DISTRIBUTION AND GROWTH IN A MONOPOLIST ECONOMY,
W69-04072 06C

PACIFIC GAS AND ELECTRIC CO., SAN FRANCISCO, CALIF.
MEETING TOMORROW'S ELECTRIC POWER NEEDS--NEW METHODS, NEW
CONCEPTS,
W69-03770 06D

PENNSYLVANIA UNIV., PHILADELPHIA HARVARD UNIV., CAMBRIDGE,
MASS CHICAGO UNIV., ILL., AND OSAKA UNIV. (JAPAN).
A NOTE ON THE GLOBAL STABILITY OF A SIMPLE GROWTH MODEL WITH
MANY CAPITAL GOODS,
W69-04087 06B

PENNSYLVANIA UNIV., PHILADELPHIA.
A NOTE ON THE DIFFERENTIABILITY OF CONSUMER DEMAND
FUNCTIONS,
W69-04080 06D

PRINCETON UNIV., N. J.
THEORY OF MEASUREMENT,
W69-03800 07B

PUBLIC HEALTH SERVICE, WASHINGTON, D. C.
ECONOMIC AND SOCIAL BENEFITS FROM IMPROVING HEALTH BY
PROVISION OF SAFE DRINKING WATER SUPPLIES,

W69-04056 06B

PURDUE UNIV., LAFAYETTE, IND.
A NOTE ON THE SYMMETRY BETWEEN BRIBES AND CHARGES,
W69-04071 06C

ELECTROKINETIC MEASUREMENTS OF COLLOIDAL-LADEN FLOW THROUGH A SAND COLUMN,
W69-04112 02A

PURDUE UNIV., LAFAYETTE, IND. AND STATE UNIV., OF NEW YORK, STONEY BROOK.
THEORY OF CONSUMER BEHAVIOR WHEN PRICES ENTER THE UTILITY FUNCTION,
W69-04079 06D

ROBERT A. TAFT SANITARY ENGINEERING CENTER, CINCINNATI, OHIO. CINCINNATI WATER RESEARCH LAB.
NEW APPROACHES TO WASTEWATER TREATMENT,
W69-03746 05D

ROBERT S. KERR WATER RESEARCH CENTER, ADA, OKLA.
PILOT STUDY OF DYNAMICS OF RESERVOIR DESTRATIFICATION,
W69-03960 05G

RUTGERS - THE STATE UNIV., NEW BRUNSWICK, N. J.
THE LAW OF WATER IN NEW JERSEY,
W69-04055 04A

SAN DIEGO STATE COLL., CALIF. DEPT. OF CIVIL ENGINEERING.
AMMONIA NITROGEN LOSSES FROM STREAMS,
W69-03745 05B

SKOPEJE UNIV. (YUGOSLAVIA).
THE TAXONOMY AND ECOLOGY OF LEECHES (HIRUDINEA) OF LAKE MENDOTA, WISCONSIN,
W69-04028 02H

SOIL CONSERVATION SERVICE, UNIVERSITY PARK, N. MEX.
AGE AND COMPARATIVE DEVELOPMENT OF DESERT SOILS AT THE GARDNER SPRING RADIOCARBON SITE, NEW MEXICO,
W69-04126 02J

STANFORD UNIV., CALIF. DEPT. OF CIVIL ENGINEERING.
THE RELATION BETWEEN RAINFALL AND RUNOFF,
W69-03890 02A

STATE RESEARCH FARM, WERRIBEE (AUSTRALIA).
THE EFFECTS OF EVAPORATION, POTENTIAL TRANSPIRATION AND RAINFALL ON DEPLETION OF SOIL MOISTURE BY IRRIGATED PERENNIAL PASTURE,
W69-03875 03F

STATE UNIVERSITY OF NEW YORK, ALBANY.
METROPOLITAN RESOURCES IN A POLICY MATRIX,
W69-04099 06B

STOCKHOLM UNIV., (SWEDEN).
SOME EFFECTS OF TAXES ON RISK TAKING,
W69-04097 06B

SYDNEY UNIV. (AUSTRALIA). DEPT. OF SOIL SCIENCE.
DETERMINATION OF THE SOLUBILITY PRODUCT OF SOIL CONSTITUENTS SUCH AS GYPSUM,
W69-04127 02G

TENNESSEE VALLEY AUTHORITY, KNOXVILLE.
TRIBUTARY AREA DEVELOPMENT TVA'S APPROACH TO SUB-REGIONAL DEVELOPMENT,
W69-04057 06B

TEXAS A AND M UNIV., COLLEGE STATION.
JULES DUPUIT AND THE EARLY THEORY OF MARGINAL COST PRICING,
W69-04085 06E

TEXAS A AND M UNIV., COLLEGE STATION. DEPT. OF METEOROLOGY.
ANOTHER EVAPORATION FORMULA,
W69-04107 02D

TEXAS A AND M UNIV., COLLEGE STATION. WATER RESOURCES INST.
DEVELOPMENT OF OPTIMIZATION - SYSTEMS ANALYSIS TECHNIQUES FOR TEXAS WATER RESOURCES,
W69-04133 05B

INFLUENCE OF FATTY ALCOHOLS AND ACIDS ON THE CLARITY AND BIOTA OF IMPOUNDED RESERVOIRS,
W69-04134 05B

RESEARCH ON THE MORPHOLOGY OF PRECIPITATION AND RUNOFF IN TEXAS,
W69-04135 02B

TEXAS UNIV., PORT ARANSAS. INST. OF MARINE SCIENCE.
HYDROCARBONS OF BLUE-GREEN ALGAE GEOCHEMICAL SIGNIFICANCE,
W69-04021 02K

TEXAS WATER DEVELOPMENT BOARD, AUSTIN.
THE TEXAS WATER PLAN.
W69-03729 06B

TOKAI UNIV., TOKYO (JAPAN).
STRENGTH AND EARTH PRESSURE OF ROCK WITH WEAK PLANES,
W69-03768 08E

TRW SYSTEMS GROUP, REDONDO BEACH, CALIF.
GROUND WATER AND COMPUTER SIMULATIONS,
W69-04149 02F

TRW SYSTEMS, SAN BERNARDINO, CALIF.
EFFECTIVE WATER RESOURCE MANAGEMENT.
W69-03702 06A

UNITED STATES LAKE SURVEY, DETROIT, MICH. ENGINEERING DIV.
THE GREAT LAKES WATER LEVELS PROBLEM,
W69-03947 02H

UNIVERSITY OF SOUTHERN CALIFORNIA, LOS ANGELES.
ANALYSIS OF WEDGE FAILURES IN LAYERED ROCKS,
W69-03761 08E

UNIVERSITY OF SOUTHERN CALIFORNIA, LOS ANGELES. DEPT. OF GEOLOGY.
THE MOVEMENT OF BEACH SAND,
W69-03754 02J

UNIVERSITY OF WESTERN ONTARIO, LONDON.
A TRANSFORMATION USED TO CIRCUMVENT THE PROBLEM OF AUTOCORRELATION,
W69-04101 06B

UTAH STATE UNIV., LOGAN.
MAN AND HIS WATER RESOURCE,
W69-04035 06D

VANDERVILT UNIV., NASHVILLE, TENN.
REVISITING MARSHALL'S CONSTANCY OF MARGINAL UTILITY OF MONEY,
W69-04086 06B

VIRGINIA POLYTECHNIC INST., BLACKSBERG, VA.
EARMARKED TAXES AND MAJORITY RULE BUDGETARY PROCESS,
W69-04067 06C

VIRGINIA UNIV., CHARLOTTESVILLE AND FLORIDA UNIV., GAINESVILLE.
A NOTE ON PUBLIC GOODS SUPPLY,
W69-04104 06B

WASHINGTON UNIV., SEATTLE.
OPTIMAL TIMING OF INNOVATIONS,
W69-04081 06B

WASHINGTON UNIV., SEATTLE. DEPT. OF ZOOLOGY.
THE SUCCESSION OF DIATOM ASSEMBLAGES IN THE RECENT SEDIMEN OF LAKE WASHINGTON,
W69-04029 05C

WEST PAKISTAN AGRICULTURAL UNIV., LYALLPUR. DEPT. OF PLANT BREEDING AND GENETICS.
STOMATA IN RELATION TO DROUGHT RESISTANCE OF WHEAT VARIETIES,
W69-04117 03P

WESTERN AUSTRALIA UNIV., NEDLANDS (AUSTRALIA). DEPT. OF ZOOLOGY.
THE GREAT INDIAN DESERT. PERSPECTIVES IN THE ECOLOGY AND PHYSIOLOGY OF SMALL DESERT MAMMALS,
W69-03889 02I

WESTERN AUSTRALIA UNIV., NEDLANDS. DEPT. OF BOTANY.
ECO-PHYSIOLOGICAL STUDIES ON PLANTS IN ARID AND SEMI-ARID REGIONS IN WESTERN AUSTRALIA. I. AUTECOLOGY OF RHAGODIA BACCATA (LABILL.) MOQ,
W69-04118 03P

WISCONSIN DEPT. OF RESOURCE DEVELOPMENT.
WATERFRONT RENEWAL.
W69-04033 04C

WISCONSIN UNIV., MADISON.
HYDRAULIC LOAD-CELL LYSIMETER, CONSTRUCTION, CALIBRATION, AND TESTS,
W69-03793 07B

WISCONSIN UNIV., MADISON. DEPT. OF ZOOLOGY.
NITROGEN FIXATION IN TWO WISCONSIN LAKES,
W69-04026 02H

WYOMING UNIV., LARAMIE.
COMMENT, EMINENT DOMAIN - UNITED STATES V RANDS, 88 S CT 7 (1967),
W69-04044 06E

ACCESSION NUMBER INDEX

6A	W69-03702	04A	W69-03781	05F	W69-03858	03F	W69-03940
2E	W69-03703	08E	W69-03782	04A	W69-03859	02G	W69-03941
2E	W69-03704	02E	W69-03783	06E	W69-03860	02E	W69-03942
2E	W69-03705	07B	W69-03784	06E	W69-03861	02J	W69-03943
4C	W69-03706	06D	W69-03785	06E	W69-03862	07B	W69-03944
4A	W69-03707	02B	W69-03786	05B	W69-03863	02E	W69-03945
4A	W69-03708	08G	W69-03787	06E	W69-03864	07B	W69-03946
4A	W69-03709	08A	W69-03788	06E	W69-03865	02H	W69-03947
4A	W69-03710	08A	W69-03789	06E	W69-03866	05B	W69-03948
4A	W69-03711	08C	W69-03790	04A	W69-03867	06B	W69-03949
4A	W69-03712	03C	W69-03791	06E	W69-03868	03B	W69-03950
4A	W69-03713	03C	W69-03792	02G	W69-03869	02F	W69-03951
4A	W69-03714	07B	W69-03793	02G	W69-03870	02E	W69-03952
4A	W69-03715	08A	W69-03794	03F	W69-03871	04C	W69-03953
5D	W69-03716	08A	W69-03795	02G	W69-03873	02J	W69-03954
5D	W69-03717	06E	W69-03796	02G	W69-03874	02H	W69-03955
5B	W69-03718	02F	W69-03797	03F	W69-03875	05A	W69-03956
5D	W69-03719	05E	W69-03798	03F	W69-03877	02J	W69-03957
2E	W69-03720	08F	W69-03799	03F	W69-03878	02A	W69-03958
7B	W69-03721	07B	W69-03800	03F	W69-03879	02F	W69-03959
3B	W69-03722	06E	W69-03801	03F	W69-03880	05G	W69-03960
2F	W69-03723	08E	W69-03802	03F	W69-03881	02F	W69-03961
2K	W69-03724	08D	W69-03803	02G	W69-03883	05B	W69-03962
2H	W69-03725	08F	W69-03804	03B	W69-03884	02A	W69-03963
2K	W69-03726	08D	W69-03805	02G	W69-03887	05D	W69-03964
2K	W69-03727	02A	W69-03806	02I	W69-03889	06D	W69-03965
2K	W69-03728	02I	W69-03807	02A	W69-03890	02K	W69-03966
6B	W69-03729	04A	W69-03809	02D	W69-03891	07B	W69-03967
5C	W69-03730	06E	W69-03810	03F	W69-03892	02E	W69-03968
2D	W69-03731	06E	W69-03811	06E	W69-03894	02F	W69-03969
5B	W69-03732	04A	W69-03812	06E	W69-03895	02F	W69-03970
2E	W69-03733	04A	W69-03813	06E	W69-03896	06D	W69-03971
2E	W69-03734	06E	W69-03814	08A	W69-03897	02F	W69-03972
2B	W69-03735	06E	W69-03815	04A	W69-03898	02G	W69-03973
2G	W69-03736	04A	W69-03816	04A	W69-03899	02F	W69-03974
2F	W69-03737	06E	W69-03817	04A	W69-03900	02F	W69-03975
5B	W69-03738	06E	W69-03818	04A	W69-03901	02F	W69-03976
2F	W69-03739	06E	W69-03819	02F	W69-03902	03F	W69-03977
2E	W69-03740	04C	W69-03820	04C	W69-03903	02E	W69-03978
2C	W69-03741	06E	W69-03821	04A	W69-03904	03F	W69-03979
5G	W69-03742	06E	W69-03822	04A	W69-03905	03B	W69-03980
7B	W69-03744	04A	W69-03823	04A	W69-03906	02E	W69-03981
5B	W69-03745	04A	W69-03824	04A	W69-03907	04A	W69-03982
5D	W69-03746	04A	W69-03825	04B	W69-03908	05G	W69-03983
4D	W69-03747	06E	W69-03826	05B	W69-03909	04A	W69-03984
7B	W69-03748	06E	W69-03827	06E	W69-03910	04A	W69-03985
5A	W69-03749	06E	W69-03828	06E	W69-03911	04A	W69-03986
2F	W69-03750	06E	W69-03829	06E	W69-03912	04A	W69-03987
3C	W69-03751	06E	W69-03830	04A	W69-03913	06E	W69-03988
2L	W69-03752	06E	W69-03831	04A	W69-03914	05B	W69-03989
7B	W69-03753	06E	W69-03832	04C	W69-03915	05G	W69-03990
2J	W69-03754	04A	W69-03833	06E	W69-03916	05B	W69-03991
5A	W69-03755	04A	W69-03834	06E	W69-03917	05D	W69-03992
8C	W69-03757	04A	W69-03835	06E	W69-03918	04A	W69-03993
8E	W69-03759	05G	W69-03836	06E	W69-03919	06E	W69-03994
8E	W69-03760	05G	W69-03837	06E	W69-03920	04A	W69-03995
8E	W69-03761	04A	W69-03839	06E	W69-03921	04A	W69-03996
8D	W69-03762	06E	W69-03840	06E	W69-03922	04A	W69-03997
8A	W69-03763	06E	W69-03841	06E	W69-03923	04A	W69-03998
8C	W69-03765	06E	W69-03842	05B	W69-03924	04A	W69-03999
8D	W69-03766	05C	W69-03843	06E	W69-03925	04A	W69-04000
3F	W69-03767	06E	W69-03844	04A	W69-03926	05G	W69-04001
8E	W69-03768	06E	W69-03845	04A	W69-03927	04A	W69-04002
3B	W69-03769	06E	W69-03846	04A	W69-03928	04A	W69-04003
6D	W69-03770	06E	W69-03847	04A	W69-03929	04A	W69-04004
8C	W69-03771	05B	W69-03848	04A	W69-03930	03D	W69-04005
6B	W69-03772	06E	W69-03849	04A	W69-03931	03D	W69-04006
8C	W69-03773	06E	W69-03850	04A	W69-03932	05B	W69-04007
8C	W69-03774	06E	W69-03851	02K	W69-03933	08E	W69-04008
8C	W69-03775	06E	W69-03852	03F	W69-03934	08A	W69-04009
8C	W69-03776	06E	W69-03853	04A	W69-03935	08C	W69-04010
8D	W69-03777	06E	W69-03854	03F	W69-03936	02E	W69-04011
8D	W69-03778	05G	W69-03855	07C	W69-03937	02G	W69-04012
8D	W69-03779	03D	W69-03856	02G	W69-03938	02G	W69-04013
6D	W69-03780	06E	W69-03857	02E	W69-03939	02B	W69-04014

02F	W69-04015	06B	W69-04060	06B	W69-04104	06E	W69-04157
02A	W69-04016	06B	W69-04061	06E	W69-04105	05B	W69-04158
05B	W69-04017	06D	W69-04062	06E	W69-04106	06E	W69-04159
02G	W69-04018	06D	W69-04063	02D	W69-04107	04A	W69-04160
02H	W69-04019	06B	W69-04064	02A	W69-04108	04A	W69-04161
02H	W69-04020	06B	W69-04065	02I	W69-04109	05B	W69-04162
02K	W69-04021	06D	W69-04066	02D	W69-04110	06E	W69-04163
02H	W69-04022	06C	W69-04067	02F	W69-04111	08I	W69-04164
05C	W69-04023	06B	W69-04068	02A	W69-04112	03F	W69-04165
05B	W69-04024	06C	W69-04069	02I	W69-04113	04C	W69-04166
02L	W69-04025	06B	W69-04070	02G	W69-04114	03E	W69-04167
02H	W69-04026	06C	W69-04071	02A	W69-04115	06E	W69-04168
02H	W69-04027	06C	W69-04072	02I	W69-04116	06E	W69-04169
02H	W69-04028	06D	W69-04073	03F	W69-04117	05B	W69-04170
05C	W69-04029	06D	W69-04074	03F	W69-04118	06E	W69-04171
05D	W69-04030	06B	W69-04075	02A	W69-04119	04A	W69-04172
02E	W69-04031	06B	W69-04076	02B	W69-04120	05B	W69-04173
06B	W69-04032	06D	W69-04077	03F	W69-04121	05B	W69-04174
04C	W69-04033	06D	W69-04078	02G	W69-04124	04A	W69-04175
06E	W69-04034	06D	W69-04079	03B	W69-04125	04A	W69-04176
06D	W69-04035	06D	W69-04080	02J	W69-04126	05B	W69-04177
06D	W69-04036	06B	W69-04081	02G	W69-04127	05G	W69-04178
06E	W69-04037	06B	W69-04082	02I	W69-04129	04A	W69-04179
04B	W69-04038	06B	W69-04083	02G	W69-04130	04A	W69-04180
05G	W69-04039	06B	W69-04084	02A	W69-04131	04A	W69-04181
06E	W69-04040	06E	W69-04085	05D	W69-04132	06E	W69-04182
06E	W69-04041	06B	W69-04086	05B	W69-04133	04D	W69-04183
06E	W69-04042	06B	W69-04087	05B	W69-04134	06E	W69-04184
06E	W69-04043	06B	W69-04088	02B	W69-04135	04A	W69-04185
06E	W69-04044	06D	W69-04089	06C	W69-04136	04A	W69-04186
06E	W69-04046	06D	W69-04090	06C	W69-04137	04A	W69-04187
05G	W69-04047	06B	W69-04091	06A	W69-04138	06E	W69-04188
09D	W69-04048	06B	W69-04092	05D	W69-04142	06E	W69-04189
06E	W69-04049	06D	W69-04093	05D	W69-04144	06E	W69-04190
06E	W69-04050	06D	W69-04094	06D	W69-04145	06E	W69-04191
06E	W69-04051	06C	W69-04095	05D	W69-04147	06E	W69-04192
06E	W69-04052	06B	W69-04096	02F	W69-04149	05G	W69-04193
05G	W69-04053	06B	W69-04097	04A	W69-04150	04A	W69-04194
06E	W69-04054	06B	W69-04098	04A	W69-04151	06E	W69-04195
04A	W69-04055	06B	W69-04099	06E	W69-04152	06E	W69-04196
06B	W69-04056	06B	W69-04100	06E	W69-04153	06E	W69-04197
06B	W69-04057	06B	W69-04101	05G	W69-04154	06E	W69-04198
06D	W69-04058	06B	W69-04102	05G	W69-04155	03E	W69-04199
03C	W69-04059	06B	W69-04103	05G	W69-04156	03E	W69-04200

Subject Fields

- 1 NATURE OF WATER
- 2 WATER CYCLE
- 3 WATER SUPPLY AUGMENTATION AND CONSERVATION
- 4 WATER QUANTITY MANAGEMENT AND CONTROL
- 5 WATER QUALITY MANAGEMENT AND PROTECTION
- 6 WATER RESOURCES PLANNING
- 7 RESOURCES DATA
- 8 ENGINEERING WORKS
- 9 MANPOWER, GRANTS, AND FACILITIES
- 10 SCIENTIFIC AND TECHNICAL INFORMATION

INDEXES

- SUBJECT INDEX
- AUTHOR INDEX
- ORGANIZATIONAL INDEX
- ACCESSION NUMBER INDEX

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF COMMERCE

LIBRARY RATE
PRINTED MATTER

CLEARINGHOUSE FOR FEDERAL
SCIENTIFIC AND TECHNICAL INFORMATION
SPRINGFIELD, VA. 22151

OFFICIAL BUSINESS

16. 33391
Se 48

UNIVERSITY OF ILLINOIS
AUG 29 1969
LIBRARY

SELECTED WATER RESOURCES ABSTRACTS

VOLUME 2, NUMBER 11
JUNE 1, 1969

WR 69-04201 -- WR 69-04700

Selected Water Resources Abstracts is published semimonthly for the Water Resources Scientific Information Center (WRSIC) by the Clearinghouse for Federal Scientific and Technical Information (CFSTI) of the Bureau of Standards, U. S. Department of Commerce. It is available to Federal agencies, contractors, or grantees in water resources upon request to: Manager, Water Resources Scientific Information Center, Office of Water Resources Research, U. S. Department of the Interior, Washington, D. C. 20240. Annual subscription is $22.00 (domestic), $27.50 (foreign), single copy price is $3.00. Certain documents abstracted in this journal can be purchased from the Clearinghouse at the prices indicated in the entry. Prepayment is required.

CLEARINGHOUSE
FOR FEDERAL SCIENTIFIC AND TECHNICAL INFORMATION
U.S. Department of Commerce, Springfield, Va., 22151

SELECTED
WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

VOLUME 2, NUMBER 11
JUNE 1, 1969

WR 69-04201 -- WR 69-04700

of funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States--now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources. WRSIC is not presently prepared to furnish loan or retention copies of the publications announced.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas. Centers, and their subject coverage, now in operation are:

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

CONTENTS

FOREWORD_____iii

SUBJECT FIELDS AND GROUPS

(Use Edge Index on back cover to Locate Subject Fields and Indexes in the journal.)

01 NATURE OF WATER
Includes the following Groups: Properties; Aqueous Solutions and Suspensions

02 WATER CYCLE
Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION
Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL
Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Non-Water Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION
Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING
Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA
Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS
Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS, AND FACILITIES
Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.

10 SCIENTIFIC AND TECHNICAL INFORMATION
Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

SELECTED WATER RESOURCES ABSTRACTS

2. WATER CYCLE

A. General

YDROLOGIC ATLAS OF UTAH,
ah Water Research Lab., Logan.
bland W. Jeppson, Gaylen L. Ashcroft, A. Leon
ber, Gaylord V. Skogerboe, and Jay M. Bagley.

port PRWG 35-1, November, 1968. 306 p, 107
, 30 tab, 125 ref. OWRR Project B-001-UTAH.

scriptors: *Hydrology, *Temperature, recipitation, *Runoff, *Groundwater, Storage quirements, Water quality, Flood frequencies, w duration.

supply valuable information describing drologic and climatologic phenomena in formats ch as charts, tables, figures and maps which can used for a wide variety of design and planning eds, the 'Hydrologic Atlas of Utah' has been pared. The components involved in the drologic cycle--temperature, precipitation, sur- e waters and ground waters--are each presented detail on a state wide basis. Each of these presen- ions consists of a section listing sources, quantity d quality of basic hydrologic data, followed by a tion of analyses of this basic data to develop ationships for extrapolating to areas lacking a, and to define probabilities of time variations. m these analyses maps, charts and/or tables e been prepared to describe that component of hydrologic cycle. The surface and ground water nponents are described in terms of both quanti- s and qualities.
9-04209

W-FREQUENCY SEA LEVEL BEHAVIOR D CONTINENTAL SHELF WAVES OFF RTH CAROLINA,
tish Columbis Univ., Vancouver. Dept. of thematics; British Columbia Univ., Vancouver. t. of Oceanography; and Commonwealth Scien- c and Industrial Research Organization, Cronul- Australia). Div. of Fisheries and Oceanography.
A. Mysak, and B. V. Hamon.
eophys Res, Vol 74, No 6, pp 1397-1405, Mar 1969. 9 p, 9 fig, 15 ref. Nonr grant 1866 (51).

scriptors: *Sea level, *Continental shelf, *Con- ntal slope, *Waves (Water), North Carolina, ssure, Variability, Water level fluctuations, velengths, Velocity, Atmospheric pressure, ging stations, Weather data, Currents (Water), quency, Frequency analysis.
ntifiers: Morehead City (NC), Southport (NC).

w-frequency sea-level behavior was investigated the basis of atmospheric pressure and sea level ervations recorded at Morehead City and thport, North Carolina. The study shows the sence of nonbarometric response of sea level to ospheric pressure off the North Carolina coast, ecially in the 3-10 day period range. Cross-spec- ns between sea levels adjusted to constant at- spheric pressure at the two stations show phase ts consistent with the hypothesis of continental f waves traveling in the direction predicted by ry, that is southward. (Gabriel-USGS)
9-04224

ISSIPATIVE RIVER FLOW MODEL,
sburgh Univ., Pa. Dept. of Civil Engineering.
ald R. Jackson.
ydrol, Vol 6, No 1, pp 33-44, Jan 1968. 12 p, 3 7 ref, 2 append.

criptors: *Routing, *Hydrograph analysis, it hydrographs, *Hyetographs, Rainfall-runoff tionships, Flood routing, Runoff, Hydrographs, rography, Streamflow forecasting, Discharge ter), Surface runoff, Synthesis.
ntifiers: Instantaneous unit hydrograph.

Runoff is predicted by use of the conceptual model of the instantaneous unit hydrograph of a stream, that is, the hydrograph of a unit rainfall excess uniformly and instantaneously applied over the basin. The model assumes routing the rainfall excess through a series of resistive and dissipative elements. Integration of the instantaneous unit hydrograph yields the unit hydrograph. The second order differential equation of a river system is derived, solved, and compared with other stream-system models. The model presented is complex and requires a digital computer for fitting to problems and for hydrograph computation. Only the rainfall excess hyetograph and the outflow hydrograph of the stream for the same storm are required for fitting purposes. (Knapp-USGS)
W69-04232

ATMOSPHERIC WATER VAPOR TRANSPORT AND THE WATER BALANCE OF NORTH AMERICA- 2. LARGE-SCALE WATER BALANCE INVESTIGATIONS,
Weather Bureau, Washington, D. C. Geophysical Fluid Dynamics Lab.
Eugene M. Rasmusson.
Mon Weather Rev, Vol 96, No 10, pp 720-734, Oct 1968. 15 p, 12 fig, 7 tab. Grants GP-820-NSF and GP-3657-NSF. Supported in part by NSF, USAF 433L Prog, and Mitre Corp.

Descriptors: *Meteorology, *Water vapor, *Synoptic analysis, Climatology, Precipitation (Atmospheric), Evapotranspiration, Weather patterns.
Identifiers: Water vapor transport.

The atmospheric water vapor flux divergence and water balance of North America are investigated. The mean vertical distribution of flux divergence is computed for the months of January (1962,1963) and July (1961,1962). Strong flux convergence in the lowest kilometer and divergence in the remainder of the troposphere were found in July. Flux convergence was found throughout the troposphere over the eastern half of the area in January, with a maximum between 900 and 950 mb.; while in the west, convergence was found above 800 mb., with weak divergence below. Over the west, the flux divergence above 500 mb. is quite significant. The vertically integrated flux divergence is used in estimating the mean difference between precipitation and evapotranspiration. Although the flux divergence exhibits a pronounced diurnal variation south of 50 deg N., particularly during the summer, the results of water balance computation over the United States and southern Canada, using twice-daily observations from the existing aerological network, indicate that reliable mean annual, seasonal, and monthly values of the mean difference between precipitation and evapotranspiration can usually be obtained when averaging over large areas. A comparison of values computed by means of the atmospheric water vapor balance equation, with those computed using Thornthwaite climatic water balance data indicates that over the United States and southern Canada the latter systematically overestimates the mean difference during the winter, and underestimates it during the summer by a substantial amount. Over eastern North America, the departure from normal of precipitation by itself serves as a fairly good quantitative indicator of the departure from normal storage change. (Knapp-USGS)
W69-04246

HEAT EXCHANGE IN THE ENVIRONMENT,
John E. Edinger, and John Geyer.
Report, Department of Sanitary Engineering and Water Resources, The Johns Hopkins University, Baltimore, Maryland, Project No. 49, June 1, 1965.

Descriptors: *Heat transfer, *Heat balance, *Hydrodynamics, *Meteorology, Thermal conductivity, Powerplants, Transfer, Heat exchangers, Equipment, Cooling, Fluid mechanics.

This report deals with the physics of heat transfer phenomena occurring in surface waters and is designed to assist engineers and scientists in carrying out temperature computations related to the heating and cooling of natural waters. In the initial chapters, known principles of meteorology, hydrodynamics, and heat transfer are used to develop general formulations for heat exchange between natural waters and the atmosphere. The formulations are then applied to situations in which temperature predictions will prove useful to the power industry.
W69-04467

GENERALIZED RAINFALL-DURATION-FREQUENCY RELATIONSHIPS,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
Frederick C. Bell.
ASCE Proc, J Hydraul Div, Vol 95, No HY1, Pap 6357, pp 311-327, Jan 1969. 17 p, 7 fig, 5 tab, 21 ref.

Descriptors: *Rainfall-runoff relationships, *Duration curves, *Depth-area-duration analysis, *Hydrograph analysis, Runoff, Rainfall disposition, Rainfall intensity, Mass curves, Runoff forecasting, Meteorology, Hydrology, Streamflow forecasting.
Identifiers: Rainfall-duration-frequency curves, Depth-duration curves, Depth-frequency curves.

Rainfall-duration-frequency estimates for engineering purposes are usually subject to large sampling errors and extensive generalizations of the basic data are therefore advantageous from the point of view of estimation efficiency. Relationships between high-intensity rainfall values for durations up to 2 hr and return periods up to 100 hr are appropriately expressed by means of 'depth-duration' and depth-frequency' ratios. These ratios are shown to have surprisingly consistent values in such diverse places as Alaska, Hawaii, Puerto Rico, South Africa and Australia, as well as the contiguous United States, and it is suggested that a physical explanation exists for such consistencies. The data may be conveniently generalized with one of several alternative depth-duration-frequency functions which should be useful for estimates in regions of limited data. (Knapp-USGS)
W69-04549

EVALUATION OF SEGMENTED IUH FROM DERIVATIVES,
Technion - Israel Inst. of Tech., Haifa. Dept. of Civil Engineering.
Mordechai H. Diskin.
ASCE Proc, J Hydraul Div, Vol 95, No NY1, Pap 6359, pp 329-346, Jan 1969. 18 p, 9 fig, 6 tab, 9 ref, append.

Descriptors: *Hydrograph analysis, *Hyetographs, *Hydrographs, *Unit hydrographs, *Mathematical studies, Mathematical models, Numerical analysis, Rainfall intensity, Rainfall disposition, Rainfall-runoff relationships, Storm runoff.
Identifiers: Instantaneous unit hydrographs, Convolutional integrals.

A new method is presented for the analysis of rainfall excess hyetographs and direct surface runoff hydrographs and for the derivation of instantaneous unit hydrographs. The method assumes that the IUH can be approximated by a segmented polygon composed of straight lines and that the duration of the rainfall excess is shorter than or equal to the duration of the shortest of the straight line segments composing the polygon. Other assumptions are that the watershed system for which the input and output curves are available is a linear time invariant system and that it is initially relaxed. The method is based on a theorem for the convolution of derivatives of functions and shows how the derivatives of the assumed instantaneous unit hydrograph can be obtained from an analysis of the shapes of the available rainfall excess hyetograph and direct surface runoff hydrograph. Numerical examples accompany the development of the method and a final example illustrating the application of the method is also included. (Knapp-USGS)
W69-04553

THE EXTREME VALUES OF PRECIPITATION PHENOMENA,
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 02B.
W69-04567

THE GENERATION OF SPRING PEAK FLOWS BY SHORT-TERM METEOROLOGICAL EVENTS,
Forestry Sciences Laboratory, Moscow, Idaho.
For primary bibliographic entry see Field 02E.
W69-04570

WATERSHED CALIBRATION METHODS,
Forest Service (USDA) Upper Darby, Pa. Northeastern Forest Experiment Station.
For primary bibliographic entry see Field 03B.
W69-04634

2B. Precipitation

CENTRAL MONTANA RAINSTORMS AND FLOODS, JUNE 6-15, 1967,
Weather Bureau, Helena, Mont. Airport Station.
R. A. Dightman.
Mon Weather Rev, Vol 96, No 11, pp 813-823, Nov 1968. 11 p, 19 fig, 2 tab, 7 ref.

Descriptors: *Floods, *Montana, *Precipitation (Atmospheric), *Historic flood, Cloudbursts, Discharge (Water), Maximum probable flood, Rain, Storm runoff.
Identifiers: Musselshell River (Mont).

The meteorological features associated with the greatest flood of record (June 6-15, 1967) in the Central Musselshell River Valley of Montana are examined and the flooding and rainfall distribution are described and compared with other Eastern Montana flood-producing storms. Applications of RADAR to forecasting this flood are discussed. In some parts of the Musselshell drainage the rainfall intensity exceeded that of a 100-yr probable maximum 2-day storm. (Knapp-USGS)
W69-04237

MARKOV CHAINS OF ORDER GREATER THAN ONE,
Oregon State Univ., Corvallis. Dept. of Statistics.
William P. Lowry, and Donald Guthrie.
Mon Weather Rev, Vol 96, No 11, pp 798-801, Nov 1968. 4 p, 6 tab, 14 ref.

Descriptors: *Markov processes, *Precipitation (Atmospheric), Weather data, New Mexico, Colorado, Oregon, Climatology, Climatic data, Climatic zones, Meteorology.
Identifiers: High-order Markov processes.

Means are proposed whereby a test for the goodness of fit and an estimate of the order of a Markov chain model may be obtained concurrently. Application of the method to daily precipitation data for 2 seasons of about 30 yr in New Mexico, Colorado, and Oregon suggests 2 tentative conclusions. First, within a single climatic area, order estimates tend toward zero as precipitation events become rarer. This may occur at the drier stations or at higher thresholds defining a wet day. Second, between climatic areas, the station with the greater diversity of air mass types will tend to have order estimates greater than the station having the same seasonal mean precipitation but a less diverse climate. (Knapp-USGS)
W69-04238

WORLD DISTRIBUTION OF MEAN MONTHLY AND ANNUAL PRECIPITABLE WATER,
California Univ., Los Angeles. Dept. of Geography.
Stanton E. Tuller.
Mon Weather Rev, Vol 96, No 11, pp 785-797, Nov 1968. 13 p, 16 fig, 1 tab, 22 ref.

Descriptors: *Precipitation (Atmospheric), *Synoptic analysis, *Precipitable water, Meteoric water, Moisture content, Water vapor, Air circulation, Meteorology, Weather patterns, Climatology, Monsoons, Weather, Weather data, Weather patterns.
Identifiers: Annual precipitable water.

Mean values of precipitable water are determined for 182 stations throughout the world using a 3-yr period and evaluation methods developed by Peterson and Showalter. The resulting distribution is presented on a series of monthly maps and a map of the annual mean value. A general latitudinal pattern is present, especially over the oceans, with Highs near the Equator and Lows at the Poles. The continents show the effects of elevation and distance from the sea. The highest yearly mean is found in the Bay of Bengal in the summer. Other areas of high precipitable water are the tropical lowlands. Lowest values are in the high latitudes, continental interiors, and at high elevations in winter. Annual ranges are greatest in the Bay of Bengal and interior Asia and lowest over the equatorial oceans. (Knapp-USGS)
W69-04239

ATMOSPHERIC WATER VAPOR TRANSPORT AND THE WATER BALANCE OF NORTH AMERICA- 2. LARGE-SCALE WATER BALANCE INVESTIGATIONS,
Weather Bureau, Washington, D. C. Geophysical Fluid Dynamics Lab.
For primary bibliographic entry see Field 02A.
W69-04246

GENERALIZED RAINFALL-DURATION-FREQUENCY RELATIONSHIPS,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
For primary bibliographic entry see Field 02A.
W69-04549

THE EXTREME VALUES OF PRECIPITATION PHENOMENA,
Colorado State Univ., Fort Collins.
Petar Todorovic, and Emir Zelenhasic.
Bull Int Ass Sci Hydrol, Vol 13, No 4, pp 7-24, Dec 1968. 18 p, 8 fig, 3 tab, 6 ref.

Descriptors: *Rainfall disposition, *Mathematical models, *Stochastic processes, *Probability, Rainfall, Statistical models, Statistical methods, Rainfall intensity, Hyetographs, Synthetic hydrology.
Identifiers: Probability of extreme events, Rainfall intensity probability.

A mathematical method is presented for interpretation and analysis of extreme values of precipitation at a given location on the surface of the earth. The method gives the corresponding distribution functions for the minimum and maximum storms during a sample composed of n successive storms, where n = 2,3,...To check the descriptive capabilities of the method, it was applied to a 70-year record of rainfall at a precipitation station at Durango, Colorado. (Knapp-USGS)
W69-04567

2C. Snow, Ice, and Frost

EFFECTS OF SOIL FREEZING ON WATER YIELDS,
Colorado State Univ., Fort Collins; and Forest Service, Washington, D. C.
Arnett C. Mace, Jr.
Forest Serv Res Note RM-121, 1968. 4 p, 1 fig, 3 tab, 13 ref.

Descriptors: *Frost, *Frozen ground, *Infiltration, *Forest soils, Arizona, Snowmelt, Soil water movement, Groundwater movement, Forests, Mountains, Snow.
Identifiers: Concrete frost, Granular frost, White Mountains (Ariz).

The effects of 2 different frost types, concrete and granular freezing, on soil water infiltration were studied in the White Mountains of Arizona. Concrete frost occurs in the open grassland areas, and appears to increase surface runoff. Only granular frost occurs in the timber types, and appears to decrease surface runoff and increase soil moisture recharge. Concrete freezing causes increased soil moisture and reduced bulk densities in the zone of freezing, whereas granular freezing has no effect on these properties. (Knapp-USGS)
W69-04251

OBSERVATIONS OF SNOWPACK ACCUMULATION, MELT, AND RUNOFF ON A SMALL ARIZONA WATERSHED,
Colorado State Univ., Fort Collins; and Forest Service, Washington, D. C.
Peter F. Ffolliott, and Edward A. Hansen.
Forest Serv Res Note RM-124, 1968. 7 p, 4 fig, 16 ref.

Descriptors: *Snowpacks, *Snow management, *Water yield improvement, *Forest management, Water resources, Runoff, Snowmelt, Overland flow, Runoff forecasting, Interception, Snow surveys, Arizona.
Identifiers: Snowpack-forest cover-runoff relations.

Intensive measurements of snow and streamflow on a 425-acre ponderosa pine watershed indicated that more than 90% of the snowpack left the watershed as runoff. Snow accumulation was inversely related to forest density, which indicates a possible opportunity for increasing snow accumulation through more intensive forest management. (Knapp-USGS)
W69-04253

GLACIERS AND WATER SUPPLY,
Geological Survey, Tacoma, Wash.
Mark F. Meier.
J Amer Water Works Ass, Vol 61, No 1, pp 8-12, Jan 1969. 5 p, 3 fig, 2 photo, 3 tab, 6 ref.

Descriptors: *Glaciers, *Melting, *Runoff, *Water sources, Climatology, Water resources development, Water supply, Management, Watershed management, Water management (Applied), Alaska, Pacific Northwest U.S., Rocky Mountain Region.
Identifiers: Glacial regulation.

About three-fourths of the world's fresh water is stored as glacier ice. In North America the volume of water stored in snow and ice is many times greater than the volume stored in all the surface waters of the continent. The impact of glaciers on water resource use is greatest in Alaska, the Pacific Northwest, Northern Rockies, and Middle Rockies. In the Northwest and Rockies the glaciers, small by Alaskan standards, are important streamflow sources and regulators. Glacial regulation makes water supply more reliable, but forecasting seasonal water release is nearly impossible by ordinary snow survey procedures, because runoff prediction depends almost entirely on summer heat balance, radiation, and albedo measurements all of which are subject to large uncertainties. Variability of runoff is reduced because unusually hot summers, which melt more ice, also usually produce less precipitation. Artificial control of glacier melting as a means of managing water resources is discussed. (Knapp-USGS)
W69-04255

THE GENERATION OF SPRING PEAK FLOWS BY SHORT-TERM METEOROLOGICAL EVENTS,
Forestry Sciences Laboratory, Moscow, Idaho.
For primary bibliographic entry see Field 02E.
W69-04570

2D. Evaporation and Transpiration

ATMOSPHERIC WATER VAPOR TRANSPORT AND THE WATER BALANCE OF NORTH AMERICA- 2. LARGE-SCALE WATER BALANCE INVESTIGATIONS,
Weather Bureau, Washington, D. C. Geophysical Fluid Dynamics Lab.
For primary bibliographic entry see Field 02A.
W69-04246

VARIATIONS OF EVAPORATION IN TIME AND SPACE: PART 1 AND PART 2,
Nottingham Univ. (England). School of Agriculture.
David C. Davenport.
J Hydrol, Vol 5, pp 312-350, 1967. 18 fig, 1 plate, 6 tab, 35 ref.

Descriptors: *Evaporation, *Diurnal distribution, *Spatial distribution, *Lysimeters, *Weather, Climate, Temperature, Winds, Vapor pressure, Humidity, Topography.
Identifiers: *Evaporimeters, Diurnal evaporation pattern, Spatial evaporation pattern.

Daily lateral, and vertical variations in measured and calculated evaporation rates were accounted for by changes in various weather factors, using simple and multiple regression analyses. Partial correlations indicated that solar radiation accounted for about 70% of the variations in water losses from dish evaporimeters, whereas the corresponding influences of temperature, vapor pressure deficit and wind, as individual factors, were about 35% nil, and 60% respectively. However, radiation, temperature, and wind, as component factors, each showed a lower correlation with evaporation, whereas vapor pressure deficit showed a higher and significant correlation. The degree of association between evaporation and weather factors was greater when the number of daily observations used in the analysis was doubled. Multiple-regression analyses showed that the combined effects of the 4 weather parameters were responsible for about 90 and 50% of the observed variations in evaporation and transpiration rates, respectively. The rates of evaporation, calculated by the multiple regression equations, agreed well with evaporation observed on days other than those used for making the regression. Significant correlations were also found between evaporation from small dishes and a US Class A pan, and between evaporation and transpiration from grass in lysimeters. (Knapp-USGS)
W69-04618

2E. Streamflow and Runoff

TRANSIENT FLOW INVESTIGATIONS FOR TVA'S BROWNS FERRY GENERATING STATION.
Tennessee Valley Authority, Knoxville.
B. Buehler, J. T. Price, and J. M. Garrison.
Proceedings, 7th Annual Sanitary and Water Resources Engineering Conference, Vanderbilt University, Nashville, Tennessee, pp 125-138 May 1968.

Descriptors: Unsteady flow, Simulation, Rivers, Reservoirs, Transient flow, Hydraulics, Computers, Open channels, Waves, Field measurements.
Identifiers: *Stream channels, Turbine operations, Tennessee Vallwater flow, *TVA.

Most mathematical modeling of unsteady flow phenomena has been limited to prismatic channels and somewhat idealized conditions. The Tennessee Valley Authority, using the numerical methods developed by Stoker, has successfully applied these techniques to a variety of complex unsteady flow problems which have occurred, or are expected to occur, in some of TVA's system of reservoirs and natural river channels. This paper describes the mathematical model of unsteady and nonuniform free-surface flow used to compute discharges, mean velocities, and water surface elevations in Wheeler Reservoir, in northern Alabama. Flows in this reservoir result primarily from widely varying hydroplant operations at Guntersville Dam at the upstream end of the reservoir and at Wheeler Dam at the downstream end. The Wheeler Reservoir computational model was set up specifically to study preoperational flow conditions at the site of the new Browns Ferry Nuclear Plant, now under construction. The plant site is about 55 miles downstream from Guntersville and 19 miles upstream from Wheeler. The mathematical model was verified against field measurements of water surface elevation and velocity. The model is described in this paper and the results from the Browns Ferry studies are given. These results include verification of the model, computed results for the plant site, and several sets of results to demonstrate the use of the model as a tool to establish a desired flow at any point along the reservoir.
W69-04203

GEOMORPHIC GROUPING OF SOILS IN WATERSHED ENGINEERING,
Agricultural Research Service, Beltsville, Md. Soil and Water Conservation Research Div.
Charles B. England, and H. N. Holtan.
J Hydrology, Vol 6, pp 13-21, 1968. 9 p, 2 tab, 3 fig, 22 ref.

Descriptors: *Geomorphology, Topography, Soil groups, Soil physical properties.
Identifiers: Hydrologic response units.

Soil properties significant to processes of infiltration, moisture storage, drainage, and the hydraulics of surface flow are related to topographic position. Areal and elevational distributions of soils provide a basis for interpretative grouping of soil mapping units in computations for watershed engineering. Soils on an ARS experimental watershed, grouped by deep upland, shallow hillside, and very deep depositional, were plotted on a contour map of the watershed surface. The elevational sequences thus obtained are representative of the hydraulic relationships between hydrologic response units in small agricultural watersheds. Profile characteristics, areal distribution, and relative elevation position of the units determine watershed response to storm rainfall. (England-USDA Hydro Lab)
W69-04207

FLOOD PLAIN INFORMATION, CALCASIEU RIVER, OAKDALE, LOUISIANA.
Switzer (Albert) and Associates, Inc., Baton Rouge, La.
For primary bibliographic entry see Field 04A.
W69-04215

FLOOD PLAIN INFORMATION, LAS CHOLLAS CREEK, SAN DIEGO COUNTY, CALIFORNIA.
Corps of Engineers, Los Angeles, Calif.
For primary bibliographic entry see Field 04A.
W69-04217

FLOOD PLAIN INFORMATION, FEATHER AND YUBA RIVERS, MARYSVILLE-YUBA CITY, CALIFORNIA.
Corps of Engineers, Sacramento, Calif.
For primary bibliographic entry see Field 04A.
W69-04218

CENTRAL MONTANA RAINSTORMS AND FLOODS, JUNE 6-15, 1967,
Weather Bureau, Helena, Mont. Airport Station.
For primary bibliographic entry see Field 02B.
W69-04237

STORAGE REQUIREMENTS FOR ARKANSAS STREAMS,
Geological Survey, Washington, D. C.
James L. Patterson.
Geol Surv Water-Supply Pap 1859-G, pp G1-G36, 1968. 36 p, 14 fig, 1 plate, 2 tab, 7 ref.

Descriptors: *Water supply, *Streamflow, *Storage, *Reservoirs, *Arkansas, Reservoir storage, Quality control, Retention, Flood control, Regulated flow, Safe yield, Waste dilution, Data collections.
Identifiers: Storage requirements.

The supply of good-quality surface water in Arkansas is abundant. Owing to seasonal and annual variability of streamflow, however, storage must be provided to insure dependable year-round supplies in most of the State. Storage requirements for draft rates that are as much as 60% of the mean annual flow at 49 continuous-record gaging stations can be obtained from tabular data in this report. Through regional analyses of streamflow data, the State was divided into 3 regions. Draft-storage diagrams for each region provide a means of estimating storage requirements for sites on streams where data are scant, provided the drainage area, the mean annual flow, and the low-flow index are known. These data are tabulated for 53 gaging stations used in the analyses and for 132 partial-record sites where only base-flow measurements have been made. Mean annual flow can be determined for any stream whose drainage lies within the State by using the runoff map in this report. Low-flow indices can be estimated by correlating base flows, determined from several discharge measurements, with concurrent flows at nearby continuous-record gaging stations, whose low-flow indices have been determined. (Knapp-USGS)
W69-04250

GLACIERS AND WATER SUPPLY,
Geological Survey, Tacoma, Wash.
For primary bibliographic entry see Field 02C.
W69-04255

MAN, VEGETATION AND THE SEDIMENT YIELDS OF RIVERS,
Hull Univ. (England). Dept. of Geography.
Ian Douglas.
Nature, Vol 215, No 5104, pp 925-928, Aug 26, 1967. 4 p, 4 fig, 26 ref.

Descriptors: *Sediment yield, *Vegetation effects, *Erosion, *Land use, Sediment discharge, Cultivation, Streams, Geomorphology, Impact (Rainfall), Slopes, Topography, Sedimentation.
Identifiers: Australia.

Reconnaissance studies in a wide range of climatic conditions in Australia suggest that sediment yields of many rivers draining areas of long human use are far in excess of yields of the geological past. Sediment yield is a combined effect of runoff and vegetation cover, both of which are affected by human use of land. Comparison of Australian rivers draining largely unsettled areas with rivers elsewhere with similar mean annual runoff but which drain settled areas, shows that the settled areas contribute as much as 50 times as much sediment as the unsettled areas. (Knapp-USGS)
W69-04269

SURFACE-WATER HYDROLOGY OF CALIFORNIA COASTAL BASINS BETWEEN SAN FRANCISCO BAY AND EEL RIVER,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 03B.
W69-04273

MEASUREMENT OF DISCHARGE BY THE MOVING-BOAT METHOD,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 07B.
W69-04547

HYDROLOGY FOR URBAN LAND PLANNING-A GUIDEBOOK ON THE HYDROLOGIC EFFECTS OF URBAN LAND USE,
Geological Survey, Washington, D. C.

For primary bibliographic entry see Field 04C.
W69-04548

STORM DRAINAGE PRACTICES OF THIRTY-TWO CITIES,
Tennessee Valley Authority, Knoxville. Div. of Water Control Planning; and Wisconsin Univ., Madison. Dept. of Civil Engineering.
Colby V. Ardis, Kenneth J. Dueker, and Arno T. Lenz.
ASCE Proc, J Hydraul Div, Vol 95, No HY1, Pap 6365, pp 383-408, Jan 1969. 26 p, 13 fig, 12 tab, 12 ref, append.

Descriptors: *Drainage, *Storm drains, *Drainage water, *Waste water disposal, *Waste water treatment, Wisconsin, Urbanization, Runoff, Storm runoff, Cost analysis, Drainage systems, Water pollution control.
Identifiers: Urban hydrology, Municipal engineering, Storm sewers.

Wisconsin cities with populations of 7,500 to over 60,000 are rapidly developing comprehensive plans independent of community size with all storm sewer designs done by registered professional engineers. Storms with 5 to 10 yr frequency are used in design. Two-foot inlets depressed one in., 12-in. minimum pipe size and pipe velocities of 2 to 15 fps are common. Storm water pollution is recognized but only 1/3 of cities have ideas on its alleviation. Urban drainage designers who provided current practice, policy, procedure, and cost information for a typical 15-acre, 6-block area indicated wide diversity in results when using the Rational Method to compute flows. Only 6 of 23 cities which contributed sample designs used variable intensities correctly in the Rational Method. Errors in the use of the runoff coefficient C was common. The resulting designs gave flows of 68 to 100 cfs at outlet; total project costs which varied from $8,000 to $65,000 for this sample area. The need for narrower guide lines for design is suggested. (Knapp-USGS)
W69-04551

EVALUATION OF SEGMENTED IUH FROM DERIVATIVES,
Technion - Israel Inst. of Tech., Haifa. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02A.
W69-04553

SOME TURBULENCE MEASUREMENTS IN OPEN-CHANNEL FLOW,
Geological Survey, Fort Collins, Colo.
R. S. McQuivey, and Everett V. Richardson.
ASCE Proc, J Hydraul Div, Vol 95, No HY1, Pap 6349, pp 209-223, Jan 1969. 15 p, 11 fig, 3 tab, 9 ref, append.

Descriptors: *Turbulence, *Open channel flow, *Anemometers, Heat transfer, Water circulation, Instrumentation, Flowmeters, Research and development, Hydraulics.
Identifiers: Hot-wire anemometers.

Measurements of the characteristics of turbulence in hydrodynamically smooth and hydrodynamically rough open-channel flow using hot-film anemometry technics showed: (a) that the relative turbulent intensity of the vertical velocity component was about 60% of the longitudinal, (b) that the spectral energy distribution was not significantly affected by the type of flow, (c) that most of the turbulent energy is contained in frequencies less than 5 hertz, (d) the macroscale of the turbulence as determined from the autocorrelation function was on the same order as the depth and (e) the ratio of the microscale to depth ranged from 0.1 to 0.2. The measurements were used to verify experimentally the longitudinal direction momentum terms in the Navier-Stokes equation and to determine qualitatively the magnitude of the production, diffusion, and dissipation terms in the energy equation. (Knapp-USGS)
W69-04555

CURRENTS IN AN INTEROCEANIC CANAL,
Corps of Engineers, Jacksonville, Fla. Interoceanic Canal Studies Branch.
Edwin W. Eden, Jr.
ASCE Proc, J Hydraul Div, Vol 95, No HY1, Pap 6342, pp 79-101, Jan 1969. 23 p, 16 fig, 7 tab, 8 ref.

Descriptors: *Canals, *Tidal effects, *Currents (Water), *Mathematical models, Navigation, Tides, Streamflow, Panama Canal, Canal design, Hydraulics.
Identifiers: Finite difference methods, Tidal currents, Panama sea-level canal.

The feasibility of a sea-level canal between the Atlantic and Pacific Oceans is under consideration by the U. S. Corps of Engineers as the agent for an Interoceanic Canal Commission appointed by President Johnson. The tidal and hydrologic studies made for the feasibility study are described, tidal currents are estimated, their impacts on the canal and the potential shipping are estimated. Considerable variation in character and range of tides is experienced. Currents in a sea-level canal were based on a mathematical model utilizing an explicit finite difference method. The current varies with tidal range and phasing and canal cross-secional width and depth, length, and roughness. Currents caused by the flow of fresh water during flood times are also considered. A method of reducing tidal currents is described. (Knapp-USGS)
W69-04557

EFFECT OF URBAN DEVELOPMENT ON FLOOD DISCHARGES-CURRENT KNOWLEDGE AND FUTURE NEEDS,
American Society of Civil Engineers, New York.
For primary bibliographic entry see Field 04C.
W69-04560

WATER RESOURCES DATA FOR IOWA, 1968--PART 1. SURFACE WATER RECORDS, PART 2. WATER QUALITY RECORDS.
Geological Survey, Iowa City, Iowa.

Geol Surv Duplicated rep, 1968. Total 257, 3 fig, 2 tab, 16 ref.

Descriptors: Data collections, *Surface waters, *Streamflow, Iowa, *Water quality, Stream gages, Lakes, Reservoirs, Stage-discharge relations, Water temperature, Sediment discharge.
Identifiers: Surface water records, Water quality records, Water resources data.

The surface-water records for the 1968 water year for gaging stations, partial-record stations, and miscellaneous sites in Iowa are presented. The data generally comprise a description of the station and a table showing the daily discharge and monthly and yearly discharge of the stream. The description of the station gives the location, drainage area, records available, type and history of gages, average discharge, extremes of discharge, and general remarks. The type of gage currently in use and the datum of the gage above mean sea level, and a condensed history of the types, locations, and datums of previous gages used during the period of records available are listed. Information on the accuracy of the records and conditions which affect the natural flow is given under 'Remarks.' Daily discharges, average discharge, extremes, yearly totals, and peak discharges are listed in a table. Chemical quality, fluvial sediment, and water temperatures are also listed. The chemical quality includes concentrations of individual dissolved constituents, hardness, specific conductance, and pH. Fluvial-sediment information is given for suspended-sediment discharges and concentrations. Water-temperature data represent once-daily observations except for stations where a continuous temperature recorder furnishes information from which daily minimums and maximums are obtained. (Knapp-USGS)
W69-04565

A MODERN STATISTICAL STUDY O MONTHLY LEVELS OF THE ORINOC RIVER,
Universidad Nacional del Zulia, Maracaib (Venezuela). Civil Engineering School.
Ignacio Rodriquez-Iturbe.
Bull Int Ass Sci Hydrol, Vol 13, No 4, pp 25-4 Dec 1968. 17 p, 13 fig, 2 tab, 12 ref.

Descriptors: *Mathematical models, *Syntheti hydrology, *Streamflow, Stochastic processes Statistical methods, Time series analysis, Forecas ing, Streamflow forecasting, Regression analysis.
Identifiers: Spectral analysis, Orinoco River.

A mathematical model is built for monthly rive flows of the Orinoco River. The model consists of cyclic part which explains up to 93% of the tot variance of the series of monthly water levels, and stochastic part which is shown to follow a 1st orde autoregressive scheme with a primary variable random component that behaves as 'white nois and appears to have near 60% chance of comin from a normal population. A time series of flo anomalies is obtained from long term monthl means. Statistical techniques are applied to the s ries of flow anomalies in order to obtain the mea number of crossings at an orbitrary level during a arbitrary time. There are also studied the mea length of an upward excursion over an arbitrar level and the mean time between successive up crossings. The actual results for the Orinoco Rive are in good agreement with the statistical theor showing that this actual results for the Orinoc River are in good agreement with the statistica theory showing that this kind of analysis can be ex tremely useful in the design and planning of rese voir operations. (Knapp-USGS)
W69-04568

THE GENERATION OF SPRING PEAK FLOW BY SHORT-TERM METEOROLOGICA EVENTS,
Forestry Sciences Laboratory, Moscow, Idaho.
Harold F. Haupt.
Bull Int Ass Sci Hydrol, Vol 13, No 4, pp 65-76 Dec 1968. 12 p, 2 fig, 2 tab, 5 ref.

Descriptors: *Rainfall-runoff relationships, *Snow melt, Runoff forecasting, Runoff, Hydrographs Temperature, Rainfall, Snowpacks, Water yield Idaho.
Identifiers: Snowmelt-runoff relationships, Experi mental watersheds.

Spring peak flows recorded over a 25-year perio in Benton Creek, a small forested watershed i northern Idaho, were studied in their relation t meteorological events. More peak flows wer generated by rain-on-snow than by clear-weathe snowmelt; the 2 types of peaks differ in magnitud and in other characteristics. Two rather simpl techniques were used to calculate the generativ capacity of a rainfall-temperature event and th hypothetical outflow of water from a snowpac during rainy and rainfree periods. Similar data o spring peaks on 2 regional subbasins were con sidered also. (Knapp-USGS)
W69-04570

TOPOLOGICAL SIGNIFICANCE OF STREAM METHODS,
Illinois Univ., Urbana.
G. Ranalli, and A. E. Scheidegger.
Bull Int Ass Sci Hydrol, Vol 13, No 4, pp 77-85 Dec 1968. 9 p, 6 fig, 8 ref.

Descriptors: *Geomorphology, *Networks, *Rive systems, Synthetic hydrology, Mathematica models, Stochastic processes, Streams.
Identifiers: Stream order, River networks, Topolo gy.

Several stream ordering and labeling methods hav been proposed in order to describe some aspects o the geometry of river networks; namely, Horton's Strahler's, Milton-Ollier's, Scheidegger's ordering

techniques, and the STORET location coding system. This paper analyzes the topological significance of each of these methods, that is, the amount of information on the topological structure of the net that they can yield. Horton's and Strahler's ordering methods give only numerical information on the distribution of channels among different classes (orders); Milton-Ollier's and Scheidegger's methods give more information, from the topological point of view, as the former assigns a unique label to each stream segment in a network, and the latter takes into account all junctions; the STORET system labels interconnections between channels, but does not use the concept of order and is therefore more suitable for other purposes than for the theoretical study of river nets. (Knapp-USGS)
W69-04571

HYDROLOGY OF CRATER, EAST AND DAVIS LAKES, OREGON,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02H.
W69-04574

DISCHARGE IN THE LOWER COLUMBIA RIVER BASIN, 1928-65,
Geological Survey, Washington, D. C.
Hollis M. Orem.
Geol Surv Circ 550, 1968. 24 p, 4 fig, 12 tab, 4 ref.

Descriptors: *Streamflow, *Streamflow forecasting, *River flow, *Columbia River, Estimating, Washington, Oregon, Stream gages, Stage-discharge relations, Data collections, Average flow, Storage, Routing.
Identifiers: *Streamflow estimation, Lower Columbia River Basin.

Estimates of monthly and annual mean discharge for 5 ungaged sites in the lower Columbia River are presented for water years 1928-65. These sites are Columbia River at Vancouver, Wash, Willamette River at mouth, Columbia River at St. Helens, Oreg, Columbia River at Longview, Wash, and Columbia River at mouth. Two tables of estimates are compiled for each site. One table lists estimates of 'observed' flow, the flows that would be measured by a gaging station. The other table lists 'adjusted' flows, the 'observed' flows adjusted for storage changes in major reservoirs and for diversion at Grand Coulee Dam. Two methods are used in making these estimates. One method involves a detailed summation of flows from all gaged and ungaged areas, allowance for precipitation on and evaporation from the channel water surface and adjustment of flow to allow for travel time from gaging stations at the Dalles, Oreg (Columbia River main stem), and at Salem, Oreg (Willamette River). The other method is the same as the summation method except that flows from individual gaged and ungaged areas below the Dalles and Salem are not summed in detail. Instead, the entire drainage area below The Dalles is divided into 3 major inflow segments and the flow from each segment is obtained from a correlation with streams that are representative of the flow from that segment. Estimates of monthly mean flows are considered to be accurate within 2 or 3%. (Knapp-USGS)
W69-04577

PEAK FLOOD DISCHARGE CONFIDENCE LIMITS,
Carnigie-Mellon Univ., Pittsburgh, Pa. Dept. of Civil Engineering.
Richard M. Shane, and Walter R. Lynn.
ASCE Proc, J Hydraul Div, Vol 95, No HY1, Pap 6329, pp 161-173, Jan 1969. 13 p, 6 fig, 2 tab, 4 ref, 4 append.

Descriptors: *Flood forecasting, *Statistical methods, Peak discharge, Probability, Statistical models, Base flow, Discharge (Water), Streamflow.
Identifiers: Probability density functions, Probability theory, Statistical analysis, Flood probability, Confidence limits.

Confidence limits along with a lower bound for the corresponding level of confidence are developed for evaluating the effect of the sampling error on flood risk evaluation from base-flow flood data. It is assumed that the number of flood peak occurrences is Poisson-distributed with exponentially distributed magnitudes. A confidence region is obtained for the Poisson and exponential distribution parameters from the asymptotic joint distribution of their maximum likelihood estimators. It is shown how this region can be used to obtain confidence limits for measures of risk which are calculated using the estimates. The limits are easy to calculate and, if desired, a graphical technique can be used. The technique is restricted, however, to situations where the base-flow record is sufficiently long so that the sampling distribution for the estimators can be approximated by a limiting normal distribution. (Knapp-USGS)
W69-04582

RIVER METAMORPHOSIS,
Colorado State Univ., Fort Collins. Dept. of Geology.
Stanley A. Schumm.
ASCE Proc, J Hydraul Div, Vol 95, No HY1, Pap 6352, pp 255-273, Jan 1969. 19 p, 2 fig, 1 tab, 25 ref, 3 append.

Descriptors: *Alluvial channels, *Erosion, *Sedimentation, *Channel morphology, Streams, Discharge (water), Rivers, Paleohydrology, Sediment transport, Geomorphology, Sediment yield, Sediment discharge, Regime, Shape, Slopes, Width, Meanders.
Identifiers: *River metamorphosis, Australia, Murrumbidgee River.

Data collected from stable alluvial rivers on the Great Plains of Western United States and on the Riverine Plain of southeastern Australia are used to demonstrate that channel width, depth, shape, meander wavelength, sinuosity and gradient are significantly related to the quantity of water and to the type of sediment load moving through these channels (ratio of bed-material load to total sediment load). Frequently during geologic time, complete alteration of river morphology (river metamorphosis) has occurred as a result of climate changes, whereas during historic time river metamorphosis occurs as a result of man induced variations of hydrologic regimen. Geologic and historic examples of river metamorphosis are used to support the empirical relations and to form the basis for deductions concerning the long-term reaction of a river system to man-induced changes of hydrologic regimen. (Knapp-USGS)
W69-04583

RECONNAISSANCE OF THE CHEMICAL QUALITY OF SURFACE WATERS OF THE SULFUL RIVER AND CYPRESS CREEK BASINS, TEXAS,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 02K.
W69-04586

WATER RESOURCES OF THE SYCAMORE CREEK WATERSHED, MARICOPA COUNTY, ARIZONA,
Geological Survey, Washington, D. C.
B. W. Thomsen, and H. H. Schumann.
Geol Surv Water-Supply Pap 1861, 1968. 53 p, 31 fig, 1 plate, 1 photo, 7 tab, 21 ref.

Descriptors: *Water resources, *Groundwater, *Surface water, *Arizona, Streamflow, Water wells, Water yield, Alluvium, Infiltration, Surface-groundwater relationships, Arid lands, Mountains, Evaporation, Floods.
Identifiers: Sycamore Creek watershed (Ariz), Maricopa County (Ariz), Aquifer tests.

The Sycamore Creek watershed is representative of many small watersheds in the southwest where much of the streamflow originates in the mountainous areas and disappears rather quickly into the alluvial deposits adjacent to the mountains. Five years of streamflow records from the Sycamore Creek watershed show that an average annual water yield of 6,110 acre-ft was obtained from the 165 sq mi (105,000 acres) of the upper hard-rock mountain area, which receives an average annual precipitation of about 20 inches. Only a small percentage of the annual water yield, however, reaches the Verde River as surface flow over the 9-mile reach of the alluvial channel below the mountain front. Flows must be more than 200 cfs to reach the river; flows less than this rate disappear into the lower alluvial area and are stored temporarily in the ground-water reservoir; most of this water is released as ground-water discharge to the Verde River at a relatively constant rate of about 4,000 acre-ft per year. Evapotranspiration losses in the lower alluvial area are controlled by the depth of the water table and averaged about 1,500 acre-ft per year. (Knapp-USGS)
W69-04587

RECONNAISSANCE OF THE CHEMICAL QUALITY OF SURFACE WATERS OF THE CANADIAN RIVER BASIN, TEXAS,
Geological Survey, Austin, Tex.
H. L. Kunze, and J. N. Lee.
Tex Water Develop Board Rep No 86, Dec 1968. 27 p, 9 fig, 4 tab, 21 ref.

Descriptors: *Water quality, *Surface waters, *Texas, Streamflow, Runoff, Saline water, Duration curves.
Identifiers: Canadian River basin (Tex), Concentration-flow-duration curves.

The quality of water in streams of the Canadian River basin, Texas, is discussed and the basic data are tabulated. Most of the Canadian River tributaries that drain rocks of the Ogallala Formation of Tertiary age and Dockum Group of Triassic age generally contain water of good quality, with dissolved-solids concentrations less than 250 ppm. However, the 12,700 sq mi of the basin in the semiarid Texas Panhandle receives an average of only 19 in. of rainfall per year, of which less than 1 in. leaves the State as runoff. The water in the Canadian River, as it enters Texas from New Mexico, already contains more than 500 ppm dissolved solids; as the river flows across the Texas Panhandle, the dissolved-solids content progressively increases. The meager flows of streams with water of good quality from Ogallala and Dockum rocks are not sufficient to dilute natural saline inflows from Permian rocks and inflows of oil-field brines and municipal wastes. Most surface waters in the basin range from hard to very hard. Calcium, sodium, magnesium, and bicarbonate are the principal dissolved constituents in most streams. Lake Meredith, completed in 1965, is the only major surface-water supply in the basin. Lake Rita Blanca is used solely for recreation. Water from Lake Meredith will be used to supplement groundwater for municipal and industrial purposes. Water impounded in this lake, although usuable for public supply, is very hard and does not meet U. S. Public Health Service standards for dissolved-solids concentrations. During extended dry periods, the dissolved solids may approach 1,000 ppm. (Knapp-USGS)
W69-04593

GENERALIZED HYDROLOGY OF PRAIRIE POTHOLES ON THE COTEAU DU MISSOURI, NORTH DAKOTA,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02H.
W69-04597

TIME OF TRAVEL OF WATER IN THE GREAT MIAMI RIVER, DAYTON TO CLEVES, OHIO,
Geological Survey, Washington, D. C.
Daniel P. Bauer.
Geol Surv Circ 546, 1968. 15 p, 8 fig, 6 tab, 4 ref.

Descriptors: *Flow measurement, *Rivers, Flow rates, Discharge (water), Tracking techniques, Dye releases, Tracers, Ohio.
Identifiers: Time of travel (streamflow), Great Miami River, Dayton (Ohio), Cleves (Ohio).

A time-of-travel dye tracer study of the Great Miami River from Dayton to Cleves, Ohio, a distance of 71.3 river miles, was made in the summer of 1965 to obtain basic information about water passage. Cumulative traveltimes of 182 and 254 hr were determined for approximate discharges of 550 and 380 cfs, respectively, at Miamisburg. Peak traveltimes averaged 91% of the centroid traveltimes for the entire reach from Dayton to Cleves. Traveltimes computed from the so-called average-velocity method (discharge/cross-sectional area) were somewhat shorter for a given index discharge than the traveltimes determined for the centroid of the dye cloud. A method utilizing a straight-line log-log plot of traveltime versus index discharge to predict approximate traveltimes is stated. The resulting equation is limited to the approximate discharge range of 300-800 cfs. (Knapp-USGS)
W69-04598

COMPILATION OF HYDROLOGIC DATA, WALLER AND WILBARGER CREEKS, COLORADO RIVER BASIN, TEXAS-1966.
Geological Survey, Austin, Tex.

Prepared in cooperation with Texas Water Development Board. Geol Surv open-file basic-data rep, 1968. 31 p, 3 fig, 1 tab, 1 append.

Descriptors: *Data collections, *Streamflow, *Urbanization, Stream gages, Rainfall-runoff relationships, Texas, Hydrologic data, Water year, Small watersheds, Hydrographs.
Identifiers: Austin (Tex), Waller Creek (Tex), Wilbarger Creek (Tex), Urban hydrology.

Streamflow data are compiled for comparison of Waller Creek, an entirely urban stream in Austin, Texas, and Wilbarger Creek, in a geologically and topographically similar setting in a rural area, for urban hydrological studies. Data are tabulated on a regular daily basis and for individual storms for the water year 1966. Each stream gaging station record includes location, drainage area, availability of records, gage type, extreme flow events, remarks, and daily gage records for the year. Hydrographs are used to show storm rainfall-runoff relationships. (Knapp-USGS)
W69-04599

WATER TEMPERATURES IN THE LOWER COLUMBIA RIVER,
Geological Survey, Washington, D. C.
A. M. Moore.
Geol Surv Circ 551, 1968. 45 p, 11 fig, 21 tab, 2 ref.

Descriptors: *Water temperature, *Columbia River, Rivers, Streamflow, Nuclear powerplants, Thermal powerplants, Thermal pollution, Heated water, Washington, Oregon.
Identifiers: Lower Columbia River Basin.

Daily observations of water temperature for 20 sites in the lower Columbia River are presented in tabular form and in profile form by months for the period August 1941 to July 1942. The profiles show minimum, mean (average), and maximum water temperatures for those months from river mile 142 to river mile 6.7. The data indicate that water temperature in the lower river trends upward from October to March and has no marked trend, or trends downward, during April to September. Analysis of the water-temperature records at Bonneville Dam (river mile 146.1) for the 1938-66 period of records shows that the months from August 1941 to July 1942 are fairly representative of average conditions except for August and January, which are about 3 deg F above and 4 deg F below average, respectively. Analysis of the Bonneville Dam records also indicates that in the mid-1950's a man-caused change in water-temperature regimen occurred that resulted in higher temperatures at Bonneville Dam for 10 months of the year but no change in March and April. The changes for the other months ranged from 0.5 deg to +2.0 deg F. This menas that average temperatures for the lower river are now somewhat warmer for most months than temperatures shown in the profiles. (Knapp-USGS)
W69-04605

REFRACTION DETERMINATION OF WATER TABLE DEPTH AND ALLUVIUM THICKNESS,
Wyoming Univ., Laramie. Minuteman School of Civil Engineering.
James Otto Duguid.
Geophysics, Vol 33, No 3, pp 481-488, June 1968. 8 p, 5 fig, 2 tab, 5 ref.

Descriptors: *Seismic studies, *Water table, *Alluvium, Geophysics, Aquifers, Gravels, Sands, Seismic properties, Interfaces, Sediments.
Identifiers: Seismic refraction studies, Seismographs.

During an investigation of alluvium using a shallow refraction seismograph, time-distance curves obtained indicated two refraction interfaces. The shallower of the interfaces is the groundwater table, whose depth was obtained with an accuracy of 10%. The deeper interface is either the surface of the bedrock or the base of the weathered zone on the bedrock. If this lower interface is the surface of the bedrock, the velocity of seismic waves in the weathered material will be considerably lower than if the interface is the base of the weathered zone. (Knapp-USGS)
W69-04607

FLOOD INFORMATION FOR FLOOD-PLAIN PLANNING,
Geological Survey, Washington, D. C.
Conrad D. Bue.
Geol Surv Circ 539, 1967. 10 p, 3 fig, 15 ref.

Descriptors: *Floods, *Land use, *Publications, Flood forecasting, State-discharge relations, Zoning, Hydrologic data, Floodproofing, Non-structural alternatives.
Identifiers: Hydrologic atlases, Flood data reports.

The collection and analysis of flood data by the U. S. Geological Survey for use in flood plain planning and regulation is reviewed. A broad view of the flood program is presented with an explanation of the nature and use of the flood-inundation maps of the U. S. Geological Survey. Floods, which are normal natural phenomena, are catastrophic simply because man occupies flood plains in competition with rivers' needs for them as high-water channels. Neither complete evacuation of flood plains nor complete control of floods is practicable. To define the risk or cost of using flood plains, the U. S. Geological Survey flood reports are prepared. Flood-plain zoning, land-use zoning, floodproofing, flood forecasting, and types of flood publication available, are discussed briefly. (Knapp-USGS)
W69-04616

WATER RESOURCES OF NEW MEXICO, OCCURRENCE, DEVELOPMENT AND USE,
State Planning Office, Santa Fe, New Mex.; and Geological Survey, Washington, D. C.
W. C. Ballance, Earl F. Sorenson, F. B. Titus, R. L. Borton, and W. A. Mourant.
N Mex State Planning Office Rep, 1967. 321 p, 46 fig, 4 plate, 63 tab, 229 ref.

Descriptors: *Water resources, *New Mexico, Data collections, Hydrologic data, Colorado River basin, Rio Grande, Arid lands, Geology, Groundwater, Surface water, Streamflow, Water yield, Water utilization, Water law, Prior appropriation, Water rights, Water sources.
Identifiers: Arkansas River, San Juan River, Pecos River.

New Mexico's water resources and water resourc development are described. The water law of th State is based on prior appropriations to ensure o derly development. The utilization of wate streamflow, geology, groundwater hydrology, se tlement and history, economics, agriculture, mi ing, and water problems of the State are describe in reports on each of the State's drainage basin The areas discussed in detail are the Arkansa River basin, Pecos River basin, Central close basins, Rio Grande basin, Western closed basin San Juan River basin, Lower Colorado River basi and Southwestern closed basins. (Knapp-USGS) W69-04627

THE AERATION CAPACITY OF STREAMS,
Geological Survey, Washington, D. C.
W. B. Langbein, and W. H. Durum.
Geol Surv Circ 542, 1967. 6 p, 4 fig, 2 tab, 9 ref.

Descriptors: *Reaeration, Dissolved oxyger Streams, Turbulence, Waste assimilative capacity Water circulation, Streamflow, Discharge (Water Depth, Velocity.
Identifiers: Reaeration coefficient.

The equation usually used for calculating the rat of oxygen absorption in water involves the concen tration of oxygen already in the water, the satura tion concentration at the given temperature, time and a coefficient of reaeration. The effects of rive hydraulic properties on the coefficient of reaera tion are studies. Experimental and field data in dicate that the reaeration coefficient varies wit the -1.33 power of depth and varies linearly wit velocity, it decreases in the downstream directio with the 0.43 power of discharge, and it is smalle in larger rivers than in smaller rivers. With a chang in discharge at a point on a river, the coefficien decreases with the 0.13 power of discharge. (K napp-USGS)
W69-04628

EFFECT ON STREAMFLOW OF FOUR FOREST PRACTICES IN THE MOUNTAINS OF WEST VIRGINIA,
Forest Service (USDA) Upper Darby, Pa Northeastern Forest Experiment Station.
For primary bibliographic entry see Field 03B.
W69-04636

2F. Groundwater

FUTURE DEVELOPMENT OF THE GROUND-WATER RESOURCE IN THE LOWER GREAT MIAMI RIVER VALLEY, OHIO - PROBLEMS AND ALTERNATIVE SOLUTIONS,
Geological Survey, Washington, D. C.
Andrew M. Speiker.
Geological Survey Professional Paper 605-D, 1968. 15 p, 5 fig, 8 ref.

Descriptors: *Ground-water safe yield, *Ground-water recharge, *Ground-water overdraft, Industrial water, Consumptive use, Water pollution, Flow augmentation, Water-rights law, Interbasin transfer, Artificial recharge.
Identifiers: *Miami River Valley (Ohio), Cincinnati (Ohio).

The valley-train sand and gravel aquifers of the Great Miami River valley below Dayton, Ohio, can be expected to yield an initial withdrawal of 300 million gallons per day-nearly three times their present rate of pumpage- provided that future developments are sufficiently distant from the present pumping centers. Most of the used ground water is returned to the river as sewage and could be recycled as induced recharge to the aquifers. This recycling would increase the total potential yield of the aquifers to much more than the initial withdrawal yield. The only limit on this recycling would be imposed by deterioration of quality of the used water or by the cost of treatment necessary to maintain adequate quality. Probably the greatest future problems will be declining ground-water levels and local overdraft, both resulting from in-

reased water use, ground-water contamination, nd the application of existing law to situations in-olving water rights. Overdraft can best be avoided y careful spacing of future ground-water develop-nents and location of these supplies in favorable ydrogeologic environments. Reuse of water by in-lustry is an alternative to developing new supplies, or it can materially reduce water consumption. Ground-water contamination, most of which is lerived from water induced from streams by pump-ng, can best be controlled by maintaining water of ood quality in the streams. Plans for management f the ground-water resource should include care-ul consideration of the close interrelation of sur-ace water and ground water.
W69-04206

SCIENTIFIC OR RULE-OF-THUMB TECHNIQUES OF GROUND-WATER MANAGEMENT - WHICH WILL PREVAIL,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 04B.
W69-04231

HYDROLOGIC PROPERTIES OF PEAT FROM A WYOMING MOUNTAIN BOG,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 02G.
W69-04234

VISCOUS DRAG AND SECONDARY FLOW IN GRANULAR BEDS,
University Coll. of Wales, Aberystwyth. Dept. of Physics.
W. M. Jones.
Brit J Appl Phys (J Phys D), Ser 2, Vol 1, No 11, pp 1559-1565, Nov 1968. 7 p, 4 fig, 13 ref.

Descriptors: *Flow, *Flow characteristics, *Porous media, *Fluid friction, Flow resistance, Viscous flow, Reynolds number, Darcys law, Capillary action, Permeability, Interstices.
Identifiers: Viscous drag, Non-Darcian flow, Secondary flow.

Departure from Darcy's law in the flow of fluids through granular beds can be interpreted as due to a regular secondary flow being set up. Experiments are described which establish a single non-dimensional curve to describe the results of the flow of air and of liquids through granular beds of spheres and of irregular particles. The model of a granular bed is discussed and experiments are described which establish the identify of the flow through helices with that through the same cylindrical tubes bent into coplanar S shapes. An equation is given relating the resistance of a granular bed to the flow through it when Darcy's law is no longer applicable.
W69-04243

ILLINOIS GROUND WATER POLLUTION,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 05B.
W69-04256

CONVECTIVE DIFFUSION IN CLAY SYSTEMS,
Illinois Univ., Urbana. Dept. of Agronomy.
Allen R. Overman.
Work supported by Dept of Interior, under Office Water Resources Res. Soil Sci Soc Amer Proc, Vol 32, No 5, pp 616-618, Sept-Oct 1968. 3 p, 2 fig, 2 tab, 7 ref.

Descriptors: *Diffusion, *Ion transport, *Clays, Dispersion, Convection, Mass transfer, Bentonite, Solutes.
Identifiers: Mass flow, Convective diffusion.

The theory of convective diffusion has been applied to transport of salt through clay columns. An expression was derived for salt distribution with the column for steady state conditions. Data from the literature were used to test the applicability of the distribution function to clay systems. The observed nonlinearity is described to high precision by the equation. However, some discrepancy occurs between calculated and measured parameters. (Knapp-USGS)
W69-04261

DEVELOPMENT OF GROUND-WATER SUPPLIES AT MISSISSIPPI TEST FACILITY, HANCOCK COUNTY, MISSISSIPPI,
Geological Survey, Washington, D. C.
Roy Newcome, Jr.
Geol Surv Water-Supply Pap 1839-H, pp H1-H28, 1967. 28 p, 11 fig, 1 plate, 3 tab, 11 ref.

Descriptors: *Water utilization, *Water quality, *Groundwater, Hydrology, Mississippi, Cooling, Industrial plants, Potable water, Aquifers, Wells, Pumping.
Identifiers: NASA project.

To insure that the large amount of water required during short periods of time for Saturn V rocket test-stand deflector cooling is available and to provide information for guidance in well construction and well spacing, a study of the groundwater resources of the Mississippi Test Facility and surrounding buffer zone was made. Potable and industrial water supplies are obtained from large-capacity wells, and the fresh-water-bearing section is up to 3,000 ft thick. Three wells for potable water have produced 1,100 to 2,500 gpm by natural flow. Water for cooling the deflectors is from 3 wells that are capable of supplying 18 mgd. Water from the supply wells is a sodium bicarbonate type with high pH, ranging in temperature from 79 deg F to 100 deg F. Artesian head on the deepest well is 104 ft above land. (Llaverias-USGS)
W69-04268

GEOCHEMISTRY OF EPIGENESIS,
Akademiya Nauk SSSR. Institut Geologii Rudnykh Mestorozhdenii, Petrografii, Mineralogii i Geokhimii.
For primary bibliographic entry see Field 02K.
W69-04274

FREE-SURFACE FLOW THROUGH HETEROGENEOUS POROUS MEDIA,
Utah State Univ., Logan. Dept. of Civil Engineering.
Roland W. Jeppson.
Research supported by National Science Foundation. ASCE Proc, J Hydraul Div, Vol 95, No HY1, Pap 6364, pp 363-381, Jan 1969. 19 p, 8 fig, 12 ref, append. Grant GK-1478.

Descriptors: *Flow, *Porous media, *Anisotropy, Seepage, Infiltration, Canal seepage, Flow nets, Approximation method, Mathematical models, Digital computers, Computer programs, Groundwater movement, Soil water movement.
Identifiers: Heterogeneous porous media, Finite difference methods.

Methods are developed for obtaining finite difference solutions to steady-state, free-surface saturated seepage flows through nonhomogeneous porous media. The formulation considers the total fluid head and the stream function as the independent variables and the coordinates x and y as the dependent variables. In the plane defined by the total fluid head and the stream function free surfaces are straight lines and the region of seepage is rectangular if no surfaces of seepage are present. The variation in permeability of the porous media can be specified by continuous functions. The methods are applied to obtain solutions to problems of seepage from canals through nonhomogeneous porous media to a drained layer at some specified depth. Several representative flownets from these solutions are presented. (Knapp-USGS)
W69-04552

GROUND-WATER CONDITIONS IN UTAH, SPRING OF 1968,
Geological Survey, Salt Lake City, Utah.
R. M. Cordova, L. J. Bjorklund, R. G. Butler, R. W. Mower, and L. R. Herbert.
Utah Div Water Resources Coop Invest Rep No 6, Oct 1968. 105 p, 56 fig, 4 tab, 6 ref.

Descriptors: *Water resources, *Groundwater, *Data collections, *Utah, Hydrologic data, Aquifers, Water quality, Water level fluctuations, Water yield, Water utilization.
Identifiers: *Periodic observations, State water plan.

The groundwater conditions in Utah in the spring of 1968 are compiled and analyzed. Information is presented on well construction, groundwater withdrawals, water-level changes, and related changes in precipitation and streamflow. Graphs show chemical quality of water. Maps show water table configuration. Most areas of important groundwater withdrawal are discussed. Areas of potential large groundwater development are discussed and mapped. Less than 2% of the Utah wells obtain water from consolidated rock, mostly lava flows, limestone, and sandstone. The remaining 98% are in gravel, sand, silt and clay in large intermountain alluvial basins. The estimated 1967 total withdrawal of groundwater was about 650,000 acre-ft, 79,200 for irrigation, 11,700 for industry, and 9,400 for public supply. The 1967 precipitation was 0.45-2.82 inches above normal, and combined with less than usual withdrawal, resulting in a general water level rise. (Knapp-USGS)
W69-04561

GROUND WATER IN GOGEBIC COUNTY, MICHIGAN,
Geological Survey, Lansing, Mich.
C. J. Doonan, and G. E. Hendrickson.
Mich Geol Surv Water Invest Rep No 8, 1968. 22 p, 5 fig, 2 map, 5 ref, 1 append.

Descriptors: *Groundwater, *Water resources, Michigan, Water wells, Water quality, Hydrologic data, Water yield, Glacial drift, Domestic water, Municipal water, Data collections.
Identifiers: Gogebic County (Mich).

The groundwater resources of Gogebic County, Michigan, are described. Information on representative wells and springs is tabulated. A geologic map is included. Most of the aquifers in the county are beds of sand and gravel in glacial drift, but some wells obtain small quantities of water from fractured bedrock. The County's groundwater resources are neigher abundant nor evenly distributed. Well yields of several hundred gal/min are available in a few small areas, but over most of the county, well yields are small to moderate, and in some areas the relatively small amount needed for a domestic supply is difficult or impossible to obtain. The most favorable areas for obtaining large supplies of water from wells are sand and gravel deposits along streams. Least favorable are areas where the Precambrian bedrock is exposed or is covered by only a few feet of glacial drift. Most wells are drilled, and about half of them are between 50 and 100 ft deep. Wells deeper than 200 ft usually fail because of small yields or poor quality of water. Water from most wells and springs is moderately hard, and some wells and springs yield water with objectionable amounts of iron. Public water supplies are obtained from wells, springs and an abandoned mine. Groundwater resources may be inadequate to meet the needs of expanding population or industry in many places in the county. Lakes and streams are potential alternate sources. Long-term records of streamflow, groundwater levels, lake levels, and quality of water will be needed for making informed management decisions. (Knapp-USGS)
W69-04564

A NOTE ON THE GHYBEN-HERZBERG FORMULA,
Technische Hogeschool, Delft (Netherlands).

Arnold Verruijt.
Bull Int Ass Sci Hydrol, Vol 13, No 4, pp 43-46, Dec 1968. 4 p, 2 fig, 3 ref.

Descriptors: *Saline water-freshwater interfaces, *Aquifers, *Coasts, Groundwater movement, Flow nets, Discharge (Water), Steady flow.
Identifiers: Coastal aquifers, Ghyben-Herzberg formula.

A generalized form of the Ghyben-Herzberg formula is derived to account for the position of the saline-freshwater interface in an unconfined coastal aquifer when fresh-water potential lines are not vertical. In the case of negligible seaward flow the formula reduces to the Ghyben-Herzberg formula, and when flow is rapid, the formula gives good results at a long distance in land, relative to the product of discharge and permeability (a length term). (Knapp-USGS)
W69-04569

PUMPING TESTS ON OPEN WELLS IN PALAR ALLUVIUM, NEAR MADRAS CITY, INDIA, AN APPLICATION OF THE PAPADOPULOS-COOPER METHOD,
Geological Survey of India, Hyderabad.
T. N. Narasimhan.
Bull Int Ass Sci Hydrol, Vol 13, No 4, pp 91-105, Dec 1968. 15 p, 6 fig, 3 tab, 7 ref.

Descriptors: *Drawdown, *Water wells, Alluvium, Pumping, Theis equation, Water level fluctuations, Aquifers, Withdrawal.
Identifiers: *Papadopulos-Cooper method, Large-diameter wells, Well storage, India, Palar River, Pumping tests, Aquifer testing.

The non-equilibrium formula of Theis has hitherto been found to be inadequate to analyse drawdown data from open wells, due to the influence of effects of well-storage on early drawdown data. Recently, a reliable type-curve method was proposed by Papadopulos and Cooper to analyse drawdowns in wells of large diameter. In order to study its practical validity, the Papadopulos-Cooper method was applied to drawdown data from 6 open wells in alluvial sands of the river Palar, near Madras City, India. The study has indicated that the method has considerable practical utility in analysing drawdown data from large diameter open wells. Besides, the method also offers an easy way of computing the duration over which the effects of well-storage are likely to influence drawdown data, in terms of aquifer transmissibility and well-radius. If a rough idea of aquifer transmissibility is available from existing data, then, such a computation, to determine the duration over which wellstorage affects drawdown, could be initially made to advantage, so that proper judgement could be exercised in using other conventional methods of analysis, such as that of Jacob or that of Theis. (Knapp-USGS)
W69-04573

HYDROLOGY OF CRATER, EAST AND DAVIS LAKES, OREGON,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02H.
W69-04574

TEMPERATURE PROSPECTING FOR SHALLOW GLACIAL AND ALLUVIAL AQUIFERS IN ILLINOIS,
Illinois State Geological Survey, Urbana.
Keros Cartwright.
Ill State Geol Surv Circ 433, 1968. 41 p, 27 fig, 4 tab, 44 ref.

Descriptors: *Groundwater, *Aquifers, *Glacial drift, *Geothermal studies, *Exploration, Mapping, Surveys, Illinois.
Identifiers: Geothermal groundwater prospecting.

Theoretical considerations of the thermal properties of glacial and alluvial deposits in Illinois suggest that a shallow aquifer might form a heat sink (or source) that would influence the temperature of the overlying soil. If shallow aquifers are nonuniformly distributed laterally, and if their effects on the temperatures of surface soil can be measured and distinguished from other factors that affect soil temperature, a possible exploration method for shallow aquifers is suggested. A positive (warm) anomaly would be expected over such aquifers in the winter and a negative anomaly in the summer. The size of the anomalies is dependent upon the thermal properties of the overburden, temperature difference between the surface and aquifer, and the depth of burial of the aquifer. A thermister at the end of an aluminum-tipped stake was used to measure soil temperatures at a depth of about 18 in. in 7 areas in Illinois where shallow aquifers were known in some detail. Maximum anomalies of about 2 deg C are present over the aquifers. Summer anomalies generally are of greater magnitude than winter anomalies. Soil differences, vegetation, and ice in the soil also affect the soil temperatures. The effect of vegetation in the summer can be as great as the anomaly produced by an aquifer. Frozen soil tends to eliminate anomalies, but this effect can be partly overcome by taking readings at a greater depth. Field data show close agreement between the location of shallow aquifers and thermal anomalies. (Knapp-USGS)
W69-04585

WATER RESOURCES OF THE SYCAMORE CREEK WATERSHED, MARICOPA COUNTY, ARIZONA,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02E.
W69-04587

GENERALIZED HYDROLOGY OF PRAIRIE POTHOLES ON THE COTEAU DU MISSOURI, NORTH DAKOTA,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02H.
W69-04597

RESISTIVITY INVESTIGATIONS OF LIMESTONE AQUIFERS IN JAMAICA,
Saint Louis Univ., St. Louis, Mo.
S. A. Vincenz.
Geophysics, Vol 33, No 6, pp 980-994, Dec 1968. 15 p, 21 fig, 1 tab, 23 ref.

Descriptors: *Hydrogeology, *Karst, *Aquifers, *Resistivity, *Surveys, Geophysics, Electrical studies, Permeability, Porosity, Water yield, Water wells, Irrigation water, Limestones.
Identifiers: *Jamaica, Pumping tests.

Resistivity depth probes were made over water wells in an alluvial interior valley of Jamaica, known as the Queen of Spain's Valley. Several types of electrode configuration were used and the observations analyzed by a technique designed to select those suitable for interpretation. The results, interpreted by standard curve matching methods, compare favorably with available well logs. They suggest that the yield is a linear function of the resistivity of the water-bearing strata. A straight line fitted to the data by the method of least squares provides a nomogram which can be used for predicting the probable yield at points where no wells exist. It is concluded that resistivity surveys can be of material assistance in a water-supply drilling program in the area. It is found that interpretation by multilayer curve-matching procedures gives more realistic results than analysis by classical two-layer master curves used in conjunction with Hummel's rule. The results suggest also that the Wenner array gives a better resolution of small resistivity contrasts than the operationally more versatile Cooper array. A conclusion of more general nature states that Helmholtz' reciprocity theorem of electrical conduction holds also for rock media. (Knapp-USGS)
W69-04600

CONVECTIVE FLOW AND ITS EFFECT ON TEMPERATURE LOGGING IN SMALL-DIAMETER WELLS,
Geological Survey, Denver, Colo.
Edward A. Sammel.
Geophysics, Vol 33, No 6, pp 1004-1012, D
1968. 9 p, 8 fig, 12 ref.

Descriptors: *Borohole geophysics, *Convecti
*Wells, Water circulation, Heat transfer, Geoth
mal studies, Heat flow, Thermal properties.
Identifiers: Small-diameter wells, Ther
gradient.

Critical thermal gradients for the onset of conv
tion in small-diameter wells are computed and
shown graphically for water of several salinities
for glycerol. A series of field and laboratory test
wells with diameters of 4.8 cm and 10.2 cm show
that water columns are unstable at temperat
gradients as low as 0.003 deg C/m. Magnitudes
thermal oscillations at higher gradients were
large as 0.49 deg C, and apparent sizes of conv
tion cells ranged up to 210 cm in height in a 1
cm cylinder and to 48 cm in wells 4.8 cm in dia
ter. Comparison of temperatures in adjacent w
showed temperature differences as great as 3 de
when thermal gradients were greater than
theoretical critical gradients. It is concluded t
temperatures in the upper zone of deep wells m
depart widely from ambient temperatures in
formations penetrated. (Knapp-USGS)
W69-04601

ON INDUCED ELECTRICAL POLARIZATI AND GROUNDWATER,
California Univ., Berkeley. Dept. of Min
Technology.
Rene Bodmer, S. H. Ward, and H. F. Morrison.
Geophysics, Vol 33, No 5, pp 805-821, Oct 19
17 p, 17 fig, 22 ref. WRC Project - W114, OW
B-002-CAL.

Descriptors: *Electrical studies, *Geophys
*Groundwater, Geochemistry, Surveys, Resistiv
Clays, Gravels, Hydrologic data, Aquif
Hydrogeology, Hydrologic properties, Artifi
recharge, Pit recharge, California.
Identifiers: Induced polarization anomalies, E
trical surveys, Potential surveys, Santa Clara Co
ty (Cal).

Clay horizons and other clay-bearing unc
solidated sediments are potential sources of
duced-polarization anomalies. If such anoma
may be detected above system noise, the induc
polarization method may be of value for in-
classification of unconsolidated sediments enco
tered in hydrological projects. One such project
ists in Santa Clara County where near-surface
consolidated sediments are frequently conside
as potential recharge areas. Of four areas surve
with induced-polarization apparatus in Santa Cl
County, only 2-yielded significant frequency-eff
anomalies, and in each of these 2 the frequency
fects were of the order of 3%. These anomal
frequency effects may be related to clayey grav
The dipole-dipole array, with spreads of 10 ft
20 ft was typically used in the study. (Kna
USGS)
W69-04606

SALINE GROUND WATER IN LOUISIANA,
Geological Survey, Washington, D. C.
A. G. Winslow, D. E. Hiller, and A. N. Turcan, J

Geol Surv Hydrol Invest Atlas HA-310, 4 she
1968. 5 map, 4 tab, 4 ref.

Descriptors: *Saline water, *Groundwater, *Lo
siana, Water resources, Saline water-freshwater
terfaces, Water chemistry, Water quality, Wa
yield, Water temperature, Water wells, Gulf coa
plain.
Identifiers: *Saline water resources.

Data are presented on the occurrence and distri
tion of saline groundwater in Louisiana. The ar

nd vertical extent of subsurface zones of saline vaters are shown and typical chemical analyses are abulated. Approximate altitudes, estimated yields, nd thicknesses of saline-water aquifers are shown y maps. (Knapp-USGS)
W69-04608

GEOHYDROLOGY OF THE COASTAL PLAIN AQUIFERS OF ARKANSAS,
Geological Survey, Washington, D. C.
R. L. Hosman.
Geol Surv Hydrol Invest Atlas HA-309, 1 sheet, 1969. 3 map, 3 tab, text.

Descriptors: *Water resources, *Hydrogeology, *Groundwater, *Gulf coastal plain, *Arkansas, Water yield, Aquifers, Artesian wells, Water quality.
Identifiers: Aquifer testing, Pumping tests.

Data on water quality, water wells, and character nd extent of the Gulf Coastal Plain system of aquifers in Arkansas are summarized in a 1-sheet ydrological atlas consisting of block diagrams showing stratigraphy and extent of aquifers, water chemical quality diagrams, and tables. The ydrological characteristics of the principal aquifers are described and a summary of pumping test results is given. The altitude of the base of fresh water is shown by a map. (Knapp-USGS)
W69-04609

RECONNAISSANCE OF THE GROUND-WATER RESOURCES OF THE MISSOURI RIVER ALLUVIUM BETWEEN ST. CHARLES AND JEFFERSON CITY, MISSOURI,
Geological Survey, Washington, D. C.
L. F. Emmett, and H. G. Jeffery.
Geol Surv Hydrol Invest Atlas HA-315, 1 sheet, 1968. 2 map, 2 graph, 1 tab, 16 ref.

Descriptors: *Water resources, *Groundwater, *Alluvium, *Missouri River, *Missouri, Water wells, Water yield, Transmissivity, Permeability, Water quality, Irrigation, Industrial water, Municipal water, Domestic wastes.
Identifiers: *Missouri River alluvium.

The groundwater resources of the Missouri River alluvium in eastern Missouri are shown by a map, cross sections, tables, and graphs. Most of the abundant groundwater in the alluvium is unused. There are no municipal well fields in the area. The only large capacity wells are a few irrigation and industrial wells. The average thickness of the alluvium is about 100 feet, of which 80 feet is saturated with water. A pumping test showed a transmissibility of 27,000 gpd per ft and a permeability of about 3,000 gpd per sq ft. The alluvial water is a calcium bicarbonate type with significant amounts of magnesium and sulfate, very hard, with a high iron content. (Knapp-USGS)
W69-04610

GROUND WATER OF THE PIEDMONT AND BLUE RIDGE PROVINCES IN THE SOUTHEASTERN STATES,
Geological Survey, Washington, D. C.
H. E. LeGrand.
Geol Surv Circ 538, 1967. 11 p, 12 fig, 2 tab.

Descriptors: *Water wells, *Water yield, *Estimating, Topography, Soils, Depth, Permeability, Transmissivity, Fractures (Geology), Hydrogeology, Groundwater movement.
Identifiers: Blue Ridge province, Piedmont province.

A scheme is presented for estimating potential well yields in the Blue Ridge and Piedmont physiographic provinces of the U. S. by site evaluation based on topography and thickness of soil. Because the area's bedrock is relatively impermeable, high-yield wells are common where thick residual soils and low topographic areas are together, and low-yield wells are in thin soil on hilltops. Tables are given for use in assigning point values to soil and topographic conditions. The point value is then used in a probability chart to estimate the chances of obtaining various well yields. Groundwater quality and the general principles of groundwater hydrology, particularly as they apply to the Piedmont and Blue Ridge provinces, are discussed. (Knapp-USGS)
W69-04615

THE HYDROLOGIC AND GEOLOGIC ASPECTS OF A PERCHING LAYER-SAN JOAQUIN VALLEY, WESTERN FRESNO COUNTY, CALIFORNIA,
Agricultural Research Service, Fresno, Calif. Soil and Water Conservation Research Div.
E. E. Haskell, Jr. and W. C. Bianchi.
Ground Water, Vol 5, No 4, pp 12-17, Oct 1967. 6 p, 7 fig, 4 tab, 10 ref.

Descriptors: *Geohydrologic units, *Geologic investigation, Irrigation wells, Electrical well logging, Water table, Alluvium, Underground structures, Hydraulic properties, Core drilling, Permeability, California.
Identifiers: *Geophysical studies, Perched water layers, Fresno County (Calif).

A shallow wide-spread perching layer was isolated in the alluvial profiles of western Fresno County, California. Field and laboratory investigations, using electrical well logging and geological surveys, gave considerable data on the physical and hydrologic properties of this perched layer and on the rate of flow associated with the layer. As a result of this investigation the hydraulic properties and descriptions for the perched zones are presented which can be used to delineate profile flow limitations at other locations in the San Joaquin Valley. This study may be used in estimating the rate at which this perched water table could rise under new management conditions of irrigation and commercial water use involving imported water. (Gabriel-USGS)
W69-04619

TEST HOLE IN AQUIFER WITH MANY WATER-BEARING ZONES AT JACKSONVILLE, FLORIDA,
Geological Survey, Jacksonville, Fla., and Geological Survey, Ocala, Fla.
G. W. Leve, and D. A. Goolsby.
Ground Water, Vol 5, No 4, pp 18-22, Oct 1967. 5 p, 7 fig, 1 tab, 1 ref.

Descriptors: *Groundwater, *Hydrologic aspects, *Geologic investigation, *Aquifers, Artesian wells, Electrical well logging, Electrical studies, Core drilling, Water quality, Water analysis.
Identifiers: Floridan aquifer, Jacksonville (Fla).

A deep (2500') well was drilled at Jacksonville, Florida to obtain geologic and hydrologic information on the deeper and unexplored part of the Floridan aquifer. The study shows that the aquifer consists of a series of water-producing zones separated by nonproductive zones. A new fresh-water producing zone and the fresh water-salt water contact was delineated. The well was completed in three separate zones in order to detect any salt-water encroachment. The article describes the technique and results of drilling the test well. (Gabriel-USGS)
W69-04620

THE INFLUENCE OF GROUNDWATER FLOW SYSTEMS ON PAVEMENT STABILITY IN HIGHWAY CUTS,
Idaho Univ., Moscow.
R. E. Williams.
Ground Water, Vol 5, No 4, pp 23-26, Oct 1967. 4 p, 2 fig, 1 tab, 7 ref.

Descriptors: *Highways, *Road construction, *Concretes, *Paving, *Stability, *Groundwater, *Flow, Flow control, Precipitation (Atmospheric), Rainfall, Zone of saturation, Ice, Illinois, Air-water interfaces.
Identifiers: Northeastern Illinois.

The failure or 'breaking up' of pavements in cuts in glacial till are commonly associated with the periods of significant groundwater recharge when such periods are concomitant with freezing and thawing. These failures were investigated in northeastern Illinois. The investigation consisted of recording precipitation and water levels, as recorded by the piezometers, during the year of 1965 and January and February of 1966. The study shows that the cuts in glacial till and of appreciable depth intersect the zones of saturation and establish local gravity, groundwater flow systems with the bottom of the cut acting as a groundwater discharge zone. Such shallow gravity flow system may bring about pavement failure by facilitating the growth of ice lenses or by developing high pressure beneath the pavement. (Gabriel-USGS)
W69-04621

TRANSMISSIBILITY DETERMINATION FROM VARIABLE DISCHARGE PUMPING TESTS,
Indiana Univ., Bloomington. Dept. of Geology.
Y. M. Sternberg.
Ground Water, Vol 5, No 4, pp 27-29, Oct 1967. 3 p, 1 fig, 2 tab, 6 ref.

Descriptors: *Groundwater, *Aquifers, *Pump testing, Discharge measurement, Synthetic hydrology, Model studies, Analytical techniques, Analysis, Aquifer characteristics.
Identifiers: *Aquifer transmissibility.

A rapid graphical technique for the determination of aquifer transmissibility from a variable discharge pumping test is presented. The technique is based on the Aron (1965) graphical solution for aquifer characteristics and detailed mathematical analysis of variable aquifer discharges developed by the author. The technique requires the following data: the variation of discharge with time during the pumping test and a record of an observation well after the well was shut off. The article contains an example of using some synthetic well-data, 18 formulas, tables and figures. (Gabriel-USGS)
W69-04622

DESIGNING PUMPED WELL CHARACTERISTICS INTO ELECTRIC ANALOG MODELS,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 06B.
W69-04623

A COMPUTER-ORIENTED GROUND-WATER INFORMATION STORAGE AND RETRIEVAL SYSTEM,
Research Council of Alberta, Edmonton.
For primary bibliographic entry see Field 07C.
W69-04624

GEOLOGY AND GROUND-WATER RESOURCES OF GREENE COUNTY, ALABAMA,
Geological Survey, University, Ala.
Kenneth D. Wahl.
Ala Geol Surv Bull 86, 1966. 93 p, 11 fig, 2 plate, 7 tab, 29 ref.

Descriptors: *Alabama, *Hydrogeology, *Aquifer characteristics, Geologic formations, Geologic mapping, Structural geology, Water chemistry, Water quality, Chlorides, Iron, Contours, Depth.
Identifiers: Greene County, Coker Formation, Gordo Formation, McShan Formation, Eutaw Formation, Mooreville Chalk, Demopolis Chalk.

The report provides groundwater information on where water is available, how much individual wells produce, what the chemical quality of the water is, how much water is utilized, what problems are present or anticipated, and the steps necessary to

solve them. Groundwater is available from sand and gravel aquifers in the Coker, Gordo, McShan, and Eutaw Formations and in the alluvial deposits. The Mooreville and Demopolis Chalks are relatively impermeable and are not sources of groundwater, although they do confine water in underlying aquifers and limit downward percolation. More than 1,000 gpm can be obtained from the Coker, Gordo, and McShan Formations. Supplies adequate for domestic or stock use can be made in alluvial deposits and Eutaw Formation. Large capacity wells can be constructed in lower terrace deposits and alluvium along major streams. Groundwater use in Greene County in 1965 was 1,150,000 gpd, with 840,000 gpd supplied from the McShan Formation. Flow from 111 wells in 1965 was 2,740,000 gpd, more than double the groundwater use. Quality-of-water from the Coker Formation is generally satisfactory but may be too mineralized for some industrial uses and the water from it has excessive hardness and chloride in the south of the county. Quality of water from the Gordo, McShan, and Eutaw Formations is good to poor. Excessive iron present in the waters can be filtered or treated or another source located. If chloride content is high, another source should be sought. Figures show contours related to major aquifers in the Coker, Gordo, and McShan Formations. Distribution of iron in water is shown for the Coker, Gordo and McShan--Eutaw Formations. Distribution of chloride is shown for the Gordo and McShan Formations. A geologic map and hydrogeologic section are included. Tables give records of selected wells, partial and comprehensive chemical analyses, lithologic and drillers' logs, geologic units and their hydrologic properties, and summary of groundwater use and flow in 1965. (Vorhis-USGS)
W69-04625

WATER RESOURCES OF NEW MEXICO, OCCURRENCE, DEVELOPMENT AND USE,
State Planning Office, Santa Fe, New Mex.; and Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02E.
W69-04627

2G. Water in Soils

HYDROLOGIC PROPERTIES OF PEAT FROM A WYOMING MOUNTAIN BOG,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
David L. Sturges.
Soil Sci, Vol 106, No 4, pp 262-264, 1968. 3 p, 2 fig, 1 tab, 5 ref.

Descriptors: *Peat, *Hydraulic conductivity, *Bulk density, *Moisture tension, Marshes, Soil types, Permeability, Porosity, Pores, Soil water movement, Porous media, Groundwater movement, Soil physical properties, Bogs.
Identifiers: Bulk wet density, Peat hydraulic properties.

Field and laboratory measurements were made of the hydrologic characteristics of peat from a mountain bog in Wyoming. Samples were taken at 0-13 and 13-25 cm in moderately decomposed peat and 36-48 cm in decomposed peat. The bulk density of the 0-13 cm sample was 0.160 g/cc, of the 13-25 cm sample 0.28 g/cc, and of the 36-48 cm sample, 0.216 g/cc. Water yields were 0.223 cc/cc at 0.10 bar suction and 0.50 cc/cc at 1.00 bar in the 0-13 cm sample, 0.140 cc/cc at 0.10 bar and 0.458 cc/cc at 1 bar in the 13-25 cm sample, and 0.076 cc/cc at 0.10 bar and 0.349 cc/cc at 1.0 bar in the 36-48 cm sample. Both bulk wet density and water retention were related to the degree of decomposition and to the pore size distribution; surface peat contained large voids which emptied at low suction and the more decomposed deeper peat had smaller pores which required greater suction to empty. In situ hydraulic conductivity was 0.0239 at 46 cm depth and 0.0161 at 91 cm. (Knapp-USGS)
W69-04234

WATER MOVEMENT IN POROUS MATERIALS - III. EVAPORATION OF WATER FROM SOIL,
Rothamsted Experimental Station, Harpenden (England).
D. A. Rose.
Brit J Appl Phys (J Phys D), Ser 2, Vol 1, No 12, pp 1779-1791, Dec 1968. 13 p, 5 fig, 30 ref.

Descriptors: *Soil water movement, *Evaporation, *Saturation, *Porous media, Soils, Soil physical properties, Soil properties, Soil physics, Laboratory tests, Capillary action, Compaction, Drainage effects, Hydrologic properties, Permeability, Wettability, Hysteresis.
Identifiers: Vertical flow equation.

A vertical flow equation is adapted to describe the evaporation of water from a semi-infinite porous medium during the second stage of drying when water loss is limited by the distribution of water in the material. Flow measurements on long columns of aggregates of 6 soil materials confirm the theory, and enable the transport parameters controlling flow to be found over the range of water content from aggregate saturation to dryness (i.e. from near pF 2 to near pF 7). Evaporation from porous media initially at a uniform water content shows a saturation profile for each material which is invariant with the product of depth and the square root of elapsed time. As saturation decreases, diffusitivities calculated from these profiles fall to a minimum and rise to a subsidiary maximum close to dryness, before falling again as saturation approaches zero, in accordance with theoretical prediction. Hydraulic conductivities fall continuously as saturation decreases. (Knapp-USGS)
W69-04242

EFFECTS OF SOIL FREEZING ON WATER YIELDS,
Colorado State Univ., Fort Collins; and Forest Service, Washington, D. C.
For primary bibliographic entry see Field 02C.
W69-04251

INFLUENCE OF WATER FLUX AND POROUS MATERIAL ON THE MOVEMENT OF SELECTED HERBICIDES,
Oklahoma State Univ., Stillwater. Dept. of Agronomy.
For primary bibliographic entry see Field 05B.
W69-04258

CONVECTIVE DIFFUSION IN CLAY SYSTEMS,
Illinois Univ., Urbana. Dept. of Agronomy.
For primary bibliographic entry see Field 02F.
W69-04261

MOISTURE-TENSION DATA FOR SELECTED SOILS ON EXPERIMENTAL WATERSHEDS,
Agricultural Research Service, Beltsville, Md.
H. N. Holtan, C. B. England, G. P. Lawless, and G. A. Schumaker.
Agr Res Serv, ARS Ser 41-144, Oct 1968. 609 p, 1 fig, 2 tab.

Descriptors: *Soil moisture, *Moisture tension, *Data collections, Soil types, Soil analysis, Soil investigations, Soil groups, Soils, Soil water, Demonstration watersheds, Experimental farms.
Identifiers: Experimental watersheds.

Moisture retention and conductivity data used in an effort to determine the influence of soils upon the hydrologic performance of agricultural watersheds are presented. Soils were sampled to represent approximately 200 Agricultural Research Service (ARS) experimental watersheds or plots at 34 locations in 23 States. Watersheds or plots were selected for length of hydrologic record and for least complexity of soils and land use. Sampling and testing were designed specifically to provide a basis for computing watershed capacities for rainfall retention and may not strictly adhere to the methods used by the Soil Conservation Service (SCS) for soil classification. The data are released as an inducement toward deterministic hydrology in watershed engineering and not as a study of soil genesis. Each record consists of a complete description of the soil and the sampling locality including location, vegetation and land use, topography, drainage, parent material, and a detailed description of all soil horizons sampled. The moisture data include weight percent of retained water, volume percent of retained water, and moisture tension. (Knapp-USGS)
W69-04266

GEOCHEMISTRY OF EPIGENESIS,
Akademiya Nauk SSSR. Institut Geologii Rudnykh Mestorozhdenii, Petrografii, Mineralogii i Geokhimii.
For primary bibliographic entry see Field 02K.
W69-04274

SILICA IN STREAMS AND GROUND WATER OF HAWAII,
Hawaii Univ., Honolulu.
Stanley N. Davis.
Hawaii Water Resources Research Center, Tech Rpt No 29, Jan 1969. 31 p, 2 fig, 10 tab, 28 ref.
OWRR Project B-010-HI.

Descriptors: *Silica, *Soil leaching, Ground-water recharge, *Surface runoff, Surface water, *Subsurface runoff, *Weathering.

Concentrations of silica in natural waters of Hawaii vary from less than 0.2 ppm in rain water to almost 90 ppm in ground water. The acquisition of silica by the water is probably most rapid near the ground surface. Between 1 and 3 ppm will go into solution within a few minutes after rain comes in contact with the rock and soil. Rain water that percolates to the subsurface and eventually becomes ground water recharge will have from 5 to 20 ppm silica before it reaches high-level dike compartments. The high-level water will continue to dissolve more silica until it has from 15 to 45 ppm silica. Some of the dike water will discharge into streams which in turn recharge the basal-water body and some will leak directly into the basal-water body. Basal water that may start with 25 to 45 ppm silica will slowly dissolve more silica until it contains from 30 to 60 ppm. Concentrations of more than about 40 ppm appear to be correlated with irrigation return water and in addition may be owing to dissolution of less weathered rocks in the more arid parts of Oahu as well as the other islands of Hawaii. Rates of silica removal in small watersheds of the high-rainfall portions of the Koolau Range appear to be as much as 8 mg/sq. cm/yr, which is more than any other area in the United States.
W69-04528

FREE-SURFACE FLOW THROUGH HETEROGENEOUS POROUS MEDIA,
Utah State Univ., Logan. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02F.
W69-04552

INFLUENCE OF SOIL STRUCTURE ON WATER RELATIONS IN LOW HUMIDIC LATOSOLS: 1. WATER RETENTION,
Hawaii Univ., Honolulu. Water Resources Research Center; and Hawaii Univ., Honolulu. Dept. of Agronomy and Soil Science.
M. L. Sharma and G. Uehara.
Soil Sci Soc Amer Proc, Vol 32, No 6, pp 765-770, Nov-Dec 1968. 6 p, 10 fig, 2 tab, 19 ref.

Descriptors: *Soil water, *Moisture tension, *Soil structure, Tensiometers, Moisture content, Soil physics, Percolation, Temperature, Unsaturated flow, Particle size, Porosity, Capillary water.
Identifiers: *Water retention, Pore size distribution, Macrofabric, Microfabric, Latosols.

xperiments were carried out to study the effect of aspects of soil structure, macrofabric and icrofabric, on the water retention characteristics f 2 latosolic soils. The soils were selected because f similarity in composition but differences in tructure. Moisture retention curves of the soils nd also of their water stable aggregates were obained. On the basis of results it was concluded that n strongly structured soils, water retention was reatly influenced by macrofabric in the tension ange between 0 to 0.3 bar, while the effect of icrofabric was more prominent beyond this ange. The influence of microfabric was also emonstrated by applying the surface tension, adius of curvature, pressure relationship on elected aggregate fractions. (Knapp-USGS)
V69-04588

NFLUENCE OF SOIL STRUCTURE ON VATER RELATIONS IN LOW HUMIC ATOSOLS: 2. WATER MOVEMENT,
Iawaii Univ, Honolulu. Water Resources Research Center; and Hawaii Univ., Honolulu. Dept. of Agronomy and Soil Science.
M. L. Sharma and G. Uehara.
Soil Sci Soc Amer Proc, Vol 32, No 6, pp 770-774, Nov-Dec 1968. 5 p, 6 fig, 15 ref.

Descriptors: *Soil water movement, *Soil structure, Saturated flow, Unsaturated flow, Moisture tension, Capillary water, Soil water, Moisture content, Percolation, Temperature, Particle size, Porosity.
Identifiers: Macrofabric, Microfabric, Pore size distribution, Latosols.

Experiments were carried out to study the effect of aspects of structure, macrofabric (arrangement of peds) and microfabric (arrangement of primary particles within the ped), on water movement. Two latosolic soils of nearly similar composition and varying greatly in soil fabric were used. Capillary conductivity of the soils and their water-stable aggregates were obtained. The results showed that the effect of macrofabric on water movement was more pronounced in the low-tension range (0-0.2 bar). Identical flow rates were obtained for the same size water stable aggregates of both soils, suggesting that intra-ped pores did not significantly contribute to water flow in this tension range. It was suggested, however, that microfabric might influence fluid flow properties in the high tension range. (Knapp-USGS)
W69-04589

THE DRYING THROUGH THE TOP SURFACE OF A VERTICAL POROUS COLUMN,
Mobil Research and Development Corp., Dallas, Tex. Field Research Lab.
J. P. Heller.
Soil Sci Soc Amer Proc, Vol 32, No 6, pp 778-786, Nov-Dec 1968. 9 p, 10 fig, 12 ref.

Descriptors: *Drying, *Porous media, Evaporation, Moisture tension, Darcys law, Unsaturated flow, Saturated flow, Soils, Capillary action, Diffusion, Drainage, Infiltration, Permeameters.
Identifiers: Haines jump, Stefan problem, Drying front.

Microscopic and macroscopic descriptions are given of the process of drying from a long porous and permeable column, initially saturated fully with a liquid which wets its grains. A comparison is made with the process of drainage, and it is shown that the 'first stage of drying' corresponds with the extension down into the pack of a saturation profile derived from the capillary pressure curve. In the second stage of drying this profile penetrates still deeper; its upper end coincides with a 'bone dry front,' the progress of which down the pack is controlled by diffusion of vapor to the surface. Results of the analysis are compared to measurements of front position during the drying of unconsolidated fluorite packs. (Knapp-USGS)
W69-04602

SOIL-WATER DIFFUSIVITY VALUES BASED UPON TIME DEPENDENT SOIL-WATER CONTENT DISTRIBUTIONS,
California Univ., Davis. Dept. of Water Science and Engineering.
D. K. Cassel, A. W. Warrick, D. R. Nielsen, and J. W. Biggar.
Work partially supported by US Army Electronics Res and Develop Activity, Ft. Huachuca, Ariz and WRRC, Univ of Calif. Soil Sci Soc Amer Proc, Vol 32, No 6, pp 774-777, Nov-Dec 1968. 4 p, 7 fig, 3 tab, 7 ref.

Descriptors: *Soil water movement, *Diffusivity, Infiltration, Unsaturated flow, Moisture tension, Capillary water, Diffusion, Porous media, Soils, Soil moisture, Temperature.
Identifiers: Soil water diffusivity.

A laboratory method based upon time dependent soil-water content distributions is presented for calculating isothermal soil-water diffusivity values for soils at 5 to 15 volume percent water. The redistribution of water within sealed soil columns was monitored by gamma-radiation attenuation at approximately 100 to 1,000 hour intervals over a period exceeding 3 months. Diffusivity values from numerical integration of the diffusion equation were obtained easily and compared favorably with those of previous investigators. (Knapp-USGS)
W69-04603

FACTORS IMPORTANT IN THE CALCULATION OF HYDRAULIC CONDUCTIVITY,
Michigan State Univ., Lansing. Dept. of Soil Science; and Hawaii Univ., Honolulu. Dept. of Agronomy and Soil Science.
R. J. Kunze, G. Uehara, and K. Graham.
Soil Sci Soc Amer Proc, Vol 32, No 6, pp 760-765, Nov-Dec 1968. 6 p, 8 fig, 1 tab, 12 ref.

Descriptors: *Hydraulic conductivity, Mathematical studies, Laboratory tests, Digital computers, Computer programs, Hysteresis, Soil moisture, Saturation, Pores, Soil water movement.
Identifiers: Moisture characteristic, Matching factor, Millington-Quirk method, Pore size distribution.

The calculation of hydraulic conductivity by a modified Millington-Quirk method with a matching factor gave conductivity values closely approximating experimentally measured values. The technique requires knowledge of the moisture characteristic and the saturated conductivity. A number of factors that affect the calculated values and improve the computational results were investigated. Calculated conductivity values decreased with an increasing number of pressure classes at low moisture contents. For all soils tested the calculated conductivities were less than the experimental values at the terminal point of the moisture characteristic. This discrepancy was partially corrected by a small change in the Millington-Quirk equation, by extending the moisture characteristics to higher suction values, and by reducing the number of pressure classes to approximately 10. A matching factor, the ratio of measured over calculated saturated conductivity, was found necessary for obtaining the best fit of calculated and measured data. Two conductivity functions calculated separately from each moisture characteristic forming a hysteresis loop, converged as the hysteresis loop was translated to higher tensions. All computations were done by computer. (Knapp-USGS)
W69-04604

VARIATIONS OF EVAPORATION IN TIME AND SPACE: PART 1 AND PART 2,
Nottingham Univ. (England). School of Agriculture.
For primary bibliographic entry see Field 02D.
W69-04618

SUBSURFACE STORMFLOW FROM FORESTED SLOPES,
Forest Service (USDA) Columbus, Ohio. Northeastern Forest Experiment Station.
Ronald Z. Whipkey.
Bulletin, Int'l. Assoc. Sci. Hydrology (1965), Xe Anne No 2, pp 74-85.

Descriptors: *Subsurface runoff, *Subsurface flow, *Hydrologic properties, *Hydraulic conductivity, Soils, Permeability, Soil physical properties, Watershed management, Hydraulic properties, Hydraulic gradient, Soil water movement.

Outflow (or quick interflow) from forested soil profiles was studied under varied rainfall intensities and depths, hydraulic gradients, and antecedent wetting conditions. Greatest quantities of outflow occurred from the transition point between sandy loam and silty loam--the fine textured layer acted as a temporary waterflow-impeding zone. Smallest quantities of flow occurred from the lower silt loam and clay loam layers. Erratic flow occurred from the surface horizon--a sandy loam soil. Little to no overland flow was recorded. The studies showed also that in coarse-textured soil, infiltrated water first travels vertically downward, then travels in an essentially lateral pattern after reaching a finer-textured soil horizon. As storm depth increased, lateral flow increased. Hydraulic gradient curves computed from hydraulic head measurements confirmed the patterns of rise and recession found in the measured outflow.
W69-04637

THEORY AND MECHANICS OF SUBSURFACE STORMFLOW,
Forest Service (USDA) Columbus, Ohio. Northeastern Forest Experiment Station.
Ronald Z. Whipkey.
Proceedings of an International Symposium on Forest Hydrology, Pennsylvania State University, (1966) Pergamon Press, 255-260.

Descriptors: *Subsurface runoff, *Subsurface flow, *Hydraulic conductivity, *Soil physical properties, *Hydrologic properties, *Permeability, Subsurface drainage, Soil moisture, Soils, Watershed management, Hydraulics, Hydraulic properties, Turbulent flow, Porous media.

A summary of concepts regarding turbulent flow through porous media and application of these to quick interflow from sloping forest souls. Results of empirical field studies are presented and discussed, a recommendation is made for further studies of quick interflow from layered, permeable, forest soils.
W69-04638

A TECHNIQUE FOR OBTAINING UNDISTURBED SOIL SAMPLES BY FREEZING IN-SITU,
Forest Service (USDA) Columbus, Ohio. Northeastern Forest Experiment Station.
Robert L. Blevins, Gerald M. Aubertin, and Nicholas Holowaychuk.
Soil Science Society of America Proceedings (1968) Vol 32, No 5.

Descriptors: *Soil investigations, *Soil analysis, *Soil physical properties, *Soil structure, *Soil texture, Soil strength, Soil stability, Soil mechanics, Soil horizons, Soil density, Soil classifications, Soil tests.

A freezing technique employing liquid nitrogen has been developed to freeze soil blocks in place. This technique allows us to take undisturbed soil samples from loose or poorly structured soils having an abundance of roots and/or a high percentage of coarse skeletal materials. The frozen blocks are transported to the laboratory where they can be cut into appropriate sizes or shapes for bulk density, moisture retention, or microslide studies.
W69-04639

WATER INTAKE ON MIDCONTINENTAL RANGELANDS AS INFLUENCED BY SOIL AND PLANT COVER,
Agricultural Research Service, Beltsville, Md. Soil and Water Conservation Research Div.; Wyoming Agricultural Experiment Station, Laramie.
Frank Rauzi, C. L. Fly, and E. J. Dyksterhuis.
U. S. Department of Agriculture, Technical Bulletin 1390, pp 1-58, 1968. 58 p, 1 map, 11 photo, 5 tab, 6 chart, 25 ref, 1 append.

Descriptors: *Intakes, *Soil-water-plant relations, *Great Plains, Soil properties, Wettability, Soil environment, Vegetation effects, Ranges, Soil groups.

Water intake studies were conducted with a mobile raindrop applicator on rangeland sites in six States in the Northern and Central Plains. Tests were designed to measure the effect of vegetational differences on the water intake of comparable soil mapping units at range fenceline contrasts. In addition, concentrations of tests were made on certain small experimental rangeland watersheds containing permanent hydrologic installations. Results of 670 tests on nine range-soil-groups located throughout a wide range in precipitation zones and latitudes were evaluated. Statistical analyses of the data included simple and multiple stepwise regressions. Equations were developed for estimating water intake rates for each range-soil-group. (A list of sixteen results obtained from the study is given on pp. 39-41 s part of the authors summary).
W69-04640

2H. Lakes

WATER POLLUTION PROBLEMS AND IMPROVEMENT NEEDS, LAKE ONTARIO AND ST. LAWRENCE RIVER BASINS.
Federal Water Pollution Control Administration, Chicago, Ill.; and New York State Dept. of Health, Albany.
For primary bibliographic entry see Field 05B.
W69-04223

A DIRECT DEMONSTRATION OF THE PHOSPHORUS CYCLE IN A SMALL LAKE,
Yale Univ., New Haven, Conn. Osborn Zoological Lab; and American Museum of Natural History, New York.
G. Evelyn Hutchinson, and Vaughan T. Bowen.
Proc Natl Acad Sci, Vol 33, No 5, pp 148-153, May 1947, 1 fig, 2 tab, 4 ref.

Descriptors: *Cycling nutrients, *Lakes, *Phosphorus compounds, Connecticut, Eutrophication, Phosphates, Phosphorus radioisotopes, Phytoplankton, Pondweeds, Stratification, Zooplankton, Cyanophyta.
Identifiers: *Linsley Pond (Conn), Potamogeton.

Ten millicuries (approximately 715.1 million counts per minute) of radiophosphorus as sodium phosphate was added to surface waters of Linsley Pond, Connecticut, in 24 equal portions on 21 June, 1946. Authors counted radioactivity in four composite samples collected on 28 June from deepest part of lake representing layers as follows: I, 0-3 meters; II, 3-6 meters; III, 6-9 meters; IV, 9-14.8 meters. Thermocline corresponded roughly with II. Determinations of total phosphorus evidenced a net movement of phosphorus into epilimnion. Of radioactivity added, 74.2% was detected in zones as follows: I, 37.2%; II, 26.5%; III, 10.5%; IV, insignificant. Most of 25,8% radiophosphorus undetected in water probably entered vegetation and sediments in contact with I. As determined from counts of radioactivity, littoral plants concentrated phosphorus a thousandfold over that found in water. Data supports hypothesis that phytoplankters utilize such phosphate, derived from mud, as arrives at trophogenic zone, which is later sedimented, even during stratification of lake, as sestonic phosphorus in dead cells and zooplanktonic feces. Paradoxical appearance of large summer blooms of cyanophytes during periods of low phosphorus concentration can be attributed to steady-state utilization of that phosphorus ultimately derived from sediments. (Eichhorn-Wisc)
W69-04520

EXPERIMENTS ON THE UTILIZATION OF NITROGEN IN FRESH WATER,
Freshwater Biological Association, Ambleside (England).
For primary bibliographic entry see Field 05C.
W69-04521

THE THERMAL CLASSIFICATION OF LAKES,
Yale Univ., New Haven, Conn. Osborn Zoological Lab.
G. E. Hutchinson, and H. Loffler.
Proc Natl Acad Sci, Vol 42, pp 84-86, 1956. 1 fig, 8 ref.

Descriptors: *Lakes, *Thermal stratification, Thermal properties, Limnology, Climatic zones, Altitude, Geographical regions, Tropical regions, Polar regions, Antarctic.
Identifiers: *Lake typology, *Regional limnology, Temperate lakes, Tropical lakes, Polar lakes, Holomictic lakes, Polymictic lakes, Oligomictic lakes, Amictic lakes, Cold monomictic lakes, Dimictic lakes, Warm monomictic lakes, Forel's classification, India, Andes, Ceylon, South America, Africa, Lake Nyasa (Africa), Lake Mohasi (Africa), Lake Tana (Africa), Lake Naivasha (Africa), Lake Rudolf (Africa), Lake Albert (Africa), Lake Victoria (Africa).

In 1880, on basis of their stratification patterns, F. A. Forel classified holomictic lakes (those circulating completely at least once during an annual cycle) as polar, temperate, and tropical. Forel's terminology has been criticized as inaccurate and somewhat inadequate, since altitude as well as latitude determine lakes' thermal properties. Hutchinson proposes substitution of following terms: cold monomictic--lakes never over 4 deg C, with winter inverse stratification under ice and summer circulation; dimictic--circulating twice annually at about 4 deg C with inverse winter and direct summer stratification; warm monomictic--always above 4 deg C, with winter circulation and direct summer stratification. Loffler's study of equatorial Andean lakes suggests two additional categories. In humid tropics, oligomictic lakes seldom mix because long-lasting stratification is induced by high stable temperatures at low altitudes; whereas polymictic lakes continuously mix because unvarying low temperatures at high altitudes never permit stratification. Inversely stratified, amictic lakes, reported from Antarctica and extremely high altitudes, are permanently ice covered and never mix. Report includes plot of altitude versus latitude, upon which is delineated a schematic distribution of lake types described. Existence of special climatic regimes probably produces considerable disturbances of the scheme. (Eichhorn-Wis)
W69-04522

ON QUESTIONS OF PRODUCTION AND PRODUCTIVITY IN ECOLOGY,
Western Reserve Univ., Cleveland, Ohio. Dept. of Biology.
For primary bibliographic entry see Field 02K.
W69-04524

LINDANE ADSORPTION BY LAKE SEDIMENTS,
Wisconsin Univ., Madison. Dept. of Soil Science.
For primary bibliographic entry see Field 05G.
W69-04525

SULFUR METABOLISM AND SEDIMENTARY ENVIRONMENT: LAKE MENDOTA, WISCONSIN,
Wisconsin Univ., Madison. Dept. of Geology.
For primary bibliographic entry see Field 05C.
W69-04526

HYDROLOGY OF CRATER, EAST AND DAVIS LAKES, OREGON,
Geological Survey, Washington, D. C.
Kenneth N. Phillips, and A. S. Van Denburgh.
Geol Surv Water-Supply Pap 1859-E, pp E1-E60, 1968. 60 p, 11 fig, 13 tab, 23 ref.

Descriptors: *Lakes, *Water quality, *Hydrologic budget, Pacific Northwest U. S., Evaporation, Seepage, Water balance, Fresh water, Lake basins, Lake bottom springs, Thermal springs, Water levels, Water level fluctuations.
Identifiers: Crater Lake, Davis Lake, East Lake.

Crater, East, and Davis Lakes are small bodies of fresh water that occupy topographically closed basins in Holocene volcanic terranes. Because the annual water supply exceeds annual evaporation, water must be lost by seepage from each lake. Crater Lake loses about 89 cfs equivalent to about 72% of its average annual supply. East Lake loses about 2.3 cfs, or about 44% of its estimated supply. Davis Lake seepage varies greatly with lake level, but the average loss is about 150 cfs, more than 90% of its total supply. The destination of the seepage loss is not definitely known for any of the lakes. An approximate water budget was computed for stationary level for each lake. Crater Lake contains about 80 ppm of dissolved solids--mostly silica, sodium, and bicarbonate, and lesser amounts of calcium, sulfate, and chloride. Much of the dissolved-solids content of Crater Lake--especially the sulfate and chloride--may be related to fumarolic and thermal-spring activity that presumably followed the collapse of Mount Mazama. Although Crater Lake loses an estimated 7,000 tons of its 1.2 million-ton salt content each yr by leakage, the chemical character of the lake did not change appreciably between 1912 and 1964. East Lake contains 200 ppm of dissolved solids, which include major proportions of calcium, sodium, bicarbonate, and sulfate, but almost no chloride. The lake apparently receives much of its dissolved solids from subsurface thermal springs. Annual solute loss from East Lake by leakage is about 450 tons, or 3% of the lake's 15,000-ton estimated solute content. Davis Lake contains only 48 ppm of dissolved solids much of which is silica and bicarbonate; chloride is almost completely absent. (Knapp-USGS)
W69-04574

IDENTIFICATION AND SOLUBILITY OF IRON SULFIDE IN ANAEROBIC LAKE SEDIMENT,
Duke Univ., Durham, N. C., Dept. of Zoology.
For primary bibliographic entry see Field 02K.
W69-04590

GENERALIZED HYDROLOGY OF PRAIRIE POTHOLES ON THE COTEAU DU MISSOURI, NORTH DAKOTA,
Geological Survey, Washington, D. C.
W. S. Eisenlohr, Jr., and C. E. Sloan.
Geol Surv Circ 558, 1968. 12 p, 4 fig, 1 photo, 1 ref.

Descriptors: *Potholes, *Lakes, Water holes, Ponds, North Dakota, Ecology, Hydrology, Groundwater movement, Water table, Runoff, Inflow, Lake basins, Limnology.
Identifiers: *Prairie potholes, Coteau du Missouri.

Hydrologic conditions on a part of the Coteau du Missouri without integrated surface drainage systems are described. The surface of the glacial drift in this region is dotted with shallow prairie potholes which hold water for varying lengths of time. Because precipitation directly on a pothole is the basic source of its water supply, and it is only about half the potential evaporation, potholes tend to go dry. Basin inflow from melting snow or rain occurs only seldom, when the soil is frozen or saturated. Net seepage outflow occurs from potholes on the higher parts of the Coteau at very low rates but it can amount to 20% to 30% of the total water loss from a pothole. Net seepage inflow occurs at the potholes on the lower parts of the Coteau. The water table tends to be a subdued image of the

pography and is generally very near the land surce. The water surfaces of the potholes are part of e water table, and therefore they can be used to repare a contour map of the water table; wells sually act as piezometers and thus are useless for ch a purpose. Generally, potholes with water latively low in dissolved soilds have net seepage utflow, and those with water containing high conentration of dissolved solids have net seepage inow. The direction and rate of groundwater moveent can therefore be inferred from the quality of ater in potholes. The species of emergent aquatic egetation that grow in potholes are directly reted to the permanence and salinity of the water at e particular site of each species. A table lists ommon species that can be used as indicators of ese conditions. (Knapp-USGS)
/69-04597

EOLOGY OF GLACIAL LAKE AGASSIZ,
IcGill Univ., Montreal (Quebec).
ohn A. Elson.
LIFE, LAND AND WATER, Winnipeg, anitoba Univ Press, pp 37-95, 1967. 58 p, 13 fig, tab.

escriptors: *Paleohydrology, *Lake stages, Radioactive dating, Deltas, Basins, Beaches, uaternary period, Paleolimnology, History, aleoclimatology, Geomorphology, Minnesota, orth Dakota, South Dakota, History.
lentifiers: Glacial Lake Agassiz, Water-level duraon, Canada, Ontario, Manitoba, Saskatchewan, lacial-lake phases, Book.

he topographic setting and geologic deposits of lacial Lake Agassiz were outlined from map stuies, air photo interpretation and synthesis of reort data. Although Lake Agassiz sediments occur ver 200,000 sq mi in North Dakota, Minnesota, outh Dakota, Ontario, Manitoba, and askatchewan, that much area was not all subnerged at any one time. Most phases in the lake istory did not exceed 80,000 sq mi at any one me. Deep-water sediments of the lake collected artially closed bedrock basins, each having its own haracteristic sediments, but the most complete seies of sediments should be in the Red River basin. he lake history includes 4 high-water stages eparated by 3 low-water stages. Glacial Lake gassiz is outlined showing either definite, approxinate, or presumed limits and outlets, and sedimentation basins are shown. The topography of the ormer lake areas is shown by 200-ft contours. The norphology is sketched to show plains, alluvial ans, abundant beach ridges, deltas, spillways, rumlin areas, De Geer moraines, and end noraines. Sketch maps outline the extent of the ake during the Herman, Norcross, Campbell, IcAuleyville, Stonewall, Gimli, and Pipun phases. total of 21 former water planes are shown diagrammatically both as to altitude and as to hronologic order. Four typical lithologic sections re presented. Tabular data for 33 deltas include atitude and longitude, area, and altitudes. Of the adio-carbon dates reported, one gives a minimum ge of lake drainage of 7.270 (plus or minus 120) r, 22 relate directly to Glacial Lake Agassiz, 12 late alluvium younger than the lake, and 8 date eat deposits in or near the lake basin. Lake fetches anging from 25 to 400 mi are tabulated in relation o wave height, beach height, energy index, wind elocity, generation time in hr, and deep water imit. (Vorhis-USGS)
W69-04617

2I. Water in Plants

EFFECTS OF FERTILIZER ON FOOD CHAIN ORGANISMS AND FISH PRODUCTION IN NORRIS RESERVOIR, TENNESSEE.
Tennessee Valley Authority, Knoxville. Fish and Wildlife Branch.

TVA Report, 1968. 19 p.

Descriptors: *Aquatic environment, Benthic fauna, Zooplankton, Fish fauna, Electrofishing, Water quality.
Identifiers: Norris Reservoir.

The ability of inorganic fertilizer to increase production and survival of fish food organisms and game fish, thereby increasing sporting fish, in localized cove areas of Norris Reservoir, Tennessee, were studied from April to October 1967. Increasing fishing and nutrients in localized areas of a reservoir in one growing season by fertilization does not appear practical. Fertilization increased the numbers of bottom organisms and zooplankton, but there was no significant change in numbers, size, species, composition, or survival of fish. Temperature and oxygen profiles, coupled with the physical characteristics (directional axis of coves in relation to main creek and cove depth and length) suggest that the age of the water may be very significant in increasing production in coves. (Seigworth-TVA)
W69-04202

2J. Erosion and Sedimentation

SEDIMENT TRANSPORT IN ESTUARINE AREAS,
King's Coll., London (England); and Sir John Cass Coll., London (England).
For primary bibliographic entry see Field 02L.
W69-04240

SEA CLIFF RETREAT NEAR SANTA BARBARA, CALIFORNIA,
California Univ., Santa Barbara.
For primary bibliographic entry see Field 02L.
W69-04241

MAN, VEGETATION AND THE SEDIMENT YIELDS OF RIVERS,
Hull Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 02E.
W69-04269

CHANNEL SEDIMENTATION AND DREDGING PROBLEMS, MISSISSIPPI RIVER AND LOUISIANA GULF COAST ACCESS CHANNELS,
Department of Agriculture, Washington, D. C.
For primary bibliographic entry see Field 04D.
W69-04501

DEFINITIVE COMPUTATIONS OF SAND DISCHARGE IN RIVERS,
Corps of Engineers, Vicksburg, Miss.
Fred B. Toffaleti.
ASCE Proc, J Hydraul Div, Vol 95, No HY1, Pap 6350, pp 225-248, Jan 1969. 24 p, 15 fig, 11 ref, append.

Descriptors: *Bed load, *Sedimentation, *Sediment discharge, Rivers, Sands, Streams, Streamflow, Sediment transport, Channel improvement, Hydraulics, Mathematical models, Digital computers, Computer programs.
Identifiers: Sand transport.

A procedure for an analytic determination of sand discharge in streams is presented especially adaptable to computer programming, requiring only a modicum of input or given data from which the sand discharge fraction are both separately and in combination completely described quantitatively and in distribution from bed to water surface. It has been tested by application and comparison with observed data in all types of rivers, small to large, under a full range of flow conditions, and to model flume experiments conducted under widely varying flow conditions with bed sands varying widely in size and size distribution. It is considered that the results by this procedure are sufficiently accurate, to warrant its use in many types of studies involving quantitative sand transport, design of channels, channel regulation works, and the assessment of probable effects of channel modifications. (Knapp-USGS)
W69-04554

RIVER METAMORPHOSIS,
Colorado State Univ., Fort Collins. Dept. of Geology.
For primary bibliographic entry see Field 02E.
W69-04533

2K. Chemical Processes

CHEMICAL CHARACTERIZATION OF PUBLIC SUPPLY,
Geological Survey, Denver, Colo.; and Denver Board of Water Commissioners, Colo.
Paul R. Barnett, Marvin W. Skougstad, and Kenneth J. Miller.
J Amer Water Works Ass, Vol 61, No 2, pp 61-67, Feb 1969. 7 p, 4 fig, 1 map, 5 tab, 8 ref.

Descriptors: *Water chemistry, *Municipal water, Colorado, Aqueous solutions, Geochemistry, Trace elements, Molybdenum, Water analysis, Water quality, Sampling.
Identifiers: Denver (Colo), Dillon Reservoir (Colo).

The dissolved chemical content of Denver's water supply was studied in a 5-month period beginning in the spring of 1966. The raw water is characterized in terms of both major and minor element constituents. The variations in concentrations over the 5-month period are described and changes in mineral character of the water resulting from plant filtration and chemical treatment processes are demonstrated. Monthly samples of raw and treated water were taken at the 5 water treatment plants and at 4 domestic taps. Water from Dillon Reservoir has an unusually high molybdenum content because of extensive molybdenum mining activity in its drainage area. Results of the analyses are tabulated. The major constituents reported are silica, Ca, Mg, Na, K, bicarbonate, sulfate, chloride, fluoride, nitrate, total solids, hardness, and noncarbonate hardness. The minor elements are Al, Ba, N, Cr, Cu, Fe, Li, Mn, Mo, Rb, Sr, Ti, and Zn. (Knapp-USGS)
W69-04245

LIMNOLOGICAL HYPOTHESIS OF THE ORIGIN OF HOT BRINES IN THE RED SEA,
Akademiya Nauk SSSR, Leningrad.
D. C. Kvasov.
Nature, Vol 221, No 5183, pp 850-851, Mar 1, 1969. 2 p, 1 tab, 18 ref.

Descriptors: *Brines, *Sea water, *Sea level, Pleistocene epoch, *Paleolimnology, Saline lakes, Saline water, Evaporation.
Identifiers: Red Sea, Red Sea hot brine pools.

The suggestion is offered that recently discovered lenses of hot brine at the bottom of the Red Sea may be remnant waters of Pleistocene lakes isolated in the Red Sea basin by lowering of sea level below the basin threshold elevation. The threshold is no more than 126 m deep, much less than Pleistocene sea level lowering, and evaporation of sea water can produce brines of the chemical and isotopic composition found in the Red Sea brine pools. Lowering of the brine-Red Sea water interface by diffusion would be only on the order of about 100 m in 14,000 years. Heat from the bottom in the Red Sea Rift Zone may be responsible for the brine temperature of up to 56.5 deg C. The possibility that the brines are remnants of Pleistocene lake waters is of great importance for further limnological work. (Knapp-USGS)
W69-04254

CONVECTIVE DIFFUSION IN CLAY SYSTEMS,
Illinois Univ., Urbana. Dept. of Agronomy.
For primary bibliographic entry see Field 02F.
W69-04261

VANADIUM CONCENTRATIONS IN COLORADO RIVER BASIN WATERS,
Colorado Univ., Boulder. Dept. of Civil Engineering; and Stanford Univ., Calif., Dept. of Civil Engineering.
K. Daniel Linstedt, and Paul Kruger.
J Amer Water Works Ass, Vol 61, No 2, pp 85-88, Feb 1969. 4 p, 2 fig, 3 tab, 4 ref.

Descriptors: *Water quality, *Trace elements, *Colorado River Basin, Colorado River, Mining, Water pollution sources, Path of pollutants, Water chemistry, Geochemistry.
Identifiers: *Vanadium, Uranium mills.

A radiochemical activation analysis procedure was devised to measure traces of vanadium, which is sometimes associated with uranium milling, in waters of the Colorado River Basin. Samples were collected at Flaming George Dam, Animas River near Cedar Hill, N. M., San Juan River near Shiprock, N. M., and 5 Colorado River sites at Loma, Colo., Glen Canyon Dam, Hoover Dam, Parker Dam, and Davis Dam. Vanadium is concentrated by a cation resin and irradiated in the Stanford University 10-Kw research reactor. Activity of the samples is compared with that of activation standards to calculate vanadium concentration of the water sample. The sensitivity of the analysis is about 1 microgram. A flow sheet of the analysis procedures is shown. Results of 160 sample analyses are tabulated. The results suggest that natural leaching of ore does not represent a major vanadium in river water. Vanadium concentration is related to uranium mill sites, and varied between 0.2 micrograms/liter upstream from any milling activity to 49.2 micrograms/liter in the vicinity of uranium-vanadium milling activities. (Knapp-USGS)
W69-04264

SILICA IN ALKALINE BRINES,
Geological Survey, Washington, D. C.; and Johns Hopkins Univ., Baltimore, Md., Dept. of Geology.
Blair F. Jones, Shirley L. Rettig, and Hans P. Eugster.
Science, Vol 158, No 3806, pp 1310-1314, Dec 8, 1967. 5 p, 3 fig, 1 tab, 18 ref.

Descriptors: *Brines, *Alkaline water, *Silica, Water analysis, Hydrogen ion concentration, Carbonates, Drainage water, Oregon, Saline water, Sulfates, Sodium, Spring waters, Boron, Fluorides, Geochemistry, Chlorides, Faults (Geology), Halides, Volcanoes.
Identifiers: Great Basin province, U.S.A., Lake Magadi, Kenya (Africa), Deep Springs Valley (Calif), Abert Lake (Oreg).

Sodium carbonate-bicarbonate brines from closed basins located in the volcanic regions of Oregon and Kenya were analyzed and described. The study shows several silica contents of up to 2,700 ppm at pH's higher than 10. This high concentration of silica can be attributed to the reaction of waters with silicates and subsequent concentration by partial evaporation. Supersaturation with respect to amorphous silica may occur for brines out of contact with silicate muds. Addition of more dilute waters to alkaline brines may lead to the lowering of pH and thus cause inorganic precipitation of silica. A drop in pH from 11.0 to 8.5 can cause precipitation of as much as 3,000 ppm silica, which corresponds to a 1.5-mm-thick layer of chert for each meter of depth of brine. (Gabriel-USGS)
W69-04270

EFFECT OF HIGH TEMPERATURES ON THE CHEMICAL COMPOSITION OF GROUND WATERS,
I. G. Kissin, and S. I. Pakhomov.
Translated from Geokhimiya, No 3, pp 341-355, 1967. Geochem Int, Vol 4, No 2, pp 295-308, 1967. 14 p, 3 fig, 6 tab, 11 ref.

Descriptors: *Water chemistry, *Groundwater, *Leaching, *Thermal water, *Ion exchange, Adsorption, Aqueous solutions, Chemical reactions, Saline water systems, Salts, Water temperature, Water quality.
Identifiers: USSR, Deep artesian basins.

The interactions of claystone and siltstone with water of various compositions at temperatures from 20 to 200 deg C were studied experimentally to investigate the water-rock chemical relationships in deep artesian basins. The composition of solutions produced by leaching changes substantially with temperature and depends on rock composition. Highly concentrated original solutions, particularly those low in calcium, extracted calcium from the rock in exchange for sodium, forming calcium-sodium chloride waters. Increase in temperature usually favors higher salinity of leaching waters but it also causes desorption of water from clays, and may decrease total water salinity in some cases. (Knapp-USGS)
W69-04271

GEOCHEMISTRY OF EPIGENESIS,
Akademiya Nauk SSSR. Institut Geologii Rudnykh Mestorozhdenii, Petrografii, Mineralogii i Geokhimii.
Aleksandr I. Perel'man.
Trans by N. N. Kohanowski, Univ. of North Dakota. Monographs in Geoscience. New York, Plenum Press, 1967. 266 p, 57 fig, 34 tab, 151 ref.

Descriptors: *Geochemistry, *Soil chemistry, *Water chemistry, *Weathering, Geomorphology, Soil formation, Provenance, Aqueous solutions, Chemical reactions, Biochemistry, Ion transport.
Identifiers: Epigene processes, Epigenesis, Geochemical prospecting, Ore formation, Ore migration, Soil biochemistry, Hydrogeochemistry.

The hydrogeochemistry of the epigene, or weathering, portion of the Earth is discussed in a textbook written for the needs of geologists using geochemical means of exploration for ores and for geomorphologists interested in biochemical processes of sediment formation. The geochemical approach to the study of epigenetic processes is necessary in problems such as geochemical prospecting and theories of exogenous ore formation, as well as the study of weathering. The importance of biological processes in mineral formation, transportation, and transformation in the upper crust is stressed. A relatively small number of epigenetic processes characterize the supergene zone, and may develop in different media - soils, alluvium, aquifers, etc. Processes of migration of elements are therefore similar in the different media, as for instance salt migration in soils and aquifers. Chemical processes and media form the basis of a scheme of classification of elements, environments, chemical reactions, and modes of transport in epigenetic processes. (Knapp-USGS)
W69-04274

EXPERIMENTS ON THE UTILIZATION OF NITROGEN IN FRESH WATER,
Freshwater Biological Association, Ambleside (England).
For primary bibliographic entry see Field 05C.
W69-04521

ON QUESTIONS OF PRODUCTION AND PRODUCTIVITY IN ECOLOGY,
Western Reserve Univ., Cleveland, Ohio. Dept. of Biology.
Charles C. Davis.
Arch Hydrobiol, Vol 59, No 2, pp 145-161, April 1963. 57 ref.

Descriptors: *Ecosystems, *Productivity, Biomass, Circulation, Ecology, Energy conversion, Eutrophication, Food webs, Harvesting, Oligotrophy, Standing crop, Trophic level.
Identifiers: *Production, Energoproductivity, Energoproduction, Organoproductivity, Organoproduction, Mesotrophy, Biogenic production, Biogenic capacity, Concepts, Chemotrophs, Terminology, Holophytes.

This paper represents an attempt to bring order to confusions and ambiguities in terms relating to trophic ecology which had arisen prior to its publication. Author distinguishes between production, the actual rate of formation of organisms under existing conditions, and productivity, the potential rate of formation of organisms under 'ideal' conditions. Such rates can be considered in terms of stored potential chemical energy (energoproduction, energoproductivity) and its subsequent dissipation or in terms of formed organic matter (organoproduction, organoproductivity) and its subsequent remineralization. Clear delineation of these four concepts leads to hierarchical scheme defining following functions of the four basic rates: gross and net primary, gross and net total, gross and net at secondary or higher trophic levels, and gross and net rates for particular groups of organisms (fish, phytoplankton, etc). Harvest and yield are defined as removal of organisms, former being more highly organized (eg, human fishing) compared with latter (eg, grazing). Author discusses examples from the literature of loose application of terms for well defined concepts including standing stock, biomass, and organomass. Davis feels that concept of productivity, as related to trophic status of lakes, loses all ecological meaning if removed from its dependence on local conditions. (Eichhorn-Wis)
W69-04524

SULFUR METABOLISM AND SEDIMENTARY ENVIRONMENT: LAKE MENDOTA, WISCONSIN,
Wisconsin Univ., Madison. Dept. of Geology.
For primary bibliographic entry see Field 05C.
W69-04526

GEOCHEMISTRY OF NATURAL WATERS,
Moscow State Univ. (USSR). Dept. of Geochemistry.
M. G. Valyashko.
Trans from Geokhimiya, No 11, pp 1395-1407, 1967. American Geological Inst Document No GI 67-11-13, 1968.

Descriptors: *Geochemistry, *Water chemistry, *Classification, Carbonates, Sulfates, Chlorides, Evaporation, Sea water, Solutes, Paleohydrology, Meteorites, Extraterrestrial hydrology.
Identifiers: Origin of water.

The composition of natural waters is related to the solubilities of the principal compounds formed by the major ions in solution. Based primarily on the relative proportions of calcium vs. carbonate species plus sulfate, the basic chemical types of water are classified as carbonate (soda), sulfate, and chloride (calcium chloride); acid waters are considered a special separate type. Natural waters are the result of degassing of the mantle. Comparison of volatiles relative to water in chondrites with the composition of sea water indicates little difference for chlorine and bromine, small decreases in iodine and boron, and large decreases for fluorine and carbon. The great variety of continental waters are derived by variable mixtures of evaporated and precipitated solutions of sea water origin. (Knapp-USGS)
W69-04562

MIGRATION OF IRON AND SULFUR WITHIN ANAEROBIC SEDIMENTS DURING EARLY DIAGENESIS,
Yale Univ., New Haven, Conn. Dept. of Geology.
Robert A. Berner.
Research supported by ACS Petroleum Res Fund and National Science Foundation. Amer J Sci, Vol 267, No 1, pp 19-42, Jan 1969. 24 p, 5 fig, 1 plate, 13 ref. Grant 1937-A2,ACS, Grant GA-1441 NSF.

Descriptors: *Iron, *Sulfides, *Anaerobic conditions, *Migration, *Bottom sediments, *Diagenesis, *Ion transport, Mud, Organic matter, Oxidation-reduction potential, Hydrogen sulfide, Model studies, Anaerobic bacteria, Sulfates.
Identifiers: Diagenetic models, Iron sulfides.

ee diagenetic models based on layered situa-
s are presented to illustrate important factors
cting the migration of iron and sulfur within
ently deposited anaerobic sediments. The 2
st important factors considered are sharp varia-
with depth of organic matter content, which is
med to be the same in each model, and the
inal concentration of reactive ferruginous
erial which is varied between models. In a low
ctive iron sediment, bacterial generation of
rogen sulfide in an organic-rich layer should
to darkening and iron sulfide formation in ad-
ing organic-poor sediment to a distance far
ater than the thickness of the organic layer.
ations derived enable calculation of this
ance and the rate of darkening from a small
ber of parameters characteristic of the sedi-
t. In a high reactive iron sediment an organic-
layer should be enriched at its boundaries in
sulfide by the diffusion of dissoved iron and
ate toward the organic layer. In sediments of
ctive iron content transitional between the high
low types, iron sulfide liese-gang banding may
n. Juxtoposed artificial sediments of greatly dif-
ng organic matter content undergo qualitative
nges predicted by the 3 models. The experi-
ts also demonstrate quantitatively the general
dity of the low iron content model. The same
soning applied to the layer models can be recast
3-dimensional context to describe changes in
anic-poor sediment surrounding an organic-rich
y, an example of the often cited reducing
ro-environment. In 1-dimensional (layer) or 3-
ensional form the high iron model may be the
rect mechanism for the formation of many
te layers, concretions, and pyritized fossils. (K-
p-USGS)
9-04572

UMINUM IONS IN AQUEOUS SOLUTIONS,
derbilt Univ., Nashville, Tenn. Dept. of Geolo-
and Missouri Univ., Columbia. Dept. of
icultural Chemistry.
. Reesman, E. E. Pickett, and W. D. Keller.
er J Sci, Vol 267, No 1, pp 99-113, Jan 1969.
, 1 fig, 3 tab, 15 ref.

scriptors: *Aluminum, *Ions, *Solubility,
queous solutions, *Free energy, Chemical reac-
s, Chemical potential, Ionization, Hydrogen ion
centration, Chemical properties, Acidity,
drolysis, Water chemistry.
ntifiers: Aluminum ion polymers.

free energy of formation of A1 (OH) sub 4 ion
A1 (OH) sub 2 ion were estimated as -311.3
-216.1 kcal/mole, respectively, from aqueous
ubility data of high-alumina and aluminum sil-
e clay minerals. The log solubility constants for
hmite are 14.4 and 15.0 respectively, yielding
soelectric point at pH of 6.70. Electrophoretic
ration of aluminum ions at various values of pH
icate that the relative effective charge on the
onic forms of aluminumions between pH 10.0
12.5 are approximately equal and opposite to
cationic forms between pH 4.07 and 2.85. A
rked 3-fold increase in distance of migration oc-
red between pH 2.85 and 1.0, indicating that a
bable 3-fold increase in effective charge, A1
H) sub 2 ion to A1 ion had occurred within this
ge in pH. (Knapp-USGS)
9-04575

TRIFICATION: IMPORTANCE TO
TRIENT LOSSES FROM A CUTOVER
RESTED ECOSYSTEM,
rtmouth Coll., Hanover, N. H. Dept. of Biologi-
Sciences; Dartmouth Coll., Hanover, N. H.,
pt. of Earth Sciences; and Yale Univ., New
ven, Conn. School of Forestry.
ne E. Likens, F. H. Bormann, and Noye M.
nson.
ence, Vol 163, No 3872, pp 1205-1206, Mar
9. 2 p, 2 tab, 13 ref.

scriptors: *Leaching, *Runoff, *Clear-cutting,
trification, Demonstration watersheds, Rainfall,
fates, Nitrates, Magnesium, Calcium, Sodium,
assium, Oxidation, Ecosystems.
Identifiers: Deforestation, Experimental watersheds.

Nitrate concentration in runoff from a plot in the Hubbard Brook Experimental Watershed was 0.9 mg/l before deforestation and increased to 53 mg/l, 2 yr later. The nitrate mobilization was probably increased by increased microbial nitrification caused by removal of vegetation, and oxidation of forest litter. Calcium concentrations increased from 1.8 to 7.6 Mg from 0.4 to 1.5, Na from 0.9 to 1.5, and K from 0.2 to 3.0 in the same 2-yr period. Sulfate decreased by about 45%. (Knapp-USGS)
W69-04584

RECONNAISSANCE OF THE CHEMICAL QUALITY OF SURFACE WATERS OF THE SULFUL RIVER AND CYPRESS CREEK BASINS, TEXAS,
Geological Survey, Austin, Tex.
Donald K. Leifeste.
Tex Water Develop Board Rep No 87, Dec 1968. 32 p, 13 fig, 6 tab, 29 ref.

Descriptors: *Water quality, *Surface waters, *Texas, Streamflow, Runoff, Saline water, Duration curves, Reservoirs.
Identifiers: Sulphur River basin (Tex), Cypress Creek basin (Tex), Concentration-flow-duration curves.

The Sulphur River and Cypress Creek basins are free of serious water-quality problems. Continued municipal and industrial growth will increase the waste-disposal burdens of the streams, and planned impoundments will cause a reduction in the streamflow which now aids in waste assimilation. As the water resources of the basins are developed, the magnitude and significance of the probable changes in water quality will necessitate studies of the resulting problems. The Sulphur River and Cypress Creek basins are adjacent basins in the northeast corner of Texas. Their combined drainage area in Texas is 6.370 sq mi. Both basins are completely within the West Gulf Coastal Plain section of the Coastal Plain physiographic province. The climate of the study basins ranges from moist subhumid to humid. The average annual precipitation ranges from 42 in. in the west to 48 in. in the east and averages about 45 in. About one-fourth of the precipitation appears in the streams as runoff. Surface water in the Sulphur River and Cypress Creek basins is generally of good chemical quality and is suitable for most municipal, industrial and agricultural purposes. The kinds and quantities of minerals dissolved in surface waters of the basins are related principally to the geology of the runoff area and to rainfall and streamflow characteristics, but are also affected by industrial activities. The water in streams is usually low in concentration of dissolved materials. Water from the Cretaceous and Tertiary rocks in the Sulphur River basin is generally of a mixed type containing less than 250 ppm dissolved solids, except in the White Oak Creek subbasin where oil-field drainage intermittently degrades the quality of the water. In the Cypress Creek basin, the Cretaceous rocks contribute a sodium chloride type water that generally contains less than 250 ppm dissolved solids. The chloride content of the surface waters is generally less than 25 ppm, except where oil-field drainage is affecting the quality of the water. All the reservoirs in the basins contain water of very good quality. The dissolved-solids concentration is usually less than 150 ppm. Water available for storage at potential reservoirs is also of very good quality. (Knapp-USGS)
W69-04586

IDENTIFICATION AND SOLUBILITY OF IRON SULFIDE IN ANAEROBIC LAKE SEDIMENT,
Duke Univ., Durham, N. C., Dept. of Zoology.
Roger W. Doyle.
Amer J Sci, Vol 266, No 10, pp 980-994, Dec 1968. 15 p, 6 fig, 1 tab, 26 ref.

Descriptors: *Sulfides, *Iron, *Solubility, *Chemical properties, Eutrophication, Bottom sediments, Ion transport, Diffusion, Oxidation, Oxidation-reduction potential, Hydrogen sulfide, Hydrogen ion concentration, Mineralogy.
Identifiers: Griegerite, Mackinawite.

The dispersed and poorly crystalline iron sulfide that darkens the color of anaerobic sediment containing high concentrations of dissolved ferrous iron has been tentatively identified as mackinawite (tetragonal FeS) in sediment from Linsley Pond, Connecticut. The mineral was identified by suspending sediment in solutions saturated with hydrogen sulfide at one atm pressure and determining the equilibrium ion activity product (equilibrium IAP) of the reaction: FeS= Fe ion + S ion. The IAP was 10 exp -17.7 compared to published values of 10 exp -17.6 for synthetic mackinawite. These values can be assumed to approximate the 'solubility product' of FeS in environments such as the hypolimnia of Linsley Pond and Lake Mendota. Calculations based on the activity of Fe, pH, and Eh in Linsley Pond indicate that mackinawite is stable relative to greigite, in agreement with observation. Since greigite has been shown to be stable relative to mackinawite in marine sediment, this mineral may be useful in differentiating Fe-rich and hydrogen sulfide-rich environments in the fossil record. (Knapp-USGS)
W69-04590

RECONNAISSANCE OF THE CHEMICAL QUALITY OF SURFACE WATERS OF THE CANADIAN RIVER BASIN, TEXAS,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 02E.
W69-04593

SALINE GROUND WATER IN LOUISIANA,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02F.
W69-04608

ASSOCIATION OF RADIUM AND URANIUM AND PEAT,
Moscow State Univ., (USSR). Dept. of Geochemistry.
N. A. Titayeva.
Trans from Geokhimiya, No 12, pp 1493-1499, 1967. Geochem Int, Vol 4, No 6, pp 1168-1174, 1967. 7 p, 4 fig, 5 tab, 22 ref.

Descriptors: *Radium radioisotopes, *Uranium radioisotopes, *Peat, *Geochemistry, Leaching, Adsorption, Reduction (Chemical), Oxidation, Bicarbonates, Clays, Sorption, Ion exchange, Soils, Humic acids.

Uranium is considerably more mobile than radium in surface waters containing small amounts of calcium bicarbonate. Radium is readily sorbed by clays as well as by peat. In peat, uranium is bound to the humic and fulvic acids soluble in alkali, whereas the radium is associated with the insoluble residue. Under oxidizing conditions, the elements appear to be retained by ion exchange, but in the presence of high concentrations of calcium in the water, the radium in the peat and in the insoluble residue becomes nearly unexchangeable. The exchangeability of that radium bound to the humic acid is, however, retained. (Knapp-USGS)
W69-04612

A GEOCHEMICAL CLASSIFICATION OF NATURAL WATERS,
Gornyi Institut, Leningrad (USSR).
A. N. Pavlov, and V. N. Shemyakin.
Geochem Int, Vol 4, No 6, pp 1159-1164, 1967. 2 fig, 1 tab, 10 ref. Trans from Geokhimiya, No 12, pp 1482-1488, 1967.

Descriptors: *Water chemistry, *Chemical properties, *Oxidation-reduction potential, *Hydrogen ion concentration, Geochemistry, Hydrogen sulfide, Oxygen, Classification.

Identifiers: Hydrogeochemistry.

On the basis of limiting values of Eh, pH, concentrations of oxygen and hydrogen sulfide, plus dissociation reactions for the principal acid and alkaline species, natural waters are separated into classes. A definite classification scheme is suggested to relate each class to real Eh and pH values. Superscripts and subscripts are then utilized to indicate oxygen and hydrogen sulfide contents of waters of each class. A graphical method for assigning waters to their classes by Eh and pH is given. (Knapp-USGS)
W69-04626

THE AERATION CAPACITY OF STREAMS,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02E.
W69-04628

2L. Estuaries

LOW-FREQUENCY SEA LEVEL BEHAVIOR AND CONTINENTAL SHELF WAVES OFF NORTH CAROLINA,
British Columbis Univ., Vancouver. Dept. of Mathematics; British Columbia Univ., Vancouver. Inst. of Oceanography; and Commonwealth Scientific and Industrial Research Organization, Cronulla (Australia). Div. of Fisheries and Oceanography.
For primary bibliographic entry see Field 02A.
W69-04224

SEDIMENT TRANSPORT IN ESTUARINE AREAS,
King's Coll., London (England); and Sir John Cass Coll., London (England).
J. E. Prentice, I. R. Beg, C. Colleypriest, R. Kirby, and P. J. C. Sutcliffe.
Nature, Vol 218, No 5148, pp 1207-1210, June 29, 1968. 4 p, 5 fig, 8 ref.

Descriptors: *Estuaries, *Sediment transport, *Sedimentation, Currents (Water), Tides, Sand waves, Sediment distribution, Water circulation.
Identifiers: England, Thames estuary, Medway estuary, Taw-Torridge estuary.

Study of sedimentation in the Thames, Medway, and Taw-Torridge estuaries of England shows varied and complex sedimentary processes of chiefly marine influence. The principal agents of transport are tidal currents; river flow reinforces the ebb-current and provides some suspended sediment. Inner reaches of estuaries receive suspended sediment from the sea and some from bank erosion. The majority of the sediment is carried in suspension near the bed but is a dense fluid, not a true bed load. The net movement of the true bed load is upstream from sources outside the estuaries, as shown by distribution of the remains of ostracods and by the symmetry of sand waves. All estuarine areas show preferred ebb and flood paths. The strongest flood path meanders, but the strongest ebb is straighter. (Knapp-USGS)
W69-04240

SEA CLIFF RETREAT NEAR SANTA BARBARA, CALIFORNIA,
California Univ., Santa Barbara.
Robert M. Norris.
Mineral Information Serv, Vol 21, No 6, pp 87-91, June 1968. 5 p, 1 map, 7 photo, 2 ref.

Descriptors: *Bank erosion, *Waves (Water), *Ocean waves, Tides, Surf, Beach erosion, California.
Identifiers: Santa Barbara (Cal), Cliff erosion, Erosion rate, Cliff recession.

A series of studies along the 10 mi of coast west of Santa Barbara, California, shows that erosion at appreciable rates occurs at most points. The coastline is a rocky cliff 40-200 ft high with a narrow sandy beach at the base. The rocks of the cliff are of Miocene to Recent age, mostly quite soft. Maximum tidal range is 9.0 ft and the average spring tide range is 5.6 ft. Most of the waves are less than 3 ft high and only occasionally exceed 4-5 ft. Cliff recession was determined by comparing present distances from USCGS triangulation station monuments with the distances measured at their installation dates, and varied from 0 to 10 inches per yr. (Knapp-USGS)
W69-04241

PATUXENT THERMAL STUDIES - SUMMARY AND RECOMMENDATIONS,
Maryland Univ., Solomons. Natural Resources Inst.; and Maryland Dept. of Natural Resources.
Joseph A. Mihursky.
Maryland Univ Nat Resources Inst Spec Rep No 1, Jan 1969. 20 p, 1 fig, 1 map, 1 tab, 82 ref. Research done under contract between Maryland Univ (NRI) and Maryland Dep Water Resources.

Descriptors: *Thermal pollution, *Estuaries, *Thermal powerplants, Heated water, Path of pollutants, Pollution abatement, Legal aspects, Social aspects, Biological communities, Ecosystems, Regulation, Control, Inspection, Operations, Standards, Water policy.
Identifiers: Patuxent estuary (Md), FWPCA.

Studies in 1962-1967 of the effects of heated water discharges into the Patuxent estuary, Maryland, are summarized and recommendations for control, regulation, powerplant operating procedures, and future studies are listed. The objectives of the program were to understand the physical, chemical, and biological effects of heated water releases, to determine quantitatively the effects of installing a major power unit at Chalk Point, and to study the factors which control populations of estuaries. The topics studied in detail are the biological role of temperature and temperature change, uses and potential uses of the estuary, history of Patuxent thermal studies, results of field studies, results of laboratory studies, predictions based on laboratory studies, evaluation of Maryland's temperature regulations, constructive uses of waste heat, site selection and alternative methods of water use, and recommendations. (Knapp-USGS)
W69-04244

ORGANIC CARBON-ORGANIC NITROGEN RATIOS OF SEDIMENTS IN A POLLUTED ESTUARY,
Tampa-Hillsborough Bay Technical Assistance Project, Tampa, Fla.; and Federal Water Pollution Control Administration, Washington, D. C., Office of Estuarine Studies.
For primary bibliographic entry see Field 05C.
W69-04248

NUTRIENT AND POLLUTANT RESPONSE OF ESTUARINE BIOTAS,
Stanford Univ., Calif.
For primary bibliographic entry see Field 05C.
W69-04276

ESTUARIES,
American Association for the Advancement of Science, Washington, D. C.
George H. Lauff.
Washington: Publication No. 83, 1967.

Descriptors: *Water pollution, *Water properties, *Estuarine fisheries, *Foreign waters, *Nekton, *Bibliographies, Sedimentation, Nutrients, Geomorphology, Ecology, Fisheries, United States, Geographical regions, Regions, Indian Ocean, Bodies of water, Oceans, Surface waters, Coasts, Salinity, Chemical properties, Water types, Animals, Aquatic animals, Aquatic life, Seston.

This is a collection of 71 papers presented at an estuarine conference. Most of the articles deal with physical and biological, rather than economic, aspects of estuaries. Two articles deal with the problem of defining estuaries. Sundry articles relate to salinity, circulation, sedimentation geomorphology, microbiota, nutrients, ecology and physiology. Several articles deal with estuarin fisheries, including those of the Gulf Coast of th United States, West Africa, Indian Ocean Coast: Zone, and Europe. The article by J. L. McHugh entitled 'Estuarine Nekton', provides excellent per spective on the general topic. Four articles relate t estuarine pollution, including 'The Role of Man i Estuarine Processes' by L. Eugene Cronin, whic provides good general perspective on past an present human influences on physical and biolog cal processes in estuaries. The book contains an ex tensive supplemental bibliography with reference through 1966.
W69-04278

PRACTICES AFFECTING SOUTH ATLANTI AND GULF COAST MARSHES AND ESTUA RIES - DREDGING AND FILLING,
Bureau of Sport Fisheries and Wildlife, Ver Beach, Fla.
For primary bibliographic entry see Field 04A.
W69-04288

DELTA-SUISUN BAY WATER QUALITY IN VESTIGATION,
Stanford Univ., Calif.
C. A. McCullough, and J. D. Vayder.
In PROCEEDINGS OF THE NATIONAL SYM POSIUM ON ESTUARINE POLLUTION, Augu 23-25, 1967, pp 676-709.

Descriptors: *Mathematical models, *Dye release *Water quality control, *California, *Tracer Geographical regions, Pacific coast regions, Re gions, Southwest U. S., Bays, Bodies of wate Tracking techniques, Path of pollutants, Mathe matical studies, Model studies, Deltas, Water pollu tion, Waste disposal, Water pollution control, Cor trol.

Water quality tests were made to assess the preser water quality of the Delta-Suisun Bay (San Fran cisco, California). A mathematical model was su perimposed on the hydraulic model to predict cor ditions resulting from changes in the location an quantities of water released into the Delt Fluorescent dye tracers were used to determine th impact of waste discharges at sensitive locations i the bay. It was concluded that saline intrusion an other water quality control problems could be cor trolled by releases of fresh water from storage area located in points around the Delta.
W69-04291

ESTUARINE NEKTON,
American Association for the Advancement o Science, Washington, D. C.
J. L. McHugh.
In ESTUARIES, 1967, pp 581-620.

Descriptors: *Estuarine fisheries, *Nekton, *Ma ket value, *Fish harvest, Estuarine environmen Aquatic habitats, Bays, Animals, Aquatic animal Aquatic life, Seston, Aquatic environment, En vironment, Fisheries, Value, Habitats, Ecology Competition, Productivity.

The general physical characteristics, as well as th biological parameters and distribution, of nekton organisms in estuaries are described. A discussio of estuarine fisheries is provided, giving figures o commercial landings and dollar values. The role o man as a predator in estuaries is discussed.
W69-04292

MECHANISMS MAINTAINING HIG PRODUCTIVITY IN GEORGIA ESTUARIES,
Federal Water Pollution Control Administratio Southeast Region, Atlanta, Ga.
Claire L. Schelake, and Eugene P. Odum.
In CLEAN WATER FOR THE NATION ESTUARIES., Proceedings of the Georgia Publi Meeting, Jekyll Island, Georgia, November 2 1968, pp 75-80.

criptors: *Georgia, *Productivity, Nutrients, es, Photosynthesis, Appalachian Mountain re-, Atlantic coastal plain, Coastal plains, Geo-hical regions, Regions, Southeast U. S., atic life, Tidal effects, Data collections.

results of studies of the extensive, unpolluted aries at Sapelo Island, Georgia, indicate that following factors are responsible for high luctivity: (1) ebb and flow water movements lting from tidal action, (2) abundant supplies utrients, (3) rapid regeneration and conserva- of nutrients due to activity of microorganisms filter feeders, (4) three types of primary duction units (harsh grass, benthic algae, and toplankton), which insure maximum utilization ght at all seasons, and (5) year-round produc- with successive crops. These factors are ussed and illustrated by data obtained by vari- workers at the University of Georgia Marine In-te, Sapelo Island.
9-04334

E MIXING PROCESSES IN A TIDAL ESTUA-

. Bowden.
rnational Journal of Air and Water Pollution, 7, No 4/5, June, 1963, pp 343-356.

criptors: *Mixing, *Mathematical studies, dal waters, Diffusion, Density currents, Cur-ts (Water), Saline water-freshwater interfaces, ndaries (Surfaces), Interfaces, Stability, cosity, Physical properties, Diffusivity, drologic properties.

author briefly reviews the literature concerned mixing processes in a tidal estuary. A modified roach is presented to account for the significant cts of density currents upon longitudinal diffu- and the importance of stability effects on ucing vertical eddy viscosity and diffusivity.
9-04444

ECOLOGICAL SURVEY OF THE USTON SHIP CHANNEL AND ADJACENT YS,
primary bibliographic entry see Field 05C.
9-04454

MPERATURE AND WATER-QUALITY CON-TIONS FOR THE PERIOD JULY, 1963, to ember, 1965, PATUXENT RIVER ESTUARY, RYLAND,
primary bibliographic entry see Field 05B.
9-04462

LAWARE RIVER MODEL STUDY REPORT . 2 - SALINITY TESTS OF EXISTING CHAN-L.
terways Experiment Station, U. S. Army Corps Engineers, Technical Memo No. 2-337, June, 54.

scriptors: *Saline water intrusion, *Delaware er, *Model studies, Reservoir construction, nstruction, Reservoir operation, Discharge ater), Fresh water, Water types, Bodies of ter, Interstate rivers, Rivers, Running waters, eams, Surface waters, Management, Operations.

inity intrusion in the Delaware Estuary is re-ted for existing (1942) channel conditions. The rposes of these studies were to determine: (1) effects of each principal factor known or be-ved to affect the nature and extent of salinity in-sion in the estuary, with a view toward arriving a proper explanation for the increase in extent of inity intrusion that has occurred in the prototype ce about 1930; and (2) the effects of the posed Incodel Plan, involving reservoir con-uction and operation to regulate the fresh-water charge of the Delaware River above Trenton, on inities throughout the estuary and especially in critical reach between Philadelphia and the laware-Pennsylvania state line. Descriptions of the prototype and the model and appurtenances, and a brief discussion of the hydraulic and salinity adjustment and verification are included in this report for the convenience of the reader. A sufficient number of representative plates showing the agreement attained between model and prototype hydraulic and salinity phenomena are included herein to demonstrate that the model is capable of accurately reproducing all pertinent phenomena of the prototype.
W69-04466

FISHERIES PROTECTING AND ENHANCEMENT WITH WATER DEVELOPMENT OF THE SACRAMENTO-SAN JOAQUIN ESTUARY,
For primary bibliographic entry see Field 06B.
W69-04472

A PRELIMINARY BIBLIOGRAPHY WITH KWIC INDEX ON THE ECOLOGY OF ESTUARIES AND COASTAL AREAS OF THE EASTERN UNITED STATES,
For primary bibliographic entry see Field 06G.
W69-04477

PHENOMENA AFFECTING IMPROVEMENT OF THE LOWER COLUMBIA ESTUARY AND ENTRANCE,
John B. Lockett.
In PROCEEDINGS OF THE INTER-AGENCY SEDIMENTATION CONFERENCE, 1963, Miscellaneous Publication No 970, June, 1965, pp 626-668. Department of Agriculture, Washington, D. C.

Descriptors: *Channel improvement, *Oregon, *Columbia River, *Jetties, Dredging, Bodies of water, Interstate rivers, Rivers, Running waters, Streams, Surface waters, Sediment distribution, Sediment control, Dikes, Earthworks, Embankments, Engineering structures, Hydraulic structures, Structures, Coastal structures, Sediment transport, Sedimentation.

This article gives an historical account of efforts to maintain a channel through the Columbia River entrance. Jetties were used with some success to confine entrance flows to alter sediment disposition. These jetties have been rebuilt and some dredging has been required. Disposal was off-shore. The article reviews more recent scientific analysis which has been conducted on sediment movement and estuarine hydraulics.
W69-04478

MANAGEMENT OF ESTUARINE FISHERIES,
American Fisheries Society, Atlantic City, New Jersey.
For primary bibliographic entry see Field 06B.
W69-04481

NATURAL AND ALTERED ESTUARINE HABITATS OF PENAEID SHRIMP,
Cornelius R. Mock.
Gulf and Caribbean Fisheries Institute, Proceedings, Vol 19, 1966, pp 86-98.

Descriptors: *Shrimp, *Habitats, *Bulkheads, *Environmental effects, *Aquatic productivity, Land reclamation, Animals, Aquatic animals, Aquatic life, Commercial shellfish, Crustaceans, Invertebrates, Shellfish, Environment, Aquatic habitats, Engineering structures, Structures, Hydraulic structures, Walls, Ecology, Productivity.

This study demonstrates what can happen to a shrimp nursery area when it is altered by bulkheading. Two areas were chosen--one adjacent to an unaltered vegetative shore and the other near a concrete bulkhead. Both had similar hydrology and sediment types, but differed in the amount of organic detritus in the bottom sediments and in water depth. Intensive sampling over a ten-month period produced 2.5 times more brown shrimp (Penaeus Aztecus) and fourteen times more white shrimp (P. Setiferus) from the natural habitat than the bulkheaded area. The preference for the unaltered habitat depended on the physical rather than the hydrologic characteristics of the habitat.
W69-04484

A PRELIMINARY ESTIMATE OF THE EFFECT OF DIVERSION OF FLOW FROM THE SUSQUEHANNA RIVER ON THE SALINITY OF THE UPPER CHESAPEAKE BAY,
D. W. Pritchard.
Paper presented to the Eleventh Meeting, Susquehanna River Basin Coordinating Committee, Elmira, New York, 1965.

Descriptors: *Salinity, *Bays, *Model study, *River flow, *Diversion, Maryland, Virginia, Chemical properties, Water properties, Bodies of water, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Geographical regions, Northeast U. S., Regions, Southeast U. S., Channel flow, Flow, Streamflow, Management, Routing, Water management (Applied).

The effects of flow from the Susquehanna River into the Chesapeake Bay upon the salinity of the Bay are reported. The relationship depends not only upon the river discharge in the recent past but also in a complex way upon the flow history. The author recommends construction of an adequately scaled hydraulic model to investigate the variables involved.
W69-04493

MAINTAINING AND ENHANCING THE ESTUARINE ENVIRONMENT,
For primary bibliographic entry see Field 06F.
W69-04512

CURRENTS IN AN INTEROCEANIC CANAL,
Corps of Engineers, Jacksonville, Fla. Interoceanic Canal Studies Branch.
For primary bibliographic entry see Field 02E.
W69-04557

SALINITY INTRUSION EFFECTS IN ESTUARY SHOALING,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
Donald R. F. Harleman, and Arthur T. Ippen.
ASCE Proc, J Hydraul Div, Vol 95, No HY1, Pap 6340, pp 9-27, Jan 1969. 19 p, 15 fig, 3 tab, 13 ref, append.

Descriptors: *Estuaries, *Currents (Water), *Encroachment, *Saline water intrusion, Tides, Shoals, Sedimentation, Froude number, Tidal effects, Discharge (Water), Streamflow.
Identifiers: Savannah River, Delaware River, Tidal currents.

In the salinity intrusion region of an estuary the internal velocity distribution in the longitudinal direction is modified by the density effects. If the velocities are averaged over a tidal cycle the result is an increase in the surface velocities in the downstream (ebb) direction and a reversal of the near-bottom velocities so that the net velocity is in the upstream (flood) direction. The region of heavy shoaling in an estuary is shown to be related to the location of the null point at which the near-bottom velocity reverses from a net landward to a net seaward direction. The location of the null point is shown to be related to the longitudinal salinity distribution through a correlation based on the local densimetric Froude number. A method is developed for predicting the longitudinal change in the region of heavy shoaling due to changes in channel depth or fresh water discharge. The method is developed from laboratory data obtained at M.I.T. and W.E.S. (Vicksburg) and is applied to the Savannah and Delaware estuaries. (Knapp-USGS)
W69-04558

DISPERSION AND FLUSHING OF POLLUTANTS IN ESTUARIES,
Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
Donald W. Pritchard.
Work supported by Office of Naval Res and U. S. Atomic Energy Comm. ASCE Proc, J Hydraul Div, Vol 95, No HY1, Pap 6344, pp 115-124, Jan 1969. 10 p, 2 fig, 3 ref, append. No. 4010 (11)NR AT (30-1)-3109, Doc. No. NYO-3109-33.

Descriptors: *Path of pollutants, *Estuaries, *Currents (Water), Mathematical models, Water pollution, Density currents, Tides, Tidal effects, Diffusion, Dispersion, Saline water, Streamflow, Tidal waters, Maryland.
Identifiers: Tidal currents, Chesapeake Bay.

The fate of a pollutant introduced into an estuary depends upon the relative density of the effluent and the receiving water, the vertical density structure of the estuary, the strength of the tidal currents, the nontidal circulation pattern, and the intensity of turbulent diffusion. Effluents having lower density than the receiving waters, and discharged from an outfall on the bottom, ascend to the surface as a buoyant plume, entraining diluting water en route. Tidal currents advect the polluted volume as an oscillating plume, and turbulent diffusion leads to further dilution of the pollutant. Numerical solutions to time dependent theoretical advection-diffusion equations can be used to depict the probable distribution of a pollutant in a tidal segment of the estuary centered on the outfall. Exchange of pollutant between tidal segments in the estuary and the ultimate flushing of the pollutant from the estuary are best treated using a 2-dimensional segmented mathematical model of the estuary. (Knapp-USGS)
W69-04559

NEW HORIZONS IN THE FIELD OF TIDAL HYDRAULICS,
Clarence F. Wicker.
ASCE Proc, JHydraul Div, Vol 95, No HY1, Pap 6346, pp 147-160, Jan 1969. 14 p, 9 ref.

Descriptors: *Reviews, *Tidal effects, Model studies, Estuaries, Surveys, Dredging, Navigation, Saline water intrusion, Canals, Harbors, Inlets (Waterways), Research and development, Sedimentation, Water pollution, Path of pollutants, Tidal energy, Waves (Water), Tsunamis.
Identifiers: Tidal hydraulics, Waterways, Tidal surges.

Tidal hydraulics is currently defined to include all aspects of tidal waterways, not merely the rise and fall of the tide and the resultant tidal currents. The states of knowledge in the subdivision of this broad field of engineering are analyzed, and the needs, if any, for new knowledge are determined. The principal subdivisions where there is insufficient information available are found to be: salinity intrusions; shoaling; and criteria for the design of channels for safe and economic navigation by ships. The nature of the research in these subdivisions are described generally, the prospects for success are indicated, and the benefits are stated. (Knapp-USGS)
W69-04579

USE OF MODELS IN RESOLVING TIDAL PROBLEMS,
Waterways Experiment Station, Vicksburg, Miss.
Henry B. Simmons.
ASCE Proc, J Hydraul Div, Vol 95, No HY1, Pap 6345, pp 125-146, Jan 1969. 22 p, 22 fig, 9 ref.

Descriptors: *Estuaries, *Tidal effects, *Hydraulic models, Saline water intrusion, Reservoir operation, Model studies, Navigation, Sedimentation, Tides, Waste disposal, Path of pollutants.
Identifiers: Delaware Estuary.

A comprehensive hydraulic model of the Delaware Estuary is described, along with the adjustment and verification of the model. Also described are a number of uses made of the model that were not contemplated when the model was designed and constructed. These include, but are not limited to, studies of factors affecting saltwater intrusion; definition of flushing characteristics of the estuary; design on new navigation facilities; improved methods for waste disposal; the need for rehabilitating existing dikes; and the effects of reservoir operation on salt water intrusion. (Knapp-USGS)
W69-04580

OPTIMUM DREDGING AND DISPOSAL PRACTICES IN ESTUARIES,
Corps of Engineers, Philadelphia, Pa. Operations Div.
Carl C. Cable.
ASCE Proc, J Hydraul Div, Vol 95, No HY1, Pap 6343, pp 103-114, Jan 1969. 12 p, 8 fig.

Descriptors: *Dredging, *Waste disposal, *Silting, *Water pollution, *Water pollution control, Dispersion, Navigation, Water conveyance, Sedimentation, Water quality, Landfills, Channel improvement.
Identifiers: Dredges, Tidal currents.

Various types of dredging plants are described; their capabilities and limitations are listed. The importance of selecting the most suitable disposal method for the job at hand is stressed. Present day emphasis on clean waters dictates that planning be redirected to studying alternate disposal methods to reduce pollutional aspect of some dredging projects. The trend is towards more positive containment of dredged materials to reduce repetitive redredging of material in the ship channels and to provide some control over water quality. (Knapp-USGS)
W69-04581

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

EFFECTS OF WASTE DISCHARGE FROM POINT LOMA SALINE WATER CONVERSION PLANT ON INTERTIDAL MARINE LIFE,
For primary bibliographic entry see Field 05C.
W69-04280

ESTIMATED COST OF DESALTING THREE FLORIDA BRACKISH WATERS,
K. G. Barnhill.
American Water Works Association, Journal, Vol 54, No 5, May, 1962, pp 526-528.

Descriptors: *Desalination, *Economic feasibility, *Costs, *Brackish water, *Florida, Demineralization, Separation techniques, Water purification, Water treatment, Saline water, Water types, Feasibility, Atlantic coastal plain, Coastal plains, Geographical regions, Gulf coastal plain, Regions, Southeast U. S.

The author presents estimated costs for desalting three brackish water supplies in Florida. The author draws attention to the fact that many brackish waters can be desalted at much lower cost than is possible with sea water.
W69-04441

THE PROSPECTS FOR DUAL-PURPOSE PLANTS,
F. E. Crever.
Nucleonics, Vol 23, No 9, September, 1965, pp 48-50.

Descriptors: *Desalination, *Economic feasibility, *Nuclear powerplants, *Multiple-purpose projects, Saline water, Demineralization, Separation techniques, Water purification, Water treatment, Powerplants, Engineering structures, Industr plants, Structures, Water types, Municipal wat Projects, Dual purpose, Feasibility, Project fea bility, Steam turbines, Equipment, Turbines, Ele tric powerplants.

The author discusses several economic and tech cal factors related to the economic feasibility dual-purpose desalination and power plan Among his conclusions are the following: (1) common misconception exists that, in combin plants, water is purified with heat that the pow generation portion would otherwise reject. In fa water can only be obtained at the expense power. (2) There is little question that light-wa reactors can supply energy for desalting at low c in modest-size plants--about 100 million gallons p day. But when we start considering billion-g capacities, we find water transportation over lo distances becoming competitive. (3) The co bined plant offers other advantages when bo products are needed and saleable. The princi benefit derives from decreasing unit cost of nucle steam-generating equipment with increasing size. W69-04463

THE ECONOMICS OF WATER PRODUCTIO USING NUCLEAR ENERGY,
J. W. Milliman.
In WATER PRODUCTION USING NUCLEA ENERGY, pp 49-73. Tucson, Arizona: The Univ sity of Arizona Press, 1966.

Descriptors: *Desalination plants, *Econon feasibility, *California, *Nuclear powerplan Desalination, Saline water, Costs, Financial fea bility, Economic justification, Economics, Paci coast regions, Electric powerplants, Industr plants, Southwest U. S., Geographical regions, R gions, Demineralization, Separation techniqu Water purification, Water treatment, Buildin Engineering structures, Structures, Powerplan Water types.

The economics of saline water conversion discussed, with special emphasis being placed up (1) alternatives to saline water conversion and (the economic issues involved in combined nucle water and power facilities and the Bechtel Study the feasibility of a combined water and power pla for Southern California. The author outlines t economic analyses that have been associated w combined nuclear water-power plants in gener and is particularly critical of the Bechtel Stud Among the major points and conclusions reach by the author are the following: (1) All kno desalinization processes are capital intensive, (Even the most optimistic costs related desalinization are not low when compared to cu rent water costs and to other water source alter tives, (3) Dual purpose (power and water) pla achieve cost savings, but low costs are sensitive stable outputs of both water and power, (4) Cit near sea-coasts, which have no obvious fresh wa alternatives and which can absorb large blocks power, would seem to be the best prospects f large-scale combination nuclear-desalting plants. W69-04483

SALINE WATER CONVERSION REPORT.
Office of Saline Water, U S Department of the terior, Washington, D. C., 1966.

Descriptors: *Desalination, *Costs, *Wa sources, *Federal government, *Water supp Saline water, Demineralization, Separati techniques, Water purification, Water treatme Desalination plants, Water types, Nuclear pow plants, Electric powerplants, Engineering str tures, Industrial plants, Powerplants, Structur California, Geographical regions, Pacific coast gion, Regions, Southwest U. S., Hudson Riv Bodies of water, Rivers, Running waters, Strear Surface waters, Texas, Central U. S., Coas plains, Gulf coastal plain, Rio Grande, Intersta rivers.

is report is made annually by the Department of Interior to the President as required by Public w 448, 82nd Congress, 2nd session. The report mmarizes the program and accomplishments of Office of Saline Water with emphasis on work mpleted in the preceding year. Among some of research mentioned are the following: (1) A al-purpose nuclear power and water plant oducing 150 million gallons/day of water and 00 megawatts of electricity was studied in rela- n to feasibility for construction and operation -shore of Orange County, California. (2) The ssibility of using desalting as an alternative urce of water in the northeast during drought riods was examined. The results indicated that sh water supply from the Hudson River currently ovides the most economic interim source, but t desalting may offer advantages in the future.) A study of saline-water conversion in relation 37 Texas cities revealed that saline-conversion sts were equal to or less than conventional water pplies in 11 instances and more expensive in 27.9 ies in the lower Rio Grande valley. The 11 in- nces represent a special case for future study cause their needs might be supplied by one or ore large-scale desalting plants.
69-04498

ATER DESALINATION: PROPOSALS FOR A OSTING PROCEDURE AND RELATED ECHNICAL AND ECONOMIC CONSIDERA- ONS.
ew York: United Nations, 1965.

escriptors: *Desalination, *Investment, *Costs, aline water, Demineralization, Separation chniques, Water purification, Water treatment, ater types, Capital costs, Operating costs, Con- ruction costs.

art I of this report gives a breakdown of the prin- pal cost items to be included under investment r desalination and proposes a procedure to obtain approximate cost for product water. Part II views the technical and economic considerations ncountered in the selection, construction, and peration of desalination plants.
69-04513

HE CONSTRUCTION BY FRANCE OF A IXED PLANT FOR PRODUCTION OF ELEC- RIC POWER AND OF SOFT WATER,
ociete Hispano-Suiza, Bois-Colombes (France).
. Brousee.
or the 8 Volume Proceedings, see Vol 2, No 9, ield 06B and W69-03305. Int Conf on Water for eace, Wash, D C, Vol 2, pp 135-145, 1968. 11 p, fig, 4 tab.

escriptors: *Desalination, *Flash distillation, Turbines, *Energy transfer, Distrillation, Electric ower, Fresh water, Sea water.
dentifiers: *Turbine gases, France.

urrently distillation is the most frequently em- loyed process in producing fresh water from sea ater for it utilizes readily the heat from electric enerators, heat which would otherwise be lost. epending upon the production ratio of electric ower to fresh water, one may be considered a by- roduct of the other. Where gas turbines are used o drive alternators, nearly all the unused potential s in the exhaust gases and installing a recovery oiler will permit efficient production of the steam ecessary to operate a flash-type evaporation ystem. Depending on the rate of instantaneous lectric consumption of the system considered, the ptimization and the regulation of the production f water under constant conditions will be able to tilize either post-combustion (reinjection of heat nto the exhaust gases) or recovery by reheating the ir used in combustion. The necessary production f water can thus be greater than, equal to, or less han that which could be produced by the amount f heat contained in the exhaust gases at a given noment. It may be possible to adjust the rate of roduction of electricity to the amount of water produced. Tables give the power, speed, and yield of selected types of turbines, the production of water by flash systems tied to turbines, and the cost of both electricity and water as determined from such installations. Figures show a diagram of a turbine-evaporation plant, a flow diagram for such a plant, and a chart showing relation of total electricity consumption to percent of turbine power used throughout a 24-hour day. (Vorhis-USGS)
W69-04595

3B. Water Yield Improvement

FRESH WATER,
Mid-Cheshire Water Board (England).
Delwyn Davies.
London, Aldus Books, 1967. 155 p.

Descriptors: *Water resources, *Water quality, *Water resources development, Water treatment, Water pollution, Water pollution control, Water reuse, Water transfer, Municipal water, Domestic water, Industrial water, Irrigation water, Desalination.
Identifiers: Textbooks, Water resources texts, World water resources.

Fresh water sources, water quality, water supply problems, and pollution causes and control are discussed in a general water-supply hydrology text intended for use by the non-specialist. The physical and chemical properties of water that make it vital to life and a major force in geology are described. The uses of water by society for industry, transportation, and human consumption are outlined. Water movement through the hydrological cycle, water resources in lakes, rivers, and aquifers, and the various means of aquisition, control, and distribution of water in various societies are discussed. Water purity and quality are described in terms both of treatment to improve poor water quality and of methods of controlling pollution of good water. Irrigation and water economy are surveyed with stress on use of water for maximum general benefit. Techniques for desalinization are discussed briefly. (Knapp-USGS)
W69-04225

STORAGE REQUIREMENTS FOR ARKANSAS STREAMS,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02E.
W69-04250

DEVELOPMENT OF GROUND-WATER SUPPLIES AT MISSISSIPPI TEST FACILITY, HANCOCK COUNTY, MISSISSIPPI,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02F.
W69-04268

SURFACE-WATER HYDROLOGY OF CALIFORNIA COASTAL BASINS BETWEEN SAN FRANCISCO BAY AND EEL RIVER,
Geological Survey, Washington, D. C.
S. E. Rantz, and T. H. Thompson.
Geol Surv Water-Supply Pap 1851, 1967. 60 p, 10 fig, 1 plate, 13 tab, 15 ref.

Descriptors: *Surface waters, *Runoff, *Precipitation, Drainage, Discharge (Water), Floods, California, Hydrology, Basins.
Identifiers: *San Francisco Bay, *Eel River.

The surface-water hydrology of coastal basins in northern California was analyzed to provide hydrologic data for use in project planning by the California Department of Water Research and other water agencies in the State. Precipitation is distinctly seasonal, 80% of it falling between the November-March period. Average annual natural runoff is about 5.5 million acre-ft and has an areal distribution similar to that of precipitation, ranging from 5 to 85 inches, in a south-to-north distribution. A flood-frequency study of the region indicates that the magnitude of floods at any given frequency can be related to the size of drainage area and to mean annual basinwide precipitation. Average discharges for each selected flood duration and frequency were correlated with drainage area and mean annual basinwide precipitation. (Llaverias-USGS)
W69-04273

GROUND-WATER CONDITIONS IN UTAH, SPRING OF 1968,
Geological Survey, Salt Lake City, Utah.
For primary bibliographic entry see Field 02F.
W69-04561

GROUND WATER IN GOGEBIC COUNTY, MICHIGAN,
Geological Survey, Lansing, Mich.
For primary bibliographic entry see Field 02F.
W69-04564

WATER RESOURCES DATA FOR IOWA, 1968--PART 1. SURFACE WATER RECORDS, PART 2. WATER QUALITY RECORDS.
Geological Survey, Iowa City, Iowa.
For primary bibliographic entry see Field 02E.
W69-04565

WATER RESOURCES OF THE SYCAMORE CREEK WATERSHED, MARICOPA COUNTY, ARIZONA,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02E.
W69-04587

RECONNAISSANCE OF THE CHEMICAL QUALITY OF SURFACE WATERS OF THE CANADIAN RIVER BASIN, TEXAS,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 02E.
W69-04593

RECONNAISSANCE OF THE GROUND-WATER RESOURCES OF THE MISSOURI RIVER ALLUVIUM BETWEEN ST. CHARLES AND JEFFERSON CITY, MISSOURI,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02F.
W69-04610

GROUND WATER OF THE PIEDMONT AND BLUE RIDGE PROVINCES IN THE SOUTHEASTERN STATES,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02F.
W69-04615

GEOLOGY AND GROUND-WATER RESOURCES OF GREENE COUNTY, ALABAMA,
Geological Survey, University, Ala.
For primary bibliographic entry see Field 02F.
W69-04625

A SUBSTITUTE FOR 2,4,5-T IN EASTERN HARDWOOD SPROUT AND BRUSH CONTROL,
Forest Service (USDA) Parsons, West Va. Northeastern Forest Experiment Station.
J. H. Patric, and John Campbell.
Proc. Northeastern Weed Control Conference 23: 320-328.

Descriptors: *Deciduous forests, *Herbicides, Vegetation regrowth, Plant growth regulators, Foliar application, 2-4-5 T, 2-4 D, *Water yield improvement.
Identifiers: *Experimental watersheds.

Two experimental watersheds on the Fernow Experimental Forest were clearcut and maintained barren with 2,4-D and 2,4,5-T. With 2,4,5-T presently unavailable, a mixture of TBA, 2,4-D, and 2,4-DP has been substituted successfully. Under our conditions of use, the substitute is as effective and economical as 2,4-D and 2,4,5-T for controlling revegetation by eastern hardwoods. (Patric-USFS)
W69-04633

WATERSHED CALIBRATION METHODS,
Forest Service (USDA) Upper Darby, Pa. Northeastern Forest Experiment Station.
Kenneth G. Reinhart.
Reprinted from International Symposium of FOREST HYDROLOGY Proceedings of a National Sci. Foundation Advanced Sci. Seminar held at the Penn. State Univ., Penna. Aug. 29 - Sept. 10, 1965. Pergamon Press, Oxford and New York.

Descriptors: *Rainfall-runoff relationships, Statistical methods, Hydrograph analysis, Water measurement, Deciduous forests, Mathematical models, *Water yield improvement, Streamflow, Watershed management.
Identifiers: *Hydrologic analysis, *Experimental watersheds.

A wide variety of streamflow characteristics can be subjected to analysis; these characteristics can be related to a number of measurable parameters in order to explain most of their variation. The covariance method of analysis is discussed along with changes in procedure to meet different conditions. The natural correlation of the characteristic under study and the parameters to which it is related is the most important factor affecting success. The control-watershed approach has given the best correlations; these might be improved by the addition of precipitation and antecedent discharge variables. It is no longer enough to determine whether a given treatment has a significant effect; we also need to know the amount of change. New and better methods are needed to attain precision for testing mild treatments on portions of watersheds and to evaluate action programs. (Reinhart-USFS)
W69-04634

EFFECTS OF ABANDONED FARMLAND ON STREAMFLOW,
Forest Service (USDA) Durham, N. H. Northeastern Forest Experiment Station.
James W. Hornbeck, and Charles A. Troendle.
West Virginia Agriculture and Forestry 2 (1): 9-10.

Descriptors: *Rainfall-runoff relationships, Water temperature, Revegetation, Water conservation, *Watershed management, Vegetative conversion, Streamflow.
Identifiers: *Abandoned farmland, *Experimental watersheds.

The U. S. Census of Agriculture reports 9% of West Virginia as abandoned farmland in 1959. Two gaged watersheds were established in 1957 on abandoned farms near Parsons, West Virginia. Despite evidence of severe erosion during farming, turbidity in these streams now is little greater than in forest streams. Maximum water temperatures ranged from 1-3F higher than in forest streams. To date, there is no evidence that natural afforestation is decreasing streamflow (Hornbeck-USFS)
W69-04635

EFFECT ON STREAMFLOW OF FOUR FOREST PRACTICES IN THE MOUNTAINS OF WEST VIRGINIA,
Forest Service (USDA) Upper Darby, Pa. Northeastern Forest Experiment Station.
K G Reinhart, A R Eschner, and G R Trimble, Jr
U S Forest Serv Res. Paper NE-1, 79 pp, illus

Descriptors *Rainfall-runoff relationships, Watersheds (Basins), Deciduous forests, Flow characteristics, Streamflow, Forest management, *Watershed management, *Water yield improvement.
Identifiers: *Timber harvest, *Experimental watersheds.

Four intensities of forest management, ranging from commercial clearcutting to an intensive selection cutting, were applied on calibrated watersheds. Increases in annual flow were related to volume cut. (Reinhart-USFS)
W69-04636

3C. Use of Water of Impaired Quality

CHESAPEAKE BAY WATER SUPPLY NEEDS - THE BIOLOGICAL POINT OF VIEW,
E. L. Cronin.
Paper presented to the Eleventh Meeting, Susquehanna River Basin Study Coordinating Committee, Elmira, New York, 1965.

Descriptors: *Salinity, *Oysters, *Bass, *Water quality, *River flow, Bodies of water, Bays, Spawning, Shellfish, Animals, Aquatic animals, Aquatic life, Fish, Freshwater fish, Pan fish, Water properties, Chemical properties, Sunfishes, Wildlife, Benthic fauna, Benthos, Commercial shellfish, Invertebrates, Marine animals, Mollusks, Water levels, Channel flow, Flow, Streamflow.

The author discusses the potential effects of variations in the quantity and qualities of water flowing into the Chesapeake Bay from the Susquehanna River. Discussed are such factors as changes in river flow upon salinity and, in turn, on oysters and the troublesome sea nettle. Also discussed are the potential effects on the spawning area in the Bay for striped bass, reportedly the greatest of such spawning areas in the entire world.
W69-04464

3D. Conservation in Domestic and Municipal Use

HYDROLOGY OF THE VALLEY-FILL AND CARBONATE-ROCK RESERVOIRS PAHRUMP VALLEY NEVADA-CALIFORNIA,
Geological Survey, Washington, D. C.
Glenn T. Malmberg.
Geol Surv Water-Supply Pap 1832, 1967. 47 p, 8 fig, 5 plate, 9 tab, 35 ref.

Descriptors: *Water levels, *Carbonate rocks, *Landfills, Reservoirs, Deposition (Sediments), Groundwater movement, Irrigation wells, Withdrawal, Water wells, Nevada, California, Aquifers, Overdraft.
Identifiers: Net pumping draft, Pahrump Valley, Water-level decline.

A reevaluation of the occurrence and availability of the groundwater supply of Pahrump Valley, not considered a hydraulically closed basin, was prompted from observations of the accelerated rate of water-level decline in wells and the decrease in the yields of springs. Investigation revealed 2 reservoir systems: in the valley fill, and in the underlying carbonate rocks. The net pumping draft in the 4-year period 1959-62 averaged about 25,000 acre-ft per yr, which is about twice the estimated perennial yield, or an overdraft of about 13,000 acre-ft per yr. During this period, pumping caused an estimated storage depletion of 15,000 acre-ft per yr. If the overdraft is maintained, depletion of stored water will continue and pumping costs will increase. Water levels near the Pahrump, Manse, and Fowler Ranches declined more than 10 ft in response to the pumping. Recycling of the present good quality water to serve future irrigation purposes could result in water deterioration. (Laverias-USGS)
W69-04267

INTERSTATE COOPERATION FOR CONSERVATION AND PROTECTION OF WATER RESOURCES.

N J Stat Ann secs 32:20-11 to 32:20-52 (1963).

Descriptors: *New Jersey, *Delaware River Basin Commission, *Water resources development, *Water supply, Public benefit, Legislation, Delaware River, Delaware, New York, Pennsylvania, Interstate commissions, Water conservation, Water use, Industrial use, Domestic water, Recreational facilities, Public health, Fisheries, Pollution abatement, Navigation, Flood control, Hydroelectric power, Dams, Reservoirs, Aqueducts, Water storage, Conduits, Surface water, Eminent domain, Riparian rights, Salt water intrusion.
Identifiers: *Minimum flow, Integrated water projects.

The Delaware River Basin Water Commission was formed by New Jersey, New York, Delaware and Pennsylvania for the purpose of conserving the water resources of the Delaware River in order that they might be applied so as to benefit all the people of the area. The Commission is designed to insure that an adequate supply of water is available for both domestic and industrial uses. A minimum flow must be ascertained and the Commission is in charge of allocating stored waters. The Commission is empowered to make surveys and construct any dams, reservoirs, and conduits which may be necessary. Each participating state shall supply three members of the council, and the Federal Government may be represented if it so desires. The Commission has the power of eminent domain and may condemn any land or water rights required for its work. It may acquire rights in state owned lands by fee simple conveyance, borrow money and issue bonds to finance its activities, and, may provide for navigation, flood control, and hydroelectric power. All reservoirs constructed shall be available for fishing and recreational uses. (Shevin-Fla)
W69-04427

PUBLIC UTILITIES: METHODS OF SUPPLYING WATER.

N J Stat Ann sec 40:62-49 (1967).

Descriptors: *Legislation, *New Jersey, *Cities, *Water supply, Public utilities, Local government, Water contracts, Water delivery, Supply contracts, Condemnation, Municipal water, Waterworks, Eminent domain, Legal aspects, Financing, Leases.

In order to obtain water, a municipality may contract with the district board of water supply commissioners in water supply district where the municipality is located. A municipality may enter into a contract, not to exceed 15 years, to obtain its water supply from another municipality having waterworks. A municipality may contract for water with a water company, such contract not to exceed 30 years. The water company may issue bonds or give a mortgage to raise money for plant expansion. A municipality may acquire by purchase or lease any waterworks or supply from any person or municipality owning it, together with all property, rights, franchises, powers, and interests. Any municipality using the power of eminent domain to acquire waterworks, shall pay as part of the award, such sum as commissioners may fix as the fair value of bills receivable. Any municipality may purchase, condemn, or acquire the necessary land and rights, within or without the municipality, for water supply purposes. It may alter or change the grade of a highway or require railroad and canal structures to be moved. Where the water supply is from more than one source, or the distribution plant to be acquired is connected with the distribution plant of the owner in the adjoining municipality, such municipality may purchase, lease, or condemn the plant in said municipality and the adjoining one. The municipality acquiring such property shall furnish water to the adjoining municipality as long as is ordered by Board of Public Utility Commissioners. (Stewart-Fla)
W69-04695

LIC UTILITIES: MUNICIPALITY AND ITS LUSIVE RIGHT TO SUPPLY WATER.
tat Ann 40:62-48 (1967).

riptors: *Legislation, *New Jersey, *Cities, ter supply, Water delivery, Pipelines, Water its, Water contracts, Municipal water, Public ies, Legal aspects, Pipe flow.
tifiers: Injunctions (Prohibitory), Injunctions ndatory).

icipalities have the exclusive right to supply r within their geographical limits. No person supply water to any other person by means of r pipes conveying water from without the mu- al limits without consent of the board having ge of the public water supply. No person within imits of any municipality shall obtain water by s from any source outside municipal limits out consent of said board. Any municipality enjoin violation of the above provisions. This on shall apply whether or not the water supply ished by the municipality is obtained by con- or from a plant owned and controlled by the icipality. (Stewart-Fla)
-04696

TER SUPPLY.

Stat Ann secs 40:36-1 to 40:36-2, 40:36-4 to 6-6, 40:36-10 (1967).

criptors: *Legislation, *New Jersey, *Water ply, *Administrative agencies, Municipal ers, Community development, Population, lic benefits, Water contracts, Legal aspects, elines utilities, Water works, Surveys, Local ernments, Eminent domain.
tifiers: *Water supply commission.

tion 1 provides that any county of over 205,000 ulation may establish a county water supply mmission composed of seven members who shall e without compensation for 2 year terms. Sec- 2 allows the water supply commission, with the roval of the board of chosen freeholders, to er into contracts with the direct water supply mmission for a technical survey of the potable er supply in the county. Section 4 allows coun- of over 350,000 population to establish a coun- ater supply commission composed of five mem- s serving without compensation for three year ns. Section 5 provides that the commission may, n the approval of the board of free-holders, pro- e water to any municipality in the county by: (1) ering into a contract with any state board, com- sion or department; (2) entering into contracts h any municipality in the state having water rks or with any corporation owning water works; purchasing or leasing any water company sup- ing water to any municipality within the county; (4) acquiring the necessary real estate, water nts, and making necessary improvements within without the state. All property shall be acquired the name of the county. Section 6 allows the mmission to sell the water acquired by it and to water mains to accomplish such sale. Section 10 vides that these statutes shall not effect the sent powers of the New Jersey Water Policy mmission or the North Jersey District Water pply Commission. (Heckerling-Fla)
9-04697

E. Conservation in Industry

ATER REQUIREMENTS OF SELECTED ORTH GEORGIA MANUFACTURING INDUS- RIES,
eorgia Univ., Athens. Dept. of Geography.
r primary bibliographic entry see Field 06D.
69-04205

3F. Conservation in Agriculture

ECONOMIC AND ENGINEERING ASPECTS OF WATER IN DELAWARE'S AGRI-BUSINESS INDUSTRY,
Raymond C. Smith.
Technical Research Project Completion Report, February, 1969. 10 p. OWRR Project B-001-DEL.

Descriptors: *Water requirements, *Water demand, *Planning.

The use of supplemental irrigation in Delaware expanded from 5,553 acres in 1954 to 17,542 acres in 1964. On the basis of acres irrigated in 1964, approximately 660 million gallons of water would be used for supplemental irrigation in a year of above average rainfall. Approximately 1,650 million gallons of water would be used in years of low rainfall. In years of low rainfall, the annual use of water for irrigation is approximately equal to the average daily flow of streams in the State for one day. Production function analysis indicated irrigation resulted in an average increase of 461 pounds in asparagus yields in 1967. Water use and waste disposal were studied in six vegetable processing plants. Waste disposal loads were determined by the average pounds of BOD and the average waste flow per case. There was a wide variation in water used per case between plants producing the same product and between products. There is a tendency to use the same absolute amount of water regardless of the amount of product being packed. The cost of intake water varied from 4 to 13 cents per 1,000 gallons. Waste disposal costs varied from 4 to 34 cents per 1,000 gallons of waste water.
W69-04204

MAJOR USES OF LAND AND WATER IN THE U. S.; WITH SPECIAL REFERENCE TO AGRICULTURE, 1964,
Economic Research Service, Washington, D. C. Natural Resource Economics Div.
H. Thomas Frey, Orville E. Krause, and Clifford Dickason.
U S Department of Agriculture, Agricultural Economic Report, 149, pp 1-74, Nov 1968. 74 p, 12 fig, 2 map, 1 photo, 33 tab, 19 ref, 1 append.

Descriptors: *Water utilization, Drainage effects, Irrigated lands, Cultivated lands, Dry farming, Land use, Agriculture.

This report continues the data series on major uses of land and water in the United States, with special reference to agriculture, published at 5-year intervals by the U.S. Department of Agriculture. Acreage data are obtained from many sources and articulated to form a summary account of the extent and distribution of land in each sub-category and in each major category of land use (cropland, pasture and range, forestland, and urban and other special uses) by State and regions as well as U.S. totals. Acreages irrigated and dry-farmed, acreages drained, and other information on water-use practices related to agriculture are also shown by State and region. In 1964, nearly three-fifths of the land area of the U.S. was used to produce crops and livestock, a fifth was ungrazed forest land, 8 percent was in special uses (of which a third is in urban and transportation uses and two-thirds in generally extensive public areas such as parks) and the remainder--12 percent--in desert and other land of limited surface use. Agricultural irrigation on 38 million acres in 1965 accounted for 41 percent of the nation's total water withdrawal from stream or ground sources.
W69-04208

IRRIGATION SYSTEMS (ESTABLISHING IRRIGATION SYSTEMS IN NEW JERSEY COUNTIES).
NJ Stat Ann secs 40:31-1 to 40:31-3 (1967).

Descriptors: *Administrative agencies, *New Jersey, *Irrigation systems, *Water sources, Irrigation programs, Pipes, Legislation, Water law, Construction, Operation and maintenance, Legal aspects.

A board of chosen freeholders may establish an irrigation system. The board is given the power to purchase real estate and water rights, erect buildings, and to purchase and install machinery deemed necessary for the establishment of the irrigation system. It is also given the power to lay pipes where necessary to reach the property lines of its customers. The board is allowed to tap any river, stream, lake, or other water sources in order to supply the system and is given the power to charge reasonable rates for the use of the water. Further, the system can be extended to other counties, provided such counties consent to the extention. (Holt-Fla)
W69-04416

SILICA IN STREAMS AND GROUND WATER OF HAWAII,
Hawaii Univ., Honolulu.
For primary bibliographic entry see Field 02G.
W69-04528

AGRICULTURAL DEVELOPMENT AND EXPANSION IN THE NILE BASIN; PROGRAMS, PRODUCTION AND IMPLICATIONS FOR U. S. AGRICULTURE,
Economic Research Service, Washington, D. C. Foreign Regional Analysis Div.
Cline J. Warren.
U S Department of Agriculture, Agricultural Economic Report 48, pp 1-114, Oct 1968. 114 p, 11 fig, 1 map, 1 dwg, 44 tab, 33 ref, 1 append.

Descriptors: *Dams, Crop production, Cultivated lands.
Identifiers: *Nile Basin.

This report considered the increase in farm production that might be expected during the next decade in the Nile Basin. The implications of increased farm production are appraised both from the standpoint of their probable impact on local economies and the international market for farm products. Special attention is given to the affect development projects will have on the production and trade of products that compete with U. S. farm exports. Cotton will likely continue to be the most important crop within the Nile Basin for some years to come. Indications are that a large bread grain deficit will still exist in the UAR by the time the full impact of the High Dam is realized. A realization of anticipated expansion in cotton production in the Nile Basin will have a decided impact on the world's cotton situation within the next decade. While extra long staple cotton from the area competes indirectly with U. S. cotton on the world market, short staple varieties compete directly with U. S. foreign sales. Sudanese shipments of surplus feed grains will compete with U. S. exports to Western Europe. Potential exports of oilseeds, citrus, and vegetables could also be a source of increased competition for U. S. sales abroad of these commodities.
W69-04641

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

FLOOD PLAIN INFORMATION, CALCASIEU RIVER, OAKDALE, LOUISIANA.
Switzer (Albert) and Associates, Inc., Baton Rouge, La.

Prepared for City of Oakdale. Corps Eng Flood Plain Rep, Aug 1968. 55 p, 6 fig, 19 plate, 12 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, Louisiana, Maximum probable flood.
Identifiers: Oakdale (La), Calcasieu River (La), Standard project flood, Intermediate regional flood.

Flooding of the Calcasieu River at Oakdale, Louisiana is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-04215

FLOOD PLAIN INFORMATION, KERN RIVER, KERNVILLE, CALIFORNIA.
Corps of Engineers, Sacramento, Calif.

Corps Eng Flood Plain Rep, May 1968. 29 p, 7 fig, 11 plate, 5 tab. Prepared for Kern County.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, California, Maximum probable flood.
Identifiers: Kernville (Calif), Kern River (Calif), Standard project flood, Intermediate regional flood.

Flooding of the Kern River, Kernville, California is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-04216

FLOOD PLAIN INFORMATION, LAS CHOLLAS CREEK, SAN DIEGO COUNTY, CALIFORNIA.
Corps of Engineers, Los Angeles, Calif.

Prepared for San Diego County and San Diego City. Corps Eng Flood Plain Rep, Mar 1968. 36 p, 14 fig, 16 plate, 10 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, California, Maximum probable flood, Historic flood, Flood protection.
Identifiers: San Diego County (Calif), Las Chollas Creek (Calif), Standard project flood, Intermediate regional flood.

Flooding of Las Chollas Creek, San Diego County, California is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-04217

FLOOD PLAIN INFORMATION, FEATHER AND YUBA RIVERS, MARYSVILLE-YUBA CITY, CALIFORNIA.
Corps of Engineers, Sacramento, Calif.

Prepared for Calif State Reclamation Board, and Butte, Sutter, and Yuba Counties. Corps Eng Flood Plain Rep, June 1968. 55 p, 30 fig, 11 plate, 9 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, California, Maximum probable flood.
Identifiers: Marysville (Calif), Yuba City (Calif), Feather River (Calif), Yuba River (Calif), Standard project flood, Intermediate regional flood.

Flooding of the Feather and Yuba Rivers, Marysville and Yuba City, California is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-04218

FLOOD PLAIN INFORMATION, PAYETTE RIVER, PAYETTE, IDAHO AND VICINITY.
Corps of Engineers, Walla Walla, Wash.

Prepared for the County of Payette. Corps Eng Flood Plain Rep, Sept 1968. 31 p, 7 fig, 11 plate, 4 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, Idaho, Maximum probable flood.
Identifiers: Payette (Idaho), Payette River, Intermediate regional flood, Standard project flood.

Flooding of the Payette River, Payette, Idaho, is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-04219

FLOOD PLAIN INFORMATION, SANTA CLARA RIVER (SATICOY TO PACIFIC OCEAN), VENTURA COUNTY, CALIFORNIA.
Corps of Engineers, Los Angeles, Calif.

Corps Eng Flood Plain Rep, June 1968. 36 p, 15 fig, 17 plate, 8 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, California, Maximum probable flood, Historic flood, Flood protection.
Identifiers: Santa Clara River (Calif), Saticoy (Calif), Standard project flood, Intermediate regional flood.

Flooding of the Santa Clara River, California is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-04220

FLOOD PLAIN INFORMATION, JOHNSO CREEK, ARLINGTON AND GRAND PRAIRI TEXAS.
Corps of Engineers, Fort Worth, Tex.

Corps Eng Flood Plain Rep, Dec 1968. 43 p, 8 f 15 plate, 11 tab.

Descriptors: *Floods, *Flood damage, Flo plains, Flood control, Non-structural alternativ Texas, Maximum probable flood.
Identifiers: Johnson Creek, Arlington (Tex), Gra Prairie (Tex), Intermediate regional flood, Sta dard project flood.

Flooding of Johnson Creek, Arlington and Gra Prairie, Texas is described in a report of flood pla problems based on records of rainfall, runoff, a historical and present flood heights. Maps, phot graphs, profiles, and cross sections indicate the e tent of flooding that has occurred and which m be expected to occur in the future. The informati is for use in study and planning ways to minimi vulnerability to flood damages by control of flo plain use by zoning and subdivision regulations, t construction of flood protection works, or by cor binations of these approaches. (Knapp-USGS)
W69-04221

FLOODS IN WOODSTOCK QUADRANGL NORTHEASTERN ILLINOIS,
Geological Survey, Washington, D. C.
Howard E. Allen.
Geol Surv Hydrol Invest Atlas HA-256, 1 shee 1968. 12 fig, 3 tab, 2 ref.

Descriptors: *Floods, *Illinois, *Flood plain Flood damage, Flood control, Non-structural alte natives, Stage-discharge relations, Hydrologic dat Gaging stations.
Identifiers: Woodstock (Ill), Flood profiles, Floo frequencies, Crest-gaging stations.

Floods in the Woodstock quadrangle, northeaster Illinois, are described in a 1-sheet hydrological a las. A map, scaled 1:24,000, shows the floode areas of the 1943, 1963, 1966, and 1967 flood and locations of gaging stations. Flood frequencie and flood profiles are shown graphically. The floo data may be used to evaluate economic develop ment of flood plains in the area, to help individual industries, and governments solve flood problem and to help formulate flood plain regulations, zon ing regulations, building codes, and plans fo recreational and waste-disposal facilities. (Knapp USGS)
W69-04249

MARITIME AGENCY STATUS, CHANNE PROBLEMS CREATED BY HUGE SHIPS CON CERNS OF AAPA.

Traffic World, Vol. 131, No. 14, September 30 1967, pp 25-29, 100-105.

Descriptors: *Channel improvement, *Harbors *Ships, Transportation.

This report on the annual convention of the Amer ican Association of Port Authorities covers thre economic issues: (1) the advantages of specialize ports, (2) the limitations to harbor and channe deepening, and (3) the importance of efficient us of land loading and transportation facilities.
W69-04287

PRACTICES AFFECTING SOUTH ATLANTI AND GULF COAST MARSHES AND ESTUA RIES - DREDGING AND FILLING,
Bureau of Sport Fisheries and Wildlife, Vero Beach, Fla.
A. R. Marshall.
Report, 1967.

Descriptors: *Marshes, *Landfills, *Dredging *Aquatic habitats, *Florida, *Fish, Silts, Habitats

vironment, Food chains, Food habits, Breeding, awning, Natural resources, Wetlands, Conserva- n, Wildlife, Animals, Wildlife conservation, ys, Bodies of water, Bayous, Atlantic coastal ain, Coastal plains, Geographical regions, Gulf astal plains, Regions, Southeast U. S., Animal havior, Behavior, Resources.

rect and indirect effects of dredging and filling the fish and wildlife resources of Florida's tuarine and freshwater habitats are discussed. spects of the problem discussed include: direct struction of swamp, marsh, and bay bottom bitat in the immediate project area; destruction spawning and nursery habitat by siltation; reduc- n of light penetration; creation of anaerobic bot- m conditions; reduction of nutrient outflow from arshes and swamps. Specific examples are cited r Boca Ciega Bay, Tampa Bay, Biscayne Bay, In- an River, and St. John's River.
69-04288

67 PROCEEDINGS OF WODCON.
orld Dredging Conference, Palos Verdes Estates, alifornia, May, 1967.

escriptors: *Dredging, *Reclamation, *Mining, Sediments, *Sampling, Land reclamation, Coastal gineering, Engineering, Hydraulic mining.

his is a compilation of the papers read at the orld Dredging Conference, May 6-8, 1967, held New York City. Topics covered were: dredge sign, coastal and reclamation dredging, sediment mpling systems, Dredging developments, and ean mining.
69-04321

EMARKS BY BRIGADIER GENERAL JOHN B. DILLARD, DIVISION ENGINEER, SOUTH ACIFIC.
eport, San Joaquin and Contra Costa Navigation terests, Concord, California, January 20, 1967.

escriptors: *California, *Ships, *Economic im- act, Transportation, Navigation, Civil engineer- g, Engineering.

he author's remarks cover the relation of deep aft shipping to regional economic development. ocal industry has become more and more depen- nt on low-cost sea transportation. The author ggests a central loading and unloading station for l and bulk products, thus requiring only one deep aft channel across the Bar in the port of ockton, California.
69-04324

ESTIMONY - NATIONAL SAND AND RAVEL ASSOCIATION,
lyde H. Slease.
stuarine Hearings, Subcommittee on Fisheries nd Wildlife Conservation of the Committee on lerchant Marine and Fisheries, House of epresentatives, 90th Congress, Serial No. 90-3, larch, 1967.

escriptors: *Sands, *Dredging, *Gravels, Estuarine environment, *Forecasting, Construc- on materials, Earth materials, Pervious soils, Soil pes, Aquatic environment, Environment.

uring the 30-year period, 1962-92, an estimated 2 billion tons of sand and gravel will be produced. resently held reserves will be exhausted in about 0 years. Approximately 10 percent of production from waterways, and most of this is estuarine. he author does not believe that sand and gravel redging is incompatible with fish and wildlife in- erests and opposes the bill before Congress ecause he fears that dredging interests will be estricted.
69-04340

THE ROLE OF RESEARCH IN THE PRESERVATION OF ESTUARIES,
James E. Sykes.
32nd North American Wildlife and Natural Resources Conference, San Francisco, California, Transactions, March 13-15, 1967, pp 150-160.

Descriptors: *Land management, *Landfills, *Environmental effects, *Research and development, Dredging, Legal aspects, Land forming, Ecology, Management, Impaired water quality, Water quality, Erosion, Conservation, Fishing.

The author cites landfill as a serious problem in many estuaries. Until the early nineteen sixties, little attention was paid to the ecological imbalances resulting from dredging and filling. One dredge-fill case is cited which set a precedent, inasmuch as it considered the data and evidence presented by marine biologists concerning the value of commercial and sport fishing of the area. The author identifies other problems for estuarine research: (1) Altered circulation can cause erosion; (2) Dwellings built on new land masses are frequently exposed to hurricanes and sea storms; (3) Water quality, a factor related to biological production, recreation, and public health, is being neglected.
W69-04347

WATERSIDE SITE PLANT LOCATIONS AND EXPANSIONS 1966.
Report, American Waterways Operators, Inc., Washington, D. C., March, 1967.

Descriptors: *Construction, *Sites, *Industrial plants, *Statistics, Rivers, Bays, Harbors, Bodies of water, Running waters, Streams, Surface waters, Buildings, Engineering structures, Structures, Data collections.

The American Waterways Operators, Inc., has kept records on the growth of industrial waterside production facilities and water-borne commerce shipping facilities for the past 14 years (since 1953). This booklet, one of a continuing series which started in 1961, lists the individual facilities built, expanded, or planned for construction on waterfront sites in 1966, by individual rivers and bays.
W69-04361

THE ZUYDERZEE WORKS.
Netherlands Government, Information Service, The Hague, Netherlands, 1967.

Descriptors: *Land reclamation, *Dam construction, *Foreign countries, Coastal engineering, Erosion, Shore protection, Agricultural engineering, Saline water intrusion, Soil treatment, Geographical regions, Regions, Construction, Engineering.

The technical progress of land reclamation from the Zuiderzee and construction of the Barrier Dam is described. Problems of salification, flushing, erosion, and treating soil are discussed. Pumping, dyke construction, and soil distribution are described.
W69-04365

WATERWORKS AND WATER SUPPLIES.
Ala Code tit 22, secs 117-140 (1958).

Descriptors: *Alabama, *Water supply, *Waterworks, *Administrative agencies, Regulations, Legislation, Permits, Water pollution control, Adoption of practices, Water management (Applied), Legal aspects, Investigating construction, Sampling, Water analysis, Supervisory control (Power), Potable water, Cities.

The state board of health has supervision and control over water supplies and waterworks. Every person, firm, corporation, or institution who furnishes water for human consumption must deliver monthly to the state laboratory samples of water furnished to consumers. A record shall be kept of the analysis of such samples. A petition for permission to furnish or supply water for human consumption must be filed with the board along with the complete plans for such water supply system. No permit is required for private property supplying less than 50 persons. After a permit is filed for the board shall conduct a complete investigation and hearing into the proposed changes. The board may order changes upon findings of impure or unwholesome water. All permits issued are revocable or subject to suspension if the water being supplied is impure. The board has the right to make investigations at any time and may require a full report on the condition of the waterworks system of any permit holder. A permit is required to construct a waterworks system. An injunction may issue against any violators of this chapter. It is unlawful to pollute the water supply of a town or city, supply polluted water to consumers, supply water without a permit, and impound water from construction work. Orders of the board may be appealed to the court of competent jurisdiction. (Sisserson-Fla)
W69-04367

HUEY V KELLER (RIGHTS OF UPPER RIPARIAN OWNER).
71 York 89-93 (CP Pa 1957).

Descriptors: *Pennsylvania, *Riparian rights, *Natural flow doctrine, *Obstruction to flow, Judicial decisions, Riparian land, Dams, Legal aspects, Water law, Diversion, Flood damage, Flooding.
Identifiers: Injunctions, Trespass.

Defendant owned land below and adjacent to Plaintiff. Plaintiff sought a mandatory injunction commanding removal of a dam on defendant's property. In addition, he proved damages due to overflow caused by the dam. Prior to 1953, a natural stream flowed through defendant's land and nowhere touched plaintiff's land. Plaintiff's land had always been dry. During the years 1953-1955, defendant dumped debris into the stream, causing water to be diverted onto plaintiff's land; this, in turn, resulted in continuous flooding and damage to plaintiff's land. Defendant unsuccessfully attempted to divert the water into a ditch. The court held that defendant was liable for damages to plaintiff's land that an injunction would issue ordering removal of the dam. The owner of lands higher up the stream has the right to have the waters flow over his land as they would naturally flow. Riparian proprietors are entitled to have the stream which washes their land flow naturally and without material diminution or alteration. One who constructs a ditch to divert a natural stream has a duty to maintain such ditch in a reasonable and proper condition; he is liable for damage resulting from flooding of other lands caused by his failure to do so. (Holt-Fla)
W69-04373

WHARVES AND FISH WEIRS.

Me Rev Stat Ann tit 38, secs 1021-1026 (1965).

Descriptors: *Legislation, *Maine, *Docks, *Weirs, Fishing, Commercial fishing, Cities, Tidal waters, Rivers, Nets, Trapping, Fish, Administrative decisions, Industries, Permits, Islands, Riparian owners, Legal aspects.

These sections pertain to wharves and fish weirs. Section 1021 defines a 'fish weir' as a fixed structure in tidewater constructed of stakes surrounded by brush or netting, forming the catch pound into which fish are led and from which they cannot readily escape. Section 1022 provides for the licensing of anyone intending to build or extend any wharf, fish weir, or trap in tidewaters within the limits of any city or town. Application shall be in writing to municipal officers. The applicant shall give a bond of $500. The applicant may appeal an adverse determination to the Superior Court within 10 days. The owners of islands outside the jurisdiction of any town shall make a determination as to the issuance of such license. Section 1023 makes

the license void unless the weir or trap is built within one year or before July 15th in any year. Section 1024 provides for consent by municipal officers of two towns if the wharf or weir is in a river or tidewater lying between them. Section 1025 provides for the recording of applications made under section 1022 and for reasonable compensation to be paid by the applicant to the municipal officers for their services, to the clerk for recording, and for an additional $5 if the license is granted. (Heckerling-Fla)
W69-04379

GENERAL POWERS OF THE BOARD OF TRUSTEES.
N Y Village Law secs 89.15, 89.16 (McKinney 1966).

Descriptors: *New York, *Flood damage, *Erosion, *Public benefits, Legislation, Municipalities, Drains, Culverts, Dams, Bulkheads, Dredging, Watercourses, Condemnation, Construction, Reservoir operation, Water supply, Aqueducts, Wells.
Identifiers: *Villages, *Board of Trustees.

The board of trustees for a village may, for the purpose of preventing damage to property within the village from floods or erosion, construct drains, culverts, dams and bulkheads, dredge channels, and regulate watercourses, ponds and watering places within or without the village. They may acquire property by purchase or condemnation. If such land is outside the limits of the village, consent of the governing body of the area in which the land is located is required. Consent may only be given after a public hearing is held. No liability will be imposed on the city giving consent, and all responsibility for maintenance and repair will be with the village making the improvement. The cost of the work shall be charged against the village and shall not be wholly against the owners of the property benefited unless consented to by the owners of at least 2/3 in amount of the assessed valuation of the taxable real property against which the improvement is to be assessed. The board of trustees of the village may also establish, regulate and repair public reservoirs, aqueducts, pumps, wells, fountains, and watering and drinking places. (Shevin-Fla)
W69-04393

NAVIGABLE WATERS OF THE STATE.

N Y Navigation Law Art 1, secs 30, 31, 32, 33, 34, 35, 36, 37 (McKinney 1966), as amended and supplemented, N Y Navigation Law Art 1, secs 30, 31, 32, 32-a, 32-b, 32-c, 33-a, 33-b, 33-c, 34, 34-a, 35, 35-a, 36, 37, 38 (McKinney Supp Dec 1968), 17 p.

Descriptors: *New York, *Navigation, *Pollution, *Navigable waters, Legislation, Administrative agencies, Excavation, Landfills, Administrative regulation, Buoys, Treatment facilities, Sewage, Water levels, Sanitary engineering, Legal aspects, Permits.
Identifiers: Obstruction to navigation, Regattas, Aids to navigation.

The commissioner of conservation has jurisdiction over navigation on the navigable waters of the state and shall enforce the provisions of this chapter. It is made unlawful to excavate, place fill in, or erect structures in or on navigable waters, without first obtaining a permit. Except as permitted by statute, the use of a net or weir in the Hudson River is a misdemeanor. Lights are required to be maintained on swing bridges across the Hudson River. It is made a misdemeanor to interfere with navigation. Sanitary facilities aboard craft on Lake George and Greenwood Lake must not discharge pollutants into the waters of the lake. The dumping of trash in Chautauqua Lake is prohibited. The act regulated the disposal of sewage and littering of waters of the state. The conservation commissioner may authorize the placing of aids to navigation in the navigable waters of the state. This chapter also applies to privately owned navigable waters. The chapter provides for the maintenance of the water level of Lake George within certain limits. (Childs-Fla)
W69-04397

TIDEWATER NAVIGATION.

N Y Nav Law secs 80, 81, 82, 83, 84, 85, 86 (McKinney 1966), as amended, N Y Nav Law secs 82, 86 (McKinney Supp 1968).

Descriptors: *New York, *Navigation, *Diversion, *River regulation, Legislation, Cities, Streams, Depth, Taxes, Navigable waters, Tidal waters, Alteration of flow, Width.
Identifiers: Tidewater creek.

A municipal corporation diverting a fresh water stream flowing into an estuary or tidewater creek previously navigable by vessels of at least 20 tons must maintain a depth of at least 3 feet below the low water mark to the head of the tidewater for the full natural width of such creek. However, in Nassau County only a 50 foot width is required. Procedures are established for giving a notice requiring the municipal corporation to restore such stream to the required depth. The superintendent of public works shall determine the depth of such stream in the event of any controversy. After 15 day notice has been given to the municipal corporation, an injunction may be obtained restraining the municipal corporation from any further diversion until the proper depth has been restored. These provisions also apply to any other person diverting any stream as described above. A penalty is prescribed for continuing to divert a stream without maintaining the required depth. The method of collecting revenues for the payment of any work required by the city of New York is provided. This act is amended and annotated. (Childs-Fla)
W69-04398

RIVERS AND STREAMS AS PUBLIC HIGHWAYS.
For primary bibliographic entry see Field 06E.
W69-04399

RIVER IMPROVEMENT.

N Y Conserv Law sec 610 (McKinney 1967).

Descriptors: *Check structures, *New York, *River regulation, *Flood control, Legislation, Floods, Damages, Alteration of flow, Dikes, Flood protection, Legal aspects, Financing.
Identifiers: Regulation of flow.

Construction of dikes, regulation of the flow of a river, and channel improvement to protect against flood damage is provided for. The owners of the properties and political subdivisions benefited by such work are to pay the costs. (Childs-Fla)
W69-04401

ABANDONMENT OF CANAL LANDS.
For primary bibliographic entry see Field 06E.
W69-04402

FLOOD CONTROL PROJECTS - LAND ACQUISITION, MAINTENANCE AND OPERATION.

N Y Unconsol Laws secs 1308, 1309, 1309a (McKinney Supp 1968). 2 p.

Descriptors: *New York, *Flood control, *Projects, *Eminent domain, Administrative agencies, Cities, Maintenance, Operation and maintenance, Ownership of beds, Legislation, Streams, Lakes, Right-of-ways, Maps, Compensation, Legal aspects, Local governments, Conservation.

The Commissioner of Conservation may, when h deems it necessary, immediately acquire any pro perty which is in the bed or beds of any stream lakes, streets, roads, highways or rights of way fo purposes connected with flood control project Once a description and map is filed in the Office o the County Clerk, title to such property transfers t the State of New York. A provision is made fo recovery, by the previous owner, of the value of th property so appropriated. Completed flood contro projects shall be maintained and operated by th Commissioner of Conservation. Municipalities ma be allowed to assume the obligation of main tenance and operation of minor projects. The Com missioner is authorized to use for flood control pur poses any property under his jurisdiction acquire for other public purposes. Transfer of such use effected by an official order of the Commissione (Sisserson-Fla)
W69-04403

CANAL COMPANIES - POWERS AND DUTIES.
N J Stat Ann secs 48:6-16, 48:6-22, 48:6-2 (1940); N J Stat Ann secs 48:6-14 to 48:6-15. 48:6-17, 48:6-19, 48:6-21 (1968 Supp).

Descriptors: *New Jersey, *Canals, *Condemna tion, *Canal construction, Legislation, Stat governments, Cities, Canal embankments, Naviga tion, Bridges, Legal aspects, Local government Maintenance.
Identifiers: Feeders.

This section initially provides the canal companie with the following powers: entry upon all lands t survey and locate the route of the canal; to buy a necessary lands; to construct, operate and maintai all canals authorized by the state; to charge tolls fo canal use; etc. The statute also allows for the bo rowing of money by the canal companies throug the issuance of bonds secured by a mortgage on th canal property and franchise. The canal companie are further allowed to abandon a feeder located i a municipality and not have to maintain that feede in a navigable state. The statute requires that eac company provide adequate bridges and passage over or under the canal where a road or highwa crosses it. Also, no canal will be constructed whic exceeds two hundred and fifty feet in width unles more land is required for the slopes of cuts and em bankments. Finally, the statute prohibits the con struction of canals within the limits of an inco porated city. (Logan-Fla)
W69-04405

PUBLIC UTILITIES - CONSTRUCTION AN OPERATION OF DAMS.

NJ Stat Ann, secs 48:7-7 to 48:7-12 (1968-6 Supp).

Descriptors: *New Jersey, *Dams, *Dam construc tion, *Public utilities, Legislation, State govern ments, Electric power, Electricity, Embankments Reservoirs, Backwater, Aqueducts, Culverts Locks, Bridges, Canals, Weirs, Gates, Turbines Pumps, Generators, Outlet works, Penstocks, Tun nels, Fish passages, Rivers, Streams, Navigation Condemnation, Eminent domain, Low water mark

These statutes discuss and authorize all corpora tions concerned with electrical power and it production, transmission, etc., to construct, main tain, repair, etc., all required dams and their work as long as the flow back and raising of the water behind these dams does not exceed ten feet abov common low water of that river or stream. An height over ten feet would require specific stat authorization. Through the right of eminen domain, the corporations also may exercise th power of condemnation subject of course to stat approval of the necessity for use of this land by th corporation. The state reserves the right to requir certain dams to be constructed so as not to impede navigation and to provide a passageway for fish (Logan-Fla)
W69-04406

NSTRUCTION OF CONVENTION HALL R.
J Stat Ann secs 40:179-109 to 40:179-112 67).

scriptors: *New Jersey, *Piers, *Parks, *Recreaal facilities, Recreation, Land use, Legislation, blic health, Cities, Oceans, Condemnation, uctures, Construction, Costs, Contracts, Financ- Legal aspects, Eminent domain.
ntifiers: *Convention Hall Pier, *Public resort, ht of notice.

y city which has planned a public park or public ort which has not yet been completed may pass ordinance to cause or permit to be erected on h park or resort a public convention hall pier for blic recreation. The city shall have the right of chase or condemn all lands required for the pro-, and it may borrow money and issue bonds to nce such purhcase or condemnation ceedings. In the alternative, the city may horize the purchase and construction of the lity and its lease for a term of years by private ties with ultimate reversion to the city free of intedness. The city will have full control over the , admission charges, commodities sold, and ing out of the facility. All net income received in operation of the hall shall be applied exclusiveo its maintenance and to the retirement of debt ured in its construction. The hall may extend 00 feet beyond the boundaries of the park, proed such extension is toward the ocean. If a city ires to pass such an ordinance, it must publish ice two weeks in advance of such passage in er that any interested party may raise objecns. (Shevin-Fla)
69-04412

IDGES OVER CERTAIN TIDAL WATERS; ANGING COURSE OF STREAM.

J Stat Ann secs 27:19-20, 27:19-21, 27:19-22 966).

scriptors: *New Jersey, *Navigable waters, ridges, *Diversion, Routing, Legislation, Regulon, Boundaries, Damages, Condemnation, gal aspects, culverts, Alteration to flow, Bridges.
ntifiers: Obstruction to navigation.

e legislature must give express permission for the nstruction of any fixed structure over or in any rt of the navigable tidal waters separating this te from any other state. The erection of docks d wharves is not forbidden. After giving notice, re shall be no liability for damages occasioned obstructing navigation caused by repairing or building a bridge, culvert or viaduct. The board chosen freeholders may acquire land for the purse of changing the course of a stream so that it l then pass at right angles to the bridge to be nstructed. These sections are annotated. (Childs-a)
69-04417

RIDGES TO CONFORM TO WHARF LINES.

J Stat Ann sec 27:19-18 (1966).

scriptors: *New Jersey, *Bridges, *Navigation, gislation, Piers, Regulation, Legal aspects, Abutents, Foundations.
entifiers: Wharf line, Obstruction to navigation.

aducts, bridges and piers, or foundations or abutents thereof, must comply with pier and wharf es fixed by any proper authority. Any viaduct or idge capable of interfering with navigation must provided with a suitable draw. (Childs-Fla)
69-04423

OPLER V MORRIS HILLS REGIONAL DISRICT (LIABILITY FOR DISCHARGING SURACE WATERS).

N J Super 409, 133 A 2d 336-340 (1957).

Descriptors: *Drains, *Artificial use, *Repulsion (Legal aspects), *Riddance (Legal aspects), New Jersey, Judicial decisions, Storm drains, Reasonable use, Damages, Rupturing, Hurricanes, Rain, Moisture stress, Foundations, Stress, Surface runoff, Drainage water, Precipitation excess, Surface drainage.

Plaintiff sued the defendant Board of Education when the force of surface water being drained from the defendant's athletic field collapsed the foundation wall of the plaintiff's home. The heavy surface flow occurred while a hurricane passed through the area. The defendant alleged that the damage was due to an act of God. The evidence disclosed that the defendant constructed an athletic field on an upslope above the plaintiff's land. Catch basins poured their flow into a common drainage outlet which discharged about 300 feet from the plaintiff's house. At the discharge point the outlet was 25 feet higher than the plaintiff's lot. The trial court found for the plaintiff and this court affirmed. The damage to the plaintiff's home was not caused solely by an act of God, but that a contributing cause was the defendant's expelling of surface water through an artificial device. When there has been a finding of a wrongdoing which is an efficient and cooperative cause of a mishap, the wrongdoer is not relieved from liability by proving that an act of God was a concurring cause. This state has recently moved from the so called 'common enemy' to a more realistic and flexible standard, the doctrine of 'reasonable use.' Under the new doctrine each possessor is legally privileged to make a reasonable use of his land, even though the flow of surface waters is altered thereby and causes some harm to others. A defendant renders himself absolutely liable if by means of an artificial device (drains, ditches) he causes surface water to flow in larger amounts or in directions other than it would naturally flow causing injury to others. (Blunt-Fla)
W69-04429

LAND RECLAMATION IN THE PO RIVER DELTA OF ITALY,
D. L. Wheeler.
Land Economics, Vol 41, 1965, pp 376-382.

Descriptors: *Land reclamation, *Land development, *Cultivation, *Dikes, *Foreign countries, Marshes, Wetlands, Land management, Soil management, Management, Earthworks, Embankments, Geographical regions, Regions, Engineering structures, Hydraulic structures, Structures, Surface drainage, Drainage.

Work was started in 1952 to drain the Valli Pega marshes on the Adriatic Sea south of the village of Comacchio. A dike was constructed, and the land was drained by 1954. By 1956 the first 900 acres was planted. Today, 6,876 acres are planted to wheat, rape-seed, and lucerne, which are especially well adapted to reclaimed soils. The contraction of the soil as the moisture content is reduced will be the most difficult future problem requiring rebuilding of present structures. Anticipated cost is $4 million; $2,300 per settler for the initial project. The long range plans are to drain 75,000 acres and resettle 7,500 people on the land. Many of these people are fishermen in the area who will be taught how to farm. The gradual development program is designed so as not to upset the economy by destroying the fishing resource before alternatives can be provided to the indigenous population. Reclamation of the entire Valli de Comacchio will cost $5.7 million.
W69-04518

FLOOD PLAIN INFORMATION, RED CEDAR RIVER, INGHAM COUNTY, MICHIGAN.
Corps of Engineers, Detroit, Mich.

Prepared for the Mich Water Resources Comm, Dept of Conservation and Tri-County Reg Planning Comm. Corps Eng Flood Plain Rep, Mar 1968. 43 p, 7 fig, 26 plate, 12 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, Michigan, Maximum probable flood.
Identifiers: Red Cedar River (Mich), Ingham County (Mich), Standard project flood, Intermediate regional flood.

Flooding of the Red Cedar River, Ingham County, Michigan is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-04529

FLOOD PLAIN INFORMATION, SNAPFINGER CREEK, DEKALB COUNTY, GEORGIA.
Corps of Engineers, Savannah, Ga.

Prepared for DeKalb County. Corps Eng Flood Plain Rep, Mar 1968. 47 p, 26 fig, 42 plate, 13 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, Georgia, Maximum probable flood, Historic flood.
Identifiers: Snapfinger Creek, DeKalb County (Ga), Standard project flood, Intermediate regional flood.

Flooding of Snapfinger Creek, DeKalb County, Georgia is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-04530

FLOOD PLAIN INFORMATION, CLEARWATER RIVER, OROFINO AND RIVERSIDE, IDAHO.
Corps of Engineers, Walla Walla, Wash.

Prepared for the city of Orofino and Clearwater County. Corps Eng Flood Plain Rep, May 1968. 32 p, 10 fig, 13 plate, 2 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, Idaho, Maximum probable flood.
Identifiers: Clearwater River (Idaho), Orofino (Idaho), Riverside (Idaho), Standard project flood, Intermediate regional flood.

Flooding of the Clearwater River, Orofino and Riverside, Idaho is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-04531

FLOOD PLAIN INFORMATION, MILL RIVER, HAMDEN, CONNECTICUT.
Corps of Engineers, Waltham, Mass.

Prepared for the town of Hamden, Conn. Corps Eng Flood Plain Rep, Mar 1968. 38 p, 9 fig, 11 plate, 6 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, Connecticut, Maximum probable flood.
Identifiers: Hamden (Conn), Mill River (Conn), Standard project flood, Intermediate regional flood.

Flooding of the Mill River, Hamden, Connecticut is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-04532

FLOOD PLAIN INFORMATION, TULE RIVER, SPRINGVILLE, CALIFORNIA.
Corps of Engineers, Sacramento, Calif.

Prepared for Tulare County. Corps Eng Flood Plain Rep, July 1968. 37 p, 19 fig, 21 plate, 8 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, California, Maximum probable flood, Historic flood.
Identifiers: Tule River (Cal), Springville (Cal), Standard project flood, Intermediate regional flood.

Flooding of the Tule River, Springville, California is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-04533

FLOOD PLAIN INFORMATION, WALNUT RIVER, WHITEWATER RIVER, KANSAS.
Corps of Engineers, Tulsa, Okla.

Prepared for Kansas Water Resources Board. Corps Eng Flood Plain Rep, April 1968. 59 p, 14 fig, 38 plate, 13 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, Kansas, Maximum probable flood, Historic flood.
Identifiers: Walnut River (Kans), Whitewater River (Kans), Standard project flood, Intermediate regional flood.

Flooding of the Walnut and Whitewater Rivers, Kansas is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-04534

FLOOD PLAIN INFORMATION, CUMBERLAND RIVER AND CLEAR FORK, WILLIAMSBURG, KENTUCKY.
Corps of Engineers, Nashville, Tenn

Prepared for the city of Williamsburg. Corps Eng Flood Plain Rep, Jan 1969. 45 p, 8 fig, 14 plate, 12 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, Kentucky, Maximum probable flood, Historic flood.
Identifiers: Cumberland River (Ky), Clear Fork (Ky), Williamsburg (Ky), Standard project flood, Intermediate regional flood.

Flooding of the Cumberland River and Clear Fork, Williamsburg, Kentucky is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-04535

FLOOD PLAIN INFORMATION, HALLS MILL CREEK, MOBILE, ALABAMA.
Corps of Engineers, Mobile, Ala.

Prepared for South Alabama Regional Planning Commission. Corps Eng Flood Plain Rep, May 1968. 27 p, 4 fig, 17 plate, 8 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, Alabama, Maximum probable flood.
Identifiers: Mobile (Ala), Halls Mill Creek (Ala), Standard project flood, Intermediate regional flood.

Flooding of Halls Mill Creek, Mobile, Alabama, is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, Photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-04536

FLOOD PLAIN INFORMATION, MERAMEC RIVER, BRUSH CREEK AND FOX CREEK, PACIFIC, MISSOURI.
Corps of Engineers, St. Louis, Mo.

Prepared for city of Pacific, Missouri. Corps Eng Flood Plain Rep, June 1968. 9 fig, 25 plate, 17 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, Missouri, Maximum probable flood, Historic flood.
Identifiers: Pacific (Mo), Meramec River (Mo), Brush Creek (Mo), Fox Creek (Mo), Standard project flood, Intermediate regional flood.

Flooding of the Meramec River, Brush Creek, and Fox Creek, Pacific, Missouri, is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-04537

FLOOD PLAIN INFORMATION, ROANOKE RIVER, AND ROANOKE AND SALEM, VIRGINIA.
Hayes, Seay, Mattern and Mattern, Roanoke, Va.

Prepared for Roanoke Valley Regional Planning Commission. Corps Eng Flood Plain Rep, July 1968. 38 p, 7 fig, 23 plate, 7 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, Virginia, Maximum probable flood, Historic flood.
Identifiers: Roanoke (Va), Salem (Va), Roanoke River (Va), Standard project flood, Intermediate regional flood.

Flooding of the Roanoke River, Roanoke and Salem, Virginia, is described in a report of flood plain problems based on records of rainfall, runoff and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-04538

FLOOD PLAIN INFORMATION, BLACK RIVER, TOWN AND MANSKER CREEKS, POCAHONTAS, ARKANSAS.
Corps of Engineers, Little Rock, Ark.

Prepared for the city of Pocahontas, Arkansas. Corps Eng Flood Plain Rep, Feb 1968. 52 p, 9 fig, 15 plate, 16 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, Arkansas, Maximum probable flood, Historic flood.
Identifiers: Pocahontas (Ark), Black River (Ark), Town Creek (Ark), Mansker Creek (Ark), Standard project flood, Intermediate regional flood.

Flooding of Black River, Town Creek, and Mansker Creek, Pocahontas, Arkansas, is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-04539

FLOOD PLAIN INFORMATION, OHIO RIVER AND TRIBUTARIES, MC CRACKEN COUNTY, KENTUCKY.
Corps of Engineers, Louisville, Ky.

Prepared for Paducah-McCracken County Planning Commission. Corps Eng Flood Plain Rep, April 1968. 53 p, 8 fig, 15 plate, 15 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, Kentucky, Maximum probable flood, Historic flood.
Identifiers: Ohio River (Ky), McCracken County (Ky), Paducah (Ky), Standard project flood, Intermediate regional flood.

Flooding of the Ohio River and tributaries, Mc Cracken County, Kentucky is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)

9-04540

OOD PLAIN INFORMATION, ARKANSAS ER, NORTH LITTLE ROCK, ARKANSAS.
ps of Engineers, Little Rock, Ark.

pared for the city of North Little Rock. Corps Flood Plain Rep, June 1968. 44 p, 19 fig, 34 e, 12 tab.

criptors: *Floods, *Flood damage, Flood ns, Flood control, Non-structural alternatives, ansas, Maximum probable flood, Historic d.
ntifiers: Arkansas River, Little Rock (Ark), ndard project flood, Intermediate regional d.

oding of the Arkansas River, North Little Rock, ansas is described in a report of flood plain blems based on records of rainfall, runoff, and orical and present flood heights. Maps, photo- hs, profiles, and cross sections indicate the ex- of flooding that has occurred and which may xpected to occur in the future. The information r use in study and planning ways to minimize nerability to flood damages by control of flood n use by zoning and subdivision regulations, the struction of flood protection works, or by com- ations of these approaches. (Knapp-USGS)
9-04541

OOD PLAIN INFORMATION ON CAMP EEK AND NORTH FORK CAMP CREEK, TROPOLITAN ATLANTA, GEORGIA.
rps of Engineers, Mobile, Ala.

pared for Atlanta Region Metropolitan nning Commission. Corps Eng Flood Plain Rep, y 1968. 41 p, 4 fig, 23 plate, 14 tab.

scriptors: *Floods, *Flood damage, Flood ns, Flood control, Non-structural alternatives, rgia, Maximum probable flood.
ntifiers: Atlanta (Ga), Camp Creek (Ga), Stan- d project flood, Intermediate regional flood.

oding of Camp Creek, Atlanta, Georgia is cribed in a report of flood plain problems based records of rainfall, runoff, and historical and sent flood heights. Maps, photographs, profiles, l cross sections indicate the extent of flooding t has occurred and which may be expected to ur in the future. The information is for use in dy and planning ways to minimize vulnerability flood damages by control of flood plain use by ing and subdivision regulations, the construc- n of flood protection works, or by combinations hese approaches. (Knapp-USGS)
9-04542

OOD PLAIN INFORMATION, MILL CREEK, RT SMITH, ARKANSAS.
rps of Engineers, Tulsa, Okla.

pared for the city of Fort Smith. Corps Eng od Plain Rep, Mar 1968. 35 p, 10 fig, 10 plate, 8 .

scriptors: *Floods, *Flood damage, Flood ins, Flood control, Non-structural alternatives, kansas, Maximum probable flood, Historic od.
ntifiers: Mill Creek (Ark), Fort Smith (Ark), ndard project flood, Intermediate regional od.

oding of Mill Creek, Fort Smith, Arkansas is scribed in a report of flood plain problems based records of rainfall, runoff, and historical and sent flood heights. Maps, photographs, profiles, d cross sections indicate the extent of flooding t has occurred and which may be expected to ur in the future. The information is for use in dy and planning ways to minimize vulnerability flood damages by control of flood plain use by ning and subdivision regulations, the construc- tion of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-04543

FLOOD PLAIN INFORMATION, BROOKLYN CREEK, ATHENS, GEORGIA.
Corps of Engineers, Savannah, Ga.

Prepared for the city of Athens. Corps Eng Flood Plain Rep, Feb 1968. 29 p, 13 fig, 10 plate, 5 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, Georgia, Maximum probable flood.
Identifiers: Athens (Ga), Brooklyn Creek (Ga), Standard project flood, Intermediate regional flood.

Flooding of Brooklyn Creek, Athens, Georgia, is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or be combinations of these approaches. (Knapp-USGS)
W69-04544

FLOOD PLAIN INFORMATION ON SHOAL CREEK, DEKALB COUNTY, GEORGIA.
Corps of Engineers, Savannah, Ga.

Prepared for DeKalb County Board of Commissioners. Corps Eng Flood Plain Rep, Apr 1967. 20 p, 12 fig, 17 plate, 4 tab, 31 ref, 2 append.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural atlernatives, Georgia, Maximum probable flood.
Identifiers: Shoal Creek, DeKalb County (Ga), Standard project flood, Intermediate regional flood.

Flooding of Shoal Creek, DeKalb County, Georgia is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-04545

FLOOD PLAIN INFORMATION, PISCATAWAY CREEK, PRINCE GEORGES COUNTY, MARYLAND.
Corps of Engineers, Baltimore, Md.

Prepared for Maryland-National Capital Park and Planning Commission. Corps Eng Flood Plain Rep, Nov 1967. 25 p, 2 fig, 8 plate, 6 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, Maryland, Maximum probable flood.
Identifiers: Piscataway Creek (Md), Prince Georges County (Md), Standard project flood, Intermediate regional flood.

Flooding of Piscataway Creek, Prince Georges County, Maryland is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-04546

STORM DRAINAGE PRACTICES OF THIRTY-TWO CITIES,
Tennessee Valley Authority, Knoxville. Div. of Water Control Planning; and Wisconsin Univ., Madison. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W69-04551

FLOOD PLAIN INFORMATION, POST OAK CREEK AND TRIBUTARIES, SHERMAN, TEXAS.
Corps of Engineers, Tulsa, Okla.

Prepared for the city of Sherman. Corps Eng Flood Plain Rep, Jan 1969. 37 p, 7 fig, 19 plate, 11 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, Texas, Maximum probable flood.
Identifiers: Sherman (Tex), Post Oak Creek (Tex), Standard project flood, Intermediate regional flood.

Flooding of Post Oak Creek and tributaries, Sherman, Texas is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-04576

ONE EXAMPLE OF MULTIPURPOSE DEVELOPMENT PROGRAM: THE RHONE,
Compagnie Nationale du Rhone (France).
Claude Gemaehling, and Pierre Savey.
For the 8 Volume Proceedings, see Vol 2, No. 9, Field 06B and W69-03305. Int Conf on Water for Peace, Wash DC, Vol 8, pp 375-390, 1968. 16 p, 3 fig, 6 photo.

Descriptors: *River basin development, *Multiple-purpose projects, *Hydroelectric power, *Agriculture, *Navigation, Project purposes, Optimum development plans, Irrigation.
Identifiers: *France, *Rhone, Donzere-Mondragon dam, Pierre-Benite project.

The Rhone River rises in Switzerland, enters France upon leaving Lake Geneva, and debouches into the Mediterranean near Marseille, after flowing 515 km in France. It is one of the largest European rivers with an average flow at its mouth of 1,400 cu m/ sec and exceptional floods of 14,000 cu m/sec. The Rhone in France is managed for hydroelectric power, navigation and irrigation by the Compagnie Nationale du Rhone. Two hydroelectric plants have been built on the upper Rhone and on the lower Rhone; 5 falls have been developed, 2 are being worked on, and 6 are being studied. The entire production of electricity will be 16 billion kwh in an average year. The Rhone is now used by small boats from Lyon to the sea but when completed it will take vessels of 3,000 tons. Agriculture will expand by irrigation and by freeing extensive areas from danger of floods. Over 1.5 million people live on the banks of the Rhone between Lyon and the sea. Building major hydraulic works in dense urban areas is a special problem. The development of the French Rhone includes among its diverse and complex accomplishments the Donzere-Mondragon dam, which once held the world record for height, and the whole Pierre-Benite project, which holds the present power record of this type. (Vorhis-USGS)
W69-04592

A RIVER HARNESSED: THE DURANCE, A SOURCE OF POWER AND AGRICULTURAL PLENITUDE,
J. N. Plichon.
For the 8 Volume Proceedings, see Vol 2, No 9, Field 06B and W69-03305. Int Conf on Water for Peace, Wash D C, Vol 4, pp 391-397, 1968. 7 p.

Descriptors: *River basin development, *Multiple-purpose projects, *Optimum development plans, Dams, Irrigation canals, Reservoirs, Flooding.
Identifiers: *France, Durance River, Serre-Poncon dam, Verdon River, Provence.

Electricite de France has harnessed the Durance, a river with a basin of 14,227 sq km and one whose violent floods and extended periods of low waters caused it to be regarded as one of the 'scorges of Provence.' In the last 15 years, it has been transformed into a source of power and agricultural riches. Upstream, the Serre-Poncon dam impounds 1 billion cu m of usable water and controls the regularization; downstream five plants in series run the waters of the Verdon confluent through their turbines and into Berre Lake along a geologically previous course of flow. A network of agricultural canals irrigates the region, which is now free from flood and low-flow problems. (Vorhis-USGS)
W69-04594

USE OF MULTI-PURPOSE STORAGE DAMS IN THE DEVELOPMENT OF THE SEINE BASIN,
Services Techniques de la Ville de Paris (France).
Rene Coulomb.
For the 8 Volume Proceedings, see Vol 2, No 9, Field 06B and W69-03305. Int Conf on Water for Peace, Wash, D C, Vol 8, pp 398-407, 1968. 10 p, 3 fig.

Descriptors: *River-basin development, *Multiple-purpose projects, *Flood control, Hydroelectric power, Tourism, Boating, Fishing, Dams.
Identifiers: France, Seine basin, Seine reservoir, Marne reservoir.

The Seine River and its tributaries can cause serious floods in the Paris area during autumn and winter but in summer the flow needs to be increased. To protect against both high- and low-flow dangers, reservoir-dams have been built, four of which were built before 1949. The Seine reservoir-dam (205 million cu m) has just been put into service. The construction of the Marne reservoir-dam (350 million cu m) has just been started and studies are being made on other dam sites upstream from Paris. After giving the main characteristics of these facilities and summarizing their operational specifications, the report explains the major advantages they represent for the entire Seine valley. In addition to regularizing the rate of flow, which provides a large measure of safety to the Paris area, the reservoir-dams make possible the production of hydro-electric power plus development of tourism, boating, and fishing. (Vorhis-USGS)
W69-04596

LOA RIVER BASIN: WATER RESOURCES AND THEIR DISTRIBUTION,
Wulf Klohn.
For the 8 Volume Proceedings, see Vol 2, No 9, Field 06B and W69-03305. Int Conf on Water for Peace, Wash, D C, Vol 8, pp 339-349, 1968. 11 p, 1 fig, 1 tab.

Descriptors: *River basin development, *Water distribution (Applied), *Administrative decisions, *Water resources development, Planning, Future planning (Projected), Brackish water, Meteorology, Mining, Copper, Aqueducts.
Identifiers: Chile, Loa River, Chuquicamata, Copper mines, Antofagasta.

The Loa River in northern Chile, whose basin covers 30,000 sq km, is the most extensive basin the country but is almost totally lacking in precipitation. Its average flow is 6 cu m/sec and flow continues year round along a 375 km course. The source of the water is not fully known coming for the most part from watersheds on the left bank that are presumed to be fed by precipitation on the Andean Plateau beyond the low divide of the Loa. Small quantities of snowmelt off of high peaks in the region also feed the river. The river divides the Chilean Desert into the Temarugal Pampas to the north and the Atacama Desert to the south. In the valley, water is not only scarce but often is brackish and soils require delicate treatment to preserve their fertility. The climate has wide daily temperature ranges and very low relative humidity. The Chuquicamata copper mines, the largest of their kind in the world, depend on water of the Loa as do other mines, associated urban settlements, and several seaports with their industries. Downstream tributaries of the Loa add brackish water. The cities of Antofagasta, Tocopilla, and Calama depend on Loa water brought from the mountain by means of long aqueducts. New legal water regulations will permit the State to administer water use most beneficially among conflicting demands from mining, municipal supplies, and agriculture. The paper gives a review of the present situation, indicates results of current research, makes a few recommendations, and sketches a plan for future research. (Vorhis-USGS)
W69-04613

FLOOD INFORMATION FOR FLOOD-PLAIN PLANNING,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02E.
W69-04616

FLOOD AND POLLUTION CONTROL: A DEEP TUNNEL PLAN FOR THE CHICAGOLAND AREA.
Metropolitan Sanitary District of Greater Chicago, Ill.

The Metropolitan Sanitary District of Greater Chicago, 100 East Erie Street, Chicago, Illinois 60611, May 1966, 61 p, 11 map, 5 tab, 7 append.

Descriptors: *Flood control, *Pollution abatement, *Underground storage, *Cost comparisons, *Estimated costs, Design criteria, Sewers, Drains, Reservoirs, Feasibility studies, Overflow, Project planning, Comparative benefits, Estimated benefits, Pumped storage, Power system operations.
Identifiers: *Deep tunnel plan, *Chicago.

After describing rainstorm, flooding and waterway pollution problems in Metropolitan Chicago, the prefeasibility report reviews six alternative underground storage plans. It recommends a comprehensive deep tunnel plan. Engineering design criteria for the plan are considered. The major components of the plan are designed with enough precision to allow prefeasibility cost estimates. They include lateral sewers, new main sewers, vertical drains, an underground reservoir, pumped-storage power, a surface reservoir, and pollution treatment. The costs of underground excavation, of plan components, and of contingency and overhead are given. Comparative flood control benefits are discussed in terms of basement flooding, flooding of industrial areas, land enhancement, and flood reduction on the waterway system. Alternative costs are given. Comparative pollution abatement benefits are not clearcut, because the Deep Tunnel Plan alone will not significantly reduce pollution throughout the entire waterway system. The report gives comparative costs for two methods of storing and treating combined overflows. Possibilities of a better scheme of separating storm and sanitary sewers must be investigated. Potential benefits and costs of tertiary and space treatment require further investigation. The report concludes that the plan merits engineering feasibility studies. Appendices discuss extensively hydrology, geology, water quality, aquifer protection, power, costs, and benefits. (Gossen-Chicago)
W69-04630

CHICAGO TUNNEL DRAINAGE PROJEC PRELIMINARY EVALUATION OF FEASIBIL TY.
Metropolitan Sanitary District of Greater Chicag Ill.

The Metropolitan Sanitary District of Great Chicago, Chicago, Illinois, May 1964. 33 p, 5 ma 9 tab, 3 chart.

Descriptors: *Project planning, *Drainage pr grams, *Underground storage, *Flood protectio Sewerage, Storage capacity, Construction, Rese voirs, Locating, Construction costs, Power syste operations, Annual costs, Annual benefits, Finan ing, Pollution abatement, Use rates, Sediment co trol.
Identifiers: *Chicago, Incremental costs, Sta development.

Approximately a third of the preliminary stu describes the project plan, another thi economics, and the final third problems for i vestigation. It recommends that an undergrou storage system, combined with storage in a high level sewer system, be designed for the Chicag flood of record. Capacities, types, and constructio of proposed storage structures are discussed. Th pumped storage facilities of the project wou release water to the lower reservoir during pea power load periods and pump it back to the upp reservoir during off-peak hours. Layout, storag capacity, and alternative locations are discusse (Gossen-Chicago)
W69-04631

EFFECTS OF ABANDONED FARMLAND O STREAMFLOW,
Forest Service (USDA) Durham, N. H. Northeas ern Forest Experiment Station.
For primary bibliographic entry see Field 03B.
W69-04635

WATER RESOURCES DEVELOPMENT B THE U S ARMY CORPS OF ENGINEERS I FLORIDA.
Corps of Engineers, Atlanta, Ga. South Atlanti Div.

U S Army Engineer Division, South Atlantic, A lanta, Ga., 30303, Jan 1969. 88 p, 1 map, 26 photo

Descriptors: *Florida, *Water resources develop ment, *Federal government, *Project planning Programs, Future planning (Projected), Multiple purpose projects, Navigation, Planning, Projec benefits, Project feasibility, Scheduling, Flood con trol, Seashores, Shore protection, Project purposes Maps.
Identifiers: *Corps of Engineers.

A brief description of water resources activitie being carried out by the Corps of Engineers in th State of Florida as of January 1, 1969 is given. Th functions of the Corps are described, and th process of initiation, authorization, and construc tion of projects is outlined. Included are section concerning projects completed, projects underway and projects authorized but not started. In addition the status of survey investigations throughout th State is briefly reported. Florida maps showing th locations of navigation, flood control, and shor protection projects are attached. (Wheeler-Fla)
W69-04643

STERKX V GRAVITY DRAINAGE DISTRIC NO 1 OF RAPIDES PARISH (VALUE OF PRO PERTY CONFISCATED FOR DRAINAGE PUR POSES).

214 So 2d 552-557 (3rd CCA La 1968).

Descriptors: *Louisiana, *Drainage systems *Eminent domain, *Condemnation, Judicial deci sions, Legal aspects, Contracts, Drainage, Canals Drainage district, Compensation.

landowner brought action against a drainage district seeking damages for trespass and compensation for the alleged taking of his land. The drainage district constructed a drainage canal across plaintiff's property. The district had orally agreed with the plaintiff's agent to pay $2,574.40 for the property confiscated. It was agreed that this 'contract' would subsequently be reduced to writing, but this never came about, the court held that an oral contract, entered into with the stipulation that the terms were later to be reduced to writing, is unenforceable between the parties if it is not in fact reduced to writing at a later time. The court then awarded plaintiff $6,032.80, the value of the property taken, which amount was in excess of the $5,024.40 prayed for in the complaint. On appeal, the award was reduced to the amount asked for by plaintiff, plus interest and costs. (Shevin-Fla)
W69-04650

WATER DISTRICTS.

N Y Town Law sec 198 (3) (McKinney 1968).

Descriptors: *New York, *Water districts, *Water works, *Water supply, Legislation, Cities, Regulation, Reservoirs, Utilities, Taxes, Local governments, Water rates, Public health, Legal aspects.
Identifiers: Liens.

After the establishment of a water district, the town board is empowered to construct improvements and regulate the water works for the purpose of supplying water for domestic and commercial uses. Provision is made for the assessment and collection of funds to pay the district's costs. The town board may contract with anyone for a supply of water to be resold to consumers in the district and 'unprotected areas,' except that no water may be sold to any consumer within another water district. The town board has the power to adopt ordinances and regulations for the operation of the district. The town board establishes the water rates to be paid by consumers. Such water charges are a lien upon the real property upon which or in connection with which the water was used. (Childs-Fla)
W69-04655

DISPOSITION OF CANALS AND CANAL PROPERTIES PROHIBITED.

N Y Const Art 15 sec 1 (McKinney 1966) (1953 version), as amended, (Supp 1968).

Descriptors: *New York, *Legislation, *Canals, *New York State Barge, State governments, Leases, Political constraints, Navigation, Legal aspects, Contracts, Regulation.

The legislature shall not sell, lease, abandon or otherwise dispose of the now existing or future improved barge canal, divisions of which are the Erie, Oswego, Champlain, Cayuga and Senaca canals, or of the terminals constructed as part of the barge canal system. No portion of the canal system existing prior to the barge canal improvement, which portion forms a part of the present barge system, may be similarly disposed of either. Such canals and terminals shall remain the property of and be under the control of the state forever. The legislature is given power to grant revocable permits for the occupancy or use of such lands and structures. (Scott-Fla)
W69-04656

BILL OF RIGHTS.

N Y Const Art 1, sec 7 (d) (McKinney 1966) (1953 version), as amended, (Supp, 1968), 1 p.

Descriptors: *New York, *Eminent domain, *Drainage, *Swamps, Legislation, State governments, Public benefits, Social needs, Land reclamation, Surface waters, Dikes, Agricultural watersheds, Drains, Ditches, Compensation, Assessments, Legal aspects.
Identifiers: Constitutions (State).

The use of property for the drainage of swamps and agricultural land is a public use. General laws may be passed permitting the owners of such lands to construct and maintain for drainage any necessary drains, ditches and dikes upon the lands of others, subject to a few certain restrictions. Just compensation must be paid for the taking of lands of another. This compensation, together with the cost of such drainage, may be wholly or partly assessed against any property thereby benefited. No special laws may be enacted for these purposes. (Scott-Fla)
W69-04658

WILLFUL INJURIES TO THE CANALS AND DRAWING WATER FROM THE CANALS.

N Y Penal Law secs 463, 464 (McKinney 1968).

Descriptors: *New York, *Legislation, *Navigation, *Canals, State governments, Laterals, Gates, Reservoirs, Locks, Lighthouses, Bridges, Buoys, Dams, Withdrawal, Boats, Damages, Legal aspects.
Identifiers: Penalties (Criminal).

Anyone who, without authority of law, willfully injures any canal belonging to the state, or any sidecut, feeder, reservoir or other works connected with the canal system; disturbs or injures any boats, locks, lights, lighthouses, beacons, buoys, bridges, buildings or machinery or other things connected with said canal system; or operates or opens, or attempts to operate or open, the machinery or apparatus on or connected with any lock, bridge, dam or gate is guilty of a felony. Anyone who, without authority of law, draws water from any canal, or from a feeder or reservoir of a canal, during the season of navigation of the canal, to the detriment or injury of navigation, is guilty of a crime. (Scott-Fla)
W69-04662

COMMERCE AND NAVIGATION.

N J State Ann secs 12:1-1 to 12:2-22 (1968).

Descriptors: *New Jersey, *Legislation, *Administrative agencies, *Navigation, Harbors, Canals, Transportation, Regulation, State governments, Rivers, Legal aspects, Surveys, Eminent domain, Construction.

The general duties and powers of the Board of Commerce and Navigation and the Director of Commerce and Navigation are set forth. The Board shall: (1) have full control of projects relating to commerce and navigation, except where such control is conferred upon other boards; (2) make such regulations governing the work of the Department of Commerce and Navigation and its employees as are necessary to promote state matters in its charge and shall keep all necessary records on file and available to the public; and (3) acquire certain lands for the New Jersey Ship Canal and donate to the federal government as much land as is necessary for the construction of the canal. The director shall: (1) be subject to the rules and regulations of the board; (2) exercise general supervision over all commerce and navigation projects; (3) enforce all laws relating to the powers and duties of the board; (4) collect information relating to the state's commerce and navigation; and (5) enter upon waterways, or riparian lands to examine and survey. (Helwig-Fla)
W69-04663

KEY SALES CO V SOUTH CAROLINA ELECTRIC AND GAS CO (DAM OPERATOR'S DUTY OF CARE IN REGARD TO FLOODING OF DOWNSTREAM PROPERTY).

290 F Supp 8-29 (D S C 1968).

Descriptors: *Riparian rights, *Reservoir operation, *Water level fluctuations, *Flood control, Peak discharge, Regional floods, Cloudbursts, Dams, Hydro-electric plants, Runoff, Downstream, South Carolina.
Identifiers: Federal Power Commission, Saluda River.

A riparian landowner brought this action against defendant utility company, charging that the latter had negligently constructed and maintained a dam for its hydro-electric plant, and that, as a result, excessive rainfall caused flood waters released from the dam to inundate plaintiff's property. The court found, after an extensive discussion of the evidence, that defendant utility had exercised due care in the operation of its dam and in maintenance of the level of the lake created by the dam. Defendant, as a matter of policy followed a rule curve to determine ideal lake elevations for each period of the year. Once excessive, unpredicted rains caused the lake level to reach the maximum allowed by the Federal Power Commission, defendant was forced to open its spillways to equalize discharge and inflow. The court held that there would have been no difference in flooding of plaintiff's property had the dam not existed, that there was no duty of flood control imposed upon the defendant by law, and that the flooding was not unlawful 'taking' of plaintiff's property by the defendant. (Kelly-Fla)
W69-04665

LAWRENCE V BEHNCKE (INTERFERENCE WITH NATURAL WATER COURSE).

150 NYS 2d 494-496 (SC 1956).

Descriptors: *New York, *Natural flow doctrine, *Watercourses (Legal), *Obstruction to flow, Judicial decisions, Riparian rights, Water law, Relative rights, Downstream, Natural flow, Natural streams, Diversion, Alteration of flow, Stream flow, Damages, Legal aspects.
Identifiers: Proper parties.

Plaintiff acquired land downstream from defendant's land. Plaintiff brought this action for damages based upon alleged diversion and obstruction of a natural water course which flowed across lands of defendant and plaintiff. The complaint contained additional allegations to the effect that defendant changed the grade of his land so as to cast surface water upon plaintiff's lands. Defendant's acts of interference with the watercourse were alleged to have occurred before plaintiff acquired the land. Defendant filed motion to dismiss, contending that the owners at the time of the alleged acts were the only parties who could bring action. The court stated the owner of land through which a natural stream flows may not divert such stream or obstruct its flow if such action would injure upper or lower proprietors. The court held that when plaintiffs took title to the land, they obtained, as part and parcel thereof, the right to have the watercourse continue to flow in its natural channel even though it had been diverted from that channel prior to the time they obtained title. Such right could be lost only by grant or adverse possession. Thus, the allegations regarding the diversion and obstruction of a natural watercourse were held sufficient to state a cause of action, however, those facts stated regarding the changing of grade were insufficient to withstand defendant's motion to dismiss and were striken from the complaint. (Wheeler-Fla)
W69-04674

SEABOARD AIR LINE RAILROAD CO V SARASOTA-FRUITVILLE DRAINAGE DISTRICT (DRAINAGE WATER DAMAGES).

251 F 2d 583-590 (5th Cir 1958).

Descriptors: *Drainage districts, *Florida, *Right-of-way, *Contracts, State government judicial decisions, Legal aspects, Condemnation, Railroads, Canals, Drainage systems, Culverts, Ditches, Damages, Easements.

Plaintiff granted a canal right of way to the defendant so that it could place drainage installations under the plaintiff's railroad track. The defendant

is immune from tort liability under Florida law. Defendant, as part of the consideration for the right of way, agreed to indemnify plaintiff for any expenses it may incur as a result of the grant. Defendant was not obligated to agree to this because it has adequate condemnation authority. Plaintiff's train was derailed as a result of the lowering of the ditches adjacent to the undertrack culverts by defendant. Defendant contended that the agreement was not enforceable because it had no authority to bind itself as an indemnitor. The court held that plaintiff did have a cause of action because the defendant had authority under state law to obtain easements by purchase or exchange. It was not required to give cash as consideration for the rights. Here, defendants promise was the consideration and therefore the contract was binding. (Molica-Fla)
W69-04682

DAVIES V SHAFFER (OBSTRUCTION OF DRAINAGE DITCHES).
58 Lackawanna Jurist 73-76 (Cp Pa 1956).

Descriptors: *Pennsylvania, *Obstruction to flow, *Ditches, *Damages, Judicial decisions, Legal aspects, Pipes, Drainage systems, Water law, Diversion, Natural flow, Rainfall, Precipitation excess.
Identifiers: Trespass, Injunction (Prohibitory), Prescriptive easements.

Plaintiff brought action to restrain defendant from trespassing on plaintiff's property and to recover damages caused by such trespass. Defendant resided on property adjacent to and lower in elevation than plaintiff's property. From 1923 to 1937 there were natural drainage ditches flowing over plaintiff's land and into defendant's property. During 1937, a roadway was constructed between the tracts in question causing increased elevation therein. Galvanized pipes were inserted under the roadway to replace the natural drainage ditches. In 1955 before a torrential rain defendant entered plaintiff's property and clogged the drainage pipes with rocks and mud. During the subsequent rain, water accumulated and substantially eroded plaintiff's lawn and damaged his shrubbery. The court held that an owner of lower land is bound to receive water as it naturally flows from land of an upper owner. The continuous flow of water through the ditches for thirty years established a right of continuance. One who interferes with such right does so at his peril. Pipes inserted to replace natural drainage ditches, if adequate, do not change character of ditches, and arbitrary filling of such pipes constitutes, a nuisance. The court entered the injunctive order and ordered plaintiff his damages and costs. (Holt-Fla)
W69-04684

SMITH V WAGNER (ARTIFICIAL CONCENTRATION OF DRAINAGE ON NEIGHBOR'S LAND).

38 Westmoreland Law Journal 181-187 (Cp Pa 1956).

Descriptors: *Pennsylvania, *Drainage water, *Damages, *Diversion structures, Artificial watercourses, Judicial decision, Drainage effects, Drainage surface waters, Riddance (Legal aspects), Surface runoff, Controlled drainage, Natural flow, Obstruction to flow, Diversion, Legal aspects, Drains.

This case deals with alteration of the natural flow of water onto plaintiff's land. Defendants diverted the natural southwesterly drainage of water to a northerly direction by constructing a drain connecting with plaintiff's drain; both these drains flowed into the state highway drainage system. As a result of defendants' actions in filling its land, and because of its mode of collecting water, all the surface drainage was discharged on plaintiff's property in a concentrated stream. Foreign material was thereby deposited to a depth of over one foot a year on plaintiff's wall and up to one inch on the lawn in front of plaintiff's house. The plaintiff has sustained damages of $287.00 to alleviate this condition. The court found the defendants had wrongfully diverted the flow of surface water and were responsible for a continuing trespass on plaintiff's property. Defendant's were liable for the $287.00 damage already sustained by plaintiff and were ordered to install and maintain a catch basin, with sump, and additional drainage ditches to eliminate the problem. The principle of law relied on by the court was that landowner may not alter the natural flow of surface water on his property by concentrating it in an artificial channel so as to damage another property owner. (Heckerling-Fla)
W69-04685

BEATTY V FLAIL (ARTIFICIAL CHANNEL OF SURFACE WATER WASHED ONTO ADJOINING LAND).
43 Del Co 293-302 (C P Pa 1956).

Descriptors: *Judicial decisions, *Pennsylvania, *Discharge (Water), *Artificial watercourses, Channel flow, Pipe flow, Soil erosion, Developed waters, Surface drainage, Surface runoff, Diffused surface water, Drainage water, Riddance (Legal aspects), Storm runoff, Legal aspects, Storm drains, Conduits, Subsurface drainage, Sewers.

Defendant builders acquired a 35 acre tract of land which abutted plaintiff's 3 acre tract. Defendants subdivided the property into lots, developed the land, and built houses thereon. Storm sewers were also constructed by defendants, and these were connected to an 18 ft. pipe which emptied 80 feet from plaintiff's property. Surface waters concentrated by the pipe caused damage to the plaintiff's driveway and land. Plaintiff asked defendant to abate this nuisance, but defendants failed to do so. Plaintiff had his driveway hard-surfaced and had the black topping replaced because of water damage. Defendants, after commencement of the suit, had leeching wells constructed which corrected the situation. Plaintiff brought suit in equity to recover damages to their property. The court held that, even though the defendant secured a competent engineer and followed the rules, regulations, and directions of the township and county planning commission, defendants were guilty of a continuing trespass against plaintiff's property, until they constructed the leeching wells, and are liable for damages inflicted and for such costs as are necessary to enable plaintiff to correct the damage. The reasoning of the court was that 'a landowner may not alter the natural flow of surface water on his property by concentrating it in an artificial channel and discharging it upon the lower land of his neighbor even though no more water is thereby collected than would naturally have flowed upon the neighbor's land in a diffused condition.' (Heckerling-Fla)
W69-04686

A K ROY, INC V BOARD OF COMM'RS (EXTENT OF LEVEE DISTRICT APPROPRIATION POWER).
237 La 541, 111 So 2d 765-769 (1959).

Descriptors: *Louisiana, *Appropriation, *Lake beds, *Ownership of beds, Administrative agencies, Judicial decisions, Levees, Lakes, Overflow, Water control, Floodwater, Flood control, State governments, Lake shores, High water mark, Legislation, Prescriptive rights, Compensation, Mississippi River, Navigable waters.

Plaintiff, A K Roy, Inc, sued the defendant to recover the value of land bordering on Lake Pontchartrain appropriated by the defendant for levee purposes. The trial court awarded plaintiff $5,115. The main argument of the defendant on appeal was that the property in dispute formed a part of the bed or shore of Lake Pontchartrain. The court stated that it was immaterial whether the property was classified as sea shore, which belongs to no one and is insusceptible of private ownership, or as the bed of a navigable lake, ownership to which is in the state up to the high water mark, since in either event plaintiff would not be entitled to compensation. However, evidence as to the extent of plaintiff's property below the ordinary high water mark was insufficient for adjudication, and the case was remanded for further proceedings. (Patterson-Fla)
W69-04689

WATER FRONT IMPROVEMENTS.
Mich Comp Laws Ann secs 123.601-123.604 (1967).

Descriptors: *Docks, *Navigable waters, *Permits, *Financing, Michigan, Ships, Boats, Local governments, Legislation, Cities, City planning, Leases, Regulation.
Identifiers: *Public landings, *Commercial craft, *Waterfront, *Revenue bonds, Local agencies, Validating legislation, Fees.

Where any city in this state with water front bordering on navigable waters has provided for acquisition, improvement or repair of water front facilities, and for revenue bond financing, such acts are hereby validated. Where any city has provided boards or commission for operation and control of such facilities, they are validated and hereby empowered to license and charge fees to ferries and other commercial craft using public landing places. Such boards or commissions may also license the construction, operation and maintenance of such wharves, docks and piers, and make appropriate rules and regulations governing such operations. Any agreements entered into for leasing of landing facilities are hereby validated, and future revenue bond financing authorized. (Harris-Fla)
W69-04692

WATER-WORKS.

Mich Comp Laws Ann sec 106.1-106.11 (1967).

Descriptors: *Michigan, *Legislation, *Water works, *Cities, Water distribution, Water rates, Water supply, Utilities, Public utilities, City planning, Ordinances, Construction, Eminent domain, Condemnation, Financing, Costs, Water law, Legal aspects.

This statute authorizes certain cities to construct and maintain water works. Any such city may purchase or erect any structure, and may acquire any land necessary for this purpose. The city may float a bond issue to finance such purchases and construction. The city electors shall vote on the question of raising the amount required for construction, but the city council shall have the authority to expend funds for maintenance following construction. Private connections shall be inserted and maintained at the landowner's expense. The board of public works shall annually establish water rates for each class of building using water. The city council may enact ordinances for the care and control of the water works. If the water works is located beyond the corporative limits of the city, the council shall have the same control as if it were in the city. The city may lay necessary pipes and aqueducts to extend any system, and it shall have the power of condemnation in carrying out this act. Any city may contract with any person or corporation for supply of water to such city. (Helwig-Fla)
W69-04693

4B. Groundwater Management

SCIENTIFIC OR RULE-OF-THUMB TECHNIQUES OF GROUND-WATER MANAGEMENT - WHICH WILL PREVAIL,
Geological Survey, Washington, D. C.
C. L. McGuinness.
Geol Surv Circ 608, 1969. 8 p, 16 ref.

Descriptors: *Water management (Applied), *Groundwater, Artificial recharge, Conjunctive use, Non-structural alternatives, Water demand,

ater utilization, Water supply, Water wells, roundwater basins.
entifiers: Water resources management, Groundter management.

nphasis in groundwater development, once rected largely to quantitatively minor (but ciologically vital) service of human and stock eds, is shifting: aquifers are treated as possible gulating reservoirs managed conjunctively with rface water. Emphasis on reducing stream pollun is stimulating interest in aquifers as possible aste-storage media. Such management of aquifers quires more data and a much better understandg of aquifer-system behavior than now exists. Imcit in this deficiency of knowledge is a danger at aquifers may be managed according to ineffece rule-of-thumb standards, or even abandoned as manageable. The geohydrologist's task is to fine both internal and boundary characteristics aquifer systems. Stratigraphy is a primary deterinant of these characteristics, but aquifers often anscend stratigraphic boundaries. Hence, there is need for aquifer studies that are very different om ordinary stratigraphic techniques. Among itical needs are techniques for measuring ossbed permeability, for using point data on rection and magnitude of permeability in defining uifer geometry, and for using geochemical ethods in studies of source of water, rate of moveent, and waste-sorbing capacities of rocks. In neral, these are techniques adequate for predictg aquifer response to imposed forces. Only when ch predictions can be made routinely can aquifer aracteristics be inserted into a master model that corporates both the hydrologic and the cioeconomic facts necessary to intelligent social tions involving water (Knapp-USGS)
69-04231

YDROLOGY OF THE VALLEY-FILL AND ARBONATE-ROCK RESERVOIRS PAHRUMP ALLEY NEVADA-CALIFORNIA,
eological Survey, Washington, D. C.
or primary bibliographic entry see Field 03D.
69-04267

OARSE FILTER MEDIA FOR ARTIFICIAL ECHARGE,
inois State Water Survey, Urbana.
oger L. Thomas.
State Water Surv Rep of Invest No 60, 1968. 23 15 fig, 16 tab, 11 ref.

escriptors: *Artificial recharge, *Pit recharge, Filters, Sands, Gravels, Particle size, Particle ape, Illinois.
entifiers: Recharge rate, Peoria (Ill).

xperiments were made on filter bed performance nd its relation to grain size of the filter media to xplain the performance of filters used in artificial charge at Peoria, Illinois. In 1951 a pit was put to operation with a 6 in. sand filter layer, and was sed for 3 yr. Because of clogging problems, oarse-grained filter medium was used from the 4th ear to the present. A second pit was built in 1956, nd the two have operated simultaneously since en. with use of 3/8-in. pea gravel, clogging of the lter layer was reduced. Between 1951 and 1965, otal recharge was over 8.5 billion gal with 3.795 rough Pit 1 and 4.717 through Pit 2. However, e advantages of higher recharge rates through the oarse filter media were lost because of clogging in e underlying aquifer. In the laboratory experients, Illinois River water was applied to 4-in. lute filter columns containing various sizes and epths of coarse filter media and aquifer materials. Vater analyses were made primarily for suspended olids and turbidity. Recharge rate, coarse medium ze, and coarse medium depth were all found to be elated to particle removal efficiency. The relationhips can be expressed by the equation: % Removal f suspended solids=-34.5 + 29.8 log D-44.0 log d-5.2 10g R where D = depth, d = diameter of partiles, and R = recharge rate. Very little change in echarge water chemical quality was caused by passage through coarse filter media. The depth of silt penetration into the aquifer appeared to be a function of recharge rate, although most of the particles which passed through the filter media were retained in the upper part of the aquifer. (Knapp-USGS)
W69-04563

4C. Effects on Water of Man's Non-Water Activities

MAN, VEGETATION AND THE SEDIMENT YIELDS OF RIVERS,
Hull Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 02E.
W69-04269

FINLEY V TEETER STONE INC (ACTION FOR DAMAGES DUE TO PUMPING PERCOLATING WATERS).

248 A 2d 106-117 (Md Ct App 1968).

Descriptors: *Maryland, *Percolating water, *Sinks, *Land subsidence, Judicial decisions, Subsurface waters, Ground water, Water law, Capillary conductivity, Pit recharge, Seepage, Voids, Quarries, Excavation, Pumping, Reasonable use, Damages, Legal aspects.
Identifiers: Negligence.

Plaintiffs owned a farm adjacent to defendant's property. Defendant operated a stone quarry on its land which contained a large quarry pit. It was necessary for defendant to keep its excavation dry by continually pumping out the water which accumulated in its quarry. This pumping caused the velocity of the ground water flowing toward the quarry to increase, which resulted in the formation of earth cavities, and in the eventual surface collapse of a part of plaintiff's land. Plaintiff brought suit for damages. Plaintiff did not contend there was interference with any flow of water in defined courses, nor did he contend defendant acted negligently. The trial court directed a verdict for defendant. The appellate court affirmed, ruling that the waters in question must be assumed to be percolating waters. The court held that since there was no showing of negligence in the excavation of the quarry, or of any waste, malice or sale of percolating waters, or other unreasonable use, defendant was not liable for the resulting damages. (Wheeler-Fla)
W69-04371

STORMWATER SEWERS FOR COUNTY ROADS; MUNICIPAL COOPERATION.

N J Stat Ann secs 27:16-24 (1966).

Descriptors: *New Jersey, *Drainage systems, *Roads, Storm drains, Legislation, Local governments, Cities, Sewers, Legal aspects, Maintenance.

The board of chosen freeholders may direct the construction of a storm water drainage system in connection with the improvement or maintenance of a county road. The act provides the procedures to be followed in accomplishing such construction. (Childs-Fla)
W69-04418

HYDROLOGY FOR URBAN LAND PLANNING-A GUIDEBOOK ON THE HYDROLOGIC EFFECTS OF URBAN LAND USE,
Geological Survey, Washington, D. C.
Luna B. Leopold.
Geol Surv Circ 554, 1968. 18 p, 8 fig, 1 tab, 28 ref.

Descriptors: *Urbanization, *Hydrologic aspects, Hydrographs, Hydrograph analysis, Storage, Sediment yield, Water temperature, Water pollution.
Identifiers: Urban hydrology.

The effects of urbanization on hyrologic factors are discussed and rainfall-runoff relations of urbanized and unurbanized watersheds are compared. Urbanization increases the amount of impervious area in a watershed so that the intensity and amount of runoff increase and peak discharges occur sooner. Sediment yields are 10-100 times larger in urbanized watersheds, water quality decreases, water temperature generally increases, and esthetic values usually decrease. Hydrographs, frequency curves, and sediment yield-discharge curves, are used to show typical effects of urbanization on streams. (Knapp-USGS)
W69-04548

EFFECT OF URBAN DEVELOPMENT ON FLOOD DISCHARGES-CURRENT KNOWLEDGE AND FUTURE NEEDS,
American Society of Civil Engineers, New York.
H. F. Smith.
ASCE Proc, J Hydraul Div, Vol 95, No HY1, Pap 6355, pp 287-309, Jan 1969. 23 p, 2 append.

Descriptors: *Bibliographies, *Urbanization, *Hydrology, Information retrieval, Discharge (Water), Floods, Hydraulics, Runoff, Surface runoff, Streamflow.
Identifiers: *Urban hydrology bibliography.

This Progress Report by the Task Force on Effect of Urban Development on Flood Discharges, Committee on Flood Control, Hydraulics Division, ASCE attempts to provide, as a guide for engineers, planners, governmental officials, and all others interested in the problems of urban runoff, an annotated up-to-date bibliography of reports, papers, and other material pertaining to the effect of urban development on flood discharges. The report includes a brief discussion of the impact on flood runoff which can be expected by urban development and the factors directly affecting the runoff regimen of a drainage area, as suburbs and cities replace the rural landscape. Included is a listing of pertinent research projects which are underway with identification of areas where, in the opinion of the Task Force, additional research is required. (Knapp-USGS)
W69-04560

THE INFLUENCE OF GROUNDWATER FLOW SYSTEMS ON PAVEMENT STABILITY IN HIGHWAY CUTS,
Idaho Univ., Moscow.
For primary bibliographic entry see Field 02F.
W69-04621

EFFECT OF A COMMERCIAL CLEARCUTTING IN WEST VIRGINIA ON OVERLAND FLOW AND STORM RUNOFF,
Forest Service (USDA) Upper Darby, Pa. Northeastern Forest Experiment Station.
Kenneth G. Reinhart.
J. Forest. 1964, 62 (3): 167-171.

Descriptors: *Rainfall-runoff relationships, Watersheds (Basins), Deciduous forests, Overland flow, *Watershed management, Storm runoff, West Virginia, Infiltration, Hydrologic aspects.
Identifiers: *Timber harvest, *Logging (Forest), Experimental watersheds.

A commercial clearcutting was made on a 74-acre gaged watershed on the Fernow Experimental Forest; skidroads were loggers' choice--without limitations as to grade or provisions for drainage. After-logging infiltration rates in the watershed remained well above maximum rainfall intensities except on portions of the skidroads. Overland flow occurred only from the skidroads; it resulted from the combination of rain directly on the skidroads and interception of subsurface flow by the road cuts. Increased storm runoff in the growing seasons--up to a maximum of about 1/2 area-inch in any one storm--was largely the result of decreases in field-moisture deficiency rather than changes in the proportions of surface and subsurface flow. This study indicates that, in judging

hydrologic condition of logged areas, perhaps as much emphasis should be placed upon road conditions and forest-floor disturbance as upon the amount of timber cut and condition of the stand. (Reinhart-USFS)
W69-04632

KERHONKSON LODGE INC V STATE OF NEW YORK (ACTION FOR DAMAGE FROM SURFACE WATER DISCHARGE).

4 App Div 2d 575, 168 N Y S 2d 56-59 (S Ct 1957).

Descriptors: *New York, *Surface waters, *Drainage systems, *Washouts, Judicial decisions, Ditches, Surface runoff, Highways, Damages, Floods, Water law, Drainage, Erosion, Drainage engineering, Cloudbursts, Flood damage, Slopes, Legal aspects.

Plaintiff owned hotel property situated on both sides of a state highway. At the time of the highway's construction, a culvert was placed under the road which discharged surface water onto one tract of plaintiff's land, and a drainage ditch, leading to the culvert, was placed along the opposite side of the road. The State later made changes in this drainage system, subsequently heavy rains caused erosion and flood damage to plaintiff's land. Plaintiff brought action for damages, alleging that the changes made by the State were the actual and proximate cause of damage. At trial, plaintiff introduced evidence tending to support these allegations. The lower court dismissed the claim on grounds that the changes were in accord with good engineering practice. The appellate court reversed, and directed a new trial. The court held that the correct issue was whether the changes increased the flow of surface water onto plaintiff's land by artificial means so as to cause the damage in question. The court also ruled that plaintiff was under no duty to keep a dry brook free from debris accumulated from surface waters discharged from the drainage ditches, which defendants contended was a contributing cause of the damages. (Wheeler-Fla)
W69-04673

GELLIS V TOWN OF HARRISON (INCREASED SURFACE RUNOFF).
159 NYS 2d 228-231 (S C 1956).

Descriptors: *New York, *Pipes, *Surface runoff, *Surface drainage, Boundaries (Property), Judicial decisions, Natural flow doctrine, Cities, Roads, Culverts, Drainage water, Legal aspects.
Identifiers: Trespass.

Plaintiff landowner sued the defendant, a municipality, alleging that the construction of a road, culvert, and catch basin by the defendant subjected plaintiff's property to increased flow of surface waters from areas that had not previously drained onto the property. The court found that there was insufficient evidence to support the plaintiff's claim. Plaintiff also repeatedly complained of the protrusion onto his property of a few feet of the pipe by which the allegedly offensive water was conveyed. Since the plaintiff did not ask for its removal in the complaint, however, the court did not order such removal, stating rather that plaintiff could remove it if he so desired. (Scott-Fla)
W69-04676

BATTISTO V PERKINS (ACTION FOR DAMAGE FROM INCREASED SURFACE WATER FLOW).

124 A 2d 288-292 (Ct App Md 1956).

Descriptors: *Maryland, *Natural flow, *Surface runoff, *Precipitation excess, Slopes, Judicial decisions, Surface waters, Water law, Relative rights, Surface drainage, Damages, Rain water, Mudflows, Artificial watercourses, Legal aspects.
Identifiers: Nuisance, Directed verdict

Defendant owned property above the lands of plaintiff and proceeded to develop his land for residential purposes. Plaintiffs alleged that as a result of this regrading and tree removal the natural flow of water was accelerated and that mud and debris were repeatedly deposited upon plaintiff's properties, causing damages. Plaintiff brought an action for nuisance to recover damages. The trial court gave a directed verdict for defendants. On appeal, plaintiffs contended that the evidence presented raised a jury submissible issue as to whether defendants took reasonable precautions against injury under the circumstances. The appellate court agreed and granted a new trial. The court stated that Maryland cases make it clear that the upper landowner cannot artificially increase or concentrate the natural flow to the detriment of the lower owner and that this rule applied to urban as well as rural lands. (Wheeler-Fla)
W69-04680

4D. Watershed Protection

MUNICIPALITIES.

Me Rev Stat Ann tit 30, sec 3553 (1965).

Descriptors: *Legislation, *Maine, *Cities, *Navigation, Erosion control, Easement, Condemnation, Project purposes, Federal project policy, Contracts, State governments, Local governments, Cost sharing, Eminent domain, Flood damage.

The statute deals with municipal assistance in the improvement of navigation and the prevention of erosion. It authorizes a municipality to acquire real estate or easements by condemnation for town ways. The provision also allows the municipality to contract with the state and federal government to comply with requirements imposed by the federal government regarding any government-approved project for improving navigation or preventing erosion and floods. The statute provides that two or more municipalities may act jointly in performing the operations. The governor has power to designate a state agency to make any investigation considered necessary. (Stewart-Fla)
W69-04380

LONG ISLAND BEACH BUGGY ASS'N V TOWN OF ISLIP (BEACH EROSION).
295 N Y S 2d 268-276 (Sup Ct 1968).

Descriptors: *New York, *Beach erosion, *Islands, *Transportation, Judicial decisions, Legal aspects, Beaches, Shores, Cities, Legislation, Easements, Highways.
Identifiers: Police power.

Plaintiffs brought an action to have the defendant's vehicle ordinance, which restricted the use of vehicles on the inland and beach routes of an adjoining island, declared unconstitutional. The ordinance was passed in an effort to curtail erosion on the island caused by vehicular traffic. The court held that the ordinance was constitutional as a proper exercise of the police power of the state, since it was aimed at insuring the safety of the inhabitants of the island. Plaintiff did not have a prescriptive easement in the inland routes since their use was not hostile or adverse to the inhabitants, who occasionally erected homes directly in the middle of the routes. Plaintiffs had no easement to use the beach route since it is property affected with a public interest and is therefore not subject to easements. The inland routes are not public highways because defendant never undertook to maintain them. The beach route is not a public highway because the legislature does not intend beaches to be open to the use of the public for purposes of vehicular travel. The ordinance did not constitute a taking of property without due process of law. (Molica-Fla)
W69-04389

CHANNEL SEDIMENTATION AND DREDGING PROBLEMS, MISSISSIPPI RIVER AND LOUISIANA GULF COAST ACCESS CHANNELS,
Department of Agriculture, Washington, D. C.
Austin B. Smith.
In PROCEEDINGS OF THE INTER-AGENCY SEDIMENTATION CONFERENCE, 1963, Miscellaneous Publication No 970, June, 1965, pp 618-626.

Descriptors: *Sedimentation, *Dredging, *Mississippi River, *Louisiana, Coastal plains, Geographical regions, Gulf coastal plain, Regions, Southeast U. S., Channels, Jetties, Structures, Hydraulic structures, Engineering structures, Embankments, Sediment transport, Bodies of water, Interstate rivers, Rivers, Running waters, Streams, Surface waters, Navigable waters, Dikes, Channel improvement, Earthworks.

Sedimentation has always been a major navigational problem at the Mississippi River passes. This is being constantly remedied by construction of retention dikes, jetties, and channelization. The quantity of sediment removed and some removal costs are indicated for certain river stretches. Sediment loads of 1,000,000 tons daily are brought to the Mississippi River mouth, extending the channel profile 100 feet per year. It is anticipated that extensive maintenance dredging will be required in the new Mississippi Gulf Outlet.
W69-04501

CITY OF TREASURE ISLAND V STRONG (ASSESSMENTS FOR EROSION CONTROL GROIN SYSTEM).
215 So 2d 473-479 (Fla 1968).

Descriptors: *Florida, *Erosion control, *Beach erosion, *Assessments, Judicial decisions, Legal aspects, Gulf of Mexico, Legislation, Estimated benefits, Taxes, Land tenure, Financing, Cost allocation, Cost-benefit theory, Cost-benefit ratio, Cost-benefit analysis.
Identifiers: City of Treasure Island, Waiver.

City ordered issuance of $350,000 in revenue certificates to finance a beach erosion control groin system. Costs were to be born by abutting landowners and those in sufficient proximity to receive the benefits of the project. A hearing was held at which no objection was made. After construction was completed, the city brought suit to collect the assessments due from several landowners. The lower court declared the assessments void, but the Supreme Court reversed. The court recognized that special assessments should not exceed the benefits accruing to the properties assessed. Nevertheless, the landowners in this case had waived their right to object since no objections were raised at the hearing. The city's failure to determine special benefits to the property was not fatal. Special assessments are permitted without an express finding as to the benefits that will accrue. The burden is on those persons aggrieved by an alleged invalid assessment to raise timely objection thereto. (Shevin-Fla)
W69-04653

STATE BEACH EROSION COMMISSION.

N J Stat Ann secs 52:9J-1 to 52:9J-3 (1955).

Descriptors: *Legislation, *New Jersey, *Beach erosion, *Administrative agencies, State governments, Bulkheads, Beaches, Shores, Coastal structures, Shore protection, Seashores, Jetties, Legal aspects, Planning, Sea walls, Coastal engineering.
Identifiers: *Beach erosion commission.

Section 1 creates a permanent commission to study the subject of the protection and preservation of beaches and shore front of the State from erosion and other damage, to effectuate such protection and preservation of the beaches and shore fronts. Section 2 provides that the commission shall be called the State Beach Erosion Commission and

hall be composed of four members of the Senate ppointed by the President of the Senate, four iembers of the General Assembly to be appointed y the Speaker, and four members at large appointed by the governor. Commissioners appointed y the governor shall serve four years, the other ommissioners shall continue from the date of their ppointment until the second Tuesday in January. he members shall serve without remuneration. ection 3 provides that the duties of the commis-on shall be to consider and provide ways and ieans to preserve the beaches and shore fronts by ecessary means and devices. The committee shall ake into consideration the advisability of repairing xisting seawalls, bulkheads, jetties, basins, and ther similar devices. (Heckerling-Fla)
V69-04698

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

REVIEW OF CHEMICAL MEASUREMENTS N WATER POLLUTION CONTROL,
ederal Water Pollution Control Administration, Vashington, D. C. Div. of Pollution Surveillance.
. G. Ballinger.
Vater and Sewage Works, Reference No 1968, pp 38-R42, Nov 29, 1968. 5 p, 8 tab, 3 ref.

Descriptors: *Water quality, *Standards, Public ealth, Potable water, Water chemistry, Chemical nalysis, Water pollution effects, Domestic water, ndustrial water, Stock water, Municipal water.
Identifiers: Water quality criteria.

he water quality parameters which must be mea-ured for most water uses are listed without specifi-ation of any quantitative criteria. The lists include n analysis of frequency of parameter usage by tate authorities, parameters for public supply, netal determinations for public supply, chemical arameters for industrial water, chemical parame-ers for fish and wildlife, pesticides in marine vaters, chemical parameters for agricultural domestic) water, and industrial waste parameters. A large number of measurements must be used to valuate water quality. Waste load analysis must in-lude not only identification of undesirable con-ituents, but also measurement of impaired desira-le constituents such as dissolved oxygen. The con-ituents to be determined are listed and references o sources of the applicable standards of concentra-ons of constituents are given. (Knapp-USGS)
V69-04222

THERMAL POLLUTION AND AQUATIC LIFE,
ureau of Sport Fisheries and Wildlife, Highlands, J. J. Sandy Hook Marine Lab.
ohn R. Clark.
ci Amer, Vol 220, No 3, pp 19-27, Mar 1969. 9 p, illus, 4 photo.

Descriptors: *Thermal pollution, *Thermal proper-es, *Aquatic life, *Aquatic environment, Aquatic opulations, Fish populations, Fish toxins, Fish hysiology, Salmon, Bass, Trout, Nutrients, Water uality control, Water policy, Water pollution reatment, Water resources, Water management Applied), Engineering structures, Plants.
Identifiers: Connecticut River, Monongahela iver, Hudson River, Thermograms.

he author discusses in a popular manner the ther-al pollution of rivers, lakes and estuaries and its ffect on fish and other organisms present in these vaters. On the basis of earlier contributions made y the Water Resources Division, U. S. Geological urvey, University of Toronto (F.E.J. Fry), the ale University (G.E. Pickford), and others, color hermograms of the Connecticut, Monongahela, nd Hudson Rivers are shown and the diagrams of sh acclimation and temperature preference are presented. The author states that there is a great variety of polluting factors; the effects of any one of these factors might be tolerable, but the cumulative and synergistic action of all of them seems likely to impoverish the water environment drastically. (Gabriel-USGS)
W69-04235

IDENTIFICATION OF PETROLEUM PRODUCTS IN ESTUARINE WATERS,
Stanford Univ., Calif.
Claude Z. Maehler, and Arnold E. Greenberg.
In PROCEEDINGS OF THE NATIONAL SYMPOSIUM ON ESTUARINE POLLUTION, August 23-25, 1967, pp 517-536.

Descriptors: *Oil wastes, *Pollutant identification, *Analytical techniques, *Gas chromatography, *Spectrophotometry, *Water analysis, Wastes identification, Organic matter, Wastes, Estuarine environment, Aquatic environment, Environments, Water quality, Analysis, Gases, Water pollution control, Control, Water pollution sources, Chromatography, Photometry, Water vapor.

The increased concern about spills of petroleum products in the estuarine environment has brought about increased demands for analytical methods of identifying pollutants and their sources. A number of qualitative comparative procedures have been described which establish the clear recognition of petroleum products in water. These procedures are capable of demonstrating characteristics of petroleum materials peculiar to individual lots, but analysis should generally include several of the techniques. They are therefore useful in comparing oil spills with reference samples. A simple sequential scheme is presented which includes gas chromatographic analysis of vapor space gas and solvent extraction followed by infrared spectrophotometric and paper chromatographic examinations.
W69-04282

DELTA-SUISUN BAY WATER QUALITY INVESTIGATION,
Stanford Univ., Calif.
For primary bibliographic entry see Field 02L.
W69-04291

THE HUDSON RIVER ESTUARY: HYDROLOGY, SEDIMENTS AND POLLUTION,
A. W. McCrone.
The Geographical Review, Vol 56, No 2, 1966, pp 175-189.

Descriptors: *Pollutant identification, *Sediments, *Radioactivity, *Hudson River, *Radioactivity effects, Chemical properties, Water properties, Aquatic life, Wildlife, Temperatures, Public health, Bodies of water, Rivers, Running waters, Streams, Animals, Aquatic animals, Cation exchange, Ion exchange, Separation techniques, Surface waters, Salinity, River beds, Streambeds, Beds, Fish, Water temperature, Hydrogen ion concentration.

A study was conducted of a 70-mile section of the Hudson River estuary from Kingston to Dobbs Ferry. The broad purpose was to observe hydrology and pollution and to obtain and analyze samples of river-bottom sediments from the Hudson estuary for radiological and associated geological and biological studies. The purpose was to identify the radioactive pollutants in the river and to determine the effect of their accumulation in the bottom muds and in organisms such as fish. Twenty-six sampling stations yielded 180 samples during the summer of 1964. Additional samples were taken from a severely polluted part of the river near Mechanicsville and from the Mohawk River near Crescent. Samples were taken of surface water, bottom water, and bottom mud. Readings were taken of salinity, temperature, and pH. Fathograms were recorded at key river cross sections. Bottom sediments were dried and analyzed for particle size and oxidizable organic matter. Minerals were identified microscopically, and cation exchange capacities and other chemical properties were determined. Radiation counts were made on sections taken of bottom core-samples. It was concluded that radioactivity concentrated in the Hudson River fish is insignificant in so far as public health is concerned.
W69-04480

EXTRACTION OF ORGANOCHLORINE AND ORGANOPHOSPHATE INSECTICIDES FROM LAKE WATERS,
Wisconsin Univ., Madison. Dept. of Soil Science.
H. B. Pionke, J. G. Konrad, G. Chesters, and D. E. Armstrong.
Analyst, Vol 93, pp 363-367, June 1968. 2 tab, 8 ref.

Descriptors: *Analytical techniques, *Organophosphorus compounds, *Insecticides, *Lakes, *Pesticides, *Phosphorus compounds, *Water pollution identification, Halogenated pesticides, Gas chromatography, Pesticide residues, Sediments, Radiochemical analysis, Chlorinated hydrocarbon pesticides, Organic pesticides, Endrin, Aldrin, Diazinon, Heptachlor, Water pollution sources, Dieldrin, Wisconsin.
Identifiers: *Chlorine compounds, *Organochlorines, Gas-liquid chromatography, Liquid scintillation spectroscopy, Radioassay, Allequash Lake (Wis), Content Lake (Wis), Crystal Lake (Wis), Little Arbor Vitae Lake (Wis), Pickeral Lake (Wis), Plum Lake (Wis), Tomahawk Lake (Wis), Malathion, Gamma-BHC, Azinphos-methyl, pp'-TDE, pp'-DDT, Heptachlor epoxide, Methoxychlor, Parathion-methyl.

Methods for analysis of pesticide residues in natural waters require sensitivity, applicability to routine analysis, and reliable extractability of pesticide. Authors describe a method, by gas-liquid chromatography, for microgram/liter concentrations of nine organochlorine and four organophosphate insecticides after benzene extraction. By radioassay with liquid scintillation spectrometer they evaluated extraction efficiencies for radioactively labelled insecticides added to distilled water and to seven lake waters (selected on basis of diversity of sediments). Mean recoveries for compounds (in parentheses: concentrations added in micrograms/liter) were: gamma-BHC (1.23), 96.7%; heptachlor (1.60), 84.6%; aldrin (2.08), 101.8%; heptachlor epoxide (3.28), 97.4%; dieldrin (3.98), 98.7%; endrin (5.02), 98.4%; pp'-TDE (6.40), 97.3%; pp'-DDT (8.90), 96.1%; methoxychlor (32.5), 97.3%; parathion methyl (gas chromatographic determination) (38), 95.3%; diazinon (40), 98.4%; malathion (50), 99.7%; azinphos-methyl (66), 99.5%. Average difference between duplicates determined at different times, an estimate of errors associated with extraction and analysis, has range, 0.7 (pp'-DDT) - 2.9 (heptachlor). Standard deviation, indicating reliability between lake-water samples, has range, 0.60 (gamma-BHC) - 2.60 (heptachlor). Although reproducible, low heptachlor recoveries (81.0-88.0%) probably evidence its degradation in aqueous systems. Method can be easily modified, authors believe, to blanket sensitivity range for determination of organochlorines in most natural waters. (Eichhorn-Wis)
W69-04523

5B. Sources of Pollution

WATER POLLUTION PROBLEMS AND IMPROVEMENT NEEDS, LAKE ONTARIO AND ST. LAWRENCE RIVER BASINS.
Federal Water Pollution Control Administration, Chicago, Ill.; and New York State Dept. of Health, Albany.

Fed Water Pollut Contr Admin, N Y Dep Health Rep, June 1968. 125 p, 19 fig, 8 plate, 15 tab, 12 ref.

Descriptors: *Water pollution, *Lake Ontario, *New York, *Eutrophication, Municipal wastes, Industrial wastes, Sewage, Water pollution control, Waste disposal, New York State Barge Canal, Streamflow, Dissolved oxygen, Water resources development.
Identifiers: Finger Lakes (NY), Lake Ontario Basin.

The water pollution problems of the U. S. waters of Lake Ontario, the St. Lawrence River, and their tributaries are summarized. Eutrophication is advanced in Lake Ontario and Oneida Lake; algae blooms and beach accumulations are serious every summer. Municipal and industrial discharge of inadequately treated wastes cause low dissolved oxygen levels in the Lower Genesee River, Oatka Creek, Honeoye Creek, Barge Canal, Upper Seneca River, Owasco Outlet, Skaneateles Creek, Black River, and Onondaga Lake. Industrial waste contamination is serious in the Upper Niagara River, Eighteen-mile Creek, Oataka Creek, Upper Seneca River, Oswego River, Onondaga Lake, Black River, Grass River, and St. Lawrence River. Bacterial contamination has closed beaches at Geneva, Rochester, and Ithaca. The Lake Ontario circulation and stratification patterns tend to hold nutrients in the inshore growing area and intensify algae blooms. New York's pure waters program should substantially solve many of the area's problems by 1972. Needs for further work in alleviating pollution are outlined and pollution control recommendations are listed. (Knapp-USGS)
W69-04223

CHARACTERISTICS OF WATER TREATMENT PLANT WASTES,
New York State Dept. of Health, Albany.
Heinz B. Russelmann.
Water and Sewage Works, Reference No 1968, pp R64-R70, Nov 29, 1968. 7 p, 2 tab, 15 ref.

Descriptors: *Water pollution sources, *Water treatment, Sludge disposal, Effluents, Water softening, Saline water, Chemical precipitation, Coagulation, Filtration, Flocculation.
Identifiers: Water treatment plant wastes.

Water treatment plants generate wastes which are often overlooked as sources of pollution. Substances removed from raw water in the course of treatment are often discharged into streams or on the surface in settling lagoons. Water treatment wastes comprise the organic mineral, or biological materials in solution or suspension in raw water, wastes from previous users who discharge into water supply streams, and chemicals added to raw water in treatment. These wastes may be toxic to wildlife, increase oxygen demand, or cause harmful and unsightly sludge deposits. Control of discharges and better ultimate disposal methods are recommended, either through legislation or by enlightened water processing plant management. Typical water treatment waste characteristics are tabulated. (Knapp-USGS)
W69-04227

PATUXENT THERMAL STUDIES - SUMMARY AND RECOMMENDATIONS,
Maryland Univ., Solomons. Natural Resources Inst.; and Maryland Dept. of Natural Resources.
For primary bibliographic entry see Field 02L.
W69-04244

ILLINOIS GROUND WATER POLLUTION,
Illinois State Water Survey, Urbana.
William H. Walker.
J Amer Water Works Ass, Vol 61, No 1, pp 31-40, Jan 1969. 10 p, 10 fig, 16 ref.

Descriptors: *Water pollution, *Groundwater, *Illinois, Water wells, Water pollution control, Water pollution sources, Water pollution treatment, Farm wastes, Industrial wastes, Sewage.
Identifiers: Water well contamination, Groundwater pollution

The groundwater pollution presently occurring in Illinois is discussed and precautionary measures to prevent more contamination in the future are described and recommended. Contamination hazard of consolidated and unconsolidated aquifers in the State is shown by maps which can be used to guide planning of locations of wells, oil wells, and garbage disposal sites. Hazards are highest in highly permeable glacial outwash and in outcropping cavernous carbonate rocks, and lowest in buried consolidated fine sandstones. Cross sections and maps show typical sources and paths of contamination in several discussed cases of groundwater pollution by hot water, organic wastes, and water of inferior chemical quality. (Knapp-USGS)
W69-04256

INFLUENCE OF WATER FLUX AND POROUS MATERIAL ON THE MOVEMENT OF SELECTED HERBICIDES,
Oklahoma State Univ., Stillwater. Dept. of Agronomy.
J. M. Davidson, C. E. Rieck, and P. W. Santelmann.
Soil Sci Soc Amer Proc, Vol 32, No 5, pp 629-633, Sept-Oct 1968. 5 p, 6 fig, 21 ref.

Descriptors: *Herbicides, *Urea pesticides, *Path of pollutants, *Soil water movement, Diffusion, Chlorides, Ion transport, Porous media, Solubility, Adsorption, Biodegradation.
Identifiers: Herbicide transport, Fluometuron, Diuron water flux, Molecuar diffusion.

The rate at which 2 substituted urea herbicides move through a water-saturated glass bead and uniformly packed soil column depends upon the water flux or average pore velocity. A 200-ml slug of 0.01N calcium sulfate solution containing either fluometuron (3- (m-trifluoromethylphenyl)-1,1-dimethylurea) or diuron (3- (3,4-dichlorophenyl)-1,1-dimethylurea) was introduced at 1 end of a 30-cm long column at a specific flux and the herbicide displaced through a column with 0.01N calcium sulfate at the same water flux. Effluent samples collected every 5-ml show fluometuron and the chloride ion to mix in a similar manner at the 2 fluxes studied. Experimental and calculated effluent concentration distributions did not agree when fluometuron was retained by the porous material. Retention isotherms were linear for fluometuron in 250 micron glass beads and Norge loam with the soil retaining more material per weight than the glass beads. However, the experimental results show the herbicide, fluometuron, appearing in the effluent earlier than predicted by the selected model. It can be concluded that fluometuron was sufficiently influenced by water flux and pore geometry to necessitate a knowledge of these parameters before estimating the amount of herbicide movement through a soil. Also, 2 herbicides from the same chemical family were found to have distinctly different soil retention properties. (Knapp-USGS)
W69-04258

POLLUTION OF THE INTERSTATE WATERS OF THE COLORADO RIVER AND ITS TRIBUTARIES....
Federal Water Pollution Control Administration, Washington, D. C.
For primary bibliographic entry see Field 05E.
W69-04272

USE OF HYDRAULIC AND MATHEMATICAL MODELS FOR DETERMINING EFFLUENT DIFFUSION IN SOUTH SAN FRANCISCO BAY,
Stanford Univ., Calif.
John A. Lager, and George Tchobanoglous.
In PROCEEDINGS OF THE NATIONAL SYMPOSIUM ON ESTUARINE POLLUTION, August 23-25, 1967, pp 384-422.

Descriptors: *California, *Mathematical models, *Waste assimilative capacity, *Hydraulic models, *Mathematical studies, *Model studies, *Waste dilution, Southwest U. S., Pacific coast region, Regions, Geographical regions, Biochemical oxyger demand, Dissolved oxygen, Oxygen demand Bodies of water, Bays, Diffusion, Effluents, Mixing Waste disposal, Dispersion, Degradation (Decom position), Water pollution.

Studies are reported summarizing the use of physical hydraulic model and a mathematica model for assessing the waste assimilative capacit of San Francisco Bay. Specific effects studied in clude initial mixing and dilution, waste dispersior and decay of waste material in the estuary. Th model studies were directed toward assessment o dissolved oxygen and BOD. It was concluded tha the mathematical model yielded more reliabl results than did the hydraulic model.
W69-04277

ESTUARINE POLLUTION OF THE CHAO PHRAYA RIVER AT BANGKOK, THAILAND,
Stanford Univ., Calif.
Ernest R. Leffel.
In PROCEEDINGS OF THE NATIONAL SYM POSIUM ON ESTUARINE POLLUTION, Augus 23-25, 1967, pp 370-383.

Descriptors: *Waste assimilative capacity, *Dis solved oxygen, *Mathematical models, *Water pol lution, *Foreign countries, Oxygen sag, Mathe matical studies, Model studies, Rivers, Bodies c water, Running waters, Streams, Surface waters.

Sources of pollution in the Chao Phraya River a Bangkok, Thailand, are outlined. A mathematica model is presented for calculating dissolved oxyge relationships in the estuary. It is stated that pollu tion conditions in the Chao Phraya estuary do nc conform to assumptions employed in the develop ment of previous formulations of oxygen sag rela tionships.
W69-04279

STATEMENT BEFORE THE SUBCOMMITTEE ON AIR AND WATER POLLUTION, APRIL 17 1968,
Committee on Public Works (U. S. Senate).
Paul W. McKee.

Descriptors: *Thermal pollution, *Virginia *Maryland, *Electric power industry, *Desigr *Forecasting, *Water utilization, Engineerin structures, Industrial plants, Structures, Contro Water pollution control, Water pollution, Industr al water, Water types, Industry, Sites, Bays, Eff ciencies, Southeast U. S., Appalachian Mountai region, Atlantic coastal plain, Coastal plains, Geo graphical regions, Northeast U. S., Regions, Coo ing water, Powerplants, Water requirements.

The Department of Water Resources has requeste investigation of the following topics: (1) Projectio of electric power needs, cooling needs, and coolin water requirements for Chesapeake Bay throug year 2010. (2) Optimal locations for future powe plants considering all water uses involved. (3) Th best plant design and operation for all environmer tal protection. (4) A review of the water uses an an estimate of the effects on them by the discharg of heated water. (5) The benefit to other uses c water by proper development of energy sources.
W69-04293

STATEMENT,
Federal Water Pollution Control Administratio Southeast Region, Atlanta, Ga.
For primary bibliographic entry see Field 06B.
W69-04303

OIL SPILL RELIEF SEEN SOON.

Oceanology International, Vol 2, No 6, Sep tember/October, 1967, p 20.

Descriptors: *Water pollution sources, *Oil indus try, *Oil wastes, *Water pollution control, O

wastes, Industries, Organic matter, Wastes, Oil, Control.

This article discusses several oil polltuion sources and related means of combating oil spillage.
W69-04308

MATHEMATICAL MODELING OF WATER QUALITY IN ESTUARIAL SYSTEMS,
Stanford Univ., Calif.
G. T. Orlob, R. P. Shubinski, and K. D. Feigner.
In PROCEEDINGS OF THE NATIONAL SYMPOSIUM ON ESTUARINE POLLUTION, August 23-25, 1967. pp 646-675.

Descriptors: *Mathematical models, *Water quality, *California, *Computer models, Mathematical studies, Model studies, Water quality control, Geographical regions, Pacific coast region, Regions, Hydrodynamics, Fluid mechanics.

This paper presents the theoretical and practical bases for the development of a mathematical model for digital computer simulation of quality changes, concentrating on the distribution in space and time of conservative constituents. It carries forward from an initial study aimed at providing the means for characterizing estuarial hydrodynamic behavior and utilizes a digital model of an estuarial network which was developed and verified for the Sacramento-San Joaquin Delta. This model was extended in a subsequent study for the Federal Water Pollution Control Administration as a part of its comprehensive investigation of the San Joaquin Master Drain and its effects on water quality in San Francisco Bay and the Delta. It formed the basic building block for the quality model reported in this paper.
W69-04311

POLICING THE OIL INDUSTRY.
Oceanology International, Vol 2, No 3, May/June, 1967, p 11.

Descriptors: *Oil industry, *Water pollution sources, Oil, Industries, Oil wastes, Organic matter, Wastes.

The article discusses various conflicts between the petroleum industry and other interests.
W69-04318

THE ROLE OF THE PHYSICAL HYDRAULIC MODEL OF SAN FRANCISCO BAY AND DELTA IN POLLUTION STUDIES,
Stanford Univ., Calif.
Harry McK. Roper, Jr.
In PROCEEDINGS OF THE NATIONAL SYMPOSIUM ON ESTUARINE POLLUTION, August 23-25, 1967, pp 423-440.

Descriptors: *Hydraulic models, *Water pollution, *Bays, *California, Model studies, Bodies of water, Geographical regions, Pacific coast region, Regions, Southwest U. S., Deltas.

The use of a physical hydraulic model developed by the Corps of Engineers for studying pollution in San Francisco Bay is discussed. The model is constructed to a horizontal scale of 1:1,000 and a vertical scale of 1:100 and occupies an area of about two acres.
W69-04329

RESPONSE TO POLLUTION OF NEW YORK HARBOR AND THAMES ESTUARY,
Wilbur N. Torpey.
Water Pollution Control Federation, Journal, Vol 39, No 11, November, 1967, pp 1797-1809.

Descriptors: *Dissolved oxygen, *Biochemical oxygen demand, *Sewage, *Water pollution, *Harbors, *New York, *Foreign countries, Ecology, Oxygen demand, Wastes, Organic matter, Appalachian Mountain region, Geographical regions, Great Lakes region, Northwest U. S., Regions, Water quality, Waste treatment.

The author presents an historical analysis of the relationship between BOD loading and dissolved oxygen content of the waters in New York Harbor and the Thames Estuary in England. The findings appear to have important implications for estuarine management. The principal conclusion was that, for both of these estuaries, '...the curve defining the relationship of organic loading rate to dissolved oxygen is considerably distorted. It does not follow the smooth path of the oxygen-sag formulations.' An unexpected finding leading to the general conclusion was that for New York Harbor '...between 1916 and 1937 the rate of application of organic load to the harbor waters more than doubled, yet the DO concentration remained substantially unchanged. After 1937, the load on the harbor was relieved greatly by the successive installation of facilities providing secondary treatment for the wastes of about four million people, yet an improvement of only five percent in the oxygen saturation was realized. Apparently, a plateau approximating 43 percent oxygen saturation exists when the organic load applied to New York Harbor water lies in the range of 3,500,000-8,000,000 people. The loading increase by 4,500,000 people and subsequent decrease by 3,000,000 was not reflected in the DO content of the waters. This behavior was, to say the least, unexpected.' The author summarizes his findings as follows: 'Under light pollutional loading the ecology is composed of higher forms of biological life such as crustacea, mollusks, and fish. When the loading increases to a rate requiring about 20 lb. oxygen/day/acre (22 kg/day/ha) instability develops, the oxygen level drops sharply, and the fish migrate. When the waters receive loading rates that require 20-132 lb/day/acre (22-148 kg/day/ha) the DO remains substantially constant for the subject 30-ft- (9-m-) deep estuaries, at between 25 and 50 percent of saturation. This zone of the DO plateau is homeostatic in nature because the symbiotic activities of algae and bacteria are able, with an assist from the atmosphere, to supply enough oxygen to accommodate load variations. However, when the loading rate exceeds an upper threshold, wherein more than about 132 lb oxygen/day/acre (148 kg/day/ha) was required, the oxygen was exhausted and anaerobic conditions ensued.'
W69-04351

SHIRLEY V NEW HAMPSHIRE WATER POLLUTION COMMISSION (VALIDITY OF ORDER TO DESIST SEWAGE DEPOSIT INTO RIVER).
124 A 2d 189-194 (N H 1956).

Descriptors: *New Hampshire, *Municipal wastes, *Public health, *Water pollution control, Legislation, Sewage bacteria, Pollutants, Water pollution, Sewage treatment, Backwater, Administrative agencies, Legal aspects, Judicial decisions, Rivers, Swimming, Public utilities.
Identifiers: Constitutionality, Police power.

The State Water Pollution Commission ordered a town to desist from discharging untreated sewage and wastes into a river. The river flowed into certain lakes and ponds created by a dam built and maintained by a utility company. The waters had been used for some time for public bathing. The order in question was issued subsequent to the Commission's findings that the waters were being polluted by the town and that a public health hazard was being created. Upon the commission's recommendation, the Legislature provided that these particular waters should be made acceptable for bathing. The order was issued to enforce the law. Town taxpayers brought suit for declaratory judgment and injunction to restrain the enforcement of the order. Plaintiffs contended the legislation was unconstitutional, as being unreasonable, arbitrary, and for the benefit of a limited class of persons, and that the commission's order was, therefore, invalid. The court affirmed the order, ruling that the public interest to which the statute was directed was not so clearly of minor importance as to make the action of the legislature in enacting it patently unreasonable. (Wheeler-Fla)
W69-04366

RIDDLE V CITY OF GREENVILLE (RIGHT TO COLLECT DAMAGES FROM POLLUTION OF STREAMS).

163 SE 2d 462-464 (SC 1968).

Descriptors: *South Carolina, *Water pollution, *Damages, *Industrial wastes, Legal aspects, Streams, Water pollution sources, Sewage, Water law, Judicial decisions.
Identifiers: Joinder of parties, Joint tort feasors, Collateral estoppel, Res judicata, Burden of proof.

Defendant City of Greenville acquired upper riparian land for use as an industrial park and leased a parcel to LTV, Inc. Defendant dumped the discharge of its sewage disposal plant and LTV discharged industrial wastes into Huff Creek, which flowed by and through plaintiff's land. Plaintiff received a judgment for damages against LTV in a prior action. Subsequently, plaintiff brought an action against defendant city to recover damages caused from pollution of the creek. The defendant claimed the prior judgment against LTV was a bar to plaintiff's suit because it involved substantially the same facts as those relied upon against defendant. The court held that plaintiff, who had the burden of proving damages, had failed to prove that any damages caused by defendant resulted from consequences other than those caused by LTV. The court relied on the maxim that 'one cannot actually recover twice for the same damage'. A judgment of nonsuit was therefore entered. (Holt-Fla)
W69-04372

THE DISCHARGE OF SEWAGE AND OTHER MATTER INTO CERTAIN WATERS IS PROHIBITED.

N Y Pub Health Law sec 1150 (McKinney 1954).

Descriptors: *New York, *Discharge, *Pollution, *Wastes, Legislation, Sewage, Effluents, Administrative agencies, Administrative regulation, Industrial wastes, Public health, Cities, Legal aspects.

The discharge of sewage or other matter injurious to the public health is prohibited, unless express permission has been given for such discharge. The discharge of sewage by a municipally owned public sewer system or the discharge of refuse or waste from any industrial establishment in operation in 1903 is not prevented. (Childs-Fla)
W69-04391

SOME CONSIDERATIONS OF OXYGEN UTILIZATION RATES IN PUGET SOUND,
C. A. Barnes, and E. E. Collias.
Journal of Marine Research, Vol 17, No 1, November 28, 1958, pp 68-80.

Descriptors: *Dissolved oxygen, *Washington, *Oxygen, Geographical regions, Pacific coast region, Pacific northwest U. S., Regions, Biochemical oxygen demand, Oxygen demand.

The changes of local oxygen concentration with time have been determined for selected basin waters in the Puget Sound system. In the photic zone of the sea, the oxygen concentration tends to be altered by local production, diffusion and advection, exchange of oxygen across the sea surface, and biochemical utilization. The average rate of oxygen utilization was 0.016 ml per liter per day, which is higher in comparison to offshore waters. Oxygen utilization rates decreased with both decreases in DO and increases in the time that the water had been standing in the basin. Some published work on Dabob Bay has also been discussed.
W69-04439

DIFFUSION OF SEWAGE EFFLUENT IN AN OCEAN-CURRENT,
Norman H. Brooks.
In PROCEEDINGS OF THE FIRST INTERNATIONAL CONFERENCE ON WASTE DISPOSAL IN THE MARINE ENVIRONMENT, July 22-25, 1959, pp 246-265. Pergamon Press, New York.

Descriptors: *Diffusion, *Waste dilution, *Sewage disposal, *California, *Ocean currents, Outlets, Design, Coliforms, Currents (Water), Municipal wastes, Geographical regions, Pacific coast region, Mathematical studies, Model studies, Southwest U. S., Regions, Bacteria, Microorganisms, Plants, Waste disposal, Water pollution sources, Sewage effluents, Bodies of water, Surface waters, Mathematical models.

Lateral mixing of sewage field in an ocean current has been analyzed, taking into account the increase of the eddy diffusivity as the field spreads. The exact solution of the partial differential equation balancing diffusion, advection, and mortality of coliform bacteria was derived, giving concentration as a function of the position in the horizontal plane downstream from the ideal line source. Simpler expressions were also obtained for the rate of spread of a sewage field and for concentrations along the centerline of the field downstream from the source. The application of these results to ocean outfall problems is explained by means of an outline of general design steps for outfall design and an example taken from an outfall plan recently prepared for the City of San Diego, California.
W69-04452

TEMPERATURE AND WATER-QUALITY CONDITIONS FOR THE PERIOD JULY, 1963, to december, 1965, PATUXENT RIVER ESTUARY, MARYLAND,
Robert L. Cory, and John W. Nauman.
U. S. Geological Survey, Washington, D. C., Open-File Report, 1967.

Descriptors: *Maryland, *Water temperature, *Thermal pollution, *Powerplants, *Physical properties, *Rivers, Atlantic coastal plain, Appalachian Mountain region, Salinity, Dissolved oxygen, Turbidity, Tides, Engineering structures, Industrial plants, Structures, Cooling water, Water types, Surface waters, Regions, Northeast U. S., Geographical regions, Coastal plains, Temperature, Water properties, Water quality, Winds, Chemical properties, Density, Bodies of water, Running waters, Streams.

Graphs and tables obtained from continuous records of surface-water temperature from five stations for the period July, 1963, through December, 1965, and of surface, salinity, dissolved oxygen, turbidity, tide-stage, wind data, and bottom temperature from a single station are presented herein. Effects of power plant cooling water on water temperature were obvious at a station near the plant's discharge point. Surface-water density at the Patuxent River Bridge varied from 1.0033 to 1.0127 with least change during the period May to September. Salinity ranged from 3 to 16.5 parts per thousand. Average salinity in the spring of 1965 was double that of spring 1964. Turbidity was high during the winter, and peak values were obtained during prolonged periods of high wind velocities. Dissolved oxygen values ranged from 3.6 to 15.0 parts per million, and percentage saturation of oxygen from 49 to 144 percent. The extreme tidal range was 5.7 feet; mean water levels were highest in summer and lowest in winter and spring.
W69-04462

PREDICTING THE CONDITION OF A POLLUTED ESTUARY,
A. L. H. Gameson, M. J. Barrett, and W. S. Preddy.

International Journal of Air and Water Pollution, Vol 9, No 10, October, 1965, pp 655-664.

Descriptors: *Waste assimilative capacity, *Thermal pollution, *Mathematical models, *Foreign countries, *Forecasting, *Organic wastes, Mathematical studies, Model studies, Water pollution, Geographical regions, Regions, Dissolved oxygen, Nitrogen compounds, Water temperature, Temperature, Water properties, Wastes.

This paper discusses the salient features of a comprehensive study of the waste assimilation capacity of the Thames Estuary and two other estuaries in England. Field observations are compared with conditions predicted by a mathematical model. Thermal and organic pollution are considered. Extremely good correlation is noted for dissolved oxygen. Reasonably good correlation was also reported for the other parameters which were inorganic nitrogen, oxidized nitrogen, ammonical nitrogen, and temperature.
W69-04469

WATER QUALITY CRITERIA--STREAM VERSUS EFFLUENT STANDARDS.
For primary bibliographic entry see Field 05G.
W69-04516

INFRARED IMAGING FOR WATER RESOURCES STUDIES,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering; and HRB-Singer, Inc., State College, Pa.
For primary bibliographic entry see Field 07B.
W69-04556

DISPERSION AND FLUSHING OF POLLUTANTS IN ESTUARIES,
Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
For primary bibliographic entry see Field 02L.
W69-04559

NITRIFICATION: IMPORTANCE TO NUTRIENT LOSSES FROM A CUTOVER FORESTED ECOSYSTEM,
Dartmouth Coll., Hanover, N. H. Dept. of Biological Sciences; Dartmouth Coll., Hanover, N. H., Dept. of Earth Sciences; and Yale Univ., New Haven, Conn. School of Forestry.
For primary bibliographic entry see Field 02K.
W69-04584

BLUE V CHARLES F HAYES AND ASSOCIATES, INC (ACTION FOR DAMAGES DUE TO FLOW OF OIL WASTES).

215 So 2d 426-429 (Miss 1968).

Descriptors: *Mississippi, *Oil wastes, *Land use, *Water pollution, Judicial decisions, Legal aspects, Land, Damages, Oil fields, Oil wells, Natural resources, Overflow, Reasonable use.
Identifiers: *Slush pits, Trespass, Nuisance.

Plaintiff owned certain lands in an oil field, and the defendant owned the oil. A well was drilled by defendant necessitating the establishment of a slush pit. Defendant then abandoned the well, leaving the pit full of contaminating matter. The pit embankment broke, and the refuse flowed over plaintiff's land, contaminating a pond and doing considerable damage. The plaintiff sued defendant for property damages. The defendant claimed that adjacent landowners had no basis for a cause of action. It was contended that each landowner is privileged to use his land for development of natural resources and any injuries thereby caused are not actionable. The court held that when one makes unreasonable use of his property he should be liable for damages or subject to an action to abate such use. It is recognized that the operator of an oil well is liable for damages caused by oil, salt water, or the like flowing from wells onto adjoining lands or streams. This was a direct infringement of the plaintiff's property rights and is properly classed as a trespass. An oil drilling company which permits waste to flow onto another's land is liable on a nuisance theory as well as trespass. (Shevin-Fla)
W69-04654

5C. Effects of Pollution

WATER POLLUTION PROBLEMS AND IMPROVEMENT NEEDS, LAKE ONTARIO AND ST. LAWRENCE RIVER BASINS.
Federal Water Pollution Control Administration, Chicago, Ill.; and New York State Dept. of Health, Albany.
For primary bibliographic entry see Field 05B.
W69-04223

THERMAL POLLUTION AND AQUATIC LIFE,
Bureau of Sport Fisheries and Wildlife, Highlands, N. J. Sandy Hook Marine Lab.
For primary bibliographic entry see Field 05A.
W69-04235

PATUXENT THERMAL STUDIES - SUMMARY AND RECOMMENDATIONS,
Maryland Univ., Solomons. Natural Resources Inst.; and Maryland Dept. of Natural Resources.
For primary bibliographic entry see Field 02L.
W69-04244

A PROBABILISTIC ANALYSIS OF DISSOLVED OXYGEN-BIOCHEMICAL OXYGEN DEMAND RELATIONSHIP IN STREAMS,
Illinois State Water Survey, Peoria; and Illinois Univ., Urbana. Water Resources Center.
V. Kothandaraman, and Ben B. Ewing.
Supported in part by funds from OWRR, Dept of Interior. J Water Pollut Contr Federation, Vol 41, No 2, pp R73-R90, Feb 1969. 18 p, 17 fig, 4 tab, 24 ref.

Descriptors: *Water pollution, *Dissolved oxygen, *Statistical methods, Streams, Biochemical oxygen demand, Mathematical models, Monte Carlo method, Ohio River, Aeration, Reaeration, Oxygen sag.
Identifiers: Streeter-Phelps equation.

Because of the wide deviation in oxygen deficit values as predicted by the Streeter-Phelps equation, a study was initiated to predict DO deficits in a stream with known initial conditions. A hypothetical stream situation is used to consider the variations in deoxygenation and reaeration rate coefficients for predicting dissolved oxygen deficits. Statistical models are formulated and tested, and simulation techniques using the Monte Carlo method are employed in predicting the probabilistic variation in DO deficits for known initial conditions. The predicted results using the probabilistic model are found to agree with the observed values within practical limits and give more consistent results than the conventional methods. (Knapp-USGS)
W69-04247

ORGANIC CARBON-ORGANIC NITROGEN RATIOS OF SEDIMENTS IN A POLLUTED ESTUARY,
Tampa-Hillsborough Bay Technical Assistance Project, Tampa, Fla.; and Federal Water Pollution Control Administration, Washington, D. C., Office of Estuarine Studies.
James H. Finger, and T. Allen Wastler.
J Water Pollut Contr Federation, Vol 41, No 2, pp R101-109, Feb 1969. 9 p, 5 fig, 1 tab, 7 ref.

Descriptors: *Sludge, *Industrial wastes, *Municipal wastes, Oxygen sag, Biochemical oxygen demand, Nitrification, Oxygen demand, Sewage, Solid wastes, Pulp wastes, South Carolina.
Identifiers: Carbon-nitrogen ratios, Charleston Harbor (S C).

The observed ratios of organic carbon-organic nitrogen in natural environments are used to dif

erentiate between sludge deposits of industrial vaste origin and those from human wastes. Field esults from Charleston Harbor show deposits of oth types in separate areas and mixtures of sludge eposits in some locations in the harbor. The C:N ation of domestic wastewater deposits is approxiately 10, while that in deposits from untreated aper mill waste is 40. (Knapp-USGS)
V69-04248

IUTRIENT AND POLLUTANT RESPONSE OF STUARINE BIOTAS,
tanford Univ., Calif.
ames B. Lackey.
n PROCEEDINGS OF THE NATIONAL SYMOSIUM ON ESTUARINE POLLUTION, August 3-25, 1967, pp 188-217.

Descriptors: *Nutrients, *Marine microorganisms, Pollutants, Recreation, Water sports, Environment, Aquatic environment, Estuarine environment, Water quality, Sewage bacteria, Environmental effects, Aquatic life, Aquatic microorganisms, Microorganisms, Seston, Invertebrates, Shellfish, Waste disposal, Sewage disposal, Water chemistry, Ecology, Water pollution, Water pollution control, Control, Algae, Plants, Commercial fishing, Fishing, Industries, Commercial shellfishing, Animals, Aquatic animals.

The behavior of microbiota--algae and protozoa--s affected by commercial, recreational, and metropolitan uses of estuarine waters are outlined. Some of the findings presented at the symposium are as follows: (1) Estuaries and bays are of great economic and recreational value, for nurseries, fishing grounds, shellfisheries, crustacean production, boating, and bathing. (2) Human activity often modifies their preferred ecology by adding nutrients or pollutants. (3) The suspended (plankton) microscopic plants and animals, and those of the interface (benthos) are most easily studied qualitatively and quantitatively. (4) Some pollutants, such as silt, sharply reduce the microscopic populations. (5) The role of the engineer with regard to estuarine studies is that of seeing that adequate biological studies are made, so that he in turn can design and construct the necessary treatment plants and outfalls which will prevent overenrichment or pollution.
W69-04276

ESTUARIES,
American Association for the Advancement of Science, Washington, D. C.
For primary bibliographic entry see Field 02L.
W69-04278

EFFECTS OF WASTE DISCHARGE FROM POINT LOMA SALINE WATER CONVERSION PLANT ON INTERTIDAL MARINE LIFE,
D. Leighton, I. Nusbaum, and S. Mulford.
Water Pollution Control Federation, Journal, Vol 39, No 7, July, 1967, pp 1190-1202.

Descriptors: *Water pollution effects, *Desalination, *California, *Waste disposal, *Intertidal areas, *Aquatic life, Regions, Demineralization, Separation techniques, Water purification, Water treatment, Geographical regions, Pacific coast region, Southwest U. S., Thermal pollution, Water pollution, Brines, Saline water, Water types.

The effects of thermal and brine discharges from the Point Loma, California, desalting plant are described. After a few months of operation, it became evident that the effluents were having a deleterious effect on at least some of the organisms, both plant and animal, which inhabit the intertidal zone. The effects were restricted to the area covered by the effluent streams and under low tide conditions. The authors conclude that the experience at Point Loma provides a clear warning that waste discharge problems would have to be resolved before there could be serious contemplation of considerably larger distillation plants.
W69-04280

MAN AND THE ESTUARY.
For primary bibliographic entry see Field 06B.
W69-04283

VIRAL POLLUTION OF SHELLFISH IN ESTUARY WATERS,
T. G. Metcalf, and W. C. Stiles.
Journal of the Sanitary Engineering Division, ASCE, Vol. 94, No. SA4, August, 1968, pp 595-609.

Descriptors: *Oysters, *Water pollution, *Estuarine environments, *Shellfish, Marine animals, Invertebrates, Commercial shellfish, Benthos, Benthic fauna, Fish, Microorganisms, Sewage treatment, Sanitary engineering, Public health, Sewage disposal, Engineering, Environmental engineering, Mollusks, Chemical reactions, Chlorination, Viruses, Wildlife, Aquatic environments, Environment, Waste treatment, Waste disposal, Animals, Aquatic animals, Aquatic life.

Enteroviruses appear in oysters following pollution of estuary waters by waste-treatment plant effluents. Primary treatment, with or without chlorination, and stabilization pond effluents are regular contributors of enterovirus. Increased levels of chlorination accompanied by prolongation of retention time lead to a reduction in the number of viral isolations made from treated effluents. Enterovirus occurs in oysters collected from seawater containing less than 70 Coliform median MPN per 100 ml. Reduction of viral pollutants to undetectable levels in oysters by depuration in estuary waters requires three to six days. Depuration efficacy was adversely affected by large numbers of viral pollutants in oysters, by water temperature falling below 10 C, or both.
W69-04296

ON POSSIBLE CONSTRUCTIVE USES OF THERMAL ADDITIONS TO ESTUARIES,
J. A. Mihursky.
BioScience, Vol. 17, No. 10, November, 1967, pp 698-702.

Descriptors: *Thermal pollution, *Beneficial use, *Commercial shellfish, *Commercial fish, *Benefits, Water pollution, Animals, Aquatic animals, Aquatic life, Invertebrates, Shellfish, Fish, Wildlife, Heated water, Water types, Water temperature, Temperature, Water properties, Fish food organisms, Ecology, Ecosystems.

Thermal loading of an estuary, common in highly industrial areas, can cause damage in some ecosystems. It can also be used constructively, however, to maintain warm temperatures for the development of food items for commercially important species, and to stimulate growth of commercially important fish and shellfish.
W69-04297

SOME ASPECTS OF POLLUTION, PARASITISM, AND INLET RESTRICTION IN THREE NEW JERSEY ESTUARIES,
Thurlow C. Nelson.
Estuaries, No. 83, 1967, pp 203-211.

Descriptors: *History, *Parasitism, *Estuarine environment, *Water pollution effects, *Oysters, *New Jersey, *Ecology, Commercial shellfish, Pathology, Aquatic environment, Environment, Animals, Aquatic animals, Aquatic life, Benthic fauna, Benthos, Invertebrates, Marine animals, Mollusks, Shellfish, Atlantic coastal plain, Coastal plains, Geographical regions, Northeast U. S., Regions, Obstruction to flow.

Since the oyster is a very sensitive biological indicator of conditions and is the best scientifically-known of all marine animals, the author uses the history of the oyster population in three New Jersey estuaries to illustrate the effect of nature and man on the ecology of the estuaries.
W69-04304

THERMAL POLLUTION: HOT ISSUE FOR INDUSTRY,
Raul Remirez.
Chemical Engineering, Vol 75, No 7, March 25, 1968, pp 48-52.

Descriptors: *Thermal pollution, *Nuclear powerplants, *Thermal powerplants, *Cooling, Water pollution, Electric powerplants, Engineering structures, Industrial plants, Powerplants, Structures, Steam turbines, Equipment, Turbines, Cooling towers, Heated water, Water types, Water pollution sources, Cost comparison, Analysis, Cost analysis, Mathematical studies.

This article discusses the problem of thermal pollution and presents some current information on the subject. The article states that '...about 70% of the industrial thermal-pollution load is attributed to the steam electric-power industry'. It also states that nuclear plants, expected to be a large percent of future construction, reject about 50 percent more heat than fossil fuel plants. Reservoirs or cooling towers could alleviate the problem, but might increase the cost of electricity one to five percent. Reuse of now wasted heat is one possibility.
W69-04325

MECHANISMS MAINTAINING HIGH PRODUCTIVITY IN GEORGIA ESTUARIES,
Federal Water Pollution Control Administration, Southeast Region, Atlanta, Ga.
For primary bibliographic entry see Field 02L.
W69-04334

THERMAL POLLUTION OF WATER,
R. H. Stroud, and P. A. Douglas.
SFI Bulletin, No. 191, January-February, 1968, pp 1-8.

Descriptors: *Thermal pollution, *Water quality control, *Benefits, *Water pollution effects, Commercial fishing, Water pollution, Beneficial use, Impaired water quality, Water quality, Heated water, Legislation, Control, Quality control.

The authors define water pollution generally as impairment of water quality to a degree which has an adverse effect on beneficial use of the water. They feel that if the desired use of the water is not impaired, there is no pollution. They argue that limited or controlled thermal additions to water can be beneficial. Furthermore, they feel that increased legislation may be necessary to insure that thermal additions are controlled. The effect of thermal pollution in estuaries is discussed.
W69-04345

THERMAL POLLUTION OF WATER.
Sport Fishing Institute Bulletin, No. 191, January 2, 1968.

Descriptors: *Thermal pollution, *Thermal powerplants, *Stream turbines, *Cooling, Nuclear powerplants, Cooling towers, Water sports, Sport fishing, Fishing, Recreation, Economic impact, Water pollution, Electric powerplants, Engineering structures, Industrial plants, Powerplants, Structures, Equipment, Turbines, Aquatic life.

This publication discusses the problem of thermal pollution and makes specific references to estuarine situations. The article states that 'the greatest source of thermal pollution is the steam-electric-station (S.E.S.) industry'. It is predicted that thermal electric production in the United States will amount to 2,000 billion kw per hour by 1980. Such production will require 200 billion gallons of water per day, of which 94 percent would be used for cooling. 'It should also be noted that power plants are invading the estuaries at an accelerated rate. This is evidenced by the fact that 22 percent were located there in 1950, whereas some 32 percent are anticipated to be adjacent to estuaries by 1980.' The article also discusses the potential effects of thermal pollution on aquatic organisms, lists thermal criteria proposed by the National

Technical Advisory Committee on Aquatic Life, discusses cooling tower alternatives for alleviating thermal pollution, and presents some data on sport fishing benefits in Biscayne Bay, Florida.
W69-04349

COMMON MISUNDERSTANDINGS ABOUT HEATED DISCHARGES,
Federal Water Pollution Control Administration, Southeast Region, Atlanta, Ga.
C. B. Wurtz.
In CLEAN WATER FOR THE NATION'S ESTUARIES, Transcript of Public Meeting, Biloxi, Mississippi, January 17, 1968, p 4.

Descriptors: *Hydroelectric plants, *Heated water, *Ecology, *Aquatic animals, *Thermal pollution, Predation, Pathogenic bacteria, Physiological ecology, Animal metabolism, Animal parasites, Water quality, Bacteria, Electric powerplants, Engineering structures, Industrial plants, Structures, Powerplants, Afterbays, Spawning, Wildlife, Dissolved oxygen, Fish, Animals, Aquatic life, Food chains, Water types, Fisheries, Public health, Microorganisms, Plants.

The author describes five common misunderstnadings about the effects of heated discharges on aquatic life. These misunderstandings relate to the belief that an increase in water temperature will: (1) Cause a reduction in the capacity of the water to retain dissolved oxygen. (2) Cause a deterioration in the 'quality' of the biological community, i.e., less desirable species of organisms will replace more desirable species. This is usually argued as an increase of only two or three degrees without any scale being mentioned. (3) Cause fish to spawn earlier, and at a time when suitable food organisms for survival of the young stages will not be present. (4) Change metabolic rates to the extent that individual organisms will be living under conditions of physiological stress, and thus be vulnerable to adverse conditions they may have otherwise resisted. (5) Cause an increase in the numbers of predators, parasites, and/or pathogens, and thus cause significant deterioration of a fisheries resource or create a public health hazard.
W69-04364

THE EFFECT OF POLLUTION BY SEWAGE UPON THE WATERS OF THE OSLO-FJORD,
T. Braarud.
Verhandlungen Internationalen Verein Limnology, Vol 12, 1955, pp 811-813.

Descriptors: *Sewage, *Foreign waters, *Marine animals, *Water pollution effects, Water pollution sources, Domestic wastes, Wastes, Water types, Animals, Aquatic animals, Aquatic life.

This article describes the configuration of Oslo Fjord and its apparent role in the pollution effects observed. Brief consideration is given to the effects of sewage on vertebrate and invertebrate marine organisms.
W69-04445

A COOLING POND PROVES CHEAPER,
R. W. Braswell.
Electrical World, Vol 140, No 22, November 30, 1953, pp 84-85.

Descriptors: *Water cooling, *Cooling towers, *Ponds, *Cost comparisons, Streams, Running waters, Rivers, Costs, Riparian rights, Cooling, Engineering structures, Water types, Recirculated water, Water rights, Bodies of water, Lakes, Standing waters, Surface waters, Analysis, Cost analysis, Mathematical studies.

The author evaluates the economics of two methods of cooling: cooling ponds and cooling towers. Cooling ponds were found to be cheaper in initial construction cost, lower maintenance cost, longer life, and about two percent saving in annual operating cost. Estimated costs of both methods have been worked out quite extensively. Direct use of a river for condensing with upstream recirculation was not feasible because of procurement of rights and permissions over the rich farm land.
W69-04447

NUTRIENTS,
Interstate Commission on the Potomac River Basin, Washington, D. C.
Morris L. Brehmer.
In PROBLEMS OF THE POTOMAC ESTUARY, January, 1964, pp 47-50.

Descriptors: *Nutrients, *Eutrophication, *Water quality, *Phosphorus, *Nitrogen, *Cost analysis, Sewage treatment, Waste treatment, Maryland, Virginia, Water pollution sources, Water pollution effects, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Geographical regions, Operating costs, Costs, Northeast U. S., Regions, Southeast U. S., District of Columbia, Cities, Inorganic compounds, Metals, Gases, Analysis, Mathematical studies.

The author briefly discusses the problem of secondary pollution stemming from excessive nutrients of sewage origin in receiving waters, with specific reference to the Potomac Estuary. He presents estimates of the daily phosphorous and nitrogen enrichment of the Potomac Estuary by Washington, D. C. Research is advised in order to determine safe nutrient levels for the Potomac Estuary and to develop methods of sewage treatment to remove phosphorus and nitrogen from sewage effluents as an economic by-product. The nitrogen and phosphorous content of sewage from Washington, D. C., if valued at 10 cents and 8 cents respectively per pound, would have a recovered value of about $3,150,000 annually, as compared with the present annual operating cost for the sewage treatment system of about $2,100,000.
W69-04448

AN ECOLOGICAL SURVEY OF THE HOUSTON SHIP CHANNEL AND ADJACENT BAYS,
G. V. Chambers, and A. K. Sparks.
Institute of Marine Science, Publications, Vol 6, 1959, pp 213-250.

Descriptors: *Water pollution, *Ecology, *Bays, *Fish populations, Southwest U. S., Geographical regions, Coastal plains, Central U. S., Ecological distribution, Water quality, Bodies of water, Dissolved oxygen, Organic matter, Silting, Sedimentation, Oil wastes, Gulf coastal plain, Texas, Sediments, Bottom sediments, Organic matter, Wastes, Industrial wastes, Effluents, Aquatic animals, Animals, Aquatic life, Aquatic populations, Population, Surveys, Regions.

An ecological survey was initiated in the summer of 1957 with data collected at frequent regular intervals. This report includes the comparison of data on temperature, chlorinity, dissolved oxygen, and related quantities with data on fish, shrimp, and crabs caught in trawls. Data are also given on currents, bottom cores, and organic content of sediments. Studies of bottom samples demonstrated that extensive silting has occurred in the ship channel and bays. Low dissolved oxygen, hydrogen sulfide production, and high organic content of the mud in the channel, all indicative of organic pollution, prevent the establishment of a normal bottom fauna. A small temperature gradient was found in the ship channel, two or three degrees higher in the upper channel than in the lower part of the survey area. When dissolved oxygen (D.O.) level is sufficient, a large and diverse population of fishes exists throughout the bays in the survey area and for a considerable distance above the Humble Oil and Refining Company's outfall. No lowering of the dissolved oxygen concentration of the ship channel attributable to Humble's effluent was found, and no effect was found to be exerted on the fish populations of the ship channel and adjacent bays by Humble's operations.
W69-04454

ANALYSIS OF A STREAM'S CAPACITY FOR ASSIMILATING POLLUTION,
M. A. Churchill.
Sewage and Inustrial Wastes, Vol 26, July 1954, p 887.

Descriptors: *Waste assimilative capacity, *Biochemical oxygen demand, *Dissolved oxygen, *Water pollution effects, Oxygen demand, Southeast U. S., Regions, Geographical regions, Rivers, Bodies of water, Running waters, Streams, Surface waters, Tennessee, Appalachian Mountain region, Central U. S.

The procedure presented in the paper suggests a statistical method to evaluate the effects of pollution load and stream flow on dissolved levels in the rivers. Basic data for Main River in Tennessee have been used for statistical development. A good correlation in regression lines to predict DO drop values for known BOD load condition was obtained.
W69-04456

EFFECTS OF HEATED EFFLUENTS UPON MARINE AND ESTUARINE ORGANISMS,
E. Naylor.
In ADVANCES IN MARINE BIOLOGY, Vol 3, pp 63-104. London and New York: Academic Press, 1965.

Descriptors: *Powerplants, *Thermal pollution, *Estuarine environment, *Growth rates, Engineering structures, Industrial plants, Structures, Aquatic environment, Environment, Rates.

The biological effects of heated effluents on estuarine life are discussed. The growth in volume of heated effluents from power plants in estuarine areas is indicated. It is suggested that there be many situations where siting power plants in estuaries could be beneficial to the marine environment, as well as other situations where such would be detrimental.
W69-04486

ON THE PREDICTION OF THE DISTRIBUTION OF EXCESS TEMPERATURE FROM A HEATED DISCHARGE IN AN ESTUARY,
Johns Hopkins University, Chesapeake Bay Institute.
D. W. Pritchard, and H. H. Carter
Technical Report No. 33, February, 1965.

Descriptors: *Thermal pollution, *Maryland, *Forecasting, Thermal power, Thermal powerplants, Water pollution, Electric powerplants, Engineering structures, Industrial plants, Powerplants, Structures, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Geographical regions, Northeast U. S., Regions.

The authors believe 'that the techniques described here will have general application; however, this paper treats the specific case of the heated effluent from the PEPCO Chalk Point Power Plant on the Patuxent estuary in Maryland, which should serve to illustrate the basic concepts'.
W69-04494

THE MARINE ENVIRONMENT IN THE VICINITY OF THE ORANGE COUNTY SANITATION DISTRICTS OCEAN OUTFALL,
C. H. Turner, E. E. Ebert, and R. G. Given.
California Fish and Game, Vol 52, No 1, 1966, pp 28-48.

Descriptors: *Ecology, *Marine animals, *Sewage effluents, *Water pollution effects, *California, Water pollution sources, Effluents, Animals, Aquatic animals, Aquatic life, Geographical regions, Pacific coast region, Regions, Southwest U. S., Outlets.

The authors report that a biological survey in the area of a sewer outfall showed that there was generally a typical faunistic assemblage for the

epths and substrates examined. Two exceptions ere (1) a reduced number of species encrusting ne last 100 feet of the outfall pipe as compared to ne central portion and (2) considerably fewer inds and numbers of organisms on an artificial eef in the area as compared to other artificial reefs xposed for the same time at the same depths.
V69-04511

XPERIMENTS ON THE UTILIZATION OF ITROGEN IN FRESH WATER,
reshwater Biological Association, Ambleside (England).
Vinifred Pennington.
ECOL, Vol 30, pp 326-340, 1942. 1 fig, 8 tab, 18 ef, 2 append, disc.

Descriptors: *Nitrogen compounds, *Nitrogen tilization, *Fresh water, Algae, Nitrate ammonim, Nitrite, Oxidation-reduction potential, Cycling utrients, Eutrophication.

The experiments described were carried out on ixed cultures of algae and bacteria in a rich culure solution containing nitrate or ammonium. No ttempt was made to differentiate between the oles of algae and bacteria in nitrogen utilization. mmonium and nitrate were both utilized, but amonium appeared to be used more rapidly. Nitrite as produced from both ammonium and nitrate, nd there was evidence that ammonium was roduced from nitrate and nitrate from ammonim. In some experiments there was a marked loss f nitrogen from the cultures, apparently due to beration of nitrogen. (Konrad-Wisc)
V69-04521

N QUESTIONS OF PRODUCTION AND RODUCTIVITY IN ECOLOGY,
Vestern Reserve Univ., Cleveland, Ohio. Dept. of iology.
or primary bibliographic entry see Field 02K.
V69-04524

ULFUR METABOLISM AND SEDIMENTARY NVIRONMENT: LAKE MENDOTA, WISCONIN,
Visconsin Univ., Madison. Dept. of Geology.
erome O. Nriagu.
Limnol Oceanogr, Vol 13, No 3, pp 430-439, July 968. 3 fig, 3 tab, 28 ref, disc.

Descriptors: *Sedimentation, *Sulfur, *Sulfur ompounds, Anaerobic conditions, Analytical echniques, Cores, Diagenesis, Eutrophication, Geochemistry, Lakes, Marl, Microbiology, Oligotrophy, Organic matter, Oxidation-reduction otential, Sediments, Sediment-water interface, ludge, Sulfates, Sulfides, Wisconsin.
dentifiers: *Lake Mendota (Wis), *Lake metabolsm, *Sedimentary environment, Sulfureta, RV Kekule, Ekman dredge, Valisneria, Potamogeton, Greigite, Hydrotroilite, Mackinawite, Marcasit, Mineralization, Acid volatile sulfide, Organic sulur.

Sulfur species in black bottom muds of Lake Mendota, Wisconsin, include sulfide dissolved in interstitial water, acid-volatile sulfides, elemental sulur, organic sulfur, and sulfates. A black, morphous, acid-soluble substance, presumably ydrotroilite, is dominant form. No pyrite or marasite was isolated from the sludge. Nearly 45% of ulfur precipitable as sulfide probably derives from nineralization of organic matter; the remainder, rom bacterial reduction of sulfates. In deep-water ores, where anaerobiosis at mud-water interface is ormally intense, concentrations of total and sulide sulfur are sharply reduced in marl compared vith those in sludge, discontinuities being demontrable at sludge-marl interface. All evidence sugests that before changes in sedimentation associated with human activity, lake had developed n anaerbiosis intense enough to permit reduction f sulfates to sulfides but had remained sludge-free y processes of self-purification. Ranges in concentrations, in ppm, of sulfur species (water depth, in meters, within parentheses) are: total, 480 (10.7)--4250 (25.3); total sulfides-sulfur, 280 (10.7)--3600 (25.3); water soluble hydrogen sulfide + HS, 0.0 (10.7 and 15.2)--4.5 (25.3); sulfate-sulfur, 5.3 (10.7)--12.0 (15.2); elemental, 13.2 (18.3)--35.6 (25.3). Report includes descriptions of analytical techniques for total, elemental, sulfate-, and sulfide-sulfur. (Eichhorn-Wis)
W69-04526

5D. Waste Treatment Processes

INDUSTRIAL WASTEWATER RECLAMATION,
Montgomery Research, Inc., Pasadena, Calif.
Carl A. Rambow.
Water and Sewage Works, Reference No 1968, pp R220-R226, Nov 29, 1968. 7 p, 8 tab, 5 ref.

Descriptors: *Water reuse, *Industrial water, *Industrial wastes, *Cost analysis, *Systems analysis, Tertiary treatment, Activated carbon, Coagulation, Electrodialysis, Membrane processes, Oxidation, Reverse osmosis, Chlorination, Flocculation, Filtration.
Identifiers: Industrial water refuse.

The costs of industrial wastewater reclamation are analyzed and tabulated. In many areas, reclaimed water is of higher quality than untreated water, so in some cases reclamation may be the most desirable solution economically and otherwise, even where water is abundant. The tabulated cost data include capital cost of tertiary treatment plants, yearly operating costs of tertiary treatment, basic system costs (activated sludge, coagulation, flocculation, clarification, filtration, and chlorination), basic system costs less secondary treatment costs, electrodialysis costs, and reverse osmosis costs. (Knapp-USGS)
W69-04226

TREATMENT AND DISPOSAL OF RADIOACTIVE WASTES,
Mississippi State Univ., State College. Dept. of Sanitary Engineering.
For primary bibliographic entry see Field 05E.
W69-04229

OZONE IN WATER TREATMENT AND WASTEWATER RENOVATION,
Miami Univ., Coral Gables, Fla. Dept. of Civil Engineering.
D. Thirumurthi.
Water and Sewage Works, Reference No 1968, pp R106-R114, Nov 29, 1968. 9 p, 2 fig, 5 tab, 33 ref.

Descriptors: *Water treatment, *Tertiary treatment, *Ozone, Sewage treatment, Chemical degradation, Aeration, Oxidation, Disinfection, Odor, Biochemical oxygen demand, Chemical oxygen demand.
Identifiers: Wastewater renovation, Ozonation.

The use of ozone in water treatment and wastewater renovation is surveyed. Ozone is not only a powerful disinfectant but also a powerful oxidant which can remove color, organic material, iron, manganese, odors, and taste from water, without adding salts, taste, or odor itself. Its deodorizing ability is strong enough to control sewage treatment odor; it is used in sewage plants in New York, Japan, and Florida for this purpose. Laboratory experiments were run to study ozone production methods, the kinetics of BOD and COD removal, and to compare the results of ozonation and aeration. The results are tabulated. A typical ozone plant with a capacity of 120 lb/day costs $70,000 to install and 15 cents per pound of ozone to operate. At these costs, a 10 mgd sewage plant can ozonate about 2 hrs per day at $500 per day, reducing BOD 40-50%, COD 20-50 percent, and ammonia 25%. Using a feed rate of 40 mg ozone in 1.0 liter of sewage, the cost is about 5 cents per 1,000 gal of sewage. (Knapp-USGS)
W69-04230

WATER REUSE FOR PUBLIC SUPPLY,
Black and Veatch, Kansas City, Mo.
Paul D. Haney.
J Amer Water Works Ass, Vol 61, No 2, pp 73-78, Feb 1969. 6 p, 29 ref.

Descriptors: *Water reuse, *Waste water treatment, Municipal water, Artificial recharge, Irrigation water, Reclaimed water, Sewage treatment, Tertiary treatment, Water pollution, Water utilization.
Identifiers: Chanute (Kans).

The problems, techniques, and history of water reuse are reviewed and discussed. In the U.S., reuse is largely indirect, with cities using the same streams for water supply that upstream cities use for waste removal. When flow is low, this may amount to processing sewage for public supply. Direct reuse of municipal wastewater is less common, but has been done in Chanute, Kansas, when a drought eliminated the water supply. Use of reclaimed water for groundwater recharge is being studied and is already in operation in Europe. Wastewater may be used directly for irrigation; its organic content and nutrients benefit plants if the water is properly reclaimed. Non-municipal sources of stream pollution, including agricultural wastes, fertilizers, and sediments are discussed. National trends in water and wastewater treatment are briefly outlined. (Knapp-USGS)
W69-04265

A 'BALAS' ALGORITHM FOR ZONED UNIFORM TREATMENT,
Stanford Univ., Calif.
Jon C. Liebman, and David H. Marks.
In PROCEEDINGS OF THE NATIONAL SYMPOSIUM ON ESTUARINE POLLUTION, August 23-25, 1967, pp 44-59.

Descriptors: *Mathematical models, *Water pollution treatment, *Waste disposal, *Waste treatment, *Cost sharing, Zoning, Regulation, Mathematical studies, Model studies.

The problem of finding appropriate treatment levels for waste discharges located along an estuary on which quality standards are imposed is complex. The uniform treatment method is expensive and inequitable. A cost-minimization model (a mathematical model of the physical characteristics of the water body employed) is efficient, but inequitable. For example, industrial plants A and B located next door to each other have similar products and wastes, but the cost-minimization solution may require A to treat while B does nothing, because the unit cost of treatment is lower at A due to more efficient operation. Thus, A bears the entire brunt of being more efficient while B pays nothing. A zoned solution is proposed wherein waste producers are divided into categories, and treatment levels are found which minimize the cost-subject to the requirement that all members of the category provide the same treatment. A branch-and-bound algorithm is developed to obtain the solution.
W69-04281

STATEMENT,
Federal Water Pollution Control Administration, Southeast Region, Atlanta, Ga.
Eugene P. Odum.
In CLEAN WATER FOR THE NATION'S ESTUARIES, Proceedings of the Georgia Public Meeting, Jekyll Island, Georgia, February 29, 1968, pp 7-18.

Descriptors: *Zoning, *Georgia, *Water quality control, *Sewage treatment, *Ecology, *Atlantic coastal plain, Regulation, Property values, Water pollution control, Water pollution treatment, Water treatment, Waste treatment, Natural resources, Resources, Fish harvest, Fishing, Industries, Appalachian Mountain region, Coastal plains, Geographical regions, Regions, Southeast U. S., Value, Quality control, Control, Recreation, Recreation facilities.

The importance of secondary waste treatment is stressed. It is further stressed that the natural high fertility and usefulness of estuaries 'dictates that use and management should be based, as far as possible, on the concept of utilization of existing resources without changing the biological productivity and the basic flow pattern of the system'. On the average, an acre of estuary is worth $500 and should be put to more valuable uses than landfill (where dry land is available) or open sewers for raw wastes. As a basis for future planning, the author proposes a pattern of use zones which have been developed by the State of Georgia. These use regions are: (1) Industrial zones--subjected to extensive modification, where pollution control and maintenance of water quality are of paramount concern, (2) Natural-use zones--where the basic pattern of landscape remains undisturbed and recreation, fishing, seafood production, etc., are the primary objectives, and (3) Research zones.
W69-04306

OPERATING COSTS OF WASTE TREATMENT IN GENERAL MOTORS,
Robert J. Brink.
Nineteenth Industrial Waste Conference, Proceedings, January, 1965, pp 12-16.

Descriptors: *Waste water treatment, *Industrial plants, *Operating costs, Industrial wastes, Treatment facilities, Waste treatment, Water treatment, Wastes, Buildings, Engineering structures, Structures, Costs.

The costs of waste-water treatment at the Buick Division of General Motors Corporation are reported.
W69-04451

DEEDS AND DATA.
Water Pollution Control Federation, Journal, Vol 36, No 4, April, 1964, pp 517-519.

Descriptors: *Sewage treatment, *Operating costs, Maintenance costs, Waste treatment, Costs, Sewage, Municipal wastes.

The article presents operating and maintenance cost experience for secondary sewage treatment facilities for plants of nine municipalities, with average daily sewage volume per plant in range of 0.2 mgd to 51.6 mgd.
W69-04465

INDUSTRIAL WASTEWATER CONTROL,
Fred C. Gurnham.
New York: Academic Press, 1965.

Descriptors: *Industrial wastes, *Industrial plants, *Waste water treatment, *Water pollution control, Water pollution sources, Buildings, Engineering structures, Structures, Waste treatment, Water treatment, Industries.

This is a basic text and reference work on the subject of industrial waste water treatment. It contains chapters on the the industrial waste water control in the following industries: Meat, Fish and fish products, Poultry and eggs, Dairy products, Canned foods, Starch and starch products, Sugar, Fermentation products, Coal mining, Metal mining, Industrial mineral mining, Coke and gas, Iron and Steel, Nonferrous metals, Petroleum, Inorganic chemicals, Organic chemicals, Metal finishing products, Pulp and paper, Textiles, Leather, Power, Atomic energy, Transportation.
W69-04471

1965 SURVEY ON DISPOSAL OF SEWAGE AND INDUSTRIAL WASTES BY FEDERAL INSTALLATIONS.
Thirty-First Report by the Committee on Government Operations, U S House of Representatives, 89th Congress, Second Session. House Report No. 1644, June 22, 1966.

Descriptors: *Federal government, *Water pollution control, *Cooling water, *Industrial wastes, *Sewage disposal, *Discharge measurement, Sewage, Sewage treatment, Wastes, Waste treatment, Control, Water types, Governments, Measurement.

The findings of this survey are reported by agency and individual facility. Estimates are presented for the daily volume of sewage discharge and the percentage treated. In addition, estimated daily discharges of cooling water are reported in connection with industrial discharges. Scheduled completion dates, by facility, for feasibility studies, engineering and design studies, and construction of facilities are listed.
W69-04507

WATER IN INDUSTRY: A SURVEY OF WATER USE IN INDUSTRY.
National Association of Manufacturers, New York; and Chamber of Commerce of the United States, Washington, D. C.

Report, January, 1965.

Descriptors: *Water utilization, *Industrial water, *Waste water treatment, *Operating costs, *Surveys, Industrial wastes, Water pollution, Pollution abatement, Capital costs, Efficiencies, Water types, Wastes, Waste treatment, Water treatment, Abatement, Costs.

The findings of a survey of industrial water use and waste treatment are reported. Intake water volume and process water treatment costs are estimated for various industries. Operating and capital replacement costs are also estimated for effluent treatment facilities. Sundry other quantitative estimates relating to industrial water use, including salt or brackish water intake for several industries, are given. Separate sections are included for the following industries: automobile industry, sugar beet industry, bituminous coal industry, cane sugar industry, chemical manufacturing, grain beverage distilling industry, investor-owned electric utility industry, industrial laundering, meat industry, petroleum refineries, pulp and paper industry, soap and detergent industry, steel industry, and tanning-leather industry.
W69-04514

ANAEROBIC DIGESTION OF PINEAPPLE MILL WASTES,
Hawaii Univ., Honolulu.
Martin J. K. McMorrow, Reginald H. F. Young, Nathan C. Burbank, Jr., L. Stephen Lau, and Howard W. Klemmer.
Tech Rpt No 27, Jan 1969. 33 p, 16 fig, 2 tab, 28 ref. OWRR Project A-001-HI.

Descriptors: *Industrial effluents, *Waste water treatment, Water pollution control, *Biological treatment.
Identifiers: *Anaerobic digestion, Cannery wastes.

The response of pineapple mill waste to anaerobic biodegradation was studied in the laboratory. A simulated mill waste with an oxygen demand equal to actual mill waste was developed from commercial pineapple juice for this study. Ammonium hydroxide was used both as a pH control and nitrogen supplement. The principal factors under study were the temperature of digestion, mixing, and phosphate supplementation for nutrient balance. The digesters were operated for 60 days. Analytical parameters were COD, sugar, pH, ORP, volatile acids, gas production, gas composition, alkalinity, and total bacterial count. Results show that the pineapple mill waste may be satisfactorily treated anaerobically if it is heated, mixed, and fortified with phosphate. Digesters operated at 90 deg F effected 66% COD reduction with gas production containing 75% CH4. The waste undergoes initial COD reduction with a rapid drop in sugar content and a corresponding rise in volatile acids. After a brief delay to regain equilibrium from this acid production stage a steady stabilization of the waste material occurs.
W69-04527

CONDITIONS FOR BETTER FILTERED WATER,
Degremont Co. (France).
G. Degremont, and R. Leviel.
For the 8 Volume Proceedings, see Vol 2, No 9, Field 06B and W69-03305. Int Conf on Water for Peace, Wash, D C, Vol 6, pp 983-993, 1968. 11 p, 2 tab.

Descriptors: *Filtration, *Filters, Water purification, Odor, Activated carbon, Ozone, Sludge treatment, Sludge, Settling basins, Flocculation, Organic matter.

Aspects of filtration are discussed. A study of the influence of the physical nature of flocculates led to a new method for measuring the physical cohension of flocculated colloidal matter, thereby enabling dosages of flocculation and coagulation reagents to be adjusted accurately. This new measurement method made it possible to study the influence of the filtration parameters: particle-size distribution, velocity, and method of washing. This in turn permits a quick laboratory examination to define the optimum filter characteristics for any given water. Conversely, fast accurate remedial action can be taken when operating difficulties occur. Research made into the behavior of sludges in so-called sludge-bed sedimentation tanks has led to the development of a rapid settling technique that can be readily adapted to existing plants. Studies also are reported on disposal of organic matter, detergents, substances that cause obnoxious tastes and viruses, by absorption agents such as active carbon. Powdered adsorption agents can be used in sludge-bed settling tanks with complete deodorization of the treated water and in 'pre-bed' filters to improve disposal of organic matter and detergents. Oxone is used widely in Europe as a virus-destroying agent. (Vorhis-USGS)
W69-04591

5E. Ultimate Disposal of Wastes

CHARACTERISTICS OF WATER TREATMENT PLANT WASTES,
New York State Dept. of Health, Albany.
For primary bibliographic entry see Field 05B.
W69-04227

SOME BASIC FACTORS IN THE CONSIDERATION AND INSTALLATION OF DEEP WELL DISPOSAL SYSTEMS,
Dow Chemical Co., Midland, Mich.
J. S. Talbot.
Water and Sewage Works, Reference No 1968, pp R213-R219, Nov 29, 1968. 7 p, 9 fig, 4 ref.

Descriptors: *Waste disposal, *Injection wells, Legal aspects, Social aspects, Public rights, Geology, Hydrologic aspects, Water resources, Water pollution, Groundwater movement.
Identifiers: Disposal wells, Public relations.

The basic disposal factors of deep injection well and the hazards of well disposal are discussed with particular attention to prevention of damage to potable groundwater, commercial mineral deposits, and mining activities. Economic, public relations, and legal factors are also major considerations for any waste disposal techniques. Most state and Federal laws either encourage or do not discourage deep well disposal, but the legal aspects of trespass on underground property and damage to property by disposal need legal clarification. Well design and surface equipment for deep well disposal are described. A method for calculating the radius of injection and formation capacity for injection is given. Geological hazards which might cause contamination of potable water are briefly described. (Knapp-USGS)
W69-04228

REATMENT AND DISPOSAL OF RADIOAC-IVE WASTES,
lississippi State Univ., State College. Dept. of anitary Engineering.
dnan Shindala.
/ater and Sewage Works, Reference No 1968, pp 210-R212, Nov 29, 1968. 3 p, 20 ref.

escriptors: *Radioactive waste disposal, *Waste eatment, Evaporation, Concrete mixes, Adsorp-on, Burning, Injection wells, Storage, Dispersion, /aste dilution, Waste storage.
lentifiers: Waste burial, Radioactive waste storage nks, Disposal wells, Radioactive waste decay.

adioactive wastes may be treated and disposed of concentration and storage, dilution and disper-on, and storage for decay. Liquid wastes must be xed in inert solids to prevent contamination of ater. They may be made into concrete, dissolved non-leachable glass, calcined in aluminum trate, adsorbed on clay, and fused into ceramic aze. The most commonly used process is fixation concrete and burial. Ion exchange extraction and /aporation are used for radioactive waste concen-ation for more efficient handling. Deep well injec-on allows very long-term detention while radioac-vity decays. Hydraulic fracturing allows injection to otherwise impermeable rocks such as shale, id cavities may be dissolved in salt beds for waste orage. Several examples of radioactive waste sposal systems now in operation are briefly escribed. (Knapp-USGS)
/69-04229

OLLUTION OF THE INTERSTATE WATERS F THE COLORADO RIVER AND ITS TRIBU-ARIES....
ederal Water Pollution Control Administration, /ashington, D. C.

roc Fed Water Pollut Contr Admin Conf, 6th ess, Denver, Colo, Append A, pp A1-A28, 1967. 8 p, 38 photo.

escriptors: *Radioactive waste disposal, *Mine astes, *Waste dumps, Water pollution sources, ath of pollutants, Leaching, Wind erosion, Public ealth, Colorado River, Colorado River basin.
lentifiers: Radioactive mill tailings piles.

he disposition and control of uranium mill ailings, which are composed largely of sand with ery long-lasting low-level radioactivity, are iscussed. Tailings piles are eroded and dispersed y wind and water and are leached by percolating ater and groundwater. Erosion and leaching hould be controlled to prevent spreading of adioactivity into widespread areas. Suggested ethods of tailings control include covering of iles and use as road construction material. Major ailings piles in the Colorado Plateau area are iscussed in detail and shown by ground and air hotographs. (Knapp-USGS)
/69-04272

CEAN OUTFALL DESIGN FOR ECONOMY F CONSTRUCTION,
ohn D. Parkhurst, Lester A. Haug, and Malcolm . Whitt.
/ater Pollution Control Federation, Journal, Vol 9, No 6, June, 1967, pp 987-993.

escriptors: *Outlet works, *Pacific coast region, Design criteria, *Sewage disposal, Conveyance tructures, Conduits, Construction costs, Capital osts, Engineering structures, Hydraulic structures, tructures, Waste disposal, Costs, Geographical re-ions, Regions, Design.

esign requirements for submarine outfalls for isposal of metropolitan sewage wastes are escribed. Specification data and costs of construc-on are given for five major submarine outfalls on ne Pacific Coast of the United States, with overall engths ranging from 3,650 feet to 22,000 feet, and ith design capacities ranging from 240 mgd to 600 gd.

W69-04313

'WATER DEMAND FOR STEAM ELECTRIC GENERATION',
For primary bibliographic entry see Field 06D.
W69-04461

5F. Water Treatment and Quality Alteration

CHARACTERISTICS OF WATER TREATMENT PLANT WASTES,
New York State Dept. of Health, Albany.
For primary bibliographic entry see Field 05B.
W69-04227

OZONE IN WATER TREATMENT AND WASTEWATER RENOVATION,
Miami Univ., Coral Gables, Fla. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05D.
W69-04230

DRINKING WATER SUPPLIES.

N Y State Sanitary Code Ch V Reg 1, 3, 4, 5 (McKinney 1954).

Descriptors: *New York, *Water sources, *Water treatment, *Environmental sanitation, Legislation, Potable water, Water supply, Administrative regulation, Administrative agencies, Fluoridation, Waterways, Water quality, Public health, Legal aspects.

The State Commissioner of Health must approve the addition of fluorine compounds to any drinking water supply. The owners and operators of public water supplies are held to a standard of due care in the maintenance and supervision of such water supplies. Before any new permanent source of water shall be placed in service, a sample must be examined and reported upon by the State Department of Health. (Childs-Fla)
W69-04394

5G. Water Quality Control

A REVIEW OF CHEMICAL MEASUREMENTS IN WATER POLLUTION CONTROL,
Federal Water Pollution Control Administration, Washington, D. C. Div. of Pollution Surveillance.
For primary bibliographic entry see Field 05A.
W69-04222

FRESH WATER,
Mid-Cheshire Water Board (England).
For primary bibliographic entry see Field 03B.
W69-04225

MARINE, ESTUARIAN, AND RIPARIAN POLLUTION DISASTERS AND THEIR CONSEQUENCES.
National Security Industrial Association, Washington, D. C.

Ocean Science and Technology Advisory Committee, Ocean Resources Subcommittee Meeting, December 12-13, 1967.

Descriptors: *Water pollution, *Disasters, *Water pollution treatment, Water treatment.

This meeting, which covered water pollution disasters, was held in three parts: Part I. Description of disaster and consequences. Part II. Technical capabilities for countermeasure. Part III. Contingency program for prevention and response. Papers with examples and suggestions were given within each category.
W69-04285

THE FUTURE OF AN ESTUARY,
Stanford Univ., Calif.
James C. McCarty, and Howard S. Harris.
In PROCEEDINGS OF THE NATIONAL SYMPOSIUM ON ESTUARINE POLLUTION, August 23-25, 1967, pp 335-369.

Descriptors: *Water quality, *Nitrogen, *Dissolved solids, *Mathematical models, *Water quality control, *California, Southwest U. S., Regions, Control, Quality control, Gases, Pacific coast region, Geographical regions, Water control, Mathematical studies, Model studies, Beneficial use, Streamflow, Channel flow, Flow, Waste treatment, Water treatment.

This paper discusses existing and future water quality in San Francisco Bay and outlines means to cope with pollution's adverse effects on beneficial uses of the Bay water. A mathematical model is employed to predict future water quality in terms of total nitrogen and total dissolved solids. Current nitrogen levels of 2 mg/liter are expected to rise to 7 mg/liter by 1990. Four means of controlling future water quality are defined: (1) control of water at the source, (2) collection and treatment of water, (3) conveyance of wastes, and (4) regulation of streamflow. It is concluded that a major obstacle to the implementation of any control program will be coordinating the diverse interests of the many agencies concerned with water quality in San Francisco Bay.
W69-04290

OIL SPILLAGE STUDY; LITERATURE SEARCH AND CRITICAL EVALUATION FOR SELECTION OF PROMISING TECHNIQUES TO CONTROL AND PREVENT DAMAGE.
Battelle Memorial Institute, Pacific Northwest Laboratories, Richland, Washington.

Report to Department of Transportation, United States Coast Guard, AD-666 289, November 20, 1967.

Descriptors: *Disasters, *Oil, *Water pollution, *Beaches, *Oily water, Water pollution effects, Water pollution treatment, Water treatment, Oceans, Bodies of water, Surface waters, Wildlife, Land reclamation, Aquatic life, Wildlife habitats, Environments, Habitats, Waterfowl, Animals, Birds.

A literature review and evaluation of the state of technology of prevention and control of major oil spillage on water. The restoration of the shore face and waterfowl habitats and the effects of oil pollution and defensive measures on aquatic life are also discussed. Specific areas of study summarized in the report include: technical aspects of tank vessel design as related to prevention of oil spillage, destruction or recovery of open sea oil slicks, protection and cleaning of the shore face and estuaries, and the effects of oil pollution and treatment agents on marine flora and fauna.
W69-04309

POLLUTION AND MARINE ECOLOGY.
Theoldore A. Olson, and Fredrick J. Burgess.
John Wiley and Sons, New York, 1967.

Descriptors: *Ecology, *Water pollution, *Littoral, *Energy transfer, *Human resources, *Environmental effects, Transfer, Resources.

This book contains the published proceedings of the 'Conference on the Status of Knowledge, Critical Research, Needs, and Potential Research Facilities Relating to Ecology and Pollution Problems in the Marine Environment'. Various papers were presented under the following broad topics: Man's Resources in the Marine Environment; Dynamics of the Littoral Marine Community; Ecological Systems; Energy Transfer; Interactions Between the Biota and the Chemical-Physical Environment; and Parameters of Marine Pollution.
W69-04310

THE DEVELOPMENT AND APPLICATION OF A TIME-VARYING DISSOLVED OXYGEN MODEL,
Stanford Univ., Calif.
George D. Pence, Jr., John M. Jeglic, and Robert V. Thomann.
In PROCEEDINGS OF THE NATIONAL SYMPOSIUM ON ESTUARINE POLLUTION, August 23-25, 1967, pp 537-585.

Descriptors: *Dissolved oxygen, *Mathematical models, *Model studies, *Computer models, Mathematical studies.

A one-dimensional time-varying mathematical model for the simulation of dissolved oxygen in an estuary is developed along with a numerical integration procedure for computer solution. Some applications of the model are presented, including a verification of one year of data and several control scheme simulations. Application of the model to variables other than oxygen and other hydraulic regimes is discussed briefly.
W69-04315

POLLUTIONAL EFFECTS OF PULP AND PAPER MILL WASTES IN PUGET SOUND.
Report of Federal Water Pollution Control Administration, Northwest Regional Office, Portland, Oregon, and Washington State Pollution Control Commission, Olympia, Washington, March, 1967.

Descriptors: *Water pollution control, *Costs, *Pulp and paper industry, *Washington, Water pollution, Pollution abatement, Water pollution effects, Pulp wastes, Water pollution treatment, Control, Abatement, Industries, Industrial wastes, Wastes, Geographical regions, Pacific coast region, Pacific northwest U. S., Regions, Water treatment.

The study's conclusions are primarily qualitative rather than quantitative. Specific recommendations are made concerning actions that the mills should be required to undertake to abate pollution, but these recommendations are apparently not based on any quantitative estimates of damage caused to competing uses, nor on estimates of investment outlays which would be required to satisfy the recommendations.
W69-04319

SPILL POLLUTION - ITS EFFECTS AND CONTROL,
National Security Industrial Association, Washington, D. C.
J. M. Rademacher.
In MARINE, ESTUARIAN, AND RIPARIAN POLLUTION DISASTERS AND THEIR CONSEQUENCES, Ocean Resources Subcommittee Meeting, December 12, 1967.

Descriptors: *Disasters, *Water pollution treatment, *Water pollution effects, Fishkill, Wildlife, Water pollution.

The author describes three incidents in which toxic material was accidentally spilled into the water. In all three incidents damage to marine wildlife was disastrous, and the lack of effective combative operations in these three cases pointed toward the need for a 'pollution emergency control program'. Such a program is described.
W69-04322

A REPORT ON POLLUTION OF THE NATION'S WATER BY OIL AND OTHER HAZARDOUS SUBSTANCES.
Report to The Secretary of the Interior and The Secretary of Transportation, 1967.

Descriptors: *Water pollution, *Oil, *Federal Government, *Legislation, *Water pollution control, Harbors, Control.

This report is the result of a special study requested by the President to determine how the resources of the nation could better cope with oil pollution problems and with other pollutants and hazardous substances. The findings include: (1) Identification of the major sources of danger. (2) An assessment of the existing resources, legal authorities, and capabilities to attack this problem. (3) A recommended action program to set forth the administrative and legislative steps needed to deal with the problems of oil and other pollution control.
W69-04326

REPORT ON WATER QUALITY CRITERIA FOR TEXAS.
Federal Water Pollution Control Administration, Southeast Region, Atlanta, Ga.

In CLEAN WATER FOR THE NATION'S ESTUARIES, Transcript of Public Meeting, Biloxi, Mississippi, January 17, 1968, p 6.

Descriptors: *Water quality, *Texas, *Water utilization, *Electric powerplants, Cooling water, Water temperature, Heated water, Engineering structures, Structures, Industrial plants, Temperature, Fish, Water types, Animals, Aquatic animals, Aquatic life, Wildlife, Thermal pollution, Central U. S., Coastal plains, Geographical regions, Gulf coastal plain, Regions, Southwest U. S., Efficiencies, Powerplants, Water pollution, Water properties.

It was pointed out that the proposed water temperature standard ('not more than a 2 C increase in ambient temperature at 100 yards from point of discharge') could result in curtailment of the operation of electric power plants as well as other industrial plants using water for cooling purposes and would seriously restrict the future development of electric power in Texas. It was also stated that there is no evidence that the present use of the waters of Texas for cooling purposes has been harmful in any way to other uses of the water including its use for fish and wildlife and for recreation.
W69-04327

ESTUARINE WATER QUALITY MANAGEMENT IN THE SACRAMENTO-SAN JOAQUIN DELTA,
Stanford Univ., Calif.
Richard L. Rosenberger, and Raymond Walsh.
In PROCEEDINGS OF THE NATIONAL SYMPOSIUM ON ESTUARINE POLLUTION, August 23-25, 1967.

Descriptors: *Legislation, *Water quality control, *California, *Planning, Long-term planning, Economic impact, Salinity, Mathematical models, Bays, Deltas, Southwest U. S., Regions, Pacific coast region, Geographical regions, Control, Quality control, Mathematical studies, Model studies, Water pollution, Chemical properties, Water properties, Bodies of water.

The San Francisco Bay-Delta Water Quality Control Program, which is a three-year study to develop a comprehensive plan for water quality control in the San Francisco Bay-Sacramento-San Joaquin Delta area of California, is summarized in this paper. Vast water development projects which would ultimately result in the complete control of inflow to the Delta and Bay are discussed. The Program's total study area covers nearly 40 percent of the state.
W69-04331

RULES ON VESSEL POLLUTION PROPOSED BY SENATOR MUSKIE.
Traffic World, Vol 132, No 3, October 21, 1967, p 101.

Descriptors: *Water pollution control, *Legislation, *Ships, Navigation, Water pollution sources.

This is a news item describing a bill to regulate discharge of wastes from vessels in United States waters.
W69-04332

SAVING OUR ESTUARIES.
Ocean Industry, Vol 2, No 10, October, 1967, pp 3-4.

Descriptors: *Water pollution control, Water pollution, Control, Water quality control, Quality control.

This article discusses steps being taken by the Federal Water Pollution Control Administration regarding estuaries.
W69-04333

WHAT'S AHEAD IN OIL RECOVERY,
John Scott.
Petroleum Engineer, Vol 39, November, 1967, pp 61-64.

Descriptors: *Oil reservoirs, *Secondary recovery (Oil), *Oil industry, Flooding, Injection, Oil, Methodology, Planning, Industries.

Total oil in-place figures are presented in comparison with a past recovery percentage of 15 percent (1930), a present percentage of 30 percent (1967), and a future recovery percentage of 40 percent (1987). Tables show past, present, and future (1980) figures of primary versus secondary recovery totals. Present and future secondary oil recovery techniques are also examined.
W69-04335

STATEMENT.
Federal Water Pollution Control Administration, Southeast Region, Atlanta, Ga.

In CLEAN WATER FOR THE NATION'S ESTUARIES, Transcript of Public Meeting, Biloxi, Mississippi, January 17, 1968, p 8.

Descriptors: *Mississippi, *Cooling towers, *Water utilization, *Thermal pollution, *Powerplants, Aquatic populations, Aquatic life, Surface waters, Streams, Running waters, Economic justification, Water quality, Standards, Heated water, Electric powerplants, Engineering structures, Industrial plants, Bodies of water, Interstate rivers, Populations, Rivers, Mississippi River, Southeast U. S., Regions, Structures, Water pollution, Water cooling, Cooling, Coastal plains, Geographical regions, Gulf coastal plain, Water types.

The Mississippi Power and Light Company contends that since it has found no change in aquatic life near discharge points of heated effluents, and since the dissipation of such effluents occurs almost immediately upon discharge into cooler waters, the cost of cooling towers is not justifiable. The evaporation of water which would occur at the Vicksburg plant, furthermore, would be in excess of 5.7 million gallons a day. They state that cooling standards ('Temperature shall not be increased more than 10 F above the intake natural prevailing background temperature after reasonable mixing a discharge water with surrounding waters.') which are applied generally in Northern sections of the United States are not realistic for the Vicksburg, Mississippi, powerplant.
W69-04342

REMOTE SENSOR SURVEILLANCE OF WATER QUALITY,
National Security Industrial Association, Washington, D. C.
Carl H. Strandberg.
In MARINE, ESTUARIAN, AND RIPARIAN POLLUTION DISASTERS AND THEIR CONSEQUENCES, Ocean Resources Subcommittee Meeting, December 12, 1967.

Descriptors: *Water resources, *Aerial photography, Remote sensing, Photography, Environmental effects, Water quality control, Resources, Analytical techniques, Data collections, Quality control, Control.

rban centers so dependent on a centralized water pply need the security of an assured supply and ality level. 'Aerial remote sensors open many w avenues of approach for analysis of water ality. Many water quality degrading factors sult in changes in water color, clarity, density, d viscosity. Aquatic population changes occur, d these may also change water color and clarity. erial photographs and imagery obtained using nphotographic sensors can be used to record sig- ficant facts and events.' Using these methods, mprehensive surveillance of water supplies will possible.
69-04343

OLIFORM-FECAL COLIFORM BACTERIA IN IDAL WATERS,
erald A. Strobel.
ournal of the Sanitary Engineering Division, SCE Vol 94, No SA4, August, 1968, pp 641-656.

escriptors: *Coliforms, *Water pollution, *Shellf- h, *Public health, Sanitary engineering, Engineer- g, Environmental engineering, Animals, Aquatic nimals, Bacteria, Microorganisms, Plants, Breed- g, Atlantic coastal plain, Coastal plains, Geo- raphical regions, Regions, Aquatic life.

he fecal coliform-coliform relationship has been xamined for several estuaries on Long Island to valuate proposed fecal coliform standards for ellfish growing waters. The level of fecal oliforms to coliforms was found to vary with ource of pollution, level of treatment provided, haracteristics of the receiving waters, and recipitation on the watershed. The data demon- rated that correlations for relating fecal coliform mits to present coliform standards must take into ccount the particular characteristics of each shell- sh growing area. These correlations should be sed until the level of public health hazard as- ociated with the various standards is better deter- nined and can be used to define new standards ased on the public health significance associated ith their use.
V69-04344

ROTECTION AND RESTORATION OF EACHES DURING AND AFTER OIL SPILLS,
National Security Industrial Association, Washing- on, D. C.
eo Tobias.
n MARINE, ESTUARIAN, AND RIPARIAN OLLUTION DISASTERS AND THEIR CON- EQUENCES, Ocean Resources Subcommittee Meeting, December 12, 1967.

Descriptors: *Oily water, *Beaches, *Disasters, Shore protection, Chemcontrol, Environmental ef- fects, Mechanical control, Water pollution control, Water pollution treatment, Control, Physical con- rol.

Defensive measures taken to combat the 'Torrey Canyon' oil spill were experimental in nature, since knowledge of effective techniques to combat oil spills is lacking. The primary objective of oil spill defensive measures is to contain the oil at sea and prevent, as much as possible, the deposition of oil on the beaches. Four methods are proposed in preventing the spread of oil on beaches: (1) use of a floating boom, (2) underwater bubble system, (3) covering beaches with polyethylene sheets, and (4) construction of a barrier dike. If the beaches should become covered with oil, two restorative techniques are proposed: (1) the chemical method, using detergents to cleanse the oil, and (2) the mechanical method, involving removal of the oil-soaked layer of sand. Although the chemical method is easier, it has been criticized for its harmful effect on the marine life of the area.
W69-04350

UTILIZATION OF THE ESTUARINE ZONE IN GEORGIA--A STATEMENT BY BIOLOGISTS FROM THE DIVISION OF BIOLOGICAL SCIENCES OF THE UNIVERSITY OF GEORGIA.
Federal Water Pollution Control Administration, Southeast Region, Atlanta, Ga.

In CLEAN WATER FOR THE NATION'S ESTUARIES, Proceedings of the Georgia Public Meeting, Jekyll Island, Georgia, February 29, 1968, pp 1-15.

Descriptors: *Georgia, *Water pollution effects, *Water utilization, *Value, Planning, Water quality control, Control, Quality control, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Geographical regions, Regions, Southeast U. S., History, Efficiencies.

The statement discusses effects which various uses will have on the estuarine region. Six aspects are covered in the report: (1) Description of physical and biological aspects of estuaries. (2) Emphasis on unique features of the estuarine complex in Georgia. (3) Historical background of estuarine degradation along the east coast of the United States (New Jersey and Florida). (4) Description of uses and value of salt marsh-estuarine complex in its present form and kinds of uses to which it may be put. (5) Effects of various pollutants on estuaries. (6) Recommendation of plans for zoning of the estuarine region of Georgia to separate incompatible uses as well as pollutants. Waste disposal is the biggest industrial use of Georgia's estuarine zones; sport fishing is the next important use, amounting to $51,000,000 in revenues in 1963; and commercial fishing follows with a value placed at $10,000,000 in 1965. Many of Georgia's estuaries still approximate their natural condition, which is important to research.
W69-04353

STATEMENT,
Federal Water Pollution Control Administration, Southeast Region, Atlanta, Ga.
William J. Verross.
In CLEAN WATERS FOR THE NATION'S ESTURARIES, Proceedings of the Georgia Public Meeting, Jekyll Island, Georgia, February 29, 1968, pp 46-52.

Descriptors: *Water quality, *Legislation, *Water utilization, *Georgia, *Pulp and paper industry, Water pollution conrol, Water pollution, Water pollution sources, Ecology, Industries, Efficiencies, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Geographical regions, Regions, Southeast U. S.

The Georgia Pulp and Paper Association submits the following points for consideration: (1) Georgia's existing law, rules, and standards involving water quality are more than adequate to protect the state's estuaries and coastal waters. (2) There is need for a great deal more research on the ecology of estuaries before additional regulation or legislation is imposed over coastal waters. (3) The Georgia Pulp and Paper Association feels that concurrent multiple use of estuaries is possible, desirable, and practical.
W69-04354

WASTE FROM WATERCRAFT.
Federal Water Pollution Control Administration, Washington, D. C.

Senate Document No. 48, 90th Congress, First Session, August 1967.

Descriptors: *Water pollution, *Ships, *Federal government, *Legislation, *Navigable waters, *Wastes, Governments, Bodies of water, Water pollution control, Control, Water pollution effects, Data collections.

This document, a report on vessel pollution in the navigable waters of the U. S., was submitted by the Secretary of the Interior to the 90th Congress, in compliance with the Clean Water Restoration Act of 1966. The report contains basic data and information on the following: (1) Dimensions, sources, and effects of the watercraft pollution problem. (2) Pollution control mechanisms. (3) Summary of existing laws and regulations (both federal and state) regarding watercraft pollution problem. (4) Ongoing activities on controlling watercraft pollution. Also, a proposed program for the control of pollution from vessels is outlined.
W69-04357

WATER QUALITY AND POLLUTION CONTROL STUDY - JAMES RIVER BASIN.
Federal Water Pollution Control Administration, Middle Atlantic Region, Charlottesville, Va.

CB-SRBP Working Document No. 14, June, 1967.

Descriptors: *Water quality, *Water pollution control, *River basins, *Estimated costs, Chemical properties, Dissolved oxygen, Hydrogen ion concentration, Regions, Costs, Solid wastes, Wastes, Toxicity, Sewage treatment, Waste treatment, Control.

This report covers immediate pollution control needs and estimated costs for providing these needs. The present water-quality conditions and biological study of the upper reaches of the James River and tributaries are summarized. The following basic criteria were used in achieving cost estimates for new facilities: (1) Dissolved oxygen not lower than 4 mg/l in the stream, (2) No appreciable settleable or floating solids, (3) No noticeable coloration or discoloration of receiving streams, (4) Toxic substances to be reduced below the toxicity of streams, (5) No appreciable change in pH of the receiving streams, and (6) Stream flow for design of sewage treatment facilities equal to minimum average seven-day low flow occurring on 10-year frequency.
W69-04359

WATER IMPROVEMENT COMMISSION.
Ala Code tit 22 secs 140 (6)-140 (9) (Supp 1967).

Descriptors: *Alabama, *Administrative agencies, *Water pollution control, *Water quality control, Water resources development, Administration, Water conservation, Water purification, Legislation, Legal aspects, Water pollution treatment, Pollution abatement, Permits, Regulation, Surface waters, Groundwater, Investigations, Programs, Planning, Sewage disposal, Standards, Control.

These statutes create the Water Improvement Commission for the purpose of improving and conserving the ground and surface waters of Alabama. The duty of the Commission is to control pollution in the waters of the state, and it shall have the powers to study and investigate all problems concerning improvement and conservation of such water and prepare programs to handle these problems. The Commission shall establish criteria standards for recognized limits of pollution, issue permits for the discharge of sewage, investigate the discharge of pollution into the waters of the state, and issue any orders necessary to execute the provisions of this chapter. (Sisserson-Fla)
W69-04377

CLARK V LINDSAY LIGHT AND CHEMICAL COMPANY (INJUNCTION FOR POLLUTION ABATEMENT).
341 Ill App 316, 93 NE 2d 441-443 (1950).

Descriptors: *Illinois, *Water pollution, *Industrial wastes, *Riparian rights, Effluents, Water law, Industrial plants, Water pollution sources, Pollutants, Pollution abatement, Downstream, Streams, Waste water (Pollution), Chemicals, Seepage, Sumps, Damages, Legal aspects.
Identifiers: Injunctions.

Defendant light and chemical company drained liquid refuse into a sump on its premises. The sump

had no outlet, it being thought that the earth would absorb the refuse. However, chemicals seeped into a nearby storm sewer which emptied into a stream flowing through petitioner's land. Petitioner sought an injunction to permanently restrain the company from further polluting the stream. While the proceeding was pending, defendant took measures to alleviate the problem. The lower court found that the pollution, although continuing, was inconsequential as compared to the effect on defendant if the junction was granted. The appellate court affirmed, sustaining the lower court's finding that damages, if any, were insignificant and would not support injunctive relief. (Wheeler-Fla)
W69-04382

HOUSEBOATS, SANITATION AND LOCATION.

Mich Comp Laws Ann secs 123.591-123.593 (1967).

Descriptors: *Michigan, *Boats, *Environmental sanitation, *Waste disposal, Local governments, Legislation, Cities, Lakes, Rivers, Canals, Navigable waters, Jurisdiction.
Identifiers: *Houseboats, *Enforcement, *County ordinances, *Violations, Penalties (Civil).

In portions of a county outside the limits of any incorporated city or village, the county board of supervisors may regulate by ordinance the sanitation requirements and location of houseboats on waters of the county within their jurisdiction. The boards shall designate a proper county or township official as an enforcement officer, and any violation of the ordinances shall be punishable as a misdemeanor. (Harris-Fla)
W69-04388

SEWAGE REMOVAL OR PURIFICATION AND CONDEMNATION OF PROPERTY.

N Y Pub Health Law sec 1104 (McKinney 1954).

Descriptors: *New York, *Water purification, *Water works, *Pollution, Legislation, Sewage, Water supply, Cities, Condemnation, Administrative agencies, Regulations, Sewage treatment, United States, Legal aspects.

The Department or the Commissioner of Water Supply, Gas and Electricity of the city of New York or the Board of Water Supply may, in order to protect a water supply from contamination, require construction and maintenance of a sewerage system. The necessary real estate, or interests therein, may be acquired by condemnation. All costs are to be paid by the person, municipality, corporation, state or state institution, park, reservation, or post owning the waterworks benefited. (Childs-Fla)
W69-04390

PUBLIC HEALTH LAW (CLASSIFICATION OF WATERS AND PREVENTION OF POLLUTION).
NY Public Health Law secs 1200, 1201, 1202 (b,c,d,e,f,i,j,l), 1205, 1220, 1221, 1222, 1225, 1250, 1251, 1252, 1260, 1261 (McKinney Supp 1968)

Descriptors: *New York, *Public health, *Water pollution control, *Sewage, Water resources development, Legislation, Water purification, Wild life, Surface waters, Underground streams, Sea water, Tidal waters, Organic wastes, Natural resources, Sewage disposal, Sewage treatment drainage, Conservation, Shellfish, Riparian rights, Industrial wastes.
Identifiers: Public policy, Marine district.

The state of New York has passed extensive legislation dealing with the problem of water pollution and the protection of public health and fish and wildlife. Their purpose is to safeguard the waters of the state from pollution. All waters of the state are included in the act. A water resources commission is set up to classify the waters and determine the standard of purity that should be maintained in each body of water. Water is classified according to its usage, i.e., drinking, bathing, fishing, and then assigned a standard of purity that must be maintained. Hearings by the commission to determine said standards are to be public. Pollution of water beyond the purity standard is made illegal as to both fresh and salt water. Permits must be obtained for the operation of a disposal system. Civil and criminal penalties are established for violation of these provisions and the use of injunctions are expressly authorized. No person other than the state acquires any actionable rights by virtue of the provision and it is in no way designed to create new or enlarge existing rights of riparian owners. (Shevin-Fla)
W69-04392

STATE SANITARY CODE.

N Y Pub Health Ch 5 reg 6, 8, 9, 10 (McKinney App 1954).

Descriptors: *Water supply, *Water treatment, *Water purification, *Sanitary engineering, Regulation, Potable water, Pipelines, Water delivery, Reservoirs, Water pollution treatment, Administrative agencies, Water quality, Public health, Storage, Chlorination, Disinfection, New York, Water supply.
Identifiers: *Emergency water supply.

The State Sanitary Code imposes certain duties and regulations on owners of public water supplies. The first regulation requires the owner to install an appropriate water treatment plant to prevent pollution. The next regulation provides that the local health officer collect samples from the distribution system of each public water supply. He may take additional samples as is deemed necessary to insure adequate sanitary quality. The third regulation prohibits the owner of a public water supply from taking or using water from an emergency source other than the regular or auxiliary sources. Neither shall the owners discontinue chlorination treatment nor make any quality change without first notifying the proper authorities. The regulations finally provide that no basin, pipe, tank, reservoir or other structure through which water is delivered for potable purposes shall be used until it has been disinfected in a manner approved by the State Health Commissioners. However, this provision does not apply to structures which subsequently satisfactorily treat and purify water used. (Stewart-Fla)
W69-04395

SANITARY QUALITY OF WATER IN SWIMMING POOLS AND AT BATHING BEACHES.

N Y State Sanitary Code ch 6 reg 12 (McKinney 1954).

Descriptors: *New York, *Environmental sanitation, *Water quality, *Public health, Legislation, Administrative regulation, Swimming pools, Water analysis, Coliforms, Alkaline water, Standards, Recreation facilities, Pollution, Bacteria, Beaches.

Provision is made for the determination of the sanitary quality of water in artificial swimming pools or bathing beaches through bacteriological examination. The examinations are to be conducted in accordance with the 'Standard Methods of Water Analysis' of the American Health Association. Standards of bacteriological quality, chemical quality and cleanliness that must be maintained in pools or bathing beaches are established. (Childs-Fla)
W69-04396

NAVIGABLE WATERS OF THE STATE.
For primary bibliographic entry see Field 04A.
W69-04397

CONSERVATION LAW.
N Y Conserv Law sec 427, as amended (McKinney Supp 1968).

Descriptors: *New York, *Water resources development, *Planning, *Water quality control, Legislation, Water pollution control, Administration, Regulation, Water conservation, Legal aspects, Administrative agencies, Standards.
Identifiers: Penalties (Criminal).

The Water Resources Commission is directed to perform duties with respect to water pollution control as provided in Article 12 of the Public Health Law. The Commission may also: (1) alter paragraph (c), subdivision 7, sec 1205, of that Law relating to water quality standards; (2) classify or alter existing classifications of the waters of the state; (3) alter the standards of quality established for the waters of the state. The Commission is authorized to adopt and enforce rules governing the use of chemicals in the waters of the state for purposes of controlling aquatic vegetation, fish, and insects; notwithstanding the Public Health Law or Conservation Law. Any violation of such rules shall be a misdemeanor. (F.H. Molica-Fla)
W69-04400

WATER QUALITY MANAGEMENT AND CONTROL.

N Y Conserv Law sec 835 Art 5 secs 5.1, 5.2 (McKinney Supp 1968).

Descriptors: *New York, *Water management, *Water quality, *Administrative agencies, Legislation, Water pollution control, Water pollution effects, Adoption of practices, Water conservation, State jurisdiction, Contracts, Surveys, Public benefits, Water utilization, River basins, Watersheds, Water resources development, Financing, Legal aspects, Investigations.

These sections deal with water quality management and control. Section 5.1 gives the commission power to undertake investigations, studies, and surveys pertaining to existing water quality, effects of projected operations on water quality, and probable future water quality. The commission may erect and maintain projects and facilities and expend funds for these purposes. Section 5.2 provides that the commission shall encourage and coordinate efforts to prevent, reduce, control, and eliminate water pollution and to maintain water quality as required by the comprehensive plan. (Heckerling-Fla)
W69-04404

COUNTY SEWERAGE AUTHORITIES.
N J Stat Ann secs 40:36A-1 to 40:36A-2, 40:36A-19, 40:36A-21 to 40:36A-23.2, 40:36A-26, 40:36A-33 to 40:36A-37 (1967).

Descriptors: *New Jersey, *Legislation, *Sewage, *Sewage districts, Sewage treatment, Domestic wastes, Industrial wastes, Municipal wastes, Pumping plants, Water pollution, Water pollution sources, Water pollution effects, Sanitary engineering, Drainage systems, Water quality, Cities, Disposal, Rivers, Administration, Local government, Public health, Safety, Condemnation, Construction, Filters, Legal aspects.

This statute authorizes the establishment of a sewerage district and district authority, and grants certain powers to the district once established. Any county wherein is located a river subject to unsafe pollution from more than one city may establish a sewerage district for the purpose of protecting such river from pollution. Where a sewerage district is established, a district authority shall be created with 7 members serving staggered terms. An authority shall be a body politic and corporate with perpetual succession as a governmental instrumentality for the purpose of protecting the public health and welfare. It shall possess the power to: (1) sue and be sued; (2) adopt a corporate seal; (3) contract debts and issue bonds; (4) acquire and

spose of property; (5) make and perform con-
acts; and (6) do all other acts necessary to pro-
le the best plan for abating pollution in any river.
o competitive district for similar purposes shall be
tablished by the county or state impairing the
hts of bond holders under this act. An authority
ay contract with adjacent authorities to initiate
nt action aimed at pollution abatement wherever
ch a joint plan is necessary. Pollutants may not be
rectly discharged into waters in any district, and
y district may enforce this prohibition by neces-
ry legal action. The State Board of Health shall
prove any construction plans authorized by this
t. An authority shall have full power to acquire
nd if necessary to effect the purposes of this act.
ch acquisition may be by purchase or through
ndemnation proceedings. (Helwig-Fla)
69-04415

EALTH AND VITAL STATISTICS: COUNTY OARD OF HEALTH.
J Stat Ann secs 26:11-10 (i) (1964).

escriptors: *Legislation, *New Jersey, *Super-
sory control, *Landfills, Sewerage sludge treat-
ent, Waste dumps, Marshes, Stagnant water,
egulation, Control, Public health, Sanitation, Ad-
inistrative agencies, Sewers.

his statute authorizes the county board of health
regulate, control and prohibit the cleaning of
wers, dumping of garbage and the filling of sun-
en lots. It also empowers the board to provide for
e filling of sunken lots which have become
epositories of stagnant water in the built up por-
ons of the county. (Stewart-Fla)
/69-04420

UISANCES AFFECTING HEALTH.
J Stat Ann secs 26: 3B-1 to 26: 3B-17 (1964).

escriptors: *New Jersey, *Water pollution con-
ol, *Public health, *Mosquitoes, Legislation,
/ater supply, Water pollution, Waste disposal,
otable water, Wastes, Bodies of water, Oceans,
ities, Effluents, Treatment facilities, Legal
spects.

he maintenance of a water supply used for drink-
ng or culinary purposes which is polluted or im-
ure is prohibited. No person may maintain any
eans of disposal of human excrement which gains
ccess to any public or private water supply. The
eposit of human excrement in any water supply is
rohibited. The deposit of waste matter causing
ollution of the ocean or other body of water is
rohibited. The maintenance of pools, cisterns,
itches, or streams in which mosquitoes breed is
rohibited. Effluents from sewage or industrial
aste treatment plants are not contemplated as
eing within the activities prohibited by the act.
he procedures to be followed in the enforcement
f this act are provided. Annotations are included.
Childs-Fla)
W69-04424

ECLARATION AND ABATEMENT OF UISANCES.
N J Stat Ann secs 26:3-45 to 26:3-63 (1964).

Descriptors: *New Jersey, *Public health, *Inspec-
ion, *Permits, Legislation, Administrative agen-
ies, Administrative regulation, Mosquitoes, Local
overnments, Legal aspects, Docks, Piers.
dentifiers: Nuisances, Vessels.

The local board of health may pass, alter, or amend
ordinances and make rules and regulations to
declare and define what shall constitute a nuisance
n or upon lots, streets, docks, wharves, vessels and
piers, and all public or private places within its ju-
risdiction. Procedures are provided for the abate-
ment of such nuisances when declared. (Childs-
Fla)
W69-04425

LOCAL BOARDS OF HEALTH - GENERAL POWERS AND DUTIES.

N J Stat Ann secs 26:3-31 (1963).

Descriptors: *New Jersey, *Water pollution control, *Water supply, *Public health, Legislation, Administrative agencies, Administrative regulation, Water pollution, Cities, Permits, Ice, Sewers, Plumbing, Legal aspects, Operation and maintenance, Local governments, State governments, Construction.

The local board of health is empowered to pass, alter, or amend ordinances and to regulate for the following purposes: (a) to protect the public water supply; (b) to prohibit cutting or sale of ice detrimental to the public health; (c) to license and regulate the sanitary conditions of public eating houses; (d) to compel property owners to connect with any sewer passing such property; (e) to regulate the practice of plumbing; (f) to regulate and prohibit the accumulation of offal and any decaying or vegetable substances; (g) to regulate the location, construction, and operation of any place used to receive or store human excrement; (h) to regulate the cleaning of any sewer, dumping of garbage, and filling of any marsh land; and, (i) to license and regulate the business of cleaning cesspools and privies. (Childs-Fla)
W69-04428

PROTECTING THE POTOMAC AT WASHINGTON,
David V. Auld.
Water Pollution Control Federation, Journal, Vol 37, No 3, March, 1965, pp 275-288.

Descriptors: *District of Columbia, *Sewers, *Flow separation, *Capital costs, *Pollution abatement, Water pollution control, Construction costs, Conduits, Conveyance structures, Detached dwellings, Growth rates, Rates, Population, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Geographical regions, Regions, Southeast U. S., Abatement, Northeast U. S., Engineering structures, Hydraulic structures, Structures, Costs, Cities.

The author describes a pollution abatement program and investments in the Washington, D. C., metropolitan area. Brief capital cost estimates of alternative plans considered by the Washington Metropolitan Council of Governments are presented. The population growth in the Washington, D. C., metropolitan area is projected through the year 2000. Capital-cost outlays for storm and sanitary sewer separation projects for small segments of the metropolitan area are tabulated. These costs are reported to have averaged about $1,500 per house for detached dwellings when contracts for separation have involved groups of 30 to 75 houses.
W69-04437

'WASTE DISPOSAL AND WATER SUPPLY',
Interstate Commission on the Potomac River Basin, Washington, D. C.
David V. Auld.
In PROBLEMS OF THE POTOMAC ESTUARY, January, 1964, pp 13-18.

Descriptors: *Waste disposal, *Water pollution control, *Biochemical oxygen demand, *Flow augmentation, *District of Columbia, Water supply, Supply, Virginia, Maryland, Forecasting, Population, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Geographical regions, Dams, Engineering structures, Hydraulic structures, Northeast U. S., Regions, Southeast U. S., Oxygen demand, Cities, Human population, Control, Flow control, Regulation, Structures.

The use of the Potomac Estuary for domestic waste assimilation is examined. Reductions in biochemical oxygen demand from the installation of secondary treatment facilities in the Washington, D. C., area are discussed. Estimates of BOD loading in 1950 and in the current year are given. A system of dams for flow augmentation is advocated to offset effects of population growth in the Washington, D. C., area.
W69-04438

A NOTE ON THE ASYMMETRY BETWEEN FEES AND PAYMENTS,
David F. Bramhall, and Edwin S. Mills.
Water Resources Research, Vol 2, No 3, 1966, pp 615-616.

Descriptors: *Water pollution control, *Industrial pollution, *Effluent, *Assessments, Control.

The authors review schemes for controlling industrial pollution by systems of effluent charges as opposed to systems of subsidies, with respect to short-run economic effects. They caution that the conclusions reviewed are incomplete because they deal with short-run effects only, and that there is an important asymmetry in long-run economic effects due to differences in amount of entry and exit in the long-run, depending on whether a fee or charge method is selected for use.
W69-04446

WATER QUALITY, A PROBLEM FOR THE ECONOMIST,
S. V. Ciriacy-Wantrup.
Journal of Farm Economics, Vol 43, No 5, December, 1961.

Descriptors: *Water quality, *Standards, *Social values, *Administration, Water pollution control, Control, Value, Cost-benefit analysis.

A general discussion of the incidence of social costs and benefits in water quality management is presented. Political and economic factors pertinent to formulation of policy objectives in water quality management are considered. Arguments are presented for a minimum quality standard for receiving waters, based on the quality required to support fish life.
W69-04457

EFFECT OF WATER TEMPERATURE ON STREAM REAERATION,
H. L. Elmore, and W. F. West.
Journal of the Sanitary Engineering Division, Vol 87, No SA6, November, 1961, pp 59-71.

Descriptors: *Reaeration, *Water temperature, *Bibliographies, *Turbulence, Temperature.

A search of the literature indicated that the effect of water temperature on stream reaeration rates had not been definitively established. A series of carefully controlled experiments reported by the authors established that the temperature coefficient and reaeration coefficient remained substantially constant over a wide range of turbulence conditions and throughout the temperature range found in natural streams.
W69-04468

GENERAL WATER QUALITY CRITERIA AND SPECIFIC WATER QUALITY STANDARDS.
Maryland Water Resources Commission, Annapolis; and Department of Water Resources, Annapolis, Md.

Water Resources Regulation 4.8, May 22, 1967.

Descriptors: *Standards, *Water quality, *Water pollution, *Maryland, *Water law, *Water supply, *Shellfish, Control, Legal aspects, Appalachian Mountain Range, Atlantic coastal plain, Coastal plains, Supply, Fish harvesting, Fish, Wildlife, Geographical regions, Regions, Northeast U. S., Animals, Aquatic animals, Aquatic life, Recreation.

Pollution and types of pollution are defined in this law. Specific waters in Maryland and standards to be exacted from these waters are listed in detail. The following water-use categories are indicated: (1) shellfish harvesting, (2) public or municipal water supply, (3) water contact recreation, (4) propagation of fish, other aquatic life and wildlife, (5) agricultural water supply, (6) industrial water supply.
W69-04470

ESTUARINE DISTRIBUTION OF NONCONSERVATIVE SUBSTANCES,
J. D. O'Connor.
Journal of the Sanitary Engineering Division, (ASCE), Vol 91, No SA1, February, 1965, pp 23-42.

Descriptors: *Mathematical models, *Waste assimilative capacity, *Water quality, *Delaware River, Rivers, Mathematical studies, Model studies, Bodies of water, Interstate rivers, Running water, Streams, Surface waters.

The application of various mathematical methods to the determination of water quality and pollution conditions in estuaries is demonstrated. Many of the estuaries of the eastern coast of the United States are characterized by uniformity over the vertical and lateral planes. This condition, reducing the basic equations to a one-dimensional problem, is analized for three common coordinate systems that describe the geometry of the various estuaries. Various types of spatial and temporal inputs are considered. The final equations are used to define the longitudinal distribution of various nonconservative substances in the estuaries of the Delaware, the East, and the James Rivers. Data from both model tests and field surveys are provided for comparison with the predicted profiles.
W69-04489

POLLUTION OF THE HUDSON RIVER AND ITS TRIBUTARIES.
Report, US Department of Health, Education, and Welfare, Public Health Service, Division of Water Supply and Pollution Control, September, 1965.

Descriptors: *Hudson river, *Recreation, *Water pollution, *Ships, Beaches, Parks, Bodies of water, Rivers, Running water, Streams, Surface waters.

This report contains some information related to the Hudson Estuary, although it is difficult to separate the information on the River from that relating strictly to the Estuary. Information on recreation and shipping in the estuary is provided, including a list of public beaches and waterfront parks.
W69-04490

BIBLIOGRAPHY ON AIR AND WATER POLLUTION,
Marie S. Richardson.
Special Libraries, July-August, 1966, pp 385-390.

Descriptors: *Water pollution, *Bibliographies, *Air pollution.

This bibliography includes literature references as well as originating sources of information on air and water pollution.
W69-04496

WATER QUALITY IMPROVEMENT PROGRAMMING PROBLEMS,
Matthew J. Sobel.
Water Resources Research, Vol 1, No 3, 1965, pp 477-487.

Descriptors: *Mathematical models, *Water quality control, *Cost-benefit ratio, *Water treatment, Systems analysis, Model studies, Mathematical studies, Control, Quality control, Regional analysis, Costs.

In recent years, the rate of investment in facilities for water-quality control has increased, and the need to program water-resources use on a regional basis has been recognized. This paper outlines the nature of regional water-quality systems and presents programming models for several water-quality improvement problems. A linear programming formulation of a static improvement in quality is contrasted with a traditional policy for programming improvements; the traditional policy results in a mixed-integer problem. The maximization of the ratio of benefits to costs of an improvement program is transformed to a linear programming problem. A stochastic natural environment leads to other programming models. The application of least-cost models is also discussed.
W69-04502

RECREATION BENEFITS FROM WATER POLLUTION CONTROL,
Joe B. Stevens.
Water Resources Research, Vol 2, No 2, 1966, pp 167-182.

Descriptors: *Benefits, *Recreation, *Sport fishing, *Water pollution control, *Estimating, Recreation demand, Elasticity of demand, Control, Demand, Toxicity, Thermal pollution, Water pollution, Dissolved oxygen, Water pollution effects, Model studies, Fishing, Water sports.

A methodology for estimating direct recreational benefits from water pollution control was developed through a model of biological and behavioral relationships involved in sports angling. A biological production function was envisaged between inputs of angling effort and the output, or yield, of fish taken. The marginal product, angling success per unit of effort, was taken to represent the 'quality' of the recreational experience. Water pollution would cause deteriorations in dissolved oxygen, temperature, or toxicity characteristics of the water, thus shifting the production function downward and causing reductions in angling success, angling effort, and recreational value of the fishery. Demand equations and 'success-effort' elasticities were estimated for three estuarial sports fisheries, and the methodology was illustrated by means of an assumed reduction in angling success. The direct recreational benefits were identified as the consumer surplus that would result from the prevention of water pollution.
W69-04504

RECENT RESULTS FROM A MATHEMATICAL MODEL OF WATER POLLUTION CONTROL IN THE DELAWARE ESTUARY,
R. V. Thomann.
Water Resources Research, Vol 1, No 3, 1965, pp 349-359.

Descriptors: *Mathematical models, *Water pollution control, *Systems analysis, *Delaware, *Dissolved oxygen, Mathematical studies, Model studies, Reaeration, Computers, Costs, Control, Atlantic coastal plain, Coastal plains, Geographical regions, Northeast U. S., Regions.

The basic concepts of systems analysis and optimum (least-cost) water pollution control are presented. The equations utilized to describe the time and space variability of dissolved oxygen are presented in a systems analysis context, and their usefulness in this form is discussed. The application of the mathematical model to the control of dissolved oxygen in the Delaware Estuary is given. Recent computer solutions are illustrated, and the sensitivity of the least-cost dissolved-oxygen improvement solutions to the rate of atmosphere reaeration is presented.
W69-04509

WATER POLLUTION CONTROL FACTS.
Report, Federal Water Pollution Control Federation, Washington, D. C., 1965.

Descriptors: *Water pollution control, *Statistics, *Municipal wastes, *Sewers, *Estimated costs, Waste water treatment, Sewage treatment, Industrial wastes, Data collections, Wastes, Conduits, Conveyance structures, Engineering structures, Hydraulic structures, Control, Waste treatment, Planning, Costs, Construction.

This report discusses various pertinent statistical data regarding pollution control requirements and costs, drawn from various publicly available publications. The content is indicated by the following table headings: New Sewer and Water Construction Put in Place in the United States, 1963, 1964, and Outlook for 1965; Construction Needs for Sewerage Utilities, Public and Private, 1962-70; Estimated Costs for Complete Separation of Stormwater and Sanitary Sewers; Estimated Costs for Partial Separation of Stormwater and Sanitary Sewers; Summary of the Backlog of Municipal Wastewater Treatment Needs, 1964; Present Municipal Wastewater Treatment Needs; Required Annual Construction Rates, Municipal Wastewater Treatment Works; Increase in Organic Industrial Wastes (Industrial); 1959 Operating and Replacement Costs for Industry Wastewater Treatment Facilities; Industrial Plants Providing No Treatment in 1959; Treatment Processes Most Frequently Mentioned by 2,162 Respondents; Water Plans; and 1959 Capital Expenditures for Construction of Wastewater Collection and Treatment Systems by Percent and Dollar Distribution.
W69-04515

WATER QUALITY CRITERIA--STREAM VERSUS EFFLUENT STANDARDS.
Water Pollution Control Federation, Journal, Vol 37, No 3, March, 1965, pp 292-315.

Descriptors: *Water quality, *Standards, *Quality control, *Streams, Effluents, Control, Bodies of water, Running waters.

A series of papers giving their authors' views relating to the subject. The papers and authors are as follows: 'Industry Views', by Harold L. Jacobs; 'Conservation View', by Ira N. Gabrielson; 'An Index-Number System for Rating Water Quality', by Robert K. Horton; 'Some Thoughts About Effluent Standards', by Walter A. Lyon; 'Stream Standards', by Earle C. Hubbard; and 'Water Quality Criteria Development', by Gordon E. McCallum.
W69-04516

LINDANE ADSORPTION BY LAKE SEDIMENTS,
Wisconsin Univ., Madison. Dept. of Soil Science.
Erik G. Lotse, Donald A. Graetz, Gordon Chesters, Gerhard B. Lee, and Leo W. Newland.
Environ Sci Technol, Vol 2, No 5, pp 353-357, May 1968. 4 fig, 2 tab, 12 ref.

Descriptors: *Adsorption, *Insecticides, *Sediments, *Lakes, Analytical techniques, Carbon isotopes, Chlorinated hydrocarbon pesticides, Correlation analysis, Digital computers, Halogenated pesticides, Hydrogen bonding, Insecticides, Pesticide kinetics, Pesticide residues, Pesticides, Radiochemical analysis, Regression analysis, Statistical methods, Water pollution effects, Water pollution sources, Water quality, Wisconsin.
Identifiers: *Lindane, Freundlich equation, Langmuir equation, Van der Waal's forces, Vilas County (Wis), Oneida County (Wis), Multiple correlation analysis.

Authors investigated the sorptive properties of eight lacustrine sediments for lindane (gamma-benzene hexachloride) by equilibrating aqueously the dissolved insecticide, uniformly labelled with radiocarbon, with sediments for 24 hours at 23 deg C, then determining residual aqueous-phase radioactivity with scintillation spectrometer. Diverse compositional characteristics of oven-dried sediments comprised the following percentage ranges: sand (greater than 50 microns diame-

, 1.6-87.5%; silt (2-50 microns), 5.1-27.5%; l clay (smaller than 2 microns), 4.0-36.4%; or- ic matter, 3.0-64.2%. Lindane adsorption (y) ld be defined by the following regression equa-, which accounts for 84% of its variation: y = 53 + 0.093L - 0.013S + 0.034R + 0.0034M + 058C, where L = lindane concentration; S = iment concentration; R = ratio, lindane:sedi- nt (micrograms/milligram); M = organic matter; C = clay content. Insecticidal adsorptions fit undlich equation, R = (k) (c-to-power-n), ere c = equilibrium concentration of lindane, where constant k = 0.295, 0.302, 0.331, 0.331, 39, 0.437 and n = 0.92, 0.89, 0.92, 0.86, 0.75, 6 when R = 0.1, 0.2, 0.5, 1.0, 2.0, 5.0. Probably ause of its low solubility lindane adsorption did fit the Langmuir equation. Because lindane is tral and does not ionize, van der Waal's forces hydrogen bonding constitute most feasible ad- otive mechanisms. (Eichhorn-Wis)
9-04525

NAGING WATER QUALITY: ECONOMICS, CHNOLOGY, INSTITUTIONS,
ources for the Future, Inc., Washington, D. C.
en V. Kneese, and Blair T. Bower.
timore, Maryland, The Johns Hopkins Press, 8. 328 p, 46 fig, 16 tab.

scriptors: *Water resources development, *Ad- istration, *Water quality control, *Planning, ater management (Applied), Watershed nagement, Governments, Institutions, Indus- s, Economics, Impaired water quality, Cost lysis, Multiple-purpose projects, Systems analy-

ntifiers: Water quality planning, Water quality nagement.

ter quality is discussed in terms of the causes of raded quality and the means of preventing and recting poor conditions by the use of proper er management, resource planning, and public icy. The economic theaory of resources alloca- is illustrated by a number of case studies of ac- l situations. Quality standards are discussed in ognition of the difficulty of assigning economic ts and value to esthetic and other intangible en- nmental and human emotional values. Regional ter quality management is treated by considering nomies of scale in both water control and ef- nt treatment. In some cases, individual industri- reatment may be uneconomical, and co-opera- or governmental regional collection and treat- nt of discharges in central plants is possible. The errelation of all elements of the hydrologic cycle uality control is stressed. (Knapp-USGS)
9-04578

TIMUM DREDGING AND DISPOSAL PRAC- ES IN ESTUARIES,
rps of Engineers, Philadelphia, Pa. Operations .

r primary bibliographic entry see Field 02L.
9-04581

OOD AND POLLUTION CONTROL: A DEEP NNEL PLAN FOR THE CHICAGOLAND EA.
tropolitan Sanitary District of Greater Chicago,

r primary bibliographic entry see Field 04A.
9-04630

HICAGO TUNNEL DRAINAGE PROJECT: ELIMINARY EVALUATION OF FEASIBILI-
tropolitan Sanitary District of Greater Chicago,

r primary bibliographic entry see Field 04A.
9-04631

LOCATION AND REALLOCATION OF ATER RESOURCES,
nerican Water Works Association, New York.

Elmo R. Morgan.
Am Water Works Ass'n J, Vol 61, No 1, pp 17-19, Jan 1969. 3 p.

Descriptors: *Water quality control, *Reservoir storage, *Water policy, *Water pollution control, Reservoirs, Storage, Multiple-purpose reservoirs, Multiple-purpose projects, Water supply, Water pollution, Water pollution control, Regulated flow, Flow control, Streamflow, Water projects.

Allocation of storage space and water in federal reservoir projects for water quality control is under study. The Department of Interior is charged with administering section 3 (b) of the Federal Water Pollution Control Act dealing with reservoir storage for quality control and streamflow regulation. The Bureau of the Budget and the Water Resources Council are formulating a national policy of water quality control, including the application of section 3 (b). Section 3 (b) must be administered in light of the national attitude toward water quality and pollution expressed in legislation, executive orders, and new state water standards. Water quality goals can be obtained through pollution control coupled with maintaining quality standards at source, including use of reservoir storage under section 3 (b). Legal power and legal mechanisms are necessary to insure effective and prudent operation of the reservoir projects. Water quality control is not a beneficial use in some states, and studies considering possible changes in the law of these states should be made. A reasonable period of time must be allowed to assess project benefits and costs. There would be a 50-50 cost sharing between the local sponsor and the government, and alternative methods should be given equal financial status. (Helwig-Fla)
W69-04647

THROWING GAS TAR OR REFUSE INTO PUBLIC WATERS AND WILLFULLY POISONING FOOD.
N Y Penal Law secs 1759, 1760 (McKinney 1968).

Descriptors: *New York, *Water pollution, *Poisons, Legislation, Public rights, State governments, Wastes, Pollutants, Toxins, Water pollution control, Sewers, Streams, Reservoirs, Wells, Springs, Legal aspects.
Identifiers: Penalties (Criminal).

Anyone who throws or deposits gas, tar, refuse or any other noxious, offensive or poisonous substance into any public waters, or any sewer or stream running into any public waters, or any sewer or stream running into such public waters, is guilty of a misdemeanor. Anyone who willfully poisons any spring, well or reservoir of water is punishable by imprisonment up to ten years in a state prison, or up to one year in a county jail, or by a fine not exceeding five hundred dollars, or both such fine and imprisonment. (Scott-Fla)
W69-04659

DEPARTMENT OF HEALTH V PASSAIC VALLEY SEWERAGE COMMISSION (DEPARTMENT OF HEALTH'S AUTHORITY OF DISCHARGE OF SEWERAGE).

100 N J Super 540, 212 A 2d 675-684 (1968).

Descriptors: *New Jersey, *Judicial decisions, *Sewage, *Water pollution control, Water pollution, Water pollution treatment, Water quality control, Water treatment, Wastes, Public health, Legislation, Municipal wastes, Disposal, Sewage effluents, Waste water disposal, State jurisdiction, Legal aspects.
Identifiers: Injunctions (Prohibitory).

Plaintiff ordered defendant to improve its sewage treatment facilities so that its effluent, pumped through an outfall line into Upper New York Bay, would be less harmful to New Jersey waters. Plaintiff then sued for summary injunctive relief. The defendant contended that plaintiff had no jurisdiction over it or its treatment and pumping plant. Plaintiff asserted that it had jurisdiction under several New Jersey statutes. The court discussed these statutes and applicable federal legislation on water pollution. The court directed defendant to comply with plaintiff's directive which required that defendant cease the discharge of improperly and insufficiently treated sewage. The court concluded that it was for plaintiff to determine what action should be taken under the exigencies of the situation. (Heckerling-Fla)
W69-04664

TOWN OF PALM BEACH SHORES V COLONNADES, INC (OCEAN POLLUTION).

216 So 2d 78-80 (4th DCA Fla 1968).

Descriptors: *Florida, *Water pollution, *Swimming pools, *Atlantic Ocean, Judicial decisions, Legal aspects, Cities, Pollution abatement, Domestic wastes, Discharge lines, Pollutants, Seepage.
Identifiers: Injunctions (Temporary), Injunctions (Prohibitory), Standing, Injunctions (Mandatory).

Defendant hotel operator maintained a swimming pool having a discharge line used to drain the pool water in the Atlantic Ocean. A break in the line at the point where it entered the ocean emitted seepage which, when sampled, indicated contamination by human or animal waste. Defendant corrected this condition by sealing off a lateral line which carried septic waste into the discharge line and, in the process of repair, sealed the break in the line, thus preventing plaintiff from conducting additional tests. Plaintiff sought to temporarily enjoin defendant from discharging the pollutants into the ocean. The court held that, although it need not be shown by clear, certain, and convincing evidence that irreparable injury will result in order for the injunction to issue, plaintiff had failed to prove that the contamination continued after the repairs were made. The plaintiff had no standing to bring the suit since the Florida Statutes give exclusive authority to seek such an injunction to the State Board of Health. (Molica-Fla)
W69-04668

BOROUGH OF WESTVILLE V WHITNEY HOME BUILDERS (SEWAGE EFFLUENTS FLOWING INTO CITY RECREATION AREA LAKE).

40 N J Super 62, 122 A 2d 233-245 (Super Ct App Div 1956).

Descriptors: *New Jersey, *Riparian rights, *Reasonable use, *Sewage disposal, Natural flow doctrine, competing uses, Water pollution, Recreation, Judicial decisions, Sewage effluents, Sewage, Sewage bacteria, E coli, Sewage treatment, Waste water disposal, Sludge disposal, Social needs, Community development, Surface waters, Ponds, Streams, Administrative agencies, Legal aspects.

Plaintiff municipality asked the court to enjoin the operation of a sewage disposal plant on the border outside of the municipality. The defendant secured the approval of the town in which the plant was located to build the plant, which was to serve 300 houses. The liquid effluent discharged by the plant flowed into a small natural stream which emptied into a pond situated in plaintiff's principal park. The plaintiff contends that it has a right to have the pond remain uncontaminated and unpolluted by the discharge of effluent and that the discharge creates a public nuisance and is productive of a hazard to the public health. The court alluded to the reasonable use doctrine under which there must be fair participation in common waters of those who have a right of property therein on the basis of what all the attendant circumstances shows to be reasonable. Finding the evidence of pollution inconclusive, the court held that the balance of uses and harms reflected by the evidence did not necessitate the issuance of an injunction. The court also inferred that mere approval by a state adminis-

trative agency would not preclude judicial relief to a riparian owner where the facts and circumstances indicate that such relief should be granted; as in this case. (Heckerling-Fla)
W69-04677

RANDALL V CLIFFORD (POLLUTION AND DESTRUCTION OF WATER SUPPLY).
122 A 2d 833-840 (Vt 1956).

Descriptors: *Vermont, *Springs, *Water pollution, *Drainage systems, Drainage practices, Ditches, Surface runoff, Runoff, Diseases, Soil contamination effects, Reasonable use, Streams, Legal aspects, Damages, Domestic water.
Identifiers: Easements by reservation, Statute of frauds, Standing.

Plaintiff conveyed a portion of his land upon which were located 2 springs supplying water for domestic use. The deed reserved to the plaintiff the right to build water lines across the property, if necessary, but did not reserve title to or rights to use of the springs. Plaintiff continued openly to use the springs. Defendant purchased the land from plaintiff's grantee, and defendant knew of and acquiesced in plaintiff's use of the springs. Defendant built a drainage ditch which caused destruction of the springs and damage to plaintiff's dooryard. Defendant also negligently disposed of a dead heifer in a manner which caused pollution of plaintiff's water supply and resulted in illness. The court held that, in order to have standing to sue for damage to the spring, Plaintiff had the burden of affirmatively demonstrating his retention of title. The deed did not reserve title, and he could not introduce parol evidence to show the parties subjectively intended that he retain title. This would vary the terms of the written instrument, contrary to the statute of frauds. Plaintiff could recover for damage to his dooryard. Since defendant knew the dead heifer would pollute plaintiff's water supply, the act was fundamentally tortious. (Helwig-Fla)
W69-04678

BURR V ADAM EIDEMILLER, INC (SUBSURFACE POLLUTION OF WATER SUPPLY).

386 Pa 416, 126 A 2d 403-408 (Pa 1956).

Descriptors: *Pennsylvania, *Subsurface drainage, *Subsurface runoff, *Water pollution, Damages, Runoff, Leaching, Springs, Acidity, Drainage water, Corrosion, Water pollution effects, Reasonable use, Natural use, Legal aspects, Domestic water.
Identifiers: Non-trespassory invasion.

Plaintiff brought suit for damages from subsurface contamination of water supply. A spring was the prime source of water for a residential area, rental cottages, and an artificial lake. Defendant had a temporary road construction site adjacent to plaintiff's property where he leached slag by spraying large amounts of water over it. The runoff entered the water supply from the spring causing an acid condition; this resulted in damage to plumbing and contamination of the lake. Plaintiff informed defendant of the contamination, but this resulted in no appreciable reduction in activities. The court ruled that in a non-trespassory invasion action, if the invasion is intentional, the conduct need only be unreasonable; not negligent or reckless. Since defendant knew of the contamination and failed to cease, his actions must be classed as 'intentional.' Upon the facts the jury would find his conduct unreasonable. The court also found that since the area was residential, defendant's activity was unnatural use of the land; this 'unnatural' use had bearing on the reasonableness of defendant's conduct (Helwig-Fla)
W69-04681

DEPARTMENT OF WATER AND AIR RESOURCES: ORGANIZATION AND POWERS GENERALLY; CONTROL OF POLLUTION.

N C Gen Stat secs 143-211, 212, 214.1, 215.1 to 215.3, 215.5 to 215.8 (1967 Supp).

Descriptors: *North Carolina, *Permits, *Water conservation, *Standards, Legislation, Administrative agencies, Classification, Water pollution, Water quality, Water quality control, Administration, Watersheds (Basins), Bodies of water, Pollution abatement, Adjudication procedure, Legal aspects, Regulation.

Water quality control and conservation is declared to be of the highest priority. The Department of Water and Air Resources is created. The Board of Water and Air Resources is directed to develop, adopt and assign classifications to all waters of the state, and to develop standards applicable thereto. Criteria for classifications and standards are set out. The character of the water and the surrounding land and the nature of past, present, and future uses are to be taken into account when assigning classifications. Notice and hearing procedures are set out. Board permits are required for any new potential sources of water pollution. Procedures for issuing and revoking such permits are set out. No person shall discharge any pollutants into the waters of the state, and the Board may issue special orders requiring pollution abatement. Requirements for voluntary projects are listed. The Board may modify and revoke regulations, investigate infractions, and hold public hearings. Judicial review of Board determinations is provided for, and penalties for violations of the act are established. The act does not cover public water supplies and sanitary disposal of sewage. (Williams-Fla)
W69-04687

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

A DISSIPATIVE RIVER FLOW MODEL,
Pittsburgh Univ., Pa. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02A.
W69-04232

A PROBABILISTIC ANALYSIS OF DISSOLVED OXYGEN-BIOCHEMICAL OXYGEN DEMAND RELATIONSHIP IN STREAMS,
Illinois State Water Survey, Peoria; and Illinois Univ., Urbana. Water Resources Center.
For primary bibliographic entry see Field 05C.
W69-04247

USE OF HYDRAULIC AND MATHEMATICAL MODELS FOR DETERMINING EFFLUENT DIFFUSION IN SOUTH SAN FRANCISCO BAY,
Stanford Univ., Calif.
For primary bibliographic entry see Field 05B.
W69-04277

A 'BALAS' ALGORITHM FOR ZONED UNIFORM TREATMENT,
Stanford Univ., Calif.
For primary bibliographic entry see Field 05D.
W69-04281

THE FUTURE OF AN ESTUARY,
Stanford Univ., Calif.
For primary bibliographic entry see Field 05G.
W69-04290

DELTA-SUISUN BAY WATER QUALITY INVESTIGATION,
Stanford Univ., Calif.
For primary bibliographic entry see Field 02L.
W69-04291

MATHEMATICAL MODELING OF WATER QUALITY IN ESTUARIAL SYSTEMS,
Stanford Univ., Calif.
For primary bibliographic entry see Field 05B.
W69-04311

DIGITAL SIMULATION OF NATURAL ANIMAL COMMUNITIES,
For primary bibliographic entry see Field 06G.
W69-04312

THE DEVELOPMENT AND APPLICATION OF A TIME-VARYING DISSOLVED OXYGEN MODEL,
Stanford Univ., Calif.
For primary bibliographic entry see Field 05G.
W69-04315

THE ROLE OF THE PHYSICAL HYDRAULIC MODEL OF SAN FRANCISCO BAY AND DELTA IN POLLUTION STUDIES,
Stanford Univ., Calif.
For primary bibliographic entry see Field 05B.
W69-04329

WATER QUALITY IMPROVEMENT PROGRAMMING PROBLEMS,
For primary bibliographic entry see Field 05G.
W69-04502

RECENT RESULTS FROM A MATHEMATICAL MODEL OF WATER POLLUTION CONTROL IN THE DELAWARE ESTUARY,
For primary bibliographic entry see Field 05G.
W69-04509

METROPOLITAN PLANNING AND RIVER BASIN PLANNING: SOME INTERRELATIONSHIPS,
Georgia Inst. of Tech., Atlanta. School of Architecture.
Guy J. Kelnhofer, Jr.
Water Resources Center Rep WRC-0268, Georgia Inst Tech, July 1968. 218 p, 13 fig, 6 tab, 229 ref OWRR 14-01-0001-874, OWRR B-009-GA. Res for report supported by matching funds from OWRR, Dept of Interior and Georgia Inst Tech.

Descriptors: *Water resources development, *Planning, *Urbanization, *River basin development, *Georgia, Colorado, Ohio, Ohio River, Arkansas, Minnesota, Mississippi River, Nebraska Long-term planning, Water supply.
Identifiers: *Atlanta, *Chattahoochee River basin Cincinnati, Little Rock, Minneapolis, St. Paul Omaha, South Platte River, Arkansas River.

Based on help from 25 leading people in Atlanta visits to Denver, Omaha, Minneapolis, St. Paul and Cincinnati, and literature research, metropolitan residents are found to be unconcerned about the development of their water resources. This attitude is caused by rivers generally being inaccessible and hidden from view of the public, by their history of being exploited for their economic value, and lack of public awareness of the value of rivers. Floods evoke much unfortunately ephemeral public concern and readiness to act. Public concern about the genuine need for river development projects is often 'bought off' by the preponderance of Federal money. The agency that should best represent a metropolitan community in water planning is the metropolitan planning commission. Where the state has supplied no intermediary mechanism to represent the local government, Federal and local agencies will cooperate to solve their mutual problems. Data on Atlanta's planning include longitudinal profile of the Chattahoochee River with existing and proposed reservoirs, waste disposal and water supply in Metropolitan Atlanta, water diversion in Metropolitan Atlanta from Chattahoochee to Flint and South River basins, and proposed Newnan Reservoir at maximum design pool in Atlanta area. Tables give hydroelectric

ıts on the Chattahoochee River with their total acity of 521,200 kw, observed coliform concenions ranging from 4,900 to 3,300,000 in June July, 1965 on the Chattahoochee River from 3 above to 41 mi below Clayton, Chattahoochee er frontage in Georgia from Buford Dam to itesburg owned by public and quasi-public ncies, and uses of Chattahoochee River ıtage by local government from Buford Dam to itesburg, Ga. (Vorhis-USGS)
9-04566

. Evaluation Process

E BUFFALO SCENIC RIVERWAY.
nessee Valley Authority, Knoxville. Div. of ervoir Properties.

A Report, September 1968. 18 p.

scriptors: *Scenery, *Aesthetics, Wild rivers, d Rivers Act, Recreation, Rivers, Streams, eam fisheries, Tennessee River.
ntifiers: Buffalo River, Tennessee.

e Tennessee Valley Authority and the State of nnessee, with participation by the National Park vice, has proposed to undertake a demonstran in scenic riverway development of the Buffalo er in middle Tennessee to show how a balanced velopment of a river for public use and enjoynt might be achieved while protecting the natu- features which account for its attractiveness. e riverway project will consist of two stages. ge I, which includes the upper half of the river-- ut 60 miles in length--will require four years to nplete. By the end of this initial development iod, there will exist a workable and manageable t of the demonstration. State II will be untaken on the lower 60 miles of the river upon npletion of State I. Cost of this project will be ıred by TVA and the State of Tennessee. The tional Park Service, as part of their development n for the Natchez Trace Parkway, will parpate in the planning and construction of facili- s at the Natchez Trace crossing of the Buffalo ver. (Taylor-TVA)
69-04201

TURE DEVELOPMENT OF THE GROUNDATER RESOURCE IN THE LOWER GREAT IAMI RIVER VALLEY, OHIO - PROBLEMS ND ALTERNATIVE SOLUTIONS,
ological Survey, Washington, D. C.
r primary bibliographic entry see Field 02F.
69-04206

RESH WATER,
id-Cheshire Water Board (England).
r primary bibliographic entry see Field 03B.
69-04225

AN AND THE ESTUARY.

nservation Foundation Letter, April 22, 1968, 8-11.

escriptors: *Costs, *Benefits, *Economic effiency, Water pollution effects, Dredging.

he economic benefits and uses of the estuary are ted. The article maintains that the benefits of tuaries are fairly easy to measure, but the onomic losses from abuses of this resource are rder to assess. Some data on economic losses om dredging, filling, and pollution of estuaries are ven.
69-04283

SUMMARY REPORT ON MARYLAND'S OMMERCIAL FISHERIES, 1957-1966,
H. Manning.
Maryland Department of Chesapeake Bay Affairs, nnapolis, 1967.

Descriptors: *Commercial fishing, *Commercial shellfish, *Fish harvest, *Market value, *Maryland, Oysters, Animals, Aquatic animals, Aquatic life, Invertebrates, Shellfish, Benthic fauna, Benthos, Marine animals, Mollusks, Value, Income, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Geographical regions, Northeast U. S., Regions, Employment.

This document reports the values of Maryland's commercial fisheries from 1957 through 1966. The landed value of Maryland's commercial fisheries products reached an all-time high of $14,012,000 in 1966, with oysters accounting for 56 percent. The value of Maryland's manufactured fisheries products reached $39,000,000 in 1966. Data are provided on the number of people employed in the fisheries industry. Maryland now leads the U. S. in oyster production and can be expected to do so for several years.
W69-04284

STATEMENT BEFORE THE SUBCOMMITTEE ON AIR AND WATER POLLUTION, APRIL 17, 1968,
Committee on Public Works (U. S. Senate).
For primary bibliographic entry see Field 05B.
W69-04293

MEASURING THE IMPACT OF THE WATERBORNE COMMERCE OF THE PORTS OF VIRGINIA ON EMPLOYMENT, WAGES, AND OTHER KEY INDICES OF THE VIRGINIA ECONOMY, 1953-1965.

Bureau of Population and Economic Research Report, University of Virginia, Charlottesville, January, 1967.

Descriptors: *Harbors, *Virginia, *Economic impact, Employment, Wages, Taxes, Transportation, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Geographical regions, Regions, Southeast U. S., Industries.

This study is concerned with measuring the effects of selected economic components resulting from, and generated by, the waterborne commerce that flows through the ports of Virginia. The economic components used are employment, wages, state and local taxes, business and industrial activities. Because most of the port activity in Virginia occurs in the ports of Hampton Roads, the findings of this study were based primarily on the waterborne commerce at Hampton Roads. This report is the twelfth of a series undertaken by the University of Virginia for the Virginia State Ports Authority and published annually since 1957.
W69-04295

FISH PROTEIN CONCENTR)TE SEEN POSSIBLE NEW INDUSTRY,
C. L. Mitchell.
Fisheries of Canada, Vol. 19, No. 11, May, 1967, pp 12-15.

Descriptors: *Commercial fishing, *Proteins, *Fish handling facilities, *Operating costs, *Foods, Fish management, Fisheries, Production costs, Fishing, Industries, Facilities, Management, Pricing, Competitive prices, Prices, Competition, Marketing, Industrial production, Costs, Foreign countries, Geographical regions, Regions.

The author states that a fish protein concentrate industry in both Canada and the U. S. will develop shortly. Canada will be able to compete favorably with the U. S. in marketing FPC because it is estimated that the market prices of FPC in Canada and the U. S. will be $300/ton and $400/ton, respectively. FPC production costs are itemized.
W69-04299

IMPORTANCE OF GULF ESTUARIES AND PROBLEMS FACING OUR FISHERY RESOURCES,
C. Mock.
11th International Game Fish Conference (1966), Proceedings, August, 1967, pp 66-68.

Descriptors: *Value, *Gulf of Mexico, *Commercial fishing, *Sport fishing, *Water pollution, *Urbanization, Estuarine fisheries, Recreation, Gulfs, Fish, Central U. S., Commercial fish, Commercial shellfish, Texas, Aquatic habitat, Environment, Tidal effects, Coastal plains, Geographical regions, Mollusks, Benthic fauna, Benthos, Marine animals, Oysters, Fisheries, Fishing, Industries, Animals, Aquatic animals, Aquatic life, Invertebrates, Shellfish, Water sports, Bodies of water, Surface waters, Resources, Wildlife, Gulf coastal plain, Regions, Southwest U. S.

The author states that the value of the sport fisherman to the American economic system probably exceeds that of the commercial fishery, and will in the future. It is estimated that the renewable fishery resources of Gulf coastal waters yield 1/2 billion pounds of fish and shellfish; 90 percent of this is from five estuarine-dependent species. The author argues that industrial and urban development in Texas will have or has had four major effects on estuaries: (1) Direct alteration or destruction of habitat; (2) Reduction of tidal exchange between Gulf and estuary; (3) Past or possible future depletion of fresh water to the bay oyster; (4) Continuing deterioration of water quality through pollution. The author feels that the future of the Texas estuary appears to be an escalation of these problems.
W69-04300

RELATIONS BETWEEN SPORT AND COMMERCIAL FISHERMEN,
F. Moss.
11th International Game Fish Conference (1966), Proceedings, August, 1967, pp 69-74.

Descriptors: *Sport fishing, *Commercial fishing, *Income, *Size, *Competition, Recreation, Fishing, Water sports, Industries.

The author states that sport fishing should be considered an industry by virtue of its dollar value, number of participants, and size of catch. Some of the conflicts between sport and commercial fishermen are discussed and some solutions are suggested.
W69-04302

STATEMENT,
Federal Water Pollution Control Administration, Southeast Region, Atlanta, Ga.
Jeff W. Napier.
In CLEAN WATER FOR THE NATION'S ESTUARIES, Transcript of Public Meeting, Biloxi, Mississippi, January 17, 1968, pp 22-30.

Descriptors: *Recreation, *Boating, *Recreation wastes, *Sport fishing, *Water pollution, Water quality, Recreation facilities, Wastes, Water sports, Sport fish, Animals, Aquatic animals, Aquatic life, Fish, Wildlife.

Estuaries are highly suitable areas for pleasure boating for several reasons, including: accessibility to urban areas and historical sight-seeing value. Estuaries also provide sheltered waters and a variety of fish species. An estimated 40 million people go boating every year, and boat owners are estimated to spend about $3 billion annually. Boating has been growing at an annual rate of more than five percent. Napier contends that sewage from pleasure boats is a highly negligible source of pollution, particularly in comparison to particular industrial plants.
W69-04303

OCEANOGRAPHY--THE EMERGING SCIENCE OF THE SEA.
Hayden Stone Investment Research Department, October, 1967.

Descriptors: *Oil industry, *Desalination, *Oceanography, *Economic prediction, *Commercial fishing, Mining, Fishing, Oceans, Bodies of water, Surface waters, Industries, Exploitation, Oil fields, Forecasting, Demineralization, Separation techniques, Water purification, Water treatment, Oil reservoirs.

Present markets in the oceanography field and their future projections (1977) are described. In-depth analysis is made of offshore petroleum field and its related companies.
W69-04305

MARINE SPORTFISHING SURVEY OF SOUTHERN CALIFORNIA PIERS AND JETTIES, 1963,
L. Pincus, J. C. Thomas, and J. A. Hansen.
California Fish and Game, Vol 53, No 2, 1967, pp 88-104.

Descriptors: *Sport fishing, *Piers, *Jetties, *California, Recreation, Fishing, Water sports, Engineering structures, Coastal structures, Geographical regions, Pacific coast region, Regions, Southwest U. S., Statistics, Data collections.

The authors supply statistics on the number of people using piers and jetties for recreational fishing. Since a considerable number of people are using these piers and jetties, it is recommended that pier-development programs be continued.
W69-04316

PLAN DEVELOPING FOR UNDERWATER PARKS.
Parks and Recreation, Vol 3, No 9, September, 1968, pp 11-12.

Descriptors: *Underwater, *Parks, *California, Recreation, Surveys, Aquatic environment, Shores, Scuba diving, Water sports, Environment, Geographical regions, Pacific coast region, Regions, Southwest U. S., Coasts, Coastal areas, Coastlines.

A survey is being conducted along the coast of California to investigate its resources, geological features, and the destruction of animal life in the tidal pools. The survey is part of a plan to create a series of underwater parks in the state. Underwater sports and marine science will be stressed.
W69-04317

WORLD OFFSHORE RIG FLEET TO BALLOON AGAIN IN 1968,
Leslie C. Rogers.
Oil and Gas Journal, Vol 66, No 1, January 1, 1968, pp 29-30.

Descriptors: *Oil industry, *Drilling, *Offshore platforms, Industries, Engineering structures, Hydraulic structures, Structures, Exploration, Gulf of Mexico, Bodies of water, Gulfs, Surface waters, Forecasting.

The author discusses future expansion of offshore oil rig construction. Also, the author tabulates present oil rig construction around the world and present idle rigs in the Gulf Coast.
W69-04328

ECONOMIC IMPACT OF MARINE-ORIENTED ACTIVITIES--A STUDY OF THE SOUTHERN NEW ENGLAND MARINE REGION,
Niels Rorholm, H. C. Lampe, Nelson Marshall, and J. F. Farrell.
Report of Rhode Island Univ., Agricultural Experiment Station, Department of Food and Resources Economics, Kingston, Rhode Island, Bulletin No. 396, 1967.

Descriptors: *Economic impact, *Estuarine environment, *Industries, *New England, Geographical regions, Regions, Northeast U. S.

The primary purpose of this report is to analyze the economic impact of those commercial enterprises that depend upon the near-ocean and the near-shore environment for their existence in given locations. The Southern New England Marine Region was selected as the study area. Chapter I describes the framework within which the marine industries operate. Chapters II and III deal with the marine industries themselves, first by way of description and subsequently in an input-output framework to facilitate a comprehensive economic impact evaluation. Chapter IV brings into consideration certain non-economic variables, and in Chapter V is discussed the growth of marine industries and the possible application of this work to other regions.
W69-04330

ESTUARINE WATER QUALITY MANAGEMENT IN THE SACRAMENTO-SAN JOAQUIN DELTA,
Stanford Univ., Calif.
For primary bibliographic entry see Field 05G.
W69-04331

SEAFARING EMPLOYMENT.

Division of Labor Studies, Office of Maritime Manpower, Washington, D. C., February 20, 1967.

Descriptors: *Manpower, *Ships, Transportation.

This is a table showing the number of jobs, by type of ship, aboard ocean-going U. S. flag merchant ships of 1000 gross tons or over from 1947.
W69-04336

THE SEAFOOD INDUSTRY, A LOCAL ANALYSIS.
City Planning Commission, Hampton, Virginia, November, 1967.

Descriptors: *Virginia, *Commercial fishing, *Commercial shellfish, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Geographical regions, Regions, Southeast U. S., Employment, Shellfish, Animals, Aquatic animals, Aquatic life, Invertebrates.

The seafood industry of Hampton, Virginia, is compared by percentages with the industry (1) in the Chesapeake Bay area, (2) on the East Coast, and (3) in the United States. Tables indicating the volume and value of the various following components in the industry are given: (1) seafood production volume, (2) value of industry, (3) employment data, and (4) seafood landings volume.
W69-04337

STATEMENT,
Federal Water Pollution Control Administration, Southeast Region, Atlanta, Ga.
Howard J. Sears.
In CLEAN WATER FOR THE NATION'S ESTUARIES, Proceedings of the Georgia Public Meeting, Jekyll Island, Georgia, February 29, 1968, pp 43-45.

Descriptors: *Fish handling facilities, *Commercial shellfish, *Georgia, *Economic impact, Environment, Habitats, Facilities, Outdoor recreation, Labor, Water pollution, Employment, Recreation facilities, Water pollution effects, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Geographical regions, Regions, Southeast U. S., Animals, Aquatic animals, Aquatic life, Invertebrates, Shellfish.

There are more than 95,000 acres of estuarine area within Glynn County, Georgia. These acres are important nursery grounds and habitats for shellfish, which provide an annual catch of 100 million pounds. The local seafood processing industry employs 1/3 of the area's manufacturing workers, including 85 percent of the local females employed in manufacturing. This industry as well as the estuarine-oriented recreation industry is being threatened by pollution.
W69-04338

ADVANCES IN THE OFF-BOTTOM CULTURE OF OYSTERS,
William N. Shaw.
Report, Gulf and Caribbean Fisheries Institute 19th Annual Session, Proceedings, Septebmer 1967, pp 108-115.

Descriptors: *Oysters, *Fish farming, *Cultura control, *Productivity, Commercial shellfish Animals, Aquatic animals, Aquatic life, Benthic fauna, Benthos, Invertebrates, Marine animals Mollusks, Shellfish, Agriculture, Control, Maryland, Virginia, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Geographica regions, Northeast U. S., Regions, Southeast U. S. Bays, Bodies of water.

The author gives a review of the research in off-bottom culture of oysters. He feels that the present decline in the oyster industry along the East Coast can only be offset by such techniques, and that one of the most significant reasons for a failing industry in the Chesapeake Bay region is the lack of private farming. It is also stated that the difficulty of obtaining exclusive use of oyster lands in the Maryland portion of the Chesapeake has prevented the development of private oyster farming.
W69-04339

SUMMARY ECONOMIC BASE STUDY CHESAPEAKE BAY DRAINAGE BASINS.
National Planning Association, Center for Economic Projections, Washington, D. C., Report No. 1409, February, 1967.

Descriptors: *Regional analysis, *Watersheds (Basins), *Economic prediction, Employment, Maryland, Virginia, District of Columbia, River basins, Industries, Community development, Data collections, Occupations, Atlantic coastal plain, Forecasting, Regions, Analysis, Appalachian Mountain region, Coastal plains, Geographical regions, Northwest U. S., Southeast U. S., Cities, Statistics.

This report highlights the analyses and major qualitative results of the Chesapeake Bay Drainage Basin Study. The study is divided into 18 economic subregions for which individual economic profiles are given. Four of these subregions are relevant to the Chesapeake Bay estuary: Subregion 8: Baltimore; Subregion 9: Peninsula (Maryland, E. Shore); Subregion 13: Washington; and Subregion 18: Norfolk. Employment data and projections are given by subregions, as are manufacturing employment data and projections. There are no data particularly pertinent to the economic activity of the estuary itself except, perhaps, the manufacture of transportation equipment. Tables are given by subregion for: (1) Cumulative population growth; (2) Per capita income; and (3) Export and residentiary employment covering the year 1960 with 10-year projections from 1970 to 1990.
W69-04346

TECHNOLOGY ADDING BILLIONS TO RESERVES.
Oil and Gas Journal, Vol 66, No 3, January 15, 1968, pp 51-53.

Descriptors: *Oil industry, *Technology, *Cost analysis, Oil reservoirs, Industries, Drilling, Transportation, Analysis, Mathematical studies.

The author discusses the gains in technology which save consumers billions of dollars and will add billions of barrels to oil reserves through the 1970's. What technology has achieved since World War II: Drilling cost - Pared $7/foot; Produced crude cost - Slashed $1/bbl.; Oil-recovery rate - Improved 13 percent; Oil-transportation cost - Reduced 50 percent; and Refinery - operating cost - Lowered 12 percent.

9-04348

CALL FOR ACTION,
ssell E. Train.
nservation Foundation Letter, April 22, 1968, p

scriptors: *Legislation, *Cost-benefit ratio, anning, *Environmental effects, *Estuarine en-nment, Conservation, Aquatic environment, vernments, Federal government.

rogram for estuarine preservation is proposed: Every coastal state should declare a moratori- on tampering with major estuaries and at the ie time create conservation and development nmissions to study each estuary, prepare a plan the estuary, and present the alternatives to the ple and governments involved. (2) Conserva- and environmental values in general should be uded in determining if permits shall be issued dredging and filling. (3) A national inventory of aries should be included in a system of pro- ed estuaries. (4) Customary techniques of com- ing cost-benefit ratios should be reassessed. We not yet know how to determine and assign ies to the intangibles of a quality environment. remain at the mercy of development account- which measures costs against benefits without luding the cost of degrading the environment ie. Such a reassessment would be a logical as- nment for a Presidential Council of Environmen- Advisors; but, lacking such a council, the assign- nt might well be given to a special Presidential force.
9-04352

OBLEMS OF CONSERVATION IN THE AT- NTIC ESTUARINE ZONE,
nel Walford.
d North American Wildlife and Natural ources Conference, Transactions, March 13- 1967, pp 161-164.

scriptors: *Water resources development, overnments, *Atlantic coastal plain, *Recrea- facilities, Social aspects, Conservation, ource development, Legislation, Recreation, ter sports, Outdoor recreation, Social impact, al governments, State governments, Coastal ins, Geographical regions, Regions, Sport fish- Fishing, Wildlife conservation.

e author says that the 'resort industry' of the At- tic coastal lowlands has had a tendency towards -destruction in its failure to recognize and nur- e the resource base on which it rests. The vast ulation which inhabits the Atlantic estuarine e tends to associate itself with metropolitan ier than regional needs; therefore the responsi- ty of estuarine conservation rests on fragmented ncies within state and local government. If it is ired to conserve the quality of the environment the Atlantic estuarine zone, the principal stion is not how can states rights be preserved, how can states work together in designing the s of the zone so as to protect their common ources.
9-04355

ATEMENT ON LIVING MARINE SOURCES OF WETLANDS AND ESTUA- ES,
nel Walford.
uarine Hearings, Subcommittee on Fisheries Wildlife Conservation of the Committee on rchant Marine and Fisheries, House of presentatives, 90th Congress, Serial No. 90-3, rch, 1967.

scriptors: *Damages, *Wetlands, *Estuarine eries, *Commercial fishing, *Estuarine environ- nt, *Atlantic Ocean, Value of estuary, Fisheries, uatic environment, Fishing, Fish, Industries, mmercial shellfish, Wildlife conservation, asts, Bodies of water, Oceans, Surface waters, imals, Aquatic animals, Aquatic life, Inver- tebrates, Shellfish, Natural resources, Resources, Marine fish, Saline water fish, Wildlife, Conservation.

Most of the world's population is concentrated on the seacoasts. At the same time more than 90 percent of food fish live in coastal waters. The Atlantic estuary is exceptionally productive. Five cases are cited where the fishery resources have been damaged.
W69-04356

PAST, PRESENT AND FUTURE OF SPORT FISHING IN TEXAS WATERS,
M. H. Weil.
11th International Game Fish Conference (1966), Proceedings, August, 1967, pp 59-65.

Descriptors: *Sport fishing, *Texas, *Habitats, *Forecasting, Channel improvement, Dams, Soil conservation, Recreation, Fishing, Water sports, Central U. S., Coastal plains, Geographical regions, Gulf coastal plain, Regions, Southwest U. S., History, Environments, Conservation, Dredging.

The author states that sport fishing in Texas waters has improved and argues that it should continue to improve. The author feels that with more people fishing, plus changes in the ecology of the area such as the damming of rivers, soil conservation practices, channel dredging for industrial development, and increased boat traffic, fishing values are affected. He feels, however, that new habitat can be encouraged to replace the old areas which may become lost. Specific examples are cited.
W69-04362

WEST COAST OIL FUTURE IS BRIGHT.
Offshore, Vol 27, No 7, June 20, 1967, pp 70-74.

Descriptors: *Oil industry, *Oil fields, *Future planning (Projected), Oil reservoirs, Industries, Planning, Forecasting, Leases, Pacific coast region, Geographical regions, Regions.

The article discusses the future of West Coast oil fields. Also discussed are the future leasing potentials and bonuses.
W69-04363

MARINE RESOURCES OF THE CORPUS CHRISTI AREA,
Arvid A. Anderson.
Bureau of Business Research, Texas Univ., Research Monograph No. 21, June, 1960.

Descriptors: *Water resources, *Value, *Texas, *Water values, Resources, Water sports, Sport fishing, Recreation, Natural gas, Mining, Commercial fishing, Waste water disposal, Transportation, Productivity, Aquatic productivity, Oil wells, Gases, Fishing, Industries, Waste disposal, Transportation, Bays, Bodies of water, Central U. S., Gulf coastal plain, Regions, Coastal plains, Geographical regions, Southwest U. S.

The report describes a study which developed estimates of dollar value per surface acre of the various economic uses of the bays in the Corpus Christi, Texas, area. Values estimated were for recreational uses, commercial fishing, oil production, natural gas production, mudshell production, industrial and municipal uses of bay water including waste assimilation, and savings resulting from shipping goods by water rather than land. A detailed summary of value estimates is given in tabular form.
W69-04436

'NATURAL RESOURCES AND THE QUALITY OF LIFE',
Harold J. Barnett, and Chandler Morse.
In READINGS IN RESOURCE MANAGEMENT AND CONSERVATION, pp 585-594. University of Chicago Press, Chicago, Illinois, 1965.

Descriptors: *Resource allocation, *Social values, *Natural resources, *Competition, Water resources development, Values, Resources, Resource development.

Barnett and Chandler discuss the social problems which have arisen in relation to the use of natural resources, e.g. whether a community has pre-emptive rights to exploit a resource irrespective of the rights of other communities to the same resource. It was concluded that it would be advisable to apply a more objective methodology to the natural-resource value problems.
W69-04440

THE CALIFORNIA OYSTER INDUSTRY,
Elinore M. Barrett.
Resources Agency of California, Department of Fish and Game, Sacramento, California, Fisheries Bulletin No. 123, 1963.

Descriptors: *Oysters, *Commercial shellfish, *California, Marketing, History, Geographical regions, Pacific coast region, Regions, Southwest U. S., Animals, Aquatic animals, Aquatic life, Benthic fauna, Benthos, Invertebrates, Marine animals, Mollusks, Shellfish.

The history and future of the California oyster industry are discussed, stating that it has entered a relatively active period after being quiescent since 1910. Tables and graphs on trends in production since 1888 are provided.
W69-04442

CHESAPEAKE BAY, A PICTORIAL MARITIME HISTORY,
M. V. Brewington.
Cornell Maritime Press, Cambridge, Maryland, 1953.

Descriptors: *History, *Maryland, *Virginia, *Bays, Commercial fishing, Fishing, Industries, Boating, Recreation, Water sports, Bodies of water, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Geographical regions, Northeast U. S., Regions, Southeast U. S.

This history treats Chesapeake Bay as a many-factored area, and traces its growth through specific subjects such as commercial fishing, boating, sports, and others.
W69-04449

RECENT DEVELOPMENTS IN EVALUATING RECREATIONAL BENEFITS,
Omer L. Carey.
Conference of the Western Economic Association, San Francisco, California, August 22, 1963.

Descriptors: *Recreation demand, *Benefits, *Recreation facilities, *Expenditures, *Evaluation, Recreation, Economic impact, Prices.

The purpose of the paper is to stress the need for economic analyses in the planning of outdoor recreation facilities, and to enumerate some of the techniques which have been used to compute recreation benefits. These techniques include: (1) Willingness to pay. (2) Evaluating economic impact. (3) Value in use - evaluation of consumer surplus in recreation. (4) Cost of alternative facilities as a measure of benefit from public facilities. (5) Opportunity cost of a recreation site, including the 'marginal method', comparing value of recreation and timber per acre of forest.
W69-04453

RECREATION,
Interstate Commission on the Potomac River Basin, Washington, D. C.
Marion Clawson.
In PROBLEMS OF THE POTOMAC ESTUARY, January, 1964, pp 19-22.

Descriptors: *Recreation, *Maryland, *Virginia, *Cost-benefit analysis, Water sports, Cost allocation, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Geographical regions, Northeast U. S., Regions, Southeast U. S., Expenditures.

This is a general discussion of the questions which must be answered to estimate the value of recreational benefits resulting from public investments. The material is presented in layman's terms.
W69-04458

FISHERIES PROTECTING AND ENHANCEMENT WITH WATER DEVELOPMENT OF THE SACRAMENTO-SAN JOAQUIN ESTUARY,
D. W. Kelley, and Jerry L. Turner.
A Symposium on Estuarine Fisheries, American Fisheries Society, Special Publication No. 3, 1966, pp 78-82.

Descriptors: *California, *Water resources development, *Estuaries, Sport fishing, Geographical regions, Pacific coast region, Regions, Southwest U. S., Fishing, Recreation, Water sports, Resource development, Bodies of water, Area redevelopment, Conservation, Natural resources, Resources, Reclamation, Coastal engineering, Engineering, Social participation, Water utilization, Coastal plains, Surface waters.

The development of a water plan through the joint efforts of biologists and engineers, '...that appears compatible with other uses of the estuary and that provides opportunities to protect and perhaps enhance the fisheries resources' is presented. The plan relates to the transfer of Northern California waters to Southern California, with respect to water in transit through the delta area. The estuary and its fish and fisheries are described. Estimates are presented of annual sport-fishing expenditures, sport-fish catch, and angler days in the estuary and adjacent areas.
W69-04472

A TEN-YEAR PROGRAM OF FEDERAL WATER RESOURCES RESEARCH.
Federal Council for Science and Technology, Committee on Water Resources Research, Office of Science and Technology, Executive Office of the President, February, 1966.

Descriptors: *Future planning (Projected), *Water resources development, *Federal budgets, Planning, Resource development.

Recommendations for a ten-year program of Federal water resources research are given. One of the recommendations is that Federal research expenditures for research on estuarine problems be increased from an actual level of about $0.5 million annually in 1965 to an annual level of about $1.0 million by 1970.
W69-04473

COMPARISONS OF METHODS FOR RECREATION EVALUATION,
Jack L. Knetsch, and Robert K. Davis.
In WATER RESEARCH, 1966, pp 125-142. Baltimore, Maryland: Johns Hopkins Press, 1967.

Descriptors: *Recreation demand, *Benefits, *Cost analysis, Recreation, Evaluation, Recreation facilities.

Methods of evaluating the benefits from outdoor recreation are reviewed. The only methods supported by the authors are those which are based on the concept of willingness to pay for services provided. Three such techniques are elaborated upon: (1) Interview methods, designed to measure recreationists' willingness to pay higher prices for using a recreation site. (2) Use of an interview method to establish willingness to drive additional distances for recreation. (3) Use of a travel-cost method to establish willingness to incur travel costs as actually measured by a count of automobiles at a recreation site. The three methods gave comparable results when tested on the same recreation area.
W69-04474

THE PRINCIPLES OF WATERFRONT RENEWAL: A SUMMARY OF EXPERIENCE IN FIFTY AMERICAN CITIES,
Richard A. Lehmann.
Landscape Architecture, Vol 56, No 4, July, 1966, pp 286-291.

Descriptors: *City planning, *Aesthetics, *Shores, *Harbors, Landscaping, Planning.

The conclusion reached in this summary is that good waterfront renewal projects should contain these aesthetic goals: (1) physical access, (2) visual access, (3) historic preservation, and (4) site identity.
W69-04476

BENEFIT-COST ANALYSIS: ITS RELEVANCE TO PUBLIC INVESTMENT DECISIONS,
Arthur Maass.
Quarterly Journal of Economics, Vol LXXX, No 2, May, 1966, pp 208-226.

Descriptors: *Cost-benefit analysis, *Public benefits, *Investment, Social values, Feasibility studies, Feasibility, Economic efficiency, Value, Social impact, Social aspects, Benefits.

The author states that 'the major limitation of benefit-cost analysis, as it has been applied in the United States, is that it ranks projects and programs in terms of economic efficiency'. He maintains that economic efficiency is not the only goal of public programs, and that the other goals, such as income redistribution, should be explicitly recognized and integrated into formal project analysis. The author states that trade-offs among the relevant benefit variables must be sought and suggests that establishment of such trade-offs is possible.
W69-04479

MANAGEMENT OF ESTUARINE FISHERIES,
American Fisheries Society, Atlantic City, New Jersey.
J. L. McHugh.
In A SYMPOSIUM ON ESTUARINE FISHERIES, NINTH ANNUAL MEETING, Supplement No. 3, 1966, pp 133-153.

Descriptors: *Estuarine fisheries, *Commercial fishing, *Sport fishing, *Value, Sport fish, Commercial fish, Fish management, Animals, Aquatic animals, Aquatic life, Fish, Wildlife, Water utilization, Efficiencies, Fishing, Industries, Recreation, Water sports, Evaluation, Coasts, Competing uses.

Almost 2/3 (by value) of the U. S. commercial catch and most of the marine sport fish catch is composed of species that spend at least a part of their lives within land-bound estuaries. Dominance of estuarine species is especially great in catches along the Atlantic and Gulf of Mexico coasts. Around 1960, the sport of fish catch was approximately 11 percent of the weight of the total commercial catch. In 1960 a catch of 590 million pounds of sport fish was estimated. For sport fishing, value is measured in money spent by the fishermen in pursuit of this recreation; for the commercial fisherman, value is measured by the dollar return in his catch. There is a need for research into the problems of management and use conflict of estuarine fisheries.
W69-04481

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS,
R. N. McKean.
New York, John Wiley and Sons, Inc., 1966.

Descriptors: *Cost-benefit analysis, *Systems analysis, *Benefits, *Bibliographies, Direct benefits, Indirect benefits, Government finance.

This book presents a general discussion of the theory and practice of benefit-cost analysis. Of special interest are the discussions regarding the nature of benefits. McKean takes the view that the value of the incremental output, not the incremental value of the industry's output, is what should be considered a benefit. He concludes that secondary benefits should be included in the estimate of benefits only if unemployment would otherwise exist. A five-page bibliography is included.
W69-04482

WHEN DOES A FISHERY BECOME UNECONOMIC,
Robert Morgan.
World Fishing, No. 14, December, 1965, pp 73-74, 77.

Descriptors: *Fish management, *Expenditures, *Demands, Fishing, Management, Commercial fishing, Industries, Productivity, Withdrawal.

The author identifies the basic elements affecting optimum fishing rate as: (1) biological--both the elements affecting organic productivity and the rate of withdrawal by fishing or by mortality from other causes; and (2) economic--elements affecting both the cost of catching and demand. Changes in any of these elements will change the optimum effort of fishing necessary to yield the greatest difference between total economic input and output. The purpose of this article is to point out that, in any consideration of overfishing or in any consideration of what is the best or optimum effort every consideration should be given to economic factors (costs and prices), as well as to biological factors. The author admits that many simplifications were made, especially in regard to the biological elements, in order to achieve a concise demonstration of the relations between the two elements. The relations are illustrated with a diagram in which effort in standard vessel units is plotted against value and cost per week. The basic curve is that of total weight caught in relation to total effort expended, each taken as an average over a period of time.
W69-04485

THE ANIMAL FOOD FISHERY IN CALIFORNIA, 1961-1962,
R. J. Nitsos, and P. H. Reed.
California Fish and Game, Vol 51, No 1, 1965, pp 16-25.

Descriptors: *Fisheries, *Furbearers, *Trawling, *Fish, *California, Production, Fishing, Animals, Aquatic animals, Aquatic life, Wildlife, Geographical regions, Pacific coast region, Regions, Southwest U. S., Statistics, Data collections.

Trawling produced 3.8 million pounds of fish in 1961 and 1.8 million pounds in 1962. These fish, some 60 species, are utilized primarily by the fur farm industry.
W69-04487

COST-BENEFIT ANALYSIS: A SURVEY,
A. R. Prest, and R. Turvey.
The Economic Journal, Vol LXXV, No 300, December, 1965, pp 683-735.

Descriptors: *Cost-benefit analysis, *History, *Bibliographies, *Surveys, Water resources, Resources.

A comprehensive review of cost-benefit analysis is presented. The history of cost-benefit analysis, general principles of application, pertinent issues involved, and applications to water and other subjects are examined. An excellent bibliography is included.
W69-04492

BLIC WORK NEEDS - MARINE PORT CILITIES.
ritime Administration, Department of Commerce, June, 1966.

scriptors: *Harbors, *Construction costs, lanning, *Estimated costs, Data collections, deral government, Coasts, Construction, Cost alation, Cost analysis, Cost trends, Long-term nning, Administration.

epared for the Joint Economic Committee of the ngress, this report describes the existing ports d terminal facilities of the United States, the nd of capital outlays for port development, and needs and prospective capital outlays for port velopment 1966-1975. The Maritime Administion projected that the capital requirements for rt terminal facilities during the decade 1966-75 are estimated to be $1,281.5 million. $605.7 llion are allocated to ports on the three sea asts. It is believed Federal financial assistance l not generally be required.
69-04495

NEATH THE SURFACE,
win L. Rothfuss.
port, Parks and Recreation, September, 1966, 715-716, 810.

escriptors: *National parks, *Virgin islands, ecreation, *Water sports, *Statistics, Scuba diving, Natural resources, Scenery, Federal reservations, Parks, Geographical regions, Islands, Regions, Swimming, Data collections, Underwater, esources.

vo areas in the U. S. Virgin Islands, Virgin Islands ational Park and Buck Island Reef National onument, administered by the National Park Service, have become known as 'underwater parks'. ey exhibit outstanding gardens, marine life, and ascapes and have become very popular snorkeland skin diving areas. Scheduled underwater ps are led by a park naturalist. In 1965, a total of 3 persons were led on 73 organized trips. By Septmber, 1966, there was already a 72 percent atndance increase over 1965. At Buck Island approximately 85 percent of the 15,461 visits to the onument last year were underwater trail uses. In rgin Islands National Park, 1965 visitation of ,000 showed a 17.6 percent increase by Septmber, 1966. Scuba diving, snorkeling, and unrwater photography are becoming important ater recreation activities.
69-04497

EEDED--A COASTWISE COMPREHENSIVE ROGRAM FOR DEVELOPMENT OF ESTUARIES,
alph A. Schmidt.
Symposium on Estuarine Fisheries, American sheries Society, Special Publication No. 3, 1966, 102-109.

escriptors: *Estuarine fisheries, *Tidal marshes, Dredging, *Permits, *Water management, Programs, Planning, Legal aspects, Land reclamation, ommercial fishing, Sport fishing, Northeast U. S., shing, Industries, Recreation, Water sports, sheries, Marshes, Wetlands, Legal aspects, egislation, Northeast U. S., Atlantic coastal plain, eographical regions, Regions, Management.

he author presents estimates of average annual eight and value of commercial finfish and shellfh landings during the 1952-61 period for the orth Atlantic Coast (Delaware to Maine), and the are of total U. S. landings these accounted for. esults of the Fish and Wildlife Service recommenations in the case of permit requests for dredging, nd reclamation, etc., in the New York City-Long land area and the New England area are iscussed. The author points out that many permits ave been granted contrary to recommendations ade by the Fish and Wildlife Service. Estimates of hysical loss of tidal marsh area from Maine to Delaware during the 1954-59 period (23,500 acres) and during the 1959-65 period (21,500 acres) are given. A breakdown by end-use of marsh area lost is also given. Legislation relating to tidelands preservation in North Atlantic Coastal States is discussed.
W69-04499

ON THE USES AND ABUSES OF ECONOMIC SCIENCE IN EVALUATING PUBLIC OUTDOOR RECREATION,
David N. Seckler.
Land Economics, Vol XLII, No 4, November, 1966, pp 485-494.

Descriptors: *Recreation demand, *Cost-benefit ratio, Recreation, Benefits, Demand, Social aspects.

Three theoretical techniques are commonly used in connection with statistical demand curves for recreation. They are: (1) Computation of benefits attributable to a recreation project as the area under the demand curve, and comparing with total project costs. (2) Defining optimum price and usage as the point where Marginal Cost = Marginal Utility, producing a maximum B-C ratio. (3) Using demand curve to compute maximum revenue available from a recreation facility. The author criticizes demand curves in general, arguing that they do not measure the utility function of recreation facilities, but reflect the diminishing marginal utility of income. He criticizes procedures to allocate recreation usage by market processes and points to the bias inherent in these methods towards higher users of recreation. The author proposes that demand curves be corrected for effects of unequal income distrubution and that corrected demand curves be applied to Technique 2 for evaluation of recreation facilities. He further porposes that real prices implicit in this evaluation not be used in actuality unless recreation is to be limited to the wealthy.
W69-04500

RECREATION BENEFITS FROM WATER POLLUTION CONTROL,
For primary bibliographic entry see Field 05G.
W69-04504

A STUDY OF THE U. S. COAST AND GEODETIC SURVEY'S PRODUCTS AND SERVICES AS RELATED TO ECONOMIC ACTIVITY IN THE U. S. CONTINENTAL SHELF REGIONS.
Battelle Memorial Inst., Columbus, Ohio.

Report, January 17, 1966.

Descriptors: *Surveys, *Continental shelf, *Economic impact, *Federal government, Regions, Continental margin, Mining, Mineral industry, Exploration, Drilling, Offshore platforms, Oil industry, Civil engineering, Coastal engineering, Recreation, Ships, Tsunamis, Saline water intrusion, Water quality, Transportation, Commercial fishing, Resource development, Governments, Generators, Agriculture, Military aspects, Research and development, Communication, Electric generators, Water resources development, Industries, Engineering structures, Hydraulic structures, Structures, Engineering, Public health, Fishing, Foods, Electrical equipment, Equipment.

The services provided by the United States Coast and Geodetic Survey are evaluated in terms of influence and effect on economic activities in the United States Continental Shelf regions. Activities are broken down into ten major groups for the purpose of this study: (1) Mining and petroleum, (2) Marine engineering, (3) Recreation, (4) Health and welfare, (5) Transportation, (6) Food and agriculture, (7) Defense and space (U. S. Coast Guard included), (8) Research and development, (9) Industry (not elsewhere classified), (10) State and local agencies. Each category covers the economic activity within the group in the U. S. continental-shelf regions, the dependency of that activity upon U. S. Coast and Geodetic Survey products and services, and the uses of and present needs for additional U. S. Coast and Geodetic Survey products and services relating to the U. S. continental-shelf regions. Sub-categories within each category are discussed in four aspects: (1) Estimate of present economic activity, (2) Estimate of worth of USCGS products and services, (3) Description of user problems and needs, (4) Estimate of future economic activity.
W69-04505

TOURISM AND RECREATION.
Little (Arthur D.), Inc., Cambridge, Mass.

Report, October 10, 1966. Project No. C-68388.

Descriptors: *Recreation, *Tourism, *Bibliographies, Water sports, Fishing, Boating, Sport fishing, Hunting.

This report appears to be based on a literature search on recreation and tourism. It encompasses leisure time activities in the United States, as a whole. Chapters on boating, hunting, and sport fishing in the United States are included. The report contains a large bibliography.
W69-04510

THE IMPACT OF THE PORT OF JACKSONVILLE ON THE ECONOMY OF THE COMMUNITY,
Jacksonville Univ., Fla. Div. of Business Administration.
N. E. Weis, and S. W. McFarland.
Report, 1965.

Descriptors: *Harbors, *Economic impact, *Florida, Income, Employment, Wages, Atlantic coastal plain, Coastal plains, Geographical regions, Gulf coastal plain, Regions, Southeast U. S., Income analysis, Analysis, Mathematical studies, Economic life, Benefits.

The volume of income resulting from and generated by the flow of goods imported and exported at the Jacksonville Talleyrand Docks and Terminal facilities during 1964 is analyzed. Principal attention is placed on an analysis of the factors and conditions which contributed to the flow of income both as a direct result of the activities of this port facility and as an indirect result of income flow from supporting services and industries. Community benefits in wages, taxes, and services are evaluated.
W69-04517

LAND RECLAMATION IN THE PO RIVER DELTA OF ITALY,
For primary bibliographic entry see Field 04A.
W69-04518

THE POLITICAL ECONOMY OF EFFICIENCY: COST-BENEFIT ANALYSIS, SYSTEMS ANALYSIS, AND PROGRAM BUDGETING,
Aaron Wildavsky.
Public Administration Review, Vol 26, No 5, December, 1966, pp 292-310.

Descriptors: *Cost-benefit analysis, *Systems analysis, *Financial feasibility, *Political aspects, Programs, Decision making, Economic efficiency, Budgeting, Administration, Financial analysis, Cost comparisons, Governments, Local governments, Political constraints, Constraints.

Some of the useful features and shortcomings of cost-benefit analysis, systems analysis, and program budgeting techniques for achieving economic efficiency are pointed out. Also discussed are the political realities involved in the application of these techniques, as well as the interrelationship between programs for economic efficiency and the political process.
W69-04519

METROPOLITAN PLANNING AND RIVER BASIN PLANNING: SOME INTERRELATIONSHIPS,
Georgia Inst. of Tech., Atlanta. School of Architecture.
For primary bibliographic entry see Field 06A.
W69-04566

MANAGING WATER QUALITY: ECONOMICS, TECHNOLOGY, INSTITUTIONS,
Resources for the Future, Inc., Washington, D. C.
For primary bibliographic entry see Field 05G.
W69-04578

DESIGNING PUMPED WELL CHARACTERISTICS INTO ELECTRIC ANALOG MODELS,
Illinois State Water Survey, Urbana.
T. A. Prickett.
Ground Water, Vol 5, No 4, 1967. pp 38-46, Oct 1967. 9 p, 9 fig, 1 tab, 11 ref.

Descriptors: *Groundwater, *Pumping, *Analog models, *Model studies, Design criteria, Water wells, Hydrologic data, Reservoir yield, Aquifers, Simulation analysis.
Identifiers: Pumped well characteristics, Electric analog models.

Errors that exist at the pumped well junctions of nonsteady-state two-dimensional flow electric analog models were analytically analyzed. The results of the study indicate that practical sustained yields and water-level data derived from pumped well junctions of electric analog models lead to overly optimistic estimates of aquifer and well yielding capabilities. This paper presents design methods for simulating pumped wells having different radii, screen lengths, partial penetrations, gravel pack sizes, and well-loss constants. The article contains the following chapters: (1) introduction; (2) pumped well junction analysis; (3) simulating pumped wells with different radii; (4) simulating pumped wells of different penetration; (5) simulating pumped wells with different turbulence losses; (6) various pumped well characteristics; (7) capacitor network analysis; and (8) summary. (Gabriel-USGS)
W69-04623

BENEFIT-COST ANALYSIS FOR WATER RESOURCES PROJECTS: A SELECTED ANNOTATED BIBLIOGRAPHY.
Tennessee Valley Authority, Knoxville.

TVA Report, Oct 1967. 105 p, 212 ref.

Descriptors: *Cost-benefit analysis, *Bibliographies, Water resources development, *Project benefits, Forecasting, Evaluation, Economic prediction, Water demand, Recreation demands, Decision making, Flood control, Water pollution control, Navigation, Land appraisal.

The 212 citations in this bibliography are concerned with the current state of the art of benefit-cost analysis for water resource projects. Principal emphasis is placed on the following project purposes: (1) Flood Control, (2) Navigation, (3) Pollution (Quality Control, and (4) Recreation. Enhancement of land value surrounding a water resource project is also emphasized. Although a water resource project may serve other purposes such as hydroelectric power and irrigation, these purposes are not explicitly considered in this compilation. For the ease of those concerned with specific aspects of project evaluation, under each subject area the literature reviewed is classified into the following basic steps in performing a benefit-cost analysis: (A) Definition of Costs and Benefits, (B) Forecasting Demand, (C) Benefit Measurement or Cost Determination, (D) Evaluation Techniques, and (E) Decision Criteria
W69-04629

FORMULA FOR WATER RESOURCES MANAGEMENT IN NEW YORK STATE,
Morris M. Cohn.
Water and Wastes Engineering, Vol 5, No 9, pp 66-67, Sep 1968. 2 p.

Descriptors: *Water resources development, *Water resources planning, *Long-term planning, *New york, Governments, Government financing, State government, Local governments, Water management, Administrative agencies, Administrative costs, Research and development, Government regulation, Water quality, Water pollution control.

New York State has been urged to manage its water resources by practicing long-range planning, coupled with dynamic development to produce water quality and water quantity-in other words P plus D equals 2Q. This article briefly reviews nine years of water planning in New York by the Temporary State Commission on Water Resources Planning and its subsequent transferee the Joint Legislative Committee on Water Resources Conservation. Under the Water Resources Planning Law of 1959, the State has encouraged local multi-purpose planning by paying 75% of the costs of such local planning work. The recent natural drought in the Northeast that affected New York, along with a different kind of drought caused by pollution and the statement of the Temporary State Commission that the time for development action was due or overdue has spurred the creation of a development agency, the State Pure Waters Authority. This agency was created initially to spur the State's governor-sponsored, multi-billion dollar pollution control program. The main thrust of the planning agencies is toward present implementation of the formula for Water Resources Management: P plus D equals 2Q. (Carruthers-Fla)
W69-04646

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

PROBLEMS OF A DRILLING CONTRACTOR,
Alden J. Laborde.
Ocean Industry, Vol 2, No 4, April, 1967, pp 22-25.

Descriptors: *Offshore platforms, *Oil wells, *Operating costs, *Drilling, Oil industry, Oil fields, Industries, Engineering structures, Hydraulic structures, Structures.

The author discusses various problems and costs associated with oil rig operations. He gives a breakdown of certain operating costs: insurance, interest, and other costs.
W69-04275

PORTS OF THE WORLD, 1967.
Shipping World, Benn Brothers, Ltd., Bouverie House, Fleet Street, London England.

Descriptors: *Harbors, *Data collections, *Facilities, Equipment, Ships.

The locations and available facilities of the major ports of the world are given. The information includes data on port charges, pier space, anchorages, inland transportation, bunkers, repair facilities, and some traffic data. Pages 471 through 532 include data on United States ports.
W69-04320

STATEMENT.
Federal Water Pollution Control Administration, Southeast Region, Atlanta, Ga.
For primary bibliographic entry see Field 05G.
W69-04342

WATER USE AND RELATED COSTS WITH COOLING TOWERS,
B. Berg, R. W. Lane, and T. C. Larson.
American Water Works Association, Journal, Vol 56, No 3, March, 1964, pp 311-329.

Descriptors: *Costs, *Cooling towers, *Evaluation, *Water reuse, Thermal pollution, Temperature, Economic feasibility, Engineering structures, Feasibility, Assessments, Cost comparisons, Analysis, Cost analysis, Mathematical studies, Water utilization, Efficiencies.

This study is primarily an economic evaluation of cooling towers for water reuse compared with once-through use. The authors state that this report presents a method whereby approximate costs for specific cooling-tower applications may be estimated and compared with the costs of non-conservative practices. The study identifies eight kinds of information needed to assess the costs of cooling-tower operations in any specific situation.
W69-04443

THE CONTRIBUTION OF THE AMERICAN MERCHANT MARINE TO THE U. S. BALANCE OF PAYMENTS.
Report, Committee of American Steamship Lines, Washington, D. C., June, 1963.

Descriptors: *Ships, *Economic impact, *Transportation, *Benefits, Foreign trade, Monetary benefits.

During recent years, operations of the U. S. Merchant fleet have contributed or saved foreign exchange expenditures totaling between 3/4 and one billion dollars per year. The U. S. liner vessels presently carry less than 30 percent of the total cargo liner movement in our foreign trade. It is estimated that if their participation were increased to the 50 percent level, the U. S. Merchant Marine's favorable contribution to our balance of payments would be increased more than $250 million per year.
W69-04460

WATER DESALINATION: PROPOSALS FOR A COSTING PROCEDURE AND RELATED TECHNICAL AND ECONOMIC CONSIDERATIONS.
For primary bibliographic entry see Field 03A.
W69-04513

6D. Water Demand

WATER REQUIREMENTS OF SELECTED NORTH GEORGIA MANUFACTURING INDUSTRIES,
Georgia Univ., Athens. Dept. of Geography.
John R. McGregor.
University of Georgia, Athens, Georgia, January 1969. 67 p, 2 fig, 1 map, 20 tab, 4 append. OWRR Project A-014-GA.

Descriptors: *Industrial water utilization, *Water users, *Water requirements, *Georgia, Water quality, Industrial water treatment, Waste water treatment.

Forty-four manufacturing industries of four-digit Standard Industrial Classification typical of North Georgia were studied to define their water requirements and to classify them in terms of their water requirements. Data for the research were collected by direct interviews and mail questionnaires. The per employee annual water intake requirement for most industries was approximated. This requirement in some industries was found to vary sharply with size or with specific products. Based on the annual per employee intake water requirement, the industries were classified into three distinct groupings--those requiring less than 10,000 gallons, those requiring 10,000 to 99,000 gallons, and those requiring 100,000 gallons or more. Significant differences in overall water requirements were found to occur among industries of the three groupings. The variety of uses of water was found to increase as the intake water requirement expanded.
W69-04205

ATER DEMAND FOR STEAM ELECTRIC NERATION',
H. Cootner, and G. O. Lof.
RESOURCES FOR THE FUTURE, Johns Hop- s Press, Baltimore, Maryland, 1965.

scriptors: *Electric power, *Water demand, ooling tower, *Thermal pollution, Economic ef- ency, Steam, Demand, Water utilization, Effi- ncies, Heated water, Engineering structures, uipment, Electric power production, Water pol- on.

s publication discusses technical and economic ects of water demand for steam electric genera- . Technical information on water demand and rmal pollution is presented. Economic informa- is presented on water use including the nomic factors involved in cooling tower nology. A regional model to calculate expected ling water demand is developed. The report s not deal specifically with saline water use for ling.
9-04461

E PUBLIC INTEREST IN PRESERVING TURAL AREAS,
. Krutilla.
THE MAINE COAST--PROSPECTS AND RSPECTIVES, October, 1966, pp 8-12. Bow- n College, Brunswick, Maine, Center for ource Studies.

scriptors: *Natural resources, *Maine, *Conser- on, Recreation, Geographical regions, New En- d, Northeast U. S., Regions, Resources.

re is a decreasing availability of natural urce commodities except at increasing real . The problem is generating interest in main- ing reserves of natural resources, whether fossil or camping grounds. The public should sup- the maintenance of reserves, because if they ot enjoy these resources at present they will be ding the option to do so in the future. This 'op- demand' is an investment.
9-04475

NEFIT-COST ANALYSIS FOR WATER SOURCES PROJECTS: A SELECTED AN- TATED BIBLIOGRAPHY.
nessee Valley Authority, Knoxville.
primary bibliographic entry see Field 06B.
9-04629

WN OF GREENWICH V GREENWICH TER CO (PUBLIC UTILITY RIVER DIVER- N).

Conn 526, 144 A 2d 318 (1958).

criptors: *Connecticut, *Public utilities, ater distribution (Applied), *Dam construc- , Judicial decisions, Governments, Permits, ter permits, Legal aspects, Flooding, Riparian ts, Interstate rivers, Eminent domain, Diver- , Water supply, Reservoirs, Interstate.
ntifiers: Public utility commissions.

endant, a Connecticut public service water pany, entered into a contract with a New York er company to construct a dam on an interstate r for the purpose of enlarging its reservoir acity to meet increasing demands for water. project, which would divert the river from the acent lands of plaintiffs, was approved by both New York Public Service Commission and the nnecticut Public Service Commission. The court l that the commission has authority to hold rings on the contract to determine whether its nation was in the public interest. The contract not an attempt to allocate and divide the ers of an interstate stream contrary to a state ute which confers such power only upon the at- ey general. On appeal, the supreme court held the trial court should not retry the case; rather ould merely determine if the commission has abused its discretion or acted arbitrarily. (Molica-Fla)
W69-04688

JONES V OZ-ARK-VAL POULTRY CO (RIGHT TO THE USE OF SUBTERRANEAN WATERS).

306 SW 2d 111-117 (Ark 1957).

Descriptors: *Reasonable use, *Arkansas, *Percolating water, *Pipe flow, Judicial decisions, Water rights, Wells, Subsurface waters, Industrial water, Water consumption, Water allocation, Legal aspects.
Identifiers: Injunctions (Prohibitory).

Plaintiffs owned small parcels of land on which they resided. The defendant owned land adjacent to plaintiffs. Defendant drilled water wells on his property, and the water from these wells was piped to chicken processing plants operated by another defendant. Plaintiffs wells, used for domestic purposes, ran dry allegedly because of the large amounts of water used by the processing plant. The court discussed the English common law rule and the American reasonable use rule as to water rights of riparian owners. The court concluded that plaintiffs were entitled to an injunction since Arkansas has adopted the reasonable use rule which applies to subterranean percolating waters. The perponderance of the evidence showed that the drying up of plaintiffs wells was a direct result of defendants unreasonable use of the water. (Heckerling-Fla)
W69-04690

6E. Water Law and Institutions

THE ROLE OF LAW IN A SYSTEM FOR LAKES ERIE AND ONTARIO,
Ohio State Univ., Columbus. Water Resources Center.
Earl Finbar Murphy.
Ohio State University Water Resources Center, Third Annual Symposium on Water Resources Research, Systems Approach to Water Quality in the Great Lakes, September, 1967, pp 105-115.

Descriptors: Methodology, Lake Erie, Lake Ontario, Dynamic programming, Non-structural alternatives, Water pollution control, Administrative agencies, Legal aspects, Jurisdiction.

The essay examines the role of law in a system to improve water quality of Lakes Erie and Ontario, the most polluted of the Great Lakes. Existing legal bodies pass laws that cannot be enforced. The essay suggests that the proposed Great Lakes Basin Commission be given jurisdiction in all the areas where drainage breaks toward the lakes. It should work closely with national, state, local, and other governments in the area, but should be allowed to form and govern itself. Models for such an approach are the Ruhrverband in Germany, the Delaware River Basin Commission in the United States, and the stream control associations in England. Means of financing are discussed. Systems analysis as a method is discussed as a dynamic mode of analysis that views nature as a whole, man as a single part. Its function is to create viable balances of nature based on patterns of human activity; and, if this is impossible, to provide the evidence for legislating change in human activity. (Gossen-Chicago)
W69-04212

A CITY AND REGIONAL PLANNING APPROACH TO A SYSTEMS APPROACH TO WATER QUALITY IN LAKE ERIE AND LAKE ONTARIO,
Ohio State Univ., Columbus. Water Resources Center.
Israel Stollman.
Ohio State University Water Resources Center. Third Annual Symposium on Water Resources Research, Systems Approach to Water Quality in the Great Lakes, September, 1967, pp 127-129.

Descriptors: Methodology, Dynamic programming, Coordination, Environment, Decision-making, Planning, Systems analysis.

There are four principles of systems analysis: (1) concern with long-run consequences of action, (2) coordinating decisions of several jurisdictions who share the effect of decisions, (3) the interconnectedness of all phenomena, and (4) dynamic planning to continually guide decisions. Planners have three activities: relating their problem to other environmental variables, resolving competing natural and human demands, and providing a framework for choices at every decision-making level, individual, local, state, federal, and international. Relevance and irrelevance of certain variables are discussed. In the thirties, the National Resources Planning Board, effectively began a comprehensive study of the interrelatedness of human and natural activities but the Board was dropped in the early forties. The crisis of the Great Lakes and their industrial neighbors compels the reinstitution of such a study. The Great Lakes Basin Commission coordinates governments for water management. It is hoped that similar steps be taken for environmental management. (Gossen-Chicago)
W69-04214

MARINE SCIENCE AFFAIRS...A YEAR OF TRANSITION.
Report of the President to the Congress on Marine Resources and Engineering Development, February, 1967.

Descriptors: *Legislation, *Federal Government, Legal aspects, Water resources, Resources, Bays, Bodies of water, Coasts, Governments.

This document is the initial report by the Marine Sciences Council to the President and puts forth steps taken to meet the objectives of the Marine Resources and Engineering Development Act of 1966. A brief section, 'Man's Uses of the Shoreline', discusses estuary problems and refers to the planned scale model of the Chesapeake Bay to be built by the Corps of Engineers.
W69-04286

A PERSPECTIVE OF REGIONAL AND STATE MARINE ENVIRONMENTAL ACTIVITIES, A QUESTIONNAIRE SURVEY, STATISTICS AND OBSERVATIONS,
Thompson (John I.) and Co., Washington, D. C.
Gilbert L. Maton, E. R. Christie, and M. J. Tenzer.

Institute of Public Administration, Report PB-177 765, February 29, 1968.

Descriptors: *Fish conservation, *Water pollution, *Federal-state water rights conflicts, *Federal jurisdiction, *State jurisdiction, Structures, Hydraulic structures, Engineering structures, Water treatment, Water purification, Separation techniques, Harbors, Marinas, Breakwaters, Shore protection, Marine animals, Marine fish, Marine fisheries, Commercial fishing, Sport fishing, Commercial shellfish, Saline water fish, Wildlife, Conservation, Wildlife conservation, Aquatic plants, Plants, Demineralization, Shellfish, Invertebrates, Industries, Fishing, Marine plants, Recreation, Desalination, Industrial wastes, Wastes, Recreation facilities, Fisheries, Animals, Aquatic animals, Aquatic life, Fish, Water sports.

This report contains a summary of data derived from questionnaires sent by the authors to qualified representatives of each of the states and territories of the United States bordering on the coasts or Great Lakes. The purpose of the report was to present information concerning the organization and function of state, local, and regional governmental agencies involved in marine environmental activities. These activities were classified into six functional areas: (1) recreation, (2) commercial fishing and living resources, (3) waste disposal, (4) non-living resources, (5) maritime commerce, and

(6) conservation. Observations: The state executive structure for marine environment activities is a diffuse policy and planning network loosely connected but with enough interaction among the cognizant agencies to permit the essential and critical programs to happen. State governments understand the significance of the marine environment and are making good policy decisions, but they take too long to do so. The states fear federal intervention in areas which have traditionally been in state control, such as sports, commercial fishing, pollution, and conservation. A bibliography associated with this study is cited elsewhere in this compilation (Report No. PB-177 764).
W69-04289

A MODEL LAND DEVELOPMENT CODE.
Tentative Draft No. 1, American Law Institute, April 24, 1968.

Descriptors: *Land development, *Governments, *Legislation, *Planning.

This is a draft of proposals concerning the legal status of the planning process. The general conclusion is that there are some techniques of regulation that a governing body should not be able to use unless there is written evidence of forethought (i.e., written plans). The proposed code is divided into 12 articles. The following is a summary of the code: (1) It grants power to local government to control land development. (2) It specifies the content of a land development plan. (3) It specifies the ways a locality can regulate development by zoning, architectural review, and eminent domain. (4) Compensation to land owners for loss of value because of coming under a new plan (e.g., zone changes from industrial to urban). (5) It suggests the standardization of procedures within the state for all permits for land development.
W69-04301

VANISHING TIDELANDS,
Polly Redford.
Atlantic Monthly, Vol 219, June, 1967, pp 75-83.

Descriptors: *Legislation, *Water pollution, *Wildlife conservation, *Habitat improvement, Water conservation, Conservation, Habitats, Environment, Management, Wildlife management, Tidal marshes, Marshes, Wetlands, Adoption of practices.

This is a journalistic portrayal of the U. S. estuaries through the eyes of a conservationist. It was written in support of Dingell's bill HR 25 and discusses some of its points. The article outlines the contamination of the Merrimack River north of Boston. Efforts by conservationists to buy sections of natural estuarine habitat are discussed.
W69-04323

STATE AND LOCAL GOVERNMENT ACTIVITIES AND ROLES IN MARINE SCIENCE, ENGINEERING AND DEVELOPMENT. A BRIEFLY ANNOTATED CATALOG OF PUBLISHED STUDIES AND REPORTS ON SUCH ORGANIZATIONAL ARRANGEMENTS AND ACTIVITIES IN THE COASTAL STATES AND IN THOSE BORDERING ON THE GREAT LAKES.
Report, John I. Thompson and Company, Washington, D. C., PB-177 764, February 14, 1968.

Descriptors: *Great Lakes region, *Coasts, *Governments, *Statistics, *Surveys, Geographical regions, Regions, Data collections.

The bibliography covers state and local administration of facilities and programs for marine activities in states on the seacoasts and bordering the Great Lakes.
W69-04341

SHIRLEY V NEW HAMPSHIRE WATER POLLUTION COMMISSION (VALIDITY OF ORDER TO DESIST SEWAGE DEPOSIT INTO RIVER).
For primary bibliographic entry see Field 05B.
W69-04366

WATERWORKS AND WATER SUPPLIES.
For primary bibliographic entry see Field 04A.
W69-04367

PAXSON V COLLINS (TITLE TO ACCRETION AND RELICTION).
100 So 2d 672-676 (3rd DCA Fla 1958).

Descriptors: *Florida, *Accretion (Legal aspects), *Riparian rights, Judicial decisions, Reliction, Boundaries (Property), Navigable waters, Ownership of beds, Seashores, Riparian land, Shores, Littoral drift.
Identifiers: Internal Improvement Fund.

The plaintiff landowners brought this suit to quiet title to lands added to the boundaries of their riparian lots by accretion. The complaint asked further that the defendant Trustees of the Internal Improvement Fund and Central and Southern Flood Control District be enjoined from conveying these accreted lands or otherwise encumbering them. On appeal from the circuit court, this court rejected the Trustees' contention that the accretions were 'submerged sovereignty lands' and hence the plaintiff's could claim no title in them. Florida follows the common-law rule vesting title to soil formed along navigable waters by accretion or reliction in the owners of the abutting land. The allegation that the defendant trustees had conveyed title to relicted lands claimed by the plaintiffs was sufficient for the circuit court of the county in which the lands were situated to obtain venue in a suit to quiet title. (Blunt-Fla)
W69-04368

FARELLY LAKE LEVEE DISTRICT OF JEFFERSON AND ARKANSAS COUNTIES V HAMPTON (RATIFICATION OF CONTRACT TO REPAY CONTRIBUTIONS FROM LANDOWNERS).

306 SW 2d 699-700 (Ark 1957).

Descriptors: *Contracts, *Arkansas, *Judicial decisions, *Levees, Rivers, Financing, Legal aspects, Contracts, Right of way.
Identifiers: Arkansas River, Ratification, Adoption, Injunctions, Ultra vires.

The State of Arkansas established plaintiff levee district by a Special Act in 1913. By 1928, the district was placed in receivership. In 1938, while plaintiff was still in receivership, the banks of the Arkansas River began caving in, and it became necessary to set the levee back to protect property. Plaintiff had no money with which to purchase a new right of way. The land for the right of way was donated by the owners of property where the new levee was to be located. One Mahaffy refused to donate a right of way, and the donating landowners contributed funds to purchase his land. Plaintiff passed a resolution stating its intent to reimburse the contributions made. This suit was brought to enjoin repayment of this alleged debt. The court held that the contributions were made voluntarily, and, since plaintiff had no authority to borrow the money, it could not later declare the loan a debt of the levee district. A contract invalid in the beginning for want of capacity or power to contract cannot later be notified. (Heckerling-Fla)
W69-04369

HARRIS V UNITED STATES (NEGLIGENCE OF TVA UNDER FEDERAL TORT CLAIMS ACT).

154 F Supp 46-51 (WD Ky 1957).

Descriptors: *Tennessee Valley Authority Project *Dams, *Gates, *United States, Judicial decisions Legislation, Boating, Fishing, Reservoirs, Rivers Coast guard regulations, Boating regulations Buoys.
Identifiers: *Federal Tort Claims Act, *Negligence

Plaintiff brought suit under the Federal Tort Claim Act, against the United States and the TVA, as ad ministrator of the estates of two decedent drowned in waters controlled by the TVA. Plaintif alleged negligence on the part of U S Engineers i charge of the Kentucky Dam Lock, and the Coas Guard in placing buoys to show a danger zon above the dam. A gate in the dam had bee opened, causing the boat in which decedents wer riding to be capsized. The court held for the defen dants. The Federal Tort Claims does not cove claims against the United States arising from ac tions of the TVA. With regard to the claim agains the TVA itself, the court held that there was n duty to warn of an obvious condition of danger The court further held that the decedents wer guilty of contributory negligence and had assume the risk in choosing to fish in an area of know danger. (Williams-Fla)
W69-04370

FINLEY V TEETER STONE INC (ACTION FOI DAMAGES DUE TO PUMPING PERCOLATIN(WATERS).
For primary bibliographic entry see Field 04C.
W69-04371

RIDDLE V CITY OF GREENVILLE (RIGHT TO COLLECT DAMAGES FROM POLLUTION O STREAMS).
For primary bibliographic entry see Field 05B.
W69-04372

HUEY V KELLER (RIGHTS OF UPPER RIPARI AN OWNER).
For primary bibliographic entry see Field 04A.
W69-04373

INTERNAL IMPROVEMENT FUND OF STAT OF FLORIDA V NOWAK (USE OF MEANDE LINES IN SETTING BOUNDARIES OF RIPARI AN PROPERTY).

401 F 2d 708-718 (5th Cir 1968).

Descriptors: *Boundary disputes, *Meander *Florida, *Rivers, High water mark, Propert boundaries, Riparian rights, Federal jurisdictio Legal aspects, Judicial decisions, Maps, Mappin Condemnation, Riparian land.
Identifiers: Federal law, Plats.

The United States instituted condemnatio proceedings against a tract of marshland claime by appellant, a representative of the state, and ap pellee. The latter claimed to have purchased th tract as part of a larger parcel of land, although th tract in question had been omitted from th original plat map. Appellant claimed that since th tract did not appear on the map, it had never bee conveyed. Evidence showed that the original su veyor had intended to meander a river whic formed the common boundary of both the dispute tract and appellee's mapped land, but had instea incorrectly drawn the meander line so that severed the marshy tract from appellant's adjace land. The court, in finding for the appellee, state that meander lines are not generally considered t be actual boundaries. The boundary of riparia land is considered to be the waterline itself, whe there is evidence that this was the surveyor's inten (Kelly-Fla)
W69-04374

HAMBURG REALTY COMPANY V WOOD (OWNERSHIP OF LAND FORMED IN RIVER).

327 S W 2d 138-155 (Mo 1959).

scriptors: *Judicial decisions, *Missouri, ccretion (Legal aspects), Islands, Missouri ver, Alluvion, Reliction, Boundaries (Property), vers, Intermmittent streams, Developed waters, ıtercourses (Legal), High water mark, Navigable ters, Navigable rivers, Riparian rights, Sand rs, Currents (Water).
ntifiers: Deeds, Adverse possession.

an action to quiet title to certain land situated in Missouri River, plaintiff alleged fee simple ord title from the county. Defendant asserted e by adverse possession. The land in question s formed by a change in the course of the river d abutted an island owned in part by plaintiff and defendant. The plaintiff paid the county 66.32 for the land (613.05 acres). The defen- nt alleges that plaintiff acquired no valid record e to land because: (1) its deed from the county s not shown to have been executed by authority the county court; and (2) the deed did not scribe any ascertainable areas or tract of land. e court, after viewing numerous deeds and 60 or re maps of the area, and after reviewing the oral timony of several witnesses, held that the deed s not void for indefiniteness and that the dence sustained a finding that such lands were med independently of an island conveyed by the nty to the plaintiffs, and that defendants were t entitled to such land under their deed to the nd which included the island as it stood at the e of their deed together with all lawfully reted land. The land in question was not reted to the island and therefore does not inure he riparian owner. (Heckerling-Fla)
59-04375

IRE V SERRA (INJUNCTION PROHIBITING E FILLING IN OF A RIVER).

6 A 2d 391-393 (N H 1954).

scriptors: *New Hampshire, *Riparian rights, easonable use, *Alteration of flow, River flow, licial decisions, Rivers, Flow rates, Landfills, limentation, Damages, Eddies, Obstruction to w, Beneficial use, Streams, Docks, Legal ects, Riparian land.
ntifiers: Injunctions, Irreparable damages.

intiffs, riparian owners, operated a boat and bait siness on the banks of a river. Defendant's land s upstream, adjacent to that of plaintiffs. Defen- nt, a stone mason, began to fill in a portion of the er directly adjacent to plaintiffs' main boat dock the purpose of storing materials and equipment his trade. Plaintiffs brought a bill in equity to rmanently enjoin further filling and further, ying for a mandatory injunction commanding noval of part of a wall and all of the fill already in ce. The trial court granted the prohibitory in- ction but refused to grant the mandatory injunc- n requiring removal of the existing fill because t present use was held to be reasonable. The rt said the existing fill did not constitute an ob- uction which would change the flow in any ap- ciable degree nor cause any appreciable sedi- ntation build up at plaintiffs' dock. On appeal by intiffs, it was held that the trial court's findings re supported by the evidence. (Wheeler-Fla)
59-04376

ATER IMPROVEMENT COMMISSION.
r primary bibliographic entry see Field 05G.
59-04377

OUNG V CITY OF ASHEVILLE (RIPARIAN GHTS).

1 N C 618 86 S E 2d 408-416 (1955).

scriptors: *Riparian rights, *Irrigation, *Water llution, *North Carolina, Stream flow, Prescrip- e rights, Sewage, Water law, Contaminants, isance, Impaired water quality, Non-consump- e use, Fouling, Water quality, Water rights, Al- ation of flow, Judicial decisions.

Plaintiff lessee's vegetable crops became contaminated when he used polluted creek water to irrigate them. A polluted creek is not a nuisance per se to a non-riparian owner nor is it a nuisance to a non-riparian owner unless his rights are invaded by the pollution. Plaintiff neither alleged that he was a riparian proprietor nor that he had acquired rights to use the creek for irrigation by prescription or adverse use. Lessee did not show he had license from the riparian owner to have the creek waters flow with undiminished quality. Lessee's damage was caused by his own act of sprinkling his cabbages and collards with creek water polluted by raw sewage, and not by an invasion of his rights by the polluter. (Hoffman-Fla)
W69-04378

WHARVES AND FISH WEIRS.
For primary bibliographic entry see Field 04A.
W69-04379

MUNICIPALITIES.
For primary bibliographic entry see Field 04D.
W69-04380

SOIL AND WATER CONSERVATION DISTRICTS.
Me Rev Stat Ann tit 12, secs 2, 3, 5, 6, 52, 53, 54, 101, 151, 154, 155, 156, 157, 158 (1965), secs 1, 3, 4, 6, 7, 51, 54, 102, 151, 152, 153, 156, 201 (Supp 1968).

Descriptors: *Soil conservation, *Statutes, *Maine, *Water conservation, Erosion control, Land management, Planning, Riparian rights, Water resources, Federal government, Legal aspects, State government, Administrative agencies, Erosion, Flood protection, Water utilization, Water management (Applied).
Identifiers: *Soil and water conservation districts, Land occupiers, Commissions.

These sections provide for Soil and Water Conservation Districts. The Committee and districts shall be created to effectuate the conservation policy of the Legislature. The district's powers and duties may not infringe upon or impair rights of any owner of riparian lands. The districts, as agents of the state, shall have power to implement preventive flood control measures: to obtain property, which thereafter will be tax exempt; to make equipment available to assist landowners in soil and water conservation; to contract and negotiate with any agency of the United States Government; and to have all the legal rights of a corporate entity. The Attorney General may be called upon for such legal advice as the Committee may require. The Committee members shall be elected for classified four-year terms and only reasonable expenses are allowed as compensation. The Committee shall offer assistance, information, and coordination to supervisors of the various districts. The supervisors of the districts shall be nominated and elected by land occupiers in the district. Where the need is such, any twenty-five land occupiers may petition the Committee for the establishment of a district, and the Committee will hold hearings to determine if a referendum should be submitted to the land occupiers of the proposed district. (Dean-Fla)
W69-04381

CLARK V LINDSAY LIGHT AND CHEMICAL COMPANY (INJUNCTION FOR POLLUTION ABATEMENT).
For primary bibliographic entry see Field 05G.
W69-04382

STATE OF TEXAS V CHUOKE (OWNERSHIP OF SUBMERGED LANDS).

154 F 2d 1-4 (5th Cir 1946).

Descriptors: *Judicial decisions, *Condemnation, *Beds under water, *Ownership of beds, Texas, Eminent domain, Federal government, Appropriation, State governments, Condemnation value, Oysters, Legislation, Bayous, Islands, Federal jurisdiction.
Identifiers: *Procedure.

This case involves the condemnation of submerged lands in Texas by the United States. The question to be resolved is how to distribute the money paid to the court as just compensation. The State of Texas claims title to the submerged lands and, therefore, feels that it is entitled to a part of the funds. The court found that the exclusive right to the submerged lands was given by the legislature to private individuals engaged in the harvesting of oysters. As a result, the court held that the state was not entitled to any part of the funds. (Stewart-Fla)
W69-04383

GEORGE V BEAVARK, INC (LAKE NAVIGABILITY FOR ADMIRALTY PURPOSES).

402 F 2d 977-981 (8th Cir 1968).

Descriptors: *Arkansas, *Non-navigable waters, *Admiralty, *Judicial decisions, Fishing, Navigation, Navigable waters, Lakes, Social function, Backwater, Dams, Federal jurisdiction, Legislation, Docks, Damages, Ships.

Petitioners were owners of a boat which caught fire and caused damage to docks. They sought to take advantage of federal limitation of liability statutes before the Federal District Court sitting in admiralty. In order to come within the statutes, the waters on which the accident occurred must have been navigable. Petitioners contended that the man-made lake was navigable because, prior to the construction of the dam, the river had been used for float fishing. The District Court noted the opinion of the Corps of Engineers that the river was non-navigable and denied the petition. In affirming, the Court of Appeals stated that if the river was navigable prior to the dam construction, it continued to be considered as a navigable stream, but ruled that float fishing was insufficient to show navigability. The Court said that the majority of jurisdictions hold that in order to be navigable, waters must be capable of practical general uses. (Wheeler-Fla)
W69-04384

STATE LAND NEEDED BY U S.
Mich Comp Laws Ann sec 3.301 (1967).

Descriptors: *Michigan, *Legislation, *Navigable waters, Navigation, Sea walls, Breakwaters, Piers, Federal government, State governments, State jurisdiction, Federal jurisdiction, Legal aspects, United States, Public lands, Water rights, Land tenure, Management.
Identifiers: Aids to navigation.

This statute authorizes the governor to convey title to and cede jurisdiction over state land covered by navigable waters to the federal government when such land is needed for federal use. The state shall retain concurrent jurisdiction for service of civil and criminal process thereon. (Helwig-Fla)
W69-04385

COUNTY ZONING.

Mich Comp Laws Ann sec 125.201 (1967).

Descriptors: *Michigan, *Legislation, *Zoning, *Local governments, Ordinance, Cities, Water conservation, Water supply, Administration, Regulation, Beach erosion, Shore protection, Oil, Natural gas, Drilling, State governments, Legal aspects.
Identifiers: *Setback lines.

This statute authorizes the county board of supervisors in any county to establish by ordinance, zoning districts outside the limits of incorporated cities for the purpose of regulating agriculture, forestry, recreation, residence, industry, trade, soil conser-

vation and water supply conservation. The board may also provide for setback lines in areas subject to beach erosion and may divide the county into districts in order to best provide such protection. (Helwig-Fla)
W69-04386

ANNEXATION OF SUBMERGED LANDS.

Mich Comp Laws Ann secs 123.581-123.583 (1967).

Descriptors: *Michigan, *Great Lakes, *Beds, *Boundaries (Property), Landfills, Ownership of beds, Islands, Local governments, Cities, Legal aspects.
Identifiers: *Submerged lands, *Annexation, *Submerged islands, Adjacent land.

Any incorporated city or village with a boundary on waters of any of the Great Lakes, shall have the power to annex submerged lands if adjacent to its boundary, the title to which is vested in a private owner pursuant to legislative act, which have no inhabitants, and are not at the time of the conveyance located in any township, city or village. If written consent is procured from the owner, annexation shall be accomplished by amending the charter of the city or village to extend the boundaries to include the land. Whenever any 'filled-in' submerged lands attached to and an extension of the upland have been in existence for more than 15 years, and any submerged islands not within any city or village but within 300 yards of the boundary shall be included within the boundary without annexation proceedings and shall also be within the boundaries of the county and other units of government. (Harris-Fla)
W69-04387

HOUSEBOATS, SANITATION AND LOCATION.
For primary bibliographic entry see Field 05G.
W69-04388

LONG ISLAND BEACH BUGGY ASS'N V TOWN OF ISLIP (BEACH EROSION).
For primary bibliographic entry see Field 04D.
W69-04389

SEWAGE REMOVAL OR PURIFICATION AND CONDEMNATION OF PROPERTY.
For primary bibliographic entry see Field 05G.
W69-04390

THE DISCHARGE OF SEWAGE AND OTHER MATTER INTO CERTAIN WATERS IS PROHIBITED.
For primary bibliographic entry see Field 05B.
W69-04391

PUBLIC HEALTH LAW (CLASSIFICATION OF WATERS AND PREVENTION OF POLLUTION).
For primary bibliographic entry see Field 05G.
W69-04392

GENERAL POWERS OF THE BOARD OF TRUSTEES.
For primary bibliographic entry see Field 04A.
W69-04393

DRINKING WATER SUPPLIES.
For primary bibliographic entry see Field 05F.
W69-04394

STATE SANITARY CODE.
For primary bibliographic entry see Field 05G.
W69-04395

SANITARY QUALITY OF WATER IN SWIMMING POOLS AND AT BATHING BEACHES.
For primary bibliographic entry see Field 05G.
W69-04396

RIVERS AND STREAMS AS PUBLIC HIGHWAYS.

N Y Nav Law secs 120, 121, 122, 123, 124, 125 (McKinney 1968).

Descriptors: *New York, *Navigation, *Obstruction to navigation, *Navigable waters, Legislation, Waterways, Barriers, Dams, Bridges, Lumber industries, Condemnation, Riparian rights.
Identifiers: Public highways, Marking timber.

Dams and bridges erected over a river or stream recognized as a public highway are required to be constructed so as to allow the free and uninterrupted passage of lumber. For this purpose, dams must have an apron 15 feet wide. Persons operating booms or other obstructions must permit the passage of lumber. Those failing to allow such passage within 10 days after notice are liable to a penalty fine and damages. The rights of riparian owners on a river or stream recognized as a public highway may be condemned for running lumber by floating or flooding. Persons running lumber down any such public highway must record some individual mark to be placed on the lumber. This mark is presumptive evidence of ownership. Persons stopping or landing lumber are liable to the owner for all damages. The Hudson River, the Allegheny, Delaware, Oswegatchie, Grasse, Raquette, West Canada Creek, Black Rivers and their tributaries are not affected by this article. (Childs-Fla)
W69-04399

CONSERVATION LAW.
For primary bibliographic entry see Field 05G.
W69-04400

RIVER IMPROVEMENT.
For primary bibliographic entry see Field 04A.
W69-04401

ABANDONMENT OF CANAL LANDS.

N Y Canal Law secs 50, 51 (McKinney Supp 1968), 1 p.

Descriptors: *Legislation, *New York, *New York State Barge Canal, *Canals, Structures, Navigation, Transportation, Land use, Land development, State governments, Administrative agencies.
Identifiers: *Abandonment.

This article deals with the abandonment of canal lands. The first section confers authority upon the Commissioner of Transportation to abandon any portion of barge canal lands or terminal lands which have outlived their usefulness to the barge canal system. It also authorizes abandonment of structures that are no longer necessary as aids to navigation or for barge canal terminal purposes. However, this authority does not include abandonment of a barge canal terminal unless such terminal is declared to be no longer useful or necessary by a special act of the legislature. The next section describes the procedure to be followed before abandonment. It requires the Commissioner to publish notice and, if warranted, to hold a hearing. After issuing the official order of abandonment, the Commissioner shall file his report in his office. It shall describe what action was taken and the land involved. (Stewart-Fla)
W69-04402

FLOOD CONTROL PROJECTS - LAND ACQUISITION, MAINTENANCE AND OPERATION.
For primary bibliographic entry see Field 04A.
W69-04403

WATER QUALITY MANAGEMENT AND CONTROL.
For primary bibliographic entry see Field 05G.
W69-04404

WATER FRONT IMPROVEMENTS.

N J Stat Ann secs 40:68-27 (Supp 1968); N J Stat Ann secs 40:68-28, 40:68-40, 40:68-41 (1967).

Descriptors: *Legislation, *New Jersey, *Erosion control, *Beach erosion, Shores, Administration, Tidal waters, Administrative agencies, Surveys, Cities, Condemnation.
Identifiers: Beach Erosion Control Commission, Elections.

Municipalities bordering on tidal waters may establish a beach erosion control district. Notice of the district to be created shall be posted in 2 public places setting forth the date of the hearing and the boundaries of the district. The ordinance setting up the district shall be approved by a majority vote on ballots printed specially for the election. The election shall be advertised at least one week in advance. Section 28 provides that if a Beach Erosion Control Commission is established it shall be known as ' (name of governing body) Beach Erosion Control Commission.' The Beach Erosion Control District, a public body politic and corporate having perpetual succession, is given power to: (1) adopt a seal; (2) sue and be sued; (3) provide for measures to prevent erosion; (4) enter into contracts; (5) borrow money and issue negotiable bonds; (6) acquire and dispose of property; and (7) employ agents necessary to carry out the purposes of this act. The district may enter onto lands or waters to make surveys, borings, soundings and examinations, and may bring condemnation suits. (Heckerling-Fla)
W69-04407

NORTH JERSEY DIST WATER SUPPL' COMM'N V CITY OF NEWARK (RESCISSION OF WATER SUPPLY CONTRACTS).

108 NJ Super 542, 248 A 2d 249-254 (1968).

Descriptors: *New Jersey, *Cities, *Supply contracts, *Judicial decisions, Legal aspects, Water costs, Water supply, Estimated costs, Water law, Legislation, Surveys.

Defendant City of Newark took action by resolution and ordinance to rescind a cooperation and service agreement. Plaintiff, North Jersey District Water Supply Commission, brought action seeking a declaratory judgement that the contract was binding upon all parties. Pursuant to enabling legislation, plaintiff was to provide adequate water supply for various participating municipalities. Defendant entered into a cooperation agreement with plaintiff for future water provisions with costs to be determined by analytical surveys. Subsequently, defendant sought to rescind the agreement because of the vagueness of terms as to the cost determination. The court held that the agreement would be preserved. Both parties had had an opportunity to survey the costs. The defendant had entered the contract on his own volition, and the court's function was not to make better contracts for the parties. The court indicated that flexibility was necessary in long range water supply contracts. (Holt-Fla)
W69-04408

BEACH CONTROL: RULES AND REGULATIONS.
N J Stat Ann secs 40:185-4, 40:185-5 (1967).

Descriptors: *New Jersey, *Beaches, *Cities, *Administration, Legislation, Beach erosion, Shore protection, Recreation, Recreation facilities, Shores, Swimming, Easements, Local governments

y city bordering on the Atlantic Ocean owning d or easement rights on land on the ocean shall ve exclusive control and care thereof, including y boardwalk or facilities now or later con-ucted. Ordinances may be passed for the govern-; and policing of such lands and facilities, pro-ed that any ordinance shall not interfere with te law. Any city may, in order to provide funds maintain and police the ocean front and to pro-t it from damage or erosion by the sea, charge a sonable fee for use of the beach by persons over years of age. (Helwig-Fla)
59-04409

ND BORDERING ON AND ADJACENT TO EAN MAY BE ACQUIRED FOR PLACES OF BLIC RESORT. REFERENDUM OF ESTION OF ADOPTION OF ACT.
J Stat Ann secs 40:179-120, 40:179-121 (1967).

scriptors: *New Jersey, *Atlantic Ocean, ecreation, *Public health, Public benefits, Ci-s, Land use, Natural resources, Recreation facili-s, Condemnation, Legislation, Financing, Legal ects, Eminent domain, Regulation, Main-ance.
ntifiers: *Resorts.

e governing body of a city bordering on the At-tic Ocean has the right to acquire lands in that y which border on the ocean, by purchase or ndemnation, for public purposes and for resorts public health and recreation. The city may issue nds in order to obtain the funds required for such dertaking. This act shall not take effect without approval of a majority of the voters in the city ected. This approval may be obtained by note at ner a special or annual election, and if approved, act will take effect immediately. (Shevin-Fla)
59-04410

QUISITION OF LANDS BORDERING AND JACENT TO THE OCEAN.

J Stat Ann secs 40:179-113 to 40:179-119 967).

scriptors: *New Jersey, *Recreation, *Public alth, *Financing, Atlantic Ocean, Public nefits, Cities, Legislation, Land use, Recrea-nal facilities, Condemnation, Buildings, Con-uction, Parks, Erection, Taxes, Legal aspects, inent domain, Regulation, Maintenance, Roads.
ntifiers: *Resorts, Public grounds commission.

e governing body of a city bordering on the At-tic Ocean may acquire lands in that city by rchase or condemnation for use as public places l resorts for public health and recreation. The y may finance the project by the issuance of nds. After such lands are acquired, a public ounds commission shall be established. The com-ssion shall have the power to erect public ildings on the grounds and shall have sole ponsibility for supervision and control of all rks and public places. The Commissioners are arged with maintenance of the property and may rform any acts necessary to the discharge of this ponsibility. In order to discharge the indebted-ss contracted, and to secure funds for the con-uction and maintenance of buildings, pavilions, dways, walks, and for the general improvement the parks, the Commission may lease or rent any rtion of the property. The city may assess taxes cover interest and principal payments on bonds tstanding under this section and may also create inking fund for the subsequent redemption of se bonds if such a fund is not already in ex-ance. (Shevin-Fla)
59-04411

ONSTRUCTION OF CONVENTION HALL ER.
r primary bibliographic entry see Field 04A.
59-04412

BOARD OF PUBLIC WORKS.

N J Stat Ann secs 40:89-1 to 40:89-3 (1967).

Descriptors: *New Jersey, *Utilities, *Public works, *Sewage systems, Legislation, Electric powerplants, Water works, Administration, Community development, City planning.
Identifiers: *Board of Public Works, Mayor.

Section 40:89-1 provides that a board of public works may be set up by ordinance in all boroughs owning or operating a waterworks, sewage system, or disposal plans, or an electric lighting plant. Sec 40:89-2 provides that the mayor shall appoint, with the advice and consent of the council, six citizens of the borough, who, with the mayor, shall be known as the 'board of public works,' to hold office for 3 years. Two members shall be appointed each year. The mayor shall not vote except in case of a tie. Section 40:89-3 confers the following powers on the board: (1) the power to lay pipes for conveying water for public or private use; (2) the power to provide for sewerage and drainage of the borough; and (3) the power to provide for the lighting of streets and public places. The laws already in force pertaining to any of these powers shall continue in full force unless inconsistent. The board shall not have the power to authorize the issuing of bonds. (Heckerling-Fla)
W69-04413

HARBOR AND WATER FRONT COMMISSION; BEACH EROSION CONTROL DISTRICT.

NJ Stat Ann secs 40:68-22 to 40:68-26 (1967).

Descriptors: *Harbors, *Beach erosion, *New Jersey, *Legislation, Water law, Cities, Flood control, Port authority, Legal aspects, State governments, Local governments, Administrative agencies, Flooding.

Each municipality is authorized to create a harbor and waterfront commission. The commissions consist of seven persons appointed initially for terms of up to five years by the governing body of the municipality. The commissioners exercise power given them by municipal ordinance concerning the management of the harbor and waterfront of the municipality and the properties located thereon. Action by the commission involving over $500 requires the approval of the municipal governing body. If the municipality borders on tidal waters and is threatened by flooding, the municipal governing body may create a beach erosion control district consisting of lands that are or may be threatened by flooding. (Hoffman-Fla)
W69-04414

COUNTY SEWERAGE AUTHORITIES.
For primary bibliographic entry see Field 05G.
W69-04415

IRRIGATION SYSTEMS (ESTABLISHING IRRIGATION SYSTEMS IN NEW JERSEY COUNTIES).
For primary bibliographic entry see Field 03F.
W69-04416

BRIDGES OVER CERTAIN TIDAL WATERS; CHANGING COURSE OF STREAM.
For primary bibliographic entry see Field 04A.
W69-04417

STORMWATER SEWERS FOR COUNTY ROADS; MUNICIPAL COOPERATION.
For primary bibliographic entry see Field 04C.
W69-04418

PROTECTION OF ROADS NEAR TIDEWATER; ACQUISITION OF LANDS.
N J Stat Ann secs 27: 16-13, 27: 16-14 (1966).

Descriptors: *New Jersey, *Tidal waters, *Erosion control, *Condemnation, Legislation, Roads, Flood protection, Local governments, Roadbanks, Eminent domain, Ditches, Drainage, Legal aspects, Operation and Maintenance.

Procedures are provided whereby county freeholders may acquire land in order to prevent damage to county roads by tidewaters. Instead of acquiring such land, an agreement may be entered into with the landowner whereby he agrees to maintain the banks and ditches along, upon, and over the adjacent lands for the protection of county roads. (Childs-Fla)
W69-04419

HEALTH AND VITAL STATISTICS: COUNTY BOARD OF HEALTH.
For primary bibliographic entry see Field 05G.
W69-04420

MOSQUITO EXTERMINATION.
N J Stat Ann secs 26:9-1 to 26:9-12.9 (1964).

Descriptors: *New Jersey, *Mosquitoes, *Insect control, *Public health, Legislation, Inspection, Abatement, Spraying, Larvae, Water treatment, Administrative agencies, State governments, Regulation, Local governments, Breeding, Legal aspects, Surveys.
Identifiers: *Mosquito control.

This article deals with the control and elimination of mosquitoes and their breeding areas within the State. The first section provides for the establishment of a state experiment station. The director of the station shall survey all areas that he feels necessary in locating breeding areas. He shall map each section surveyed and indicate all breeding areas, the adopted method of extermination and the probable cost. In addition, the director, at the request of a local health board, shall survey any suspected territory and provide a map to the local board. Whenever doing a survey, the director shall notify the local board of health of a breeding area. The local board shall investigate the ownership and notify the owners to abate the breeding place. If the owner fails to comply, the local board shall abate the nuisance. The next provision deals with the budget of the state experiment station. The director may spend such amount for mosquito extermination as may be appropriated by the legislature. Finally, the article creates in the Department of Conservation and Economic Development a permanent commission known as the State Mosquito Control Commission. Its duty will be to make a continuous study of mosquito control and elimination within the state. It may also recommend to the legislature any desirable changes regarding legislation and appropriations. Furthermore, the commission may make recommendations to the director of the state experiment stations regarding breeding places and their abatement. (Stewart-Fla)
W69-04421

PUBLIC SWIMMING POOLS AND PLACES.

NJ Stat Ann secs 26:4A-1 to 26:4A-3 (1964).

Descriptors: *New Jersey, *Swimming pools, *Safety, *Regulation, Legislation, Recreational facilities, Control, Administrative agencies, Public health, Legal aspects.
Identifiers: Penalties.

This statute deals with the operation of a swimming pool or swimming area for profit. It dictates that the owner shall provide adequate and trained personnel for life-saving when the pool or area is open to the public. In addition, the statute also requires the owner to supply proper appliances for resuscitation during open hours. The statute empowers the State Department of Health to establish reasonable rules and regulations to carry out provisions of this act. Violations of this act are punishable by a fine of $50 for the first offense and $100 for each subsequent offense. (Stewart-Fla)
W69-04422

BRIDGES TO CONFORM TO WHARF LINES.
For primary bibliographic entry see Field 04A.
W69-04423

NUISANCES AFFECTING HEALTH.
For primary bibliographic entry see Field 05G.
W69-04424

DECLARATION AND ABATEMENT OF NUISANCES.
For primary bibliographic entry see Field 05G.
W69-04425

ATLANTIC STATES MARINE FISHERIES COMMISSION.

N J Stat Ann secs 32:21-1 to 32:21-11 (1963).

Descriptors: *Fish conservation, *Fish management, *Interstate compacts, *Interstate commissions, New Jersey, Atlantic Ocean, Marine fisheries, Legislation, Geographical regions, Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, Delaware, Maryland, Virginia, North Carolina, South Carolina, Georgia, Florida, Marine fish, Shellfish, Anadromous fish, Fish stocking, Fish eggs, Commercial fishing, Sport fishing.

The purpose of this compact is to promote the better utilization of the fisheries of the Atlantic Seaboard. The Atlantic States Fisheries Commission will be composed of representatives from Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Delaware, Maryland, Virginia, North Carolina, South Carolina, Georgia, and Florida. Any other state contiguous with the aforementioned states and riparian upon water frequented by anadromous fish may become a member. The agreement will become operative as to those states executing it whenever two or more states join in its execution. Each state joining shall appoint three representatives to sit on the Commission. The Commission shall make inquiries as to the best method for conserving the fisheries. It may recommend use of the police powers of the signatory states in order to preserve the fisheries and may make recommendation that the affected waters be stocked. The United States Fish and Wild Life Service shall assist in the Commission's endeavors, and an advisory commission composed of commercial fishermen and salt-water anglers shall be formed. The states shall make annual appropriations to support the commission. By consent of two states, the commission may be given authority to regulate the fishing operations and vessels of those states with respect to their fisheries. (Shevin-Fla)
W69-04426

INTERSTATE COOPERATION FOR CONSERVATION AND PROTECTION OF WATER RESOURCES.
For primary bibliographic entry see Field 03D.
W69-04427

LOCAL BOARDS OF HEALTH - GENERAL POWERS AND DUTIES.
For primary bibliographic entry see Field 05G.
W69-04428

HOPLER V MORRIS HILLS REGIONAL DISTRICT (LIABILITY FOR DISCHARGING SURFACE WATERS).
For primary bibliographic entry see Field 04A.
W69-04429

ISLANDS IN DELAWARE RIVER.
N J Stat Ann secs 52:28-29 to 52:28-31 (1955).

Descriptors: *New Jersey, *Legislation, *Delaware River, *Islands, Pennsylvania, Interstate rivers, Interstate compacts, State governments, Legal aspects, Land tenure, Jurisdiction.

Commissioners from New Jersey and Pennsylvania met for the purpose of dividing the islands in the Delaware River, and an agreement was made which provides that: (1) the islands in the river are divided between the states according to this agreement; and (2) any islands which may be formed after the agreement will belong to the nearer state. (Heckerling-Fla)
W69-04430

OWNERS OF MARSH AND MEADOW LANDS.
N J Stat Ann secs 50:2-13 to 50:2-16 (1955).

Descriptors: *Legislation, *New Jersey, *Shellfish, *Gates, Clams, Riparian rights, Oysters, Ditches, Boats, Non-navigable waters, Locks, Ownership of beds, Legal aspects, Navigable waters, Relative rights.
Identifiers: *Obstruction to navigation.

Any person may plant oysters or clams on his property in creeks, ditches, or ponds, and such shellfish are to be deemed personal property. The owner of lands on which oysters or clams grow may erect a fence or gates across creeks or ditches to prevent any person from entering the same, however, such fences and gates cannot interfere with navigation. Any person trespassing by boat within the fences or gates shall be deemed guilty of violation of this chapter. No person shall have exclusive right to any natural oyster bed or ground. (Heckerling-Fla)
W69-04431

TIME, MANNER AND PURPOSE OF TAKING SHELLFISH.

N J Stat Ann secs 50:2-10 to 50:2-12 (1955).

Descriptors: *Legislation, *New Jersey, *Commercial shellfish, Dredging, Clams, Oysters, Tidal waters, Legal aspects, Regulation, Fish harvest, Boats.
Identifiers: Power boats.

The following rules are codified: (1) no power boat shall engage in the taking of shellfish from natural beds while under power except as otherwise provided under Section 50:3-6 of this Title; (2) no clams shall be taken by power boat, whereby the soil or bottom where the clams are found is agitated or disturbed by the propellor or other mechanically driven apparatus for the purpose of catching clams; (3) no oysters may be dredged or clams taken by instrument before sunrise or after sunset or on Sunday; and (4) no seed oysters or hard shell clams under one and one-half inches in length taken from natural beds shall be sold and taken out of the state for the purpose of planting on grounds in any other state. Possession of such shellfish outside of the state shall be prima facie evidence of violation of this section. (Heckerling-Fla)
W69-04432

ROUGH CULL LAW.

N J Stat Ann secs 50:2-7 to 50:2-8 (1955).

Descriptors: *Legislation, *New Jersey, *Commercial shellfish, *Oysters, Dredging, Clams, Beds, Shellfish, Fishing, Conservation, Legal aspects, Tidal waters.
Identifiers: *Culling.

New Jersey's Rough Cull law provides: (1) All oysters taken from any beds shall be culled as soon as they are emptied out of the tongs or dredges; and (2) No more than fifteen per cent of the material left after culling shall be shells. All shells except oysters and clams shall be immediately thrown back onto the beds or grounds. (Heckerling-Fla)
W69-04433

GENERAL POWERS AND DUTIES.

N J Stat Ann sec 50:1-5 (1955).

Descriptors: *Legislation, *New Jersey, *Shellfish, Commercial shellfish, Administrative agencies, Regulation, Legal aspects, Fish conservation, Resource development, Navigable waters, Non-navigable waters.

This section provides that The Board of Shellfisheries shall have full control over the shellfish industry and the protection of shellfish throughout the state. It may make rules necessary for the preservation and improvement of the shellfish industry. It shall report annually to the legislature. (Heckerling-Fla)
W69-04434

BOARD OF GAME AND FISH COMMISSIONERS: POWERS AND DUTIES.
N J Stat Ann sec 23:2-3 (1940).

Descriptors: *New Jersey, *Wildlife management, *Wildlife conservation, *Fish stocking, Legislation, Animals, Fish, Birds, Natural resources, Conservation, Hatching, Streams, Administrative agencies, Administration.
Identifiers: *Board of Fish and Game Commissioners.

The powers and duties of the Board of Fish and Game Commissioners include: (1) insuring the protection and propagation of fish, birds and game animals, and enforcing the laws relating thereto; (2) stocking streams and closing them for 48 hours thereafter; (3) controlling all hatching stations owned by the state; (4) investigating any complaint concerning any illegal apparatus for taking fish, removing the same, and arresting and prosecuting the offender; (5) reporting to the legislature annually on all official operations, making suggestions and recommendations. The Board may stock with fish or game only water or land open to all licensed anglers and hunters or specifically designated public sanctuaries. The Board may stock waters under control of the Boy Scouts, Y.M.C.A., Y.W.C.A. or other public organizations during camp operations. (Helwig-Fla)
W69-04435

LITTERING AND OBSTRUCTIONS,
Interstate Commission on the Potomac River Basin, Washington, D. C.
Wayne W. Bridges.
In PROBLEMS OF THE POTOMAC ESTUARY, January 1964, pp 57-59.

Descriptors: *Maryland, *Virginia, *Legislation, *Wastes, *Floating, Aquatic drift, Driftwood, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Geographical regions, Northeast U. S., Regions, Southeast U. S.

This report defines the problem of floating debris in the Potomac Estuary. Legislation relating to the prevention and control of littering is discussed.
W69-04450

POLITICS AND THE MARINE FISHERIES,
W. M. Chapman.
In FISHERIES OF NORTH AMERICA, First North American Fisheries Conference Proceedings, 1965, pp 8-16.

Descriptors: *Marine fisheries, *Oceanography, *Legislation, *Political aspects, *Federal government, Commercial fishing, Competition, Productivity, Natural resources, Fisheries, Oceans, Fishing, Industries, Legal aspects, Regulation, Water law, Federal jurisdiction, Jurisdiction, State jurisdiction, Relative rights, Governments, Water policy, Water rights, State governments, Profit, Foreign countries, Geographical regions, Regions, Resources, Water resources development, Bodies of water, Surface waters.

Reasons for the inability of the United States to compare favorably with other countries in fishery are presented. One of these reasons is that most

ır fishing regulations are at the state level and are ısed on such a variety of complex and sometimes volved conflicts that it is impossible to determine e effects of this legislation without extensive gal, economic, social, and resource research on e state level. It is suggested that a Department of e Ocean be established, with a Secretary of abinet rank, which will coordinate within the nited States all aspects of oceanography, includ- g fisheries.
69-04455

ANAGING WATER QUALITY: ECONOMICS, ECHNOLOGY, INSTITUTIONS,
esources for the Future, Inc., Washington, D. C.
or primary bibliographic entry see Field 05G.
69-04578

NE EXAMPLE OF MULTIPURPOSE EVELOPMENT PROGRAM: THE RHONE,
ompagnie Nationale du Rhone (France).
or primary bibliographic entry see Field 04A.
69-04592

RGANIZATION OF SURVEYS AND YDROLOGICAL RESEARCH IN DEVELOP- G COUNTRIES,
ffice for Scientific and Technical Research Over- as, Paris (France).
A. Rodier.
or the 8 Volume Proceedings, see Vol 2, No 9, eld 06B and W69-03305. Int Conf on Water for ace, Wash D C, Vol 5, pp 804-809, 1968. 6 p.

escriptors: *Organizations, *Administrative encies, *Surveys, Soil surveys, Climatic data, ydrologic data, Training.
entifiers: *French West Africa, ORSTOM.

or 20 years ORSTOM (Office de Recherche ientifique et Technique d'Outre Mer) has had sponsibility for the major portion of the studies ade in the departments and former French over- as territories and in other developing tropical or editerranean States. Often no hydrological study d been made before the arrival of ORSTOM. The neral research policy followed by ORSTOM is to ve a flexible, realistic attitude, closely linked th the development needs, and to follow closely der of priority. The acquisition of basic data must ve top priority. The organization and exploita- n of the basic network must be carried out con- rrently with the initial research. The study of presentative basins must make up for the brief- ss of network observations. The existing rainfall ta should be used as well as the implementation a minimum program of basic research on aporation and percolation. The practical studies at can serve to channel the research programs d furnish additional means for carrying on this search must not be neglected. Equipment and ethods should be completely adaped to all work- g conditions. The program should not neglect the ining of native personnel who, according to plan, e to take over gradually from the foreign experts. orhis-USGS)
69-04614

ATIONAL WATER LAWS AND ADMINISTRA- ON AS ELEMENTS OF WATER DEVELOP- ENT,
illermo J. Cano.
ernational Conference on Water For Peace, Vol pp 3-17 (1968). 15 p, 14 ref. For 8-volume oceedings see Vol 2, No 9, Field 06B, W69- 305.

scriptors: *Legislation, *Legal aspects, *Ad- nistration, *Water policy, United States, State vernments, Water law, Interstate rivers, Interna- nal law, Groundwater, Federal government, ater allocation (Policy), Water control, Legal ects.
ntifiers: International water development.

Standard water law models cannot be formulated to serve the entire world since physical conditions and legal systems are too widely varied. Interdisciplinary study is recommended for water law experts. Water law should be flexible. Legal reform which affects existing water rights can be accomplished by the payment, in certain instances, of compensation for divested rights. International watersheds should be taken into account when national water policy is being formulated. Watersheds do not coincide with artificial political boundaries. The approach of different countries to the problem of interjurisdictional rivers is discussed. Ideal water legislation and its relationship to legislation dealing with other natural resources, and the concept of water ownership are commented upon. Finally, water rights, water uses, and groundwater are discussed. (Williams-Fla)
W69-04644

ORGANIZATION ARRANGEMENT FOR DEVELOPMENT AND OPERATION OF THE MISSOURI RIVER BASIN PROJECTS,
C. A. Cocks, and T. Waara.
International Conference on Water for Peace, Vol 5, pp 359-364 (1968), 6 p, 1 chart. For 8-volume proceedings see Vol 2, No 9, Field 06B, W69-03305.

Descriptors: *Missouri River, *Agricultural watershed, *River basin commissions, *River basin development, United States, Watersheds (Basins), Missouri, Kansas, Colorado, Iowa, Nebraska, Wyoming, Minnesota, South Dakota, North Dakota, Montana, River basins, Rainfall, Irrigation, Flood protection, Reservoirs, Regulated flow, Navigation, Hydroelectric power, Engineering, Storage, Tributaries, Economic prediction, Legal aspects.
Identifiers: Missouri River Basin, Dept of Agriculture, Corp of Engineers, Dept of Labor, Federal Power Commission, Missouri Basin Inter-Agency Committee.

The Missouri River Basin spreads over 529,000 square miles. Through extensive cooperation between seven key federal water resources agencies and the ten basin states, great strides have been made to control the waters of the Missouri River. Systems of agricultural levees to protect agricultural lands and the major cities located along the river have been constructed. Hydroelectric plants have been built along with flood protection projects. The effective coordination between the federal agencies and the states has been achieved through the Coordinating Committee of Missouri River Stem Operations which is made up of the chief water resources engineer of each state and a member of each federal agency involved. This preserves to each state the opportunity to represent its own interests. The value of the group has been amply demonstrated, and long term planning is currently underway. (Shevin-Fla)
W69-04645

FORMULA FOR WATER RESOURCES MANAGEMENT IN NEW YORK STATE,
For primary bibliographic entry see Field 06B.
W69-04646

ORGANIZATION FOR THE REGULATION OF LAKE ONTARIO,
Harley F. Lawhead.
International Conference On Water For Peace, Vol 5, pp 139-148, Washington, 1968. 10 p. For 8-volume proceedings see Vol 2, No 9, Field 06B, W69-03305.

Descriptors: *Lake Ontario, *Treaties, *International Joint Commission, *Flow control, Administrative agencies, Administration, St Lawrence River, Flow measurement, Regulation, Water levels, Hydroelectric power, Legal aspects.

Pursuant to the Boundary Waters Treaty of 1909 the United States and Canada entered into an agreement in 1952 to provide for the development of power sources in the International Rapids Section of the St Lawrence River. Such development is accomplished through the regulation of the outflows of Lake Ontario. The mechanics of this regulation are discussed. The order of the International Joint Commission authorizing the power project established a Board of Control to oversee the project. Its duties and membership are discussed. Four subordinate organizations and their duties are discussed. The Board of Control is to provide technical determinations and reviews, and to monitor the regulation of Lake Ontario. It also reviews applications by power entities seeking variation of the flow. (Williams-Fla)
W69-04648

WATER RIGHTS AND REGULATION IN THE EASTERN UNITED STATES,
Harold H. Ellis.
International Conference On Water For Peace, Vol 5, pp 649-667, Washington, 1968. 18 p, 66 ref. For 8-volume proceedings see Vol 2, No 9, Field 06B, W69-03305.

Descriptors: *Water rights, *Water law, *Riparian rights, *Relative rights, Navigable waters, Percolating water, Surface runoff, Underground streams, Contracts, Federal government, Groundwater, Appropriation, Stream flow, Impoundments, Water pollution, Condemnation, Public rights, Shores, Federal-state water rights, Conflicts, Local governments, Dams, Water pollution control.
Identifiers: Natural watercourses, Water use permit systems, Access.

The general legal rules dealing with water supply use in the eastern states are determined by state courts and by state, and, to a lesser extent, by federal legislation. Natural water supplies are classified in legal terms as natural watercourses, diffused surface water, percolating groundwater, and underground streams. The ownership and use of these water supplies is determined by riparian doctrine, navigability, and contractual agreements. Legislation dealing with water rights is increasingly necessary. This legislation is vital because of the decline of the relative water abundance in the eastern states which has resulted in expanding water use conflicts. Some methods of legislative control include water use permit systems, minimum streamflows or lake level requirements, pollution control measures, and preferential and condemnation provisions. Many problems have begun emerging, including: (1) the respective roles of courts, governments, and administrative agencies; (2) private and public rights; and (3) the coordination of water allocation and pollution control. (Hoffman-Fla)
W69-04649

CHEROKEE NATION OR TRIBE OF INDIANS IN OKLAHOMA V OKLAHOMA (RIGHT TO RIVERBEDS OF ARKANSAS RIVER).

402 F 2d 739-748 (10th Cir 1968).

Descriptors: *River beds, *Oklahoma, *Ownership of beds, Rivers, Arkansas, Boundaries (Property), United States, Navigable waters, Natural resources, Legal aspects, Judicial decisions, Treaties, Indian reservations, Mississippi River, Jurisdiction, Tides, Surveys, Fisheries.
Identifiers: *Arkansas River, *Indians, Grand River, Canadian River, Injunctions.

The Cherokee, Choctaw, and Chickasaw Indian Tribes in Oklahoma all claimed title to the bed of the Arkansas River. The state of Oklahoma made a similar claim. The Indians brought suit, praying for an injunction against use of the river bed by Oklahoma. The question was whether certain treaties between the Indians and the United States conveyed ownership of the bed to them. In the treaties granting the Indians certain areas as reservations, no mention was made of the beds of the rivers located therein. The court held that the omission of

any mention of ownership of river beds did not show intent to pass ownership to the Indians. Congress had provided that all states, upon entering the union, acquired ownership of the river beds within their borders. The court held that Oklahoma entered the union on equal footing with the original 13 states, and thus title to the bed in question was rested in the state of Oklahoma. (Shevin-Fla)
W69-04651

BURGESS V PINE ISLAND CORP (LAND SEPARATED FROM ISLAND BY NON-NAVIGABLE STREAM NOT AN ISLAND).

215 So 2d 755-759 (2d DCA Fla 1968).

Descriptors: *Florida, *Islands, *Boundaries (Property), *Non-navigable waters, Judicial decisions, Legal aspects, Navigable waters, Watercourses, High water mark, Low water mark, Boundary disputes.
Identifiers: Deeds.

Defendant, Pine Island Corporation, had received a warranty deed for all of fractional section 36 on the mainland of Pine Island. The plaintiff had obtained a quit claim deed to all of fractional section 36 other than that located on the mainland of Pine Island. A 70-acre tract of land located southeast of plaintiff's land was in dispute. This tract was clearly separated from plaintiff's land by a watercourse. A smaller watercourse ran between the tract and defendant's land. Plaintiff contended that the tract should be classified as an island and included in the lands conveyed to him. The watercourse separating the tract from defendant's land was navigable only at high tide and had a depth of only a few inches at low tide. The court found the watercourse in question to be non-navigable since it did not consistently have a capacity for navigation. The court alluded to that quality which might be termed 'permanency' as being characteristic of those land masses properly called 'islands.' The fact that the land in question is surrounded by water during some periods is not determinative. The court held that the tract in question was part of the mainland and thus belonged to defendant. (Shevin-Fla)
W69-04652

POWERS OF CITIES.

N Y General City Law secs 20 (2), 20 (8), 20 (8a) (McKinney 1968).

Descriptors: *New York, *Cities, *Drainage, *Navigation, Legislation, State governments, Local governments, Sewers, Storm drains, Condemnation, Sewage disposal, Sewage, Water supply, Flood control, Right-of-way, Bridges, Beds, Navigable waters, Docks, Piers, Diversion, Landfills, Public benefits.

Cities may obtain and hold real and personal property within or without the city limits. They may condemn real property for the construction, maintenance and operation of sewage disposal plants, water supply systems, and drainage channels and structures for flood control, as well as all necessary rights-of-way for the above projects, and for any public or municipal purpose. Land so obtained may be sold or conveyed, but the rights of a city in and to its waterfront, ferries, bridges, wharves, submerged lands, streets, parks and all other public places are inalienable, except where specifically permitted in this section. Cities may control the waterfront and waterways of the city, and may establish, operate and regulate docks, piers, wharves, warehouses and all adjuncts and facilities for navigation and commerce and for the utilization of the waterfront, waterways and adjacent property. Cities may control filling and diversion of watercourses, except when authorized by a state or federal agency, by requiring that permits be obtained before such activities are commenced. Such permits may be denied if the city determines that the proposed filling or diversion is detrimental to the drainage or welfare of the city. (Scott-Fla)
W69-04657

PUBLIC NUISANCE DEFINED.
N Y Penal Law sec 1530 (McKinney 1968).

Descriptors: *New York, *Public health, *Safety, *Navigation, Legislation, Public rights, State governments, Navigable rivers, Navigable waters, Barriers, Reasonable use, Lakes, Streams, Bays, Canals, Basins, Creeks, Dredging, Legal aspects.
Identifiers: Penalties (Criminal).

A 'public nuisance' is a crime against the order and economy of the state. Public nuisance consists of doing, or omitting to do, an act that annoys, injures or endangers the health, safety, repose or comfort of a considerable number of persons; unlawfully interferes with, obstructs, or tends to obstruct, or renders dangerous for passage a lake, navigable river, stream, bay, canal or basin, or a stream, creek or other body of water which has been dredged or cleared at public expense, or a public park, square, street or highway; offends public decency; or in any way renders a considerable number of persons insecure in life or the use of property. (Scott-Fla)
W69-04660

INTERFERING WITH NAVIGATION.

N Y Penal Law sec 1505 (McKinney 1968).

Descriptors: *New York, *Legislation, *Navigable waters, *Navigation, Public rights, State governments, Safety, Bays, Sounds, Harbors, Boats, Depth, Legal aspects.
Identifiers: Penalties (Criminal).

Anyone who throws, or causes, or permits to be thrown any ashes, earth, cinders, stone or other material from any boat or vessel into any navigable waters of the state, or who builds any structure therein that would in any way lessen the depth of such water or interfere with its free and safe navigation, is guilty of a misdemeanor. (Scott-Fla)
W69-04661

LITTLE V UNITED STATES (WRONGFUL DEATH LIABILITY FOR DAM MAINTENANCE).

290 F Supp 581-588 (E D La 1968).

Descriptors: *Louisiana, *Federal government, *Dams, Rivers, Damages, Canals, United States, Operation and maintenance, Dam construction, Boating, Judicial decisions, Legal aspects.
Identifiers: *Wrongful death, Assumption of risk, Contributory negligence, Suits in admiralty act, Corps of Engineers.

Plaintiff brought an action for the wrongful death of her husband. The decedent was drowned in a river across which the Corps of Engineers had erected a sill to back water into a nearby canal. Warning signs were up in the area of the sill, which completely obstructs navigation on the river and causes a five foot drop on its downstream side. Decedent, who was familiar with the sill and the swift currents in the stream, used a hoist, which had been erected on one side of the sill by unknown persons, to raise his boat up over the drop. This operation completed, the decedent attempted to propel his boat upstream stern first. The swift current forced the boat back and over the sill; the boat sank and decedent drowned. The court held for the defendant, ruling that decedent had been warned regarding the dangerous conditions created by the sill. In proceeding as he did, Plaintiff's intestate assumed the risk or was contributory negligence, thus barring plaintiff's claim. Defendant had no duty to construct a portage around the sill. The question of whether defendant was negligent in failing to remove the hoist is not relevant in this case since such failure was not the actual or proximate cause of the accident. (Molica-Fla)
W69-04666

HUNTER V CITY OF SHREVEPORT (BRIDGE CONSTRUCTION).

216 So 2d 140-145 (Cir Ct App La 1968).

Descriptors: *Louisiana, *Water supply, *Pollution, *Bridge construction, Judicial decisions, Legal aspects, Governments, Reservoir storage, Public health, City planning, Highway effects, Lakes, Water pollution, Cities, Local governments, Eminent domain.

Plaintiffs, taxpayers of defendant city and consumers of water supplied by defendant sought to enjoin construction of a proposed highway bridge over a lake which was the primary source of water for the city. Several of the plaintiffs were owners of property which would be affected by the construction. Defendant obtained title to the lake bed from the state for the purpose of providing pure and wholesome water for its citizens. The lower court ruled against plaintiffs' contentions that the route selected by the defendant state highway department was arbitrary and unreasonable and constituted a threat to the health of the city's inhabitants by creating a danger of pollution. On appeal, the court held that the possibility of vehicular accidents on the bridge resulting in noxious materials being dumped into the lake is too ideal and unrealistic. The proposed construction would merely add to the dangers of pollution which presently exist from other sources. The city considered the additional hazards of pollution which would result from the construction and plaintiffs have not shown that its decision was arbitrary or capricious or that the trial court abused its discretion in finding for the defendants. (Molica-Fla)
W69-04667

TOWN OF PALM BEACH SHORES V COLONNADES, INC (OCEAN POLLUTION).
For primary bibliographic entry see Field 05G.
W69-04668

TOWN OF HEMPSTEAD, LIDO BEACH, NASSAU COUNTY (CONDEMNATION AWARDS).
294 N Y S 2d 809-813 (Sup Ct 1968).

Descriptors: *New York, *Condemnation value, *Accretion (Legal aspects), Judicial decisions, Legal aspects, Condemnation, Compensation, Cities, Governments, Interests, Interest rate, Local governments, Eminent domain.
Identifiers: Condemnation awards.

Claimant owned property which was condemned by petitioner municipality for the purpose of developing a recreational park within the town limits. Petitioner objected to a court finding that .59 more acres of land than shown upon petitioner's taking map were confiscated due to the accretion of material onto claimant's land. The court held that because there was an accretion to claimant's land between December, 1965, and December, 1966, and the de facto taking of claimant's land occurred on June 15, 1966, and there is no engineering study to indicate how much of this accretion existed on the date of the taking, that it will be inferred that one half of the accreted land was in existence at the date of the taking. The court also found that a 10% increment to the condemnation award was proper since the comparable sales used to arrive at the amount of the award did not reflect the increased value of the land due to a zone change. The State must pay 6% interest in condemnation proceedings and it would be unconstitutional for petitioner, a subdivision of the State, to pay 4%. (Molica-Fla)
W69-04669

DEPARTMENT OF HIGHWAYS OF LOUISIANA V UNITED STATES (REVOCATION OF BRIDGE PERMIT).

159 F Supp 341-345 (Ct Cl 1958).

escriptors: *Federal government, *Navigable aters, *Bridges, *Permits, Legislation, Judicial cisions, Administrative agencies, Administrative cisions, State governments, Bridge construction, annels, Legal aspects, Damages, Contracts, mpensation, Cost repayment.
entifiers: Commerce clause, Due process.

e Louisiana Department of Highways applied to e federal government for permission to construct bridge across the Gulf Intercoastal Waterway. rsuant to the General Bridge Act of 1946, the ans were approved, and a certificate authorizing certain type of bridge in a certain place was thorized. Several months after construction was gun, however, plaintiff was notified that work ould be stopped. A second permit was signed, thorizing construction of a different type of idge in a different place. Plaintiff filed suit, claim- g as damages the costs already incurred in con- uction of the bridge. It was contended that the st certificate created a contractual relationship tween the parties and that subsequent revocation such certificate constituted breach of contract. It s also contended that this action by the govern- ent was tantamount to taking of property, for hich the fifth amendment required just compen- tion. The court found for the United States, hold- g that the certificate did not constitute a contract d that there was no unconstitutional deprivation property. Congress may legislate concerning idge construction over navigable waters pursuant its power to regulate interstate commerce. (Wil- ms-Fla)
69-04670

NITED STATES V REPUBLIC STEEL CORP NJUNCTION TO FORCE COMPANY TO ESTORE RIVER TO ORIGINAL DEPTH).

5 F Supp 442-454 (ND Ill 1957).

escriptors: *United States, *Industrial wastes, Dredging, *Depth, Illinois, Judicial decisions, vers, Industries, Navigable rivers, Navigation, bstruction to flow, Rivers and Harbors Act, Legal pects, Legislation.

e United States brought suit against defendants eking an injunction against continued discharge industrial solids into the Calumet River without a rmit from the Department of the Army. The suit so sought to secure a mandatory injunction quiring defendants to dredge the river to its iginal depth. The United States alleged that de- ndant's activities were in violation of sections 10 d 13 of the Rivers and Harbors Appropriation ct of 1899 (33 USCA, secs 403 and 407). The urt held the Illinois statute of limitations inap- icable and found that the evidence established at defendants were responsible at least to some gree, for reduction in the river's depth. The court tablished a formula for payment by defendants of e dredging costs and, after reciting its findings of ct and conclusions of law, issued the orders ayed for. (Williams-Fla)
69-04671

APITAL V PORT WASHINGTON YACHT LUB (ACTION FOR LATERAL SUPPORT OF AND, WITH ADDITIONAL CLAIMS FOR SUR- ACE WATER DAMAGE).
72 N Y S 2d 78-82 (S C 1958).

escriptors: *New York, *Reasonable use, *Ob- ruction to flow, *Land development, Surface aters, Surface runoff, Damages, Natural flow, Ju- cial decisions, Water law, Slopes, Backfill, Sur- ce drainage, Mudflows, Legal aspects, Alteration flow, Relative rights.
entifiers: Negligence.

aintiff and defendant were adjoining landowners. efendant removed part of a hill which sloped om plaintiff's property in order to provide addi- onal parking facilities for his yacht club. Plaintiff ed to require defendant to furnish lateral support to his land and for damages resulting from an earth buildup around his swimming pool and from surface waters which were thrown back on his land, allegedly as a result of defendant's excavations. Defendant counterclaimed for damages due to plaintiff's alteration of the natural contour of his land in preparation for real estate development, which alteration caused water, mud, and debris to be discharged on defendant's property. The court ruled that plaintiff could maintain the support action but dismissed both water damage claims. The court held that defendant was not liable for improving and grading his land even though the effect of such activities was to repel and reject surface waters which formerly flowed across it. Defendant's counterclaim was dismissed, the court finding that plaintiff was not negligent in preparing his land for building operations. (Wheeler-Fla)
W69-04672

MALONE V CUSTOM MANOR (PRIVATE WATER LINES).

158 N Y S 2d 241-247 (S C 1956).

Descriptors: *New York, *Water contracts, *Water conveyance, *Public utilities, Community development, Judicial decisions, Water supply, Water rates, Pipes, Water districts, Water distribution (Applied), Legal aspects, Regulation.

Plaintiffs purchased property from the defendant, a real-estate developer. At the time the deeds were delivered, the parties executed contracts which provided that the defendant would supply water to the plaintiffs at a specific rate until the defendant's private water line was purchased by and transferred to a water district. Plaintiffs sought an injunction against collection of payments under the contract and a declaratory judgment that the contracts were void. Plaintiffs alleged that the defendant was in the business of transportation or distribution of water for a fee without having complied with the provisions of the Transportation Corporations Law and the Public Service Law. The court found that those laws did not apply to defendant since it merely installed a pipeline through which water might be temporarily supplied, without profit, to those to whom the defendant had sold houses, and not to the public generally. The water line continued to be defendant's private property, subject only to the rights granted to plaintiffs. Since the business was not affected with the public interest, it was not subject to public regulation. (Scott-Fla)
W69-04675

WAGNER V CITY OF BALTIMORE (NAVIGABLE RIVER BEDS).
124 A 2d 815-821 (Ct App Md 1956).

Descriptors: *Maryland, *Ownership of beds, *Patents, *Islands, Navigable waters, Navigable rivers, River beds, Non-navigable waters, Tidal waters, Riparian rights, Riparian land, Legislation, Rivers, Bank accretion (Legal aspects), Alluvium, Alluvial channel, Legal aspects.
Identifiers: Navigable-in-fact.

The City of Baltimore issued a patent for an island in the Patapsco River to defendant's successors in title. The city brought action to set aside the patent, such action being based on a statute prohibiting the issuance of a patent if the lands are covered by navigable waters, or if such issuance would impair the riparian rights of landowners. The court found that although the island had been building up for a long period in 1909, it was submerged at mean low tide. Where a river is navigable lengthwise, all the waters between the opposite shores are navigable waters. Navigable channels ran on both sides of the island making the entire river bed 'lands under navigable water.' The court discussed, but found it unnecessary to decide, which test was used to determine navigability. The water could recede entirely from alluvium, and at that point, the island would become connected with the shore. This would impair the riparian rights of the shore owner. Thus the patent is violative of the statute. (Helwig-Fla)
W69-04679

FRYE V PENNSYLVANIA RAILROAD CO (RAILROAD'S LIABILITY FOR NEGLIGENTLY MAINTAINING CULVERT THROUGH RIGHT-OF-WAY).

39 WESTMORELAND L J 169-174 (CP Pa 1957).

Descriptors: *Culverts, *Pennsylvania, *Streams, *Obstruction to flow, Judicial decisions, Legal aspects, Right-of-way, Water law, Ditches, Drainage, Damages, Erosion.
Identifiers: Negligence.

Plaintiff brought action in tort against defendant railroad to recover for damage done to plaintiff's real and personal property. Defendant owned right-of-way across plaintiff's property. A culvert was erected on the right-of-way to allow drainage of a natural watercourse flowing through the property. Said culvert was not maintained by defendant and subsequently became clogged, causing water to accumulate and damage plaintiff's property. The court held that it was defendant's duty to properly maintain the culvert; failure to adequately maintain the culvert rendered defendant liable for resulting damage. The damage awarded was an amount required to restore plaintiff's real and personal property to its previous condition, but limit by the fair market value of the property. (Holt-Fla)
W69-04683

CAMPBELL BROWN CO, INC V ELKINS (RIVERBED OWNERSHIP).

93 S E 2d 248-268 (Sup Ct App W Va 1956).

Descriptors: *West Virginia, *Navigable rivers, *Ownership of beds, *Dredging, Judicial decisions, Riparian rights, Coal mines, Legal aspects, River beds, Mineral industries, Mine wastes, Mining, Legislation, Relative rights, State governments.

Defendant conducted a coal dredging operation on the bed of a river which was included in the letters patent to his remote grantor. Plaintiff, conducting coal dredging operations downstream pursuant to a license subsequently granted by the State, sought to restrain defendant's operation which interfered with his dredging. The court held that a legislative act passed subsequent to the grant of the patent to defendant's grantor vitiated any title given to navigable river beds. By virtue of public policy the title to all navigable river beds is in the State and as such are not within the meaning of the section of the constitution dealing with forfeited, waste, and unappropriated lands. The river was at one time navigable and in law it will always remain so. To be such, a river does not have to be continually and easily navigable. The coal being distracted from the river bed is coal discarded from an upstream coalfield and is therefore abandoned property, title to which is in the State. (Molica-Fla)
W69-04691

DECLARATION OF POLICY.
N Y Conserv Law sec 401 (McKinney 1967).

Descriptors: *New York, *Water resources, *Water conservation, *Public benefits, Legislation, Recreation, Storage, Agriculture, Domestic water, Municipal water, Public health, Water pollution, Irrigation water, Beneficial use.
Identifiers: *Public policy.

The public policy of the state in reference to the control of its water resources shall be as follows: (1) the regulation of water resources shall be exercised pursuant to the laws of the state; (2) waters shall be conserved for all public beneficial uses; (3) planning shall be undertaken for the conservation and development of the water resources, and resources shall not be wasted; (4) consideration

shall be given to the relative importance of different uses of the waters; (5) acquisition, storage, diversion and use of water for domestic and municipal purposes shall have priority; (6) alterations in the conditions of the waters shall be carried out in a manner that least impairs the important uses; (7) reasonable standards of purity must be maintained and wildlife and fish protected. The use of all known available and reasonable methods to prevent and control pollution, wastage and unreasonable disturbances and defilement of the waters shall be required; (8) and the regulated acquisition, storage, diversion and use of water for the supplemental irrigation of agricultural lands within the state is a public purpose and use, in the interests of the health, safety and welfare of the people of the state. (Shevin-Fla)
W69-04694

DELAWARE RIVER.

N J Stat Ann secs 52:28-23 to 52:28-26 (1955).

Descriptors: *New Jersey, *Legislation, *Delaware River, *Interstate compacts, Pennsylvania, Interstate rivers, State governments, State jurisdiction, Islands, Ships, Shores, Legal aspects, Regulation.
Identifiers: Islets, Penalties (Criminal).

The Commissioners of New Jersey and Pennsylvania have agreed to, and New Jersey has codified, the following provisions: (1) An agreement settling the jurisdictional questions relative to the Delaware River and islands within it; and (2) because of the uncertainty over the jurisdiction of the river, the following rules were established: (A) The Delaware River is a common highway equally free and open to both states. Each legislature may regulate fisheries on the river annexed to their respective shores; (B) Each state shall have concurrent jurisdiction upon the water. Each anchored vessel shall be considered exclusively within the jurisdiction of such state; every vessel aground or fastened to the shore shall be within that state. All crimes, trespasses or damages committed on the river shall be within the jurisdiction of the state where the wrongdoer is first apprehended, arrested, or prosecuted; (C) Islands, islets, and dry lands in the river belong to the state to which they lie nearer. However, certain islands are excepted from this rule. (Heckerling-Fla)
W69-04699

EQUITABLE GAS CO V ROCCA (RIGHTS OF LANDOWNER TO CONSTRUCT A RESERVOIR OVER AN EASEMENT ON THAT LAND).

35 Wash Co 25, 6 D and L 2d 453-465 (C P Washington County Pa 1954).

Descriptors: *Easements, *Right-of-way, *Reservoir construction, *Reasonable use, Pennsylvania, Judicial decisions, Flooding, Pipelines, Floodgates, Locks, Reservoirs, Relative rights, Legal aspects, Operation and maintenance.
Identifiers: Ingress, Egress, Injunctions (Prohibitory).

Plaintiff, holder of an easement across defendant's property, sought a permanent injunction prohibiting the flooding of part of the property to form a reservoir. Such reservoir would completely cover plaintiff's pipeline. The court recognized plaintiff's right of ingress and egress to and from his pipeline for purposes of operation and maintenance. It also recognized defendant's right of the free use of his property and the utility to the defendant. Due to the fact that defendant agreed to construct the reservoir with floodgates or locks enabling him to drain the reservoir within five hours, the court refused to permanently enjoin construction since the correlative rights of both parties would be protected by such drainage feature; the plaintiff would have adequate access rights and defendant would be enabled to construct his reservoir. (Logan-Fla)
W69-04700

6F. Nonstructural Alternatives

FLOOD PLAIN INFORMATION, KERN RIVER, KERNVILLE, CALIFORNIA.
Corps of Engineers, Sacramento, Calif.
For primary bibliographic entry see Field 04A.
W69-04216

FLOOD PLAIN INFORMATION, PAYETTE RIVER, PAYETTE, IDAHO AND VICINITY.
Corps of Engineers, Walla Walla, Wash.
For primary bibliographic entry see Field 04A.
W69-04219

FLOOD PLAIN INFORMATION, SANTA CLARA RIVER (SATICOY TO PACIFIC OCEAN), VENTURA COUNTY, CALIFORNIA.
Corps of Engineers, Los Angeles, Calif.
For primary bibliographic entry see Field 04A.
W69-04220

FLOOD PLAIN INFORMATION, JOHNSON CREEK, ARLINGTON AND GRAND PRAIRIE, TEXAS.
Corps of Engineers, Fort Worth, Tex.
For primary bibliographic entry see Field 04A.
W69-04221

FLOODS IN WOODSTOCK QUADRANGLE, NORTHEASTERN ILLINOIS,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 04A.
W69-04249

STATEMENT,
Federal Water Pollution Control Administration, Southeast Region, Atlanta, Ga.
For primary bibliographic entry see Field 05D.
W69-04306

THE URGENT NEED FOR LANDSCAPE ZONING OF THE ESTUARINE REGION ACCORDING TO ECO-SYSTEM PRINCIPLES,
Federal Water Pollution Control Administration, Department of Interior, Southeast Region, Atlanta, Ga.
Eugene P. Odum.
In CLEAN WATER FOR THE NATION'S ESTUARIES, Proceedings of the Georgia Public Meeting, Jekyll Island, Georgia, November 29, 1968, p 4.

Descriptors: *Ecosystems, *Multiple purpose, *Zoning, *Competing uses, Water utilization, Regulation, Efficiencies.

The article is a 'plea for a package of three basic approaches in regard to estuaries: (1) Consideration of the estuarine landscape as one major ecological system (ecosystem) with inter-dependent components and functions; (2) Recognition by professionals and the public alike of the basic ecological laws that result in conflict between 'man' and 'nature' as the first step in resolving multi-purpose conflicts; (3) Need to establish immediately a ground swell of public opinion for landscape zoning as the only practical solution to desired multiple use objectives which must involve both preservation and use.'
W69-04307

MAINTAINING AND ENHANCING THE ESTUARINE ENVIRONMENT,
A. H. Underhill.
A Symposium on Estuarine Fisheries, American Fisheries Society, Special Publication No. 3, 1966, pp 127-129.

Descriptors: *Land reclamation, *Zoning, *Legislation, *Estuarine environment, Management, Planning, Regulation, Governments.

This paper presents a brief general discussion of different means of accomplishing preservation of valuable estuarine areas by a representative of the U. S. Bureau of Outdoor Recreation. The means which the author suggests as having merit are '(1) public ownership, (2) zoning, (3) comprehensive planning by interagency groups, and (4) legislation, at all levels of government, to support zoning, comprehensive planning, and other necessary actions'.
W69-04512

FLOOD PLAIN INFORMATION, RED CEDAR RIVER, INGHAM COUNTY, MICHIGAN.
Corps of Engineers, Detroit, Mich.
For primary bibliographic entry see Field 04A.
W69-04529

FLOOD PLAIN INFORMATION, SNAPFINGER CREEK, DEKALB COUNTY, GEORGIA.
Corps of Engineers, Savannah, Ga.
For primary bibliographic entry see Field 04A.
W69-04530

FLOOD PLAIN INFORMATION, CLEARWATER RIVER, OROFINO AND RIVERSIDE, IDAHO.
Corps of Engineers, Walla Walla, Wash.
For primary bibliographic entry see Field 04A.
W69-04531

FLOOD PLAIN INFORMATION, MILL RIVER, HAMDEN, CONNECTICUT.
Corps of Engineers, Waltham, Mass.
For primary bibliographic entry see Field 04A.
W69-04532

FLOOD PLAIN INFORMATION, TULE RIVER, SPRINGVILLE, CALIFORNIA.
Corps of Engineers, Sacramento, Calif.
For primary bibliographic entry see Field 04A.
W69-04533

FLOOD PLAIN INFORMATION, WALNUT RIVER, WHITEWATER RIVER, KANSAS.
Corps of Engineers, Tulsa, Okla.
For primary bibliographic entry see Field 04A.
W69-04534

FLOOD PLAIN INFORMATION, CUMBERLAND RIVER AND CLEAR FORK, WILLIAMSBURG, KENTUCKY.
Corps of Engineers, Nashville, Tenn.
For primary bibliographic entry see Field 04A.
W69-04535

FLOOD PLAIN INFORMATION, HALLS MILL CREEK, MOBILE, ALABAMA.
Corps of Engineers, Mobile, Ala.
For primary bibliographic entry see Field 04A.
W69-04536

FLOOD PLAIN INFORMATION, MERAMEC RIVER, BRUSH CREEK AND FOX CREEK, PACIFIC, MISSOURI.
Corps of Engineers, St. Louis, Mo.
For primary bibliographic entry see Field 04A.
W69-04537

FLOOD PLAIN INFORMATION, ROANOKE RIVER, AND ROANOKE AND SALEM, VIRGINIA.
Hayes, Seay, Mattern and Mattern, Roanoke, Va.
For primary bibliographic entry see Field 04A.
W69-04538

FLOOD PLAIN INFORMATION, BLACK RIVER, TOWN AND MANSKER CREEKS, POCAHONTAS, ARKANSAS.
Corps of Engineers, Little Rock, Ark.
For primary bibliographic entry see Field 04A.
W69-04539

FLOOD PLAIN INFORMATION, OHIO RIVER AND TRIBUTARIES, MC CRACKEN COUNTY, KENTUCKY.
Corps of Engineers, Louisville, Ky.
For primary bibliographic entry see Field 04A.
W69-04540

FLOOD PLAIN INFORMATION, ARKANSAS RIVER, NORTH LITTLE ROCK, ARKANSAS.
Corps of Engineers, Little Rock, Ark.
For primary bibliographic entry see Field 04A.
W69-04541

FLOOD PLAIN INFORMATION ON CAMP CREEK AND NORTH FORK CAMP CREEK, METROPOLITAN ATLANTA, GEORGIA.
Corps of Engineers, Mobile, Ala.
For primary bibliographic entry see Field 04A.
W69-04542

FLOOD PLAIN INFORMATION, MILL CREEK, FORT SMITH, ARKANSAS.
Corps of Engineers, Tulsa, Okla.
For primary bibliographic entry see Field 04A.
W69-04543

FLOOD PLAIN INFORMATION, BROOKLYN CREEK, ATHENS, GEORGIA.
Corps of Engineers, Savannah, Ga.
For primary bibliographic entry see Field 04A.
W69-04544

FLOOD PLAIN INFORMATION ON SHOAL CREEK, DEKALB COUNTY, GEORGIA.
Corps of Engineers, Savannah, Ga.
For primary bibliographic entry see Field 04A.
W69-04545

FLOOD PLAIN INFORMATION, PISCATAWAY CREEK, PRINCE GEORGES COUNTY, MARYLAND.
Corps of Engineers, Baltimore, Md.
For primary bibliographic entry see Field 04A.
W69-04546

FLOOD PLAIN INFORMATION, POST OAK CREEK AND TRIBUTARIES, SHERMAN, TEXAS.
Corps of Engineers, Tulsa, Okla.
For primary bibliographic entry see Field 04A.
W69-04576

FLOOD INFORMATION FOR FLOOD-PLAIN PLANNING,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02E.
W69-04616

6G. Ecologic Impact of Water Development

DIGITAL SIMULATION OF NATURAL ANIMAL COMMUNITIES,
G. J. Panlik.
In POLLUTION AND MARINE ECOLOGY, New York: Interscience Publishers, 1967, pp 67-85.

Descriptors: *Ecology, *Model studies, *Digital computers, *Simulation analysis, Computer models, Computers, Equipment, Instrumentation, Systems analysis.

The article describes the use of digital-computer simulation for ecological studies. The author believes that simulation techniques could be beneficially applied to ecological problems, but that they have not yet found such application except in selected instances. The author describes various models and their application as well as the differences between analytical solutions and simulation approaches. Simulation languages of potential use in modeling ecological systems are discussed.
W69-04312

STATEMENT BEFORE THE SUBCOMMITTEE ON AIR AND WATER POLLUTION,
Ruth Patrick.
Report of Committee on Public Works, U. S. Senate, Washington, D. C., April 17, 1968.

Descriptors: *Virginia, *Ecology, *Maryland, *Electric powerplants, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Geographical regions, Northeast U. S., Bays, Southeast U. S., Regions, Engineering structures, Industrial plants, Powerplants, Structures, Bodies of water.

Dr. Patrick's statement is a description of a program of studies carried out in the vicinity of electric generating plants in Chesapeake Bay to determine the condition of the estuaries (Monocacy and Patuxent rivers) before the plants began to operate, particularly in reference to ecological conditions. Fifteen pages of tables accompany the statement.
W69-04314

COMMON MISUNDERSTANDINGS ABOUT HEATED DISCHARGES,
Federal Water Pollution Control Administration, Southeast Region, Atlanta, Ga.
For primary bibliographic entry see Field 05C.
W69-04364

A PRELIMINARY BIBLIOGRAPHY WITH KWIC INDEX ON THE ECOLOGY OF ESTUARIES AND COASTAL AREAS OF THE EASTERN UNITED STATES,
Robert Livingstone, Jr.
Report, U. S. Department of the Interior, Fish and Wildlife Service, Washington, D. C., May, 1965.

Descriptors: *Bibliographies, *Ecology, *Documentation, *Coasts, Environment, Southeast U. S., Northeast U. S.

This bibliography, which contains more than 5,470 references, is an initial effort to bring together references on the ecology of estuaries and coastal water of the eastern United States, and stresses the period 1900-60. It is the starting point for the compilation of a more comprehensive list of the future. The bibliography is in two parts: (1) the complete entries listed alphabetically by authors and (2) a KWIC index (keyword-in-context) to significant words relevant to title and context.
W69-04477

07. RESOURCES DATA

7A. Network Design

TOPOLOGICAL SIGNIFICANCE OF STREAM METHODS,
Illinois Univ., Urbana.
For primary bibliographic entry see Field 02E.
W69-04571

7B. Data Acquisition

A SHIELDED THERMISTOR PROBE WITH PORTABLE INSTRUMENT FOR MEASURING SNOWPACK TEMPERATURES,
Colorado State Univ., Fort Collins; and Forest Service, Washington, D. C.
G. J. Gottfried, and C. J. Campbell.
Forest Serv Res Note RM-120, 1968. 3 p, 2 fig, 1 tab, 1 ref.

Descriptors: *Instrumentation, *Temperature, *Thermometers, *Snowpacks, Snowmelt, Water supply, Snow cover, Snow management, Snow surveys, Water equivalent, Water yield.
Identifiers: Snowpack thermistor, Snowpack temperature, Shielded thermistor.

A phenol-resin-based shield has been designed to protect a thermistor probe that can be inserted into a snowpack. The shield also serves as an insulator between the thermistor and the aluminum pole used to push the probe assembly into the snowpack. With the probe and Wheatstone bridge circuit, temperatures can be measured within the snowpack to 0.1 deg C. (Knapp-USGS)
W69-04252

SEISMIC EXPLORATION AT SEA,
E. M. McNatt.
Ocean Industry, Vol. 2, No. 6, June, 1967, pp 30-33.

Descriptors: *Exploration, *Seismic studies, *Geophysics, Geologic formations, Remote sensing, Sounding, Sub-surface investigations, Analytical techniques, Costs.

Problems involved in seismographic exploration at sea include: too little depth penetration, too much noise, too little resolving power, and too high a cost. Present offshore seismic exploration survey costs per mile are roughly one-third of those on land.
W69-04294

REMOTE SENSOR SURVEILLANCE OF WATER QUALITY,
National Security Industrial Association, Washington, D. C.
For primary bibliographic entry see Field 05G.
W69-04343

A SUPPLEMENTARY REPORT ON THE COASTAL WETLANDS INVENTORY OF LONG ISLAND, NEW YORK.

Fish and Wildlife Service, Division of River Basin Studies, June, 1965.

Descriptors: *Wetlands, *Land reclamation, *Surveys, Recreation, Industries, Marinas, Recreation facilities, Waste disposal, Landfills, Forecasting.

Aerial photographs and ground observations were used to determine the physical loss of wetlands since the initial survey in 1954; 13 percent were lost in 1954-59, 18 percent were lost in 1959-64. Thirty-four percent of the destruction was due to housing development, 17 percent to recreational development, 13 percent to industry, six percent to marinas and channels, four percent to airports, three percent to roads, and one percent to waste disposal. Approximately 88 percent of the wetlands were considered vulnerable.
W69-04506

MEASUREMENT OF DISCHARGE BY THE MOVING-BOAT METHOD,
Geological Survey, Washington, D. C.
George F. Smoot, and Charles E. Novak.
Geol Surv Tech Water-Resources Invest, Book 3, Chapter A11, 1969. 22 p, 12 fig, 1 tab, 4 ref.

Descriptors: *Discharge (Water), *Discharge measurement, Rivers, Estuaries, Streamflow, Stream gages, Calibrations, Boats, Current meters, Channel morphology, Sounding, Acoustics, Bathymetry, Fathometers, Surveys.
Identifiers: Stream gaging, Moving-boat streamflow measurement.

The procedures for measuring discharge in large streams by the moving-boat technique are

described. During the traverse of a boat across a stream, a sonic sounder records the geometry of the cross section, and a continuously operating current meter senses the combined stream and boat velocities. These data are converted to discharge for the cross section quickly, efficiently, and inexpensively. Measurements obtained by the moving-boat technique compare within 5% of measurements obtained by conventional means. Field and office procedures applicable to this method are outlined. Theory of technique is developed and equipment required is described. Selection and preparation of the cross section is detailed. A complete facsimile example of computation of a moving-boat measurement is given, and the determination and application of adjustment factors are described. (Knapp-USGS)
W69-04547

SOME TURBULENCE MEASUREMENTS IN OPEN-CHANNEL FLOW,
Geological Survey, Fort Collins, Colo.
For primary bibliographic entry see Field 02E.
W69-04555

INFRARED IMAGING FOR WATER RESOURCES STUDIES,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering; and HRB-Singer, Inc., State College, Pa.
James I. Taylor, and Ronald W. Stingelin.
ASCE Proc, J Hydraul Div, Vol 95, No HY1, Pap 6331, pp 175-189, Jan 1969. 15 p, 11 fig, 8 ref.

Descriptors: *Remote sensing, *Infrared radiation, Instrumentation, Thermal radiation, Aircraft, Electronic equipment, Photometry, Estuaries, Currents (Water), Path of pollutants, Tracking techniques, Streamflow, Water resources.
Identifiers: Infrared scanners, Infrared detection, Aerial infrared surveys.

With the easing of security restrictions, increasing attention has been given to the applicability of infrared remote sensing in water resources studies. Infrared scanning systems provide a pictorial display of the infrared energy emitted by terrain features. Geometric distortions are usually present in the imagery, but are of minor consequence in the interpretation. Recent applications include studies of the interaction of river and sea water and attendant current patterns in a tidal estuary, and current patterns and pollutions studies in the Great Lakes. The informational content of the infrared imagery can be improved for special purposes through various enhancement techniques, including variable detector-filter configurations, provision for manual gain control, signal differentiation, and development of a calibrated line-scan imaging system. (Knapp-USGS)
W69-04556

ON INDUCED ELECTRICAL POLARIZATION AND GROUNDWATER,
California Univ., Berkeley. Dept. of Mineral Technology.
For primary bibliographic entry see Field 02F.
W69-04606

REFRACTION DETERMINATION OF WATER TABLE DEPTH AND ALLUVIUM THICKNESS,
Wyoming Univ., Laramie. Minuteman School of Civil Engineering.
For primary bibliographic entry see Field 02E.
W69-04607

7C. Evaluation, Processing and Publication

MARKOV CHAINS OF ORDER GREATER THAN ONE,
Oregon State Univ., Corvallis. Dept. of Statistics.
For primary bibliographic entry see Field 02B.
W69-04238

A COMPUTER-ORIENTED GROUND-WATER INFORMATION STORAGE AND RETRIEVAL SYSTEM,
Research Council of Alberta, Edmonton.
Wm. R. Turner.
Ground Water, Vol 5, No 4, pp 30-37, Oct 1967. 8 p, 5 fig, 4 ref.

Descriptors: *Groundwater, *Data processing, *Data storage and retrieval, *Transmissivity, Computer models, Computer programs, Data collections, Analog computers, Hydrology, Environmental effects.
Identifiers: *Hydrodat computer-oriented system, *Aquifer transmissibility, Variable discharge.

The Hydrodat computer-oriented system developed for this purpose is a modification of the format developed by the U. S. Geological Survey and conforms to the proposed interagency compatibility requirements set forth by the Canada Department of Energy, Mines, and Resources. The basic elements of the systems are: a well-schedule form for the recording and coding of geologic, hydrologic, and water-quality data; and five 80-column IBM punch cards for transferring the coded data to magnetic tape. The article contains the following chapters: (1) introduction; (2) system development; (3) the Hydrodat System; (4) data processing; (5) master files; and (6) conclusions. Several examples of well-schedule forms are given in the article. (Gabriel-USGS)
W69-04624

08. ENGINEERING WORKS

8A. Structures

PHENOMENA AFFECTING IMPROVEMENT OF THE LOWER COLUMBIA ESTUARY AND ENTRANCE,
For primary bibliographic entry see Field 02L.
W69-04478

PORT INFORMATION SOURCES.

Report, Division of Ports and Systems, Office of Maritime Promotion, Maritime Administration, Washington, D. C., September, 1966.

Descriptors: *Harbors, *Administration, *Bibliographies, *Operations, *Design, *Construction, Data collections, Publications, Technical writing, Information retrieval, Design data, Fabrication.

A list of all publications and available information sources on port administration, port operation, port design, and port construction is presented.
W69-04491

STORM DRAINAGE PRACTICES OF THIRTY-TWO CITIES,
Tennessee Valley Authority, Knoxville. Div. of Water Control Planning; and Wisconsin Univ., Madison. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W69-04551

8B. Hydraulics

TRANSIENT FLOW INVESTIGATIONS FOR TVA'S BROWNS FERRY GENERATING STATION.
Tennessee Valley Authority, Knoxville.
For primary bibliographic entry see Field 02E.
W69-04203

VISCOUS DRAG AND SECONDARY FLOW IN GRANULAR BEDS,
University Coll. of Wales, Aberystwyth. Dept. of Physics.
For primary bibliographic entry see Field 02F.
W69-04243

STEAM-ELECTRIC PLANT CONSTRUCTION COST AND ANNUAL PRODUCTION EXPENSES--1965.

Federal Power Commission, 1966.

Descriptors: *Electric powerplants, *Steam turbins, *Cost analysis, *Construction costs, Powerplants, Thermal powerplants, Engineering structures, Industrial plants, Structures, Equipment, Turbines, Analysis, Mathematical studies, Electric power, Costs.

This report is primarily designed to provide data on steam-electric powerplant costs. It also provides a listing of the larger plants and their sources of condensing water. A complete listing of plants is available in the Federal Power Commission files.
W69-04503

8C. Hydraulic Machinery

THERMAL POLLUTION OF WATER.
For primary bibliographic entry see Field 05C.
W69-04349

CONSERVATION OF THE NATURAL RESOURCES OF NEW ENGLAND, THE PASSAMAQUODDY TIDAL POWER PROJECT AND UPPER SAINT JOHN RIVER HYDROELECTRIC DEVELOPMENT.
Report, Department of the Interior, Washington, D. C., July, 1965.

Descriptors: *Tidal energy, *Tidal powerplants, *Hydroelectric plants, *New England, *Project feasibility, Energy, Electric powerplants, Engineering structures, Industrial plants, Powerplants, Structures, Afterbays, Cost-benefit analysis, Geographical regions, Northeast U. S., Feasibility, Hydroelectric power, Electric power, Governments.

This report transmits to the President comments by various Federal and State groups and individuals concerning the report of the Passamaquoddy-Saint John River Study Committee. The latter report presents the findings of studies concerning the feasibility and desirability of the Passamaquoddy Tidal Power Project and the Upper Saint John River Hydroelectric Power Development.
W69-04459

SOME TURBULENCE MEASUREMENTS IN OPEN-CHANNEL FLOW,
Geological Survey, Fort Collins, Colo.
For primary bibliographic entry see Field 02E.
W69-04555

THE CONSTRUCTION BY FRANCE OF A MIXED PLANT FOR PRODUCTION OF ELECTRIC POWER AND OF SOFT WATER,
Societe Hispano-Suiza, Bois-Colombes (France).
For primary bibliographic entry see Field 03A.
W69-04595

8H. Rapid Excavation

OPTIMUM DREDGING AND DISPOSAL PRACTICES IN ESTUARIES,
Corps of Engineers, Philadelphia, Pa. Operations Div.
For primary bibliographic entry see Field 02L.
W69-04581

9. MANPOWER, GRANTS AND FACILITIES

A. Education (Extramural)

HE TEACHING AND RESEARCH PROGRAMS N HYDROLOGY AT FACULTY OF PHYSICAL ND MATHEMATICAL SCIENCES OF THE NIVERSITY OF CHILE,
hile Univ., Santiago.
spildora C. Basilio.
or the 8 Volume Proceedings, see Vol 2, No 9, ield 06B and W69-03305. Int Conf on Water for eace, Wash, D C, Vol 5, pp 787-794, 1968. 8 p, 2 ab, 5 ref.

escriptors: *Training, *Universities, *Hydrology, esearch facilities, Human resources, Mathe-atics.
lentifiers: *Chile, Chile University.

he present and future programs are outlined for aining hydrologists in the School of Physical ciences and Mathematics, University of Chile. Supplemental courses in fields related to hydrology are offered in other schools of the University. The human and material resources in hydrology of the school are indicated, and principal lines of research are outlined. (Vorhis-USGS)
W69-04611

9D. Grants, Contracts, and ResearchAct Allotments

WATER RESOURCES RESEARCH CATALOG.

Office of Water Resources Research, Department of the Interior, Washington, D. C., Vol 3, December 1967.

Descriptors: *Water resources development, *Bibliographies, *Research and development, *Federal government, Governments.

This publication is an annotated compilation of 4,193 federally-supported water resources research projects in progress as of December, 1966.
W69-04360

10. SCIENTIFIC AND TECHNICAL INFORMATION

NATIONAL ESTUARINE INVENTORY: HANDBOOK OF DESCRIPTORS,
Federal Water Pollution Control Administration, Washington, D. C. Office of Estuarine Studies.
T. A. Wastler, and L. C. deGuerrero.
FWPCA Report, June, 1968.

Descriptors: *Documentation, *Information retrieval, *United States, *Estuarine environment, *Water pollution, Geographical regions, Regions, Aquatic environment, Environment.

The handbook is a skeleton for the recording of information. It consists of a set of tables for the organization of information and data. It is designed for the National Estuarine Pollution Study. The appendix contains a list of all estuaries in United States boundaries.
W69-04358

SUBJECT INDEX

ANDONED FARMLAND
EFFECTS OF ABANDONED FARMLAND ON STREAMFLOW,
W69-04635 03B

ANDONMENT
ABANDONMENT OF CANAL LANDS.
W69-04402 06E

CRETION(LEGAL ASPECTS)
PAXSON V COLLINS (TITLE TO ACCRETION AND RELICTION).
W69-04368 06E

HAMBURG REALTY COMPANY V WOODS (OWNERSHIP OF LAND FORMED IN RIVER).
W69-04375 06E

TOWN OF HEMPSTEAD, LIDO BEACH, NASSAU COUNTY (CONDEMNATION AWARDS).
W69-04669 06E

MINISTRATION
BEACH CONTROL RULES AND REGULATIONS.
W69-04409 06E

WATER QUALITY, A PROBLEM FOR THE ECONOMIST,
W69-04457 05G

PORT INFORMATION SOURCES.
W69-04491 08A

MANAGING WATER QUALITY ECONOMICS, TECHNOLOGY, INSTITUTIONS,
W69-04578 05G

NATIONAL WATER LAWS AND ADMINISTRATION AS ELEMENTS OF WATER DEVELOPMENT,
W69-04644 06E

MINISTRATIVE AGENCIES
WATERWORKS AND WATER SUPPLIES.
W69-04367 04A

WATER IMPROVEMENT COMMISSION.
W69-04377 05G

WATER QUALITY MANAGEMENT AND CONTROL.
W69-04404 05G

IRRIGATION SYSTEMS (ESTABLISHING IRRIGATION SYSTEMS IN NEW JERSEY COUNTIES).
W69-04416 03F

ORGANIZATION OF SURVEYS AND HYDROLOGICAL RESEARCH IN DEVELOPING COUNTRIES,
W69-04614 06E

COMMERCE AND NAVIGATION.
W69-04663 04A

WATER SUPPLY.
W69-04697 03D

STATE BEACH EROSION COMMISSION.
W69-04698 04D

MINISTRATIVE DECISIONS
LOA RIVER BASIN WATER RESOURCES AND THEIR DISTRIBUTION,
W69-04613 04A

MIRALTY
GEORGE V BEAVARK, INC (LAKE NAVIGABILITY FOR ADMIRALTY PURPOSES).
W69-04384 06E

SORPTION
LINDANE ADSORPTION BY LAKE SEDIMENTS,
W69-04525 05G

RIAL PHOTOGRAPHY
REMOTE SENSOR SURVEILLANCE OF WATER QUALITY,
W69-04343 05G

STHETICS
THE BUFFALO SCENIC RIVERWAY.
W69-04201 06B

THE PRINCIPLES OF WATERFRONT RENEWAL A SUMMARY OF EXPERIENCE IN FIFTY AMERICAN CITIES,
W69-04476 06B

RICULTURAL WATERSHED
ORGANIZATION ARRANGEMENT FOR DEVELOPMENT AND OPERATION OF THE MISSOURI RIVER BASIN PROJECTS,
W69-04645 06E

RICULTURE
ONE EXAMPLE OF MULTIPURPOSE DEVELOPMENT PROGRAM THE RHONE,
W69-04592 04A

R POLLUTION
BIBLIOGRAPHY ON AIR AND WATER POLLUTION,
W69-04496 05G

LABAMA
WATERWORKS AND WATER SUPPLIES.
W69-04367 04A

WATER IMPROVEMENT COMMISSION.
W69-04377 05G

GEOLOGY AND GROUND-WATER RESOURCES OF GREENE COUNTY, ALABAMA,
W69-04625 02F

ALKALINE WATER
SILICA IN ALKALINE BRINES,
W69-04270 02K

ALLUVIAL CHANNELS
RIVER METAMORPHOSIS,
W69-04583 02E

ALLUVIUM
REFRACTION DETERMINATION OF WATER TABLE DEPTH AND ALLUVIUM THICKNESS,
W69-04607 02E

RECONNAISSANCE OF THE GROUND-WATER RESOURCES OF THE MISSOURI RIVER ALLUVIUM BETWEEN ST. CHARLES AND JEFFERSON CITY, MISSOURI,
W69-04610 02F

ALTERATION OF FLOW
POIRE V SERRA (INJUNCTION PROHIBITING THE FILLING IN OF A RIVER).
W69-04376 06E

ALUMINUM
ALUMINUM IONS IN AQUEOUS SOLUTIONS,
W69-04575 02K

ANAEROBIC CONDITIONS
MIGRATION OF IRON AND SULFUR WITHIN ANAEROBIC SEDIMENTS DURING EARLY DIAGENESIS,
W69-04572 02K

ANAEROBIC DIGESTION
ANAEROBIC DIGESTION OF PINEAPPLE MILL WASTES,
W69-04527 05D

ANALOG MODELS
DESIGNING PUMPED WELL CHARACTERISTICS INTO ELECTRIC ANALOG MODELS,
W69-04623 06B

ANALYTICAL TECHNIQUES
IDENTIFICATION OF PETROLEUM PRODUCTS IN ESTUARINE WATERS,
W69-04282 05A

EXTRACTION OF ORGANOCHLORINE AND ORGANOPHOSPHATE INSECTICIDES FROM LAKE WATERS,
W69-04523 05A

ANEMOMETERS
SOME TURBULENCE MEASUREMENTS IN OPEN-CHANNEL FLOW,
W69-04555 02E

ANISOTROPY
FREE-SURFACE FLOW THROUGH HETEROGENEOUS POROUS MEDIA,
W69-04552 02F

ANNEXATION
ANNEXATION OF SUBMERGED LANDS.
W69-04387 06E

APPROPRIATION
A K ROY, INC V BOARD OF COMM'RS (EXTENT OF LEVEE DISTRICT APPROPRIATION POWER).
W69-04689 04A

AQUATIC ANIMALS
COMMON MISUNDERSTANDINGS ABOUT HEATED DISCHARGES,
W69-04364 05C

AQUATIC ENVIRONMENT
EFFECTS OF FERTILIZER ON FOOD CHAIN ORGANISMS AND FISH PRODUCTION IN NORRIS RESERVOIR, TENNESSEE.
W69-04202 02I

THERMAL POLLUTION AND AQUATIC LIFE,
W69-04235 05A

AQUATIC HABITATS
PRACTICES AFFECTING SOUTH ATLANTIC AND GULF COAST MARSHES AND ESTUARIES - DREDGING AND FILLING,
W69-04288 04A

AQUATIC LIFE
THERMAL POLLUTION AND AQUATIC LIFE,
W69-04235 05A

EFFECTS OF WASTE DISCHARGE FROM POINT LOMA SALINE WATER CONVERSION PLANT ON INTERTIDAL MARINE LIFE,
W69-04280 05C

AQUATIC PRODUCTIVITY
NATURAL AND ALTERED ESTUARINE HABITATS OF PENAEID SHRIMP,
W69-04484 02L

AQUEOUS SOLUTIONS
ALUMINUM IONS IN AQUEOUS SOLUTIONS,
W69-04575 02K

AQUIFER CHARACTERISTICS

GEOLOGY AND GROUND-WATER RESOURCES OF GREENE COUNTY, ALABAMA,
W69-04625 02F

AQUIFER TRANSMISSIBILITY
TRANSMISSIBILITY DETERMINATION FROM VARIABLE DISCHARGE PUMPING TESTS,
W69-04622 02F

A COMPUTER-ORIENTED GROUND-WATER INFORMATION STORAGE AND RETRIEVAL SYSTEM,
W69-04624 07C

AQUIFERS
A NOTE ON THE GHYBEN-HERZBERG FORMULA,
W69-04569 02F

TEMPERATURE PROSPECTING FOR SHALLOW GLACIAL AND ALLUVIAL AQUIFERS IN ILLINOIS,
W69-04585 02F

RESISTIVITY INVESTIGATIONS OF LIMESTONE AQUIFERS IN JAMAICA,
W69-04600 02F

TEST HOLE IN AQUIFER WITH MANY WATER-BEARING ZONES AT JACKSONVILLE, FLORIDA,
W69-04620 02F

TRANSMISSIBILITY DETERMINATION FROM VARIABLE DISCHARGE PUMPING TESTS,
W69-04622 02F

ARIZONA
WATER RESOURCES OF THE SYCAMORE CREEK WATERSHED, MARICOPA COUNTY, ARIZONA,
W69-04587 02E

ARKANSAS
STORAGE REQUIREMENTS FOR ARKANSAS STREAMS,
W69-04250 02E

FARELLY LAKE LEVEE DISTRICT OF JEFFERSON AND ARKANSAS COUNTIES V HAMPTON (RATIFICATION OF CONTRACT TO REPAY CONTRIBUTIONS FROM LANDOWNERS).
W69-04369 06E

GEORGE V BEAVARK, INC (LAKE NAVIGABILITY FOR ADMIRALTY PURPOSES).
W69-04384 06E

GEOHYDROLOGY OF THE COASTAL PLAIN AQUIFERS OF ARKANSAS,
W69-04609 02F

JONES V OZ-ARK-VAL POULTRY CO (RIGHT TO THE USE OF SUBTERRANEAN WATERS).
W69-04690 06D

ARKANSAS RIVER
CHEROKEE NATION OR TRIBE OF INDIANS IN OKLAHOMA V OKLAHOMA (RIGHT TO RIVERBEDS OF ARKANSAS RIVER).
W69-04651 06E

ARTIFICIAL RECHARGE
COARSE FILTER MEDIA FOR ARTIFICIAL RECHARGE,
W69-04563 04B

ARTIFICIAL USE
HOPLER V MORRIS HILLS REGIONAL DISTRICT (LIABILITY FOR DISCHARGING SURFACE WATERS).
W69-04429 04A

ARTIFICIAL WATERCOURSES
BEATTY V PLAIL (ARTIFICIAL CHANNEL OF SURFACE WATER WASHED ONTO ADJOINING LAND).
W69-04686 04A

ASSESSMENTS
A NOTE ON THE ASYMMETRY BETWEEN FEES AND PAYMENTS,
W69-04446 05G

CITY OF TREASURE ISLAND V STRONG (ASSESSMENTS FOR EROSION CONTROL GROIN SYSTEM).
W69-04653 04D

ATLANTA
METROPOLITAN PLANNING AND RIVER BASIN PLANNING SOME INTERRELATIONSHIPS,
W69-04566 06A

ATLANTIC COASTAL PLAIN
STATEMENT,
W69-04306 05D

PROBLEMS OF CONSERVATION IN THE ATLANTIC ESTUARINE ZONE,
W69-04355 06B

ATLANTIC OCEAN
STATEMENT ON LIVING MARINE RESOURCES OF WETLANDS AND ESTUARIES,
W69-04356 06B

LAND BORDERING ON AND ADJACENT TO OCEAN MAY BE ACQUIRED FOR PLACES OF PUBLIC RESORT. REFERENDUM OF QUESTION OF ADOPTION OF ACT.
W69-04410 06E

TOWN OF PALM BEACH SHORES V COLONNADES, INC (OCEAN POLLUTION).
W69-04668 05G

BANK EROSION
SEA CLIFF RETREAT NEAR SANTA BARBARA, CALIFORNIA,
W69-04241 02L

BASS
CHESAPEAKE BAY WATER SUPPLY NEEDS - THE BIOLOGICAL POINT OF VIEW,
W69-04464 03C

BAYS
THE ROLE OF THE PHYSICAL HYDRAULIC MODEL OF SAN FRANCISCO BAY AND DELTA IN POLLUTION STUDIES,
W69-04329 05B

CHESAPEAKE BAY, A PICTORIAL MARITIME HISTORY,
W69-04449 06B

AN ECOLOGICAL SURVEY OF THE HOUSTON SHIP CHANNEL AND ADJACENT BAYS,
W69-04454 05C

A PRELIMINARY ESTIMATE OF THE EFFECT OF DIVERSION OF FLOW FROM THE SUSQUEHANNA RIVER ON THE SALINITY OF THE UPPER CHESAPEAKE BAY,
W69-04493 02L

BEACH EROSION
LONG ISLAND BEACH BUGGY ASS'N V TOWN OF ISLIP (BEACH EROSION).
W69-04389 04D

WATER FRONT IMPROVEMENTS.
W69-04407 06E

HARBOR AND WATER FRONT COMMISSION BEACH EROSION CONTROL DISTRICT.
W69-04414 06E

CITY OF TREASURE ISLAND V STRONG (ASSESSMENTS FOR EROSION CONTROL GROIN SYSTEM).
W69-04653 04D

STATE BEACH EROSION COMMISSION.
W69-04698 04D

BEACH EROSION COMMISSION
STATE BEACH EROSION COMMISSION.
W69-04698 04D

BEACHES
OIL SPILLAGE STUDY LITERATURE SEARCH AND CRITICAL EVALUATION FOR SELECTION OF PROMISING TECHNIQUES TO CONTROL AND PREVENT DAMAGE.
W69-04309 05G

PROTECTION AND RESTORATION OF BEACHES DURING AND AFTER OIL SPILLS,
W69-04350 05G

BEACH CONTROL RULES AND REGULATIONS.
W69-04409 06E

BED LOAD
DEFINITIVE COMPUTATIONS OF SAND DISCHARGE IN RIVERS,
W69-04554 02J

BEDS
ANNEXATION OF SUBMERGED LANDS.
W69-04387 06E

BEDS UNDER WATER
STATE OF TEXAS V CHUOKE (OWNERSHIP OF SUBMERGED LANDS).
W69-04383 06E

BENEFICIAL USE
ON POSSIBLE CONSTRUCTIVE USES OF THERMAL ADDITIONS TO ESTUARIES,
W69-04297 05C

BENEFITS
MAN AND THE ESTUARY.
W69-04283 06B

ON POSSIBLE CONSTRUCTIVE USES OF THERMAL ADDITIONS TO ESTUARIES,
W69-04297 05C

THERMAL POLLUTION OF WATER,
W69-04345 05C

RECENT DEVELOPMENTS IN EVALUATING RECREATIONAL BENEFITS,
W69-04453 06B

THE CONTRIBUTION OF THE AMERICAN MERCHANT MARINE TO THE U. S. BALANCE OF PAYMENTS.
W69-04460 06C

COMPARISONS OF METHODS FOR RECREATION EVALUATION,
W69-04474 06B

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS,
W69-04482 06B

RECREATION BENEFITS FROM WATER POLLUTION CONTROL,
W69-04504 05G

BIBLIOGRAPHIES
ESTUARIES,
W69-04278 02L

WATER RESOURCES RESEARCH CATALOG.
W69-04360 09D

EFFECT OF WATER TEMPERATURE ON STREAM REAERATION,
W69-04468 05G

A PRELIMINARY BIBLIOGRAPHY WITH KWIC INDEX ON THE ECOLOGY OF ESTUARIES AND COASTAL AREAS OF THE EASTERN UNITED STATES,
W69-04477 06G

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS,
W69-04482 06B

PORT INFORMATION SOURCES.
W69-04491 08A

COST-BENEFIT ANALYSIS A SURVEY,
W69-04492 06B

BIBLIOGRAPHY ON AIR AND WATER POLLUTION,
W69-04496 05G

TOURISM AND RECREATION.
W69-04510 06B

EFFECT OF URBAN DEVELOPMENT ON FLOOD DISCHARGES-CURRENT KNOWLEDGE AND FUTURE NEEDS,
W69-04560 04C

BENEFIT-COST ANALYSIS FOR WATER RESOURCES PROJECTS A SELECTED ANNOTATED BIBLIOGRAPHY.
W69-04629 06B

BIOCHEMICAL OXYGEN DEMAND
RESPONSE TO POLLUTION OF NEW YORK HARBOR AND THAMES ESTUARY,
W69-04351 05B

'WASTE DISPOSAL AND WATER SUPPLY',
W69-04438 05G

ANALYSIS OF A STREAM'S CAPACITY FOR ASSIMILATING POLLUTION,
W69-04456 05C

BIOLOGICAL TREATMENT
ANAEROBIC DIGESTION OF PINEAPPLE MILL WASTES,
W69-04527 05D

BOARD OF FISH AND GAME COMMISSIONERS
BOARD OF GAME AND FISH COMMISSIONERS POWERS AND DUTIES.
W69-04435 06E

BOARD OF PUBLIC WORKS
BOARD OF PUBLIC WORKS.
W69-04413 06E

BOARD OF TRUSTEES
GENERAL POWERS OF THE BOARD OF TRUSTEES.
W69-04393 04A

BOATING
STATEMENT,
W69-04303 06B

BOATS
HOUSEBOATS, SANITATION AND LOCATION.
W69-04388 05G

BOREHOLE GEOPHYSICS
CONVECTIVE FLOW AND ITS EFFECT ON TEMPERATURE LOGGING IN SMALL-DIAMETER WELLS,
W69-04601 02F

BOTTOM SEDIMENTS
MIGRATION OF IRON AND SULFUR WITHIN ANAEROBIC SEDIMENTS DURING EARLY DIAGENESIS,
W69-04572 02K

BOUNDARIES(PROPERTY)
ANNEXATION OF SUBMERGED LANDS.
W69-04387 06E

BURGESS V PINE ISLAND CORP (LAND SEPARATED FROM ISLAND BY NON-NAVIGABLE STREAM NOT AN ISLAND).
W69-04652 06E

BOUNDARY DISPUTES
INTERNAL IMPROVEMENT FUND OF STATE OF FLORIDA V NOWAK (USE OF MEANDER LINES IN SETTING BOUNDARIES OF RIPARIAN PROPERTY).
W69-04374 06E

BRACKISH WATER
ESTIMATED COST OF DESALTING THREE FLORIDA BRACKISH WATERS,
W69-04441 03A

BRIDGE CONSTRUCTION
HUNTER V CITY OF SHREVEPORT (BRIDGE CONSTRUCTION).
W69-04667 06E

BRIDGES
BRIDGES OVER CERTAIN TIDAL WATERS CHANGING COURSE OF STREAM.
W69-04417 04A

BRIDGES TO CONFORM TO WHARF LINES.
W69-04423 04A

DEPARTMENT OF HIGHWAYS OF LOUISIANA V UNITED STATES (REVOCATION OF BRIDGE PERMIT).
W69-04670 06E

BRINES
LIMNOLOGICAL HYPOTHESIS OF THE ORIGIN OF HOT BRINES IN THE RED SEA,
W69-04254 02K

SILICA IN ALKALINE BRINES,
W69-04270 02K

BULK DENSITY
HYDROLOGIC PROPERTIES OF PEAT FROM A WYOMING MOUNTAIN BOG,
W69-04234 02G

BULKHEADS
NATURAL AND ALTERED ESTUARINE HABITATS OF PENAEID SHRIMP,
W69-04484 02L

CALIFORNIA
USE OF HYDRAULIC AND MATHEMATICAL MODELS FOR DETERMINING EFFLUENT DIFFUSION IN SOUTH SAN FRANCISCO BAY,
W69-04277 05B

EFFECTS OF WASTE DISCHARGE FROM POINT LOMA SALINE WATER CONVERSION PLANT ON INTERTIDAL MARINE LIFE,
W69-04280 05C

THE FUTURE OF AN ESTUARY,
W69-04290 05G

DELTA-SUISUN BAY WATER QUALITY INVESTIGATION,
W69-04291 02L

MATHEMATICAL MODELING OF WATER QUALITY IN ESTUARIAL SYSTEMS,
W69-04311 05B

MARINE SPORTFISHING SURVEY OF SOUTHERN CALIFORNIA PIERS AND JETTIES, 1963,
W69-04316 06B

PLAN DEVELOPING FOR UNDERWATER PARKS.
W69-04317 06B

REMARKS BY BRIGADIER GENERAL JOHN A. B. DILLARD, DIVISION ENGINEER, SOUTH PACIFIC.
W69-04324 04A

THE ROLE OF THE PHYSICAL HYDRAULIC MODEL OF SAN FRANCISCO BAY AND DELTA IN POLLUTION STUDIES,
W69-04329 05B

ESTUARINE WATER QUALITY MANAGEMENT IN THE SACRAMENTO-SAN JOAQUIN DELTA,
W69-04331 05G

THE CALIFORNIA OYSTER INDUSTRY,
W69-04442 06B

DIFFUSION OF SEWAGE EFFLUENT IN AN OCEAN-CURRENT,
W69-04452 05B

FISHERIES PROTECTING AND ENHANCEMENT WITH WATER DEVELOPMENT OF THE SACRAMENTO-SAN JOAQUIN ESTUARY,
W69-04472 06B

THE ECONOMICS OF WATER PRODUCTION USING NUCLEAR ENERGY,
W69-04483 03A

THE ANIMAL FOOD FISHERY IN CALIFORNIA, 1961-1962,
W69-04487 06B

THE MARINE ENVIRONMENT IN THE VICINITY OF THE ORANGE COUNTY SANITATION DISTRICTS OCEAN OUTFALL,
W69-04511 05C

CANAL CONSTRUCTION
CANAL COMPANIES - POWERS AND DUTIES.
W69-04405 04A

CANALS
ABANDONMENT OF CANAL LANDS.
W69-04402 06E

CANAL COMPANIES - POWERS AND DUTIES.
W69-04405 04A

CURRENTS IN AN INTEROCEANIC CANAL,
W69-04557 02E

DISPOSITION OF CANALS AND CANAL PROPERTIES PROHIBITED.
W69-04656 04A

WILLFUL INJURIES TO THE CANALS AND DRAWING WATER FROM THE CANALS.
W69-04662 04A

CAPITAL COSTS
PROTECTING THE POTOMAC AT WASHINGTON,
W69-04437 05G

CARBONATE ROCKS
HYDROLOGY OF THE VALLEY-FILL AND CARBONATE-ROCK RESERVOIRS PAHRUMP VALLEY NEVADA-CALIFORNIA,
W69-04267 03D

CHANNEL IMPROVEMENT
MARITIME AGENCY STATUS, CHANNEL PROBLEMS CREATED BY HUGE SHIPS CONCERNS OF AAPA.
W69-04287 04A

PHENOMENA AFFECTING IMPROVEMENT OF THE LOWER COLUMBIA ESTUARY AND ENTRANCE,
W69-04478 02L

CHANNEL MORPHOLOGY

RIVER METAMORPHOSIS,
W69-04583 02E

CHATTAHOOCHEE RIVER BASIN
METROPOLITAN PLANNING AND RIVER BASIN PLANNING SOME INTERRELATIONSHIPS,
W69-04566 06A

CHECK STRUCTURES
RIVER IMPROVEMENT.
W69-04401 04A

CHEMICAL PROPERTIES
IDENTIFICATION AND SOLUBILITY OF IRON SULFIDE IN ANAEROBIC LAKE SEDIMENT,
W69-04590 02K

A GEOCHEMICAL CLASSIFICATION OF NATURAL WATERS,
W69-04626 02K

CHICAGO
FLOOD AND POLLUTION CONTROL A DEEP TUNNEL PLAN FOR THE CHICAGOLAND AREA.
W69-04630 04A

CHICAGO TUNNEL DRAINAGE PROJECT PRELIMINARY EVALUATION OF FEASIBILITY.
W69-04631 04A

CHILE
THE TEACHING AND RESEARCH PROGRAMS IN HYDROLOGY AT FACULTY OF PHYSICAL AND MATHEMATICAL SCIENCES OF THE UNIVERSITY OF CHILE,
W69-04611 09A

CHLORINE COMPOUNDS
EXTRACTION OF ORGANOCHLORINE AND ORGANOPHOSPHATE INSECTICIDES FROM LAKE WATERS,
W69-04523 05A

CITIES
MUNICIPALITIES.
W69-04380 04D

NORTH JERSEY DIST WATER SUPPLY COMM'N V CITY OF NEWARK (RESCISSION OF WATER SUPPLY CONTRACTS).
W69-04408 06E

BEACH CONTROL RULES AND REGULATIONS.
W69-04409 06E

POWERS OF CITIES.
W69-04657 06E

WATER-WORKS.
W69-04693 04A

PUBLIC UTILITIES METHODS OF SUPPLYING WATER.
W69-04695 03D

PUBLIC UTILITIES MUNICIPALITY AND ITS EXCLUSIVE RIGHT TO SUPPLY WATER.
W69-04696 03D

CITY PLANNING
THE PRINCIPLES OF WATERFRONT RENEWAL A SUMMARY OF EXPERIENCE IN FIFTY AMERICAN CITIES,
W69-04476 06B

CLASSIFICATION
GEOCHEMISTRY OF NATURAL WATERS,
W69-04562 02K

CLAYS
CONVECTIVE DIFFUSION IN CLAY SYSTEMS,
W69-04261 02F

CLEAR-CUTTING
NITRIFICATION IMPORTANCE TO NUTRIENT LOSSES FROM A CUTOVER FORESTED ECOSYSTEM,
W69-04584 02K

COASTS
STATE AND LOCAL GOVERNMENT ACTIVITIES AND ROLES IN MARINE SCIENCE, ENGINEERING AND DEVELOPMENT. A BRIEFLY ANNOTATED CATALOG OF PUBLISHED STUDIES AND REPORTS ON SUCH ORGANIZATIONAL ARRANGEMENTS AND ACTIVITIES IN THE COASTAL STATES AND IN THOSE BORDERING ON THE GREAT LAKES.
W69-04341 06E

A PRELIMINARY BIBLIOGRAPHY WITH KWIC INDEX ON THE ECOLOGY OF ESTUARIES AND COASTAL AREAS OF THE EASTERN UNITED STATES,
W69-04477 06G

A NOTE ON THE GHYBEN-HERZBERG FORMULA,
W69-04569 02F

COLIFORMS
COLIFORM-FECAL COLIFORM BACTERIA IN TIDAL WATERS,
W69-04344 05G

COLORADO RIVER BASIN
VANADIUM CONCENTRATIONS IN COLORADO RIVER BASIN WATERS,
W69-04264 02K

COLUMBIA RIVER
PHENOMENA AFFECTING IMPROVEMENT OF THE LOWER COLUMBIA ESTUARY AND ENTRANCE,
W69-04478 02L

DISCHARGE IN THE LOWER COLUMBIA RIVER BASIN, 1928-65,
W69-04577 02E

WATER TEMPERATURES IN THE LOWER COLUMBIA RIVER,
W69-04605 02E

COMMERCIAL CRAFT
WATER FRONT IMPROVEMENTS.
W69-04692 04A

COMMERCIAL FISH
ON POSSIBLE CONSTRUCTIVE USES OF THERMAL ADDITIONS TO ESTUARIES,
W69-04297 05C

COMMERCIAL FISHING
A SUMMARY REPORT ON MARYLAND'S COMMERCIAL FISHERIES, 1957-1966,
W69-04284 06B

FISH PROTEIN CONCENTR)TE SEEN POSSIBLE NEW INDUSTRY,
W69-04299 06B

IMPORTANCE OF GULF ESTUARIES AND PROBLEMS FACING OUR FISHERY RESOURCES,
W69-04300 06B

RELATIONS BETWEEN SPORT AND COMMERCIAL FISHERMEN,
W69-04302 06B

OCEANOGRAPHY--THE EMERGING SCIENCE OF THE SEA.
W69-04305 06B

THE SEAFOOD INDUSTRY, A LOCAL ANALYSIS.
W69-04337 06B

STATEMENT ON LIVING MARINE RESOURCES OF WETLANDS AND ESTUARIES,
W69-04356 06B

MANAGEMENT OF ESTUARINE FISHERIES,
W69-04481 06B

COMMERCIAL SHELLFISH
A SUMMARY REPORT ON MARYLAND'S COMMERCIAL FISHERIES, 1957-1966,
W69-04284 06B

ON POSSIBLE CONSTRUCTIVE USES OF THERMAL ADDITIONS TO ESTUARIES,
W69-04297 05C

THE SEAFOOD INDUSTRY, A LOCAL ANALYSIS.
W69-04337 06B

STATEMENT,
W69-04338 06B

TIME, MANNER AND PURPOSE OF TAKING SHELLFISH.
W69-04432 06E

ROUGH CULL LAW.
W69-04433 06E

THE CALIFORNIA OYSTER INDUSTRY,
W69-04442 06B

COMPETING USES
THE URGENT NEED FOR LANDSCAPE ZONING OF THE ESTUARINE REGION ACCORDING TO ECO-SYSTEM PRINCIPLES,
W69-04307 06F

COMPETITION
RELATIONS BETWEEN SPORT AND COMMERCIAL FISHERMEN,
W69-04302 06B

'NATURAL RESOURCES AND THE QUALITY OF LIFE',
W69-04440 06B

COMPUTER MODELS
MATHEMATICAL MODELING OF WATER QUALITY IN ESTUARIAL SYSTEMS,
W69-04311 05B

THE DEVELOPMENT AND APPLICATION OF A TIME-VARYING DISSOLVED OXYGEN MODEL,
W69-04315 05G

CONCRETES
THE INFLUENCE OF GROUNDWATER FLOW SYSTEMS ON PAVEMENT STABILITY IN HIGHWAY CUTS,
W69-04621 02F

CONDEMNATION
STATE OF TEXAS V CHUOKE (OWNERSHIP OF SUBMERGED LANDS).
W69-04383 06E

CANAL COMPANIES - POWERS AND DUTIES.
W69-04405 04A

PROTECTION OF ROADS NEAR TIDEWATER ACQUISITION OF LANDS.
W69-04419 06E

STERKX V GRAVITY DRAINAGE DISTRICT NO 1 OF RAPIDES PARISH (VALUE OF PROPERTY CONFISCATED FOR DRAINAGE PURPOSES).
W69-04650 04A

CONDEMNATION VALUE
TOWN OF HEMPSTEAD, LIDO BEACH, NASSAU COUNTY (CONDEMNATION AWARDS).
W69-04669 06E

CONNECTICUT

TOWN OF GREENWICH V GREENWICH WATER CO (PUBLIC UTILITY RIVER DIVERSION).
W69-04688 06D

NSERVATION
THE PUBLIC INTEREST IN PRESERVING NATURAL AREAS,
W69-04475 06D

NSTRUCTION
WATERSIDE SITE PLANT LOCATIONS AND EXPANSIONS 1966.
W69-04361 04A

PORT INFORMATION SOURCES.
W69-04491 08A

NSTRUCTION COSTS
PUBLIC WORK NEEDS - MARINE PORT FACILITIES.
W69-04495 06B

STEAM-ELECTRIC PLANT CONSTRUCTION COST AND ANNUAL PRODUCTION EXPENSES--1965.
W69-04503 08B

NTINENTAL SHELF
LOW-FREQUENCY SEA LEVEL BEHAVIOR AND CONTINENTAL SHELF WAVES OFF NORTH CAROLINA,
W69-04224 02A

A STUDY OF THE U. S. COAST AND GEODETIC SURVEY'S PRODUCTS AND SERVICES AS RELATED TO ECONOMIC ACTIVITY IN THE U. S. CONTINENTAL SHELF REGIONS.
W69-04505 06B

NTINENTAL SLOPE
LOW-FREQUENCY SEA LEVEL BEHAVIOR AND CONTINENTAL SHELF WAVES OFF NORTH CAROLINA,
W69-04224 02A

NTRACTS
FARELLY LAKE LEVEE DISTRICT OF JEFFERSON AND ARKANSAS COUNTIES V HAMPTON (RATIFICATION OF CONTRACT TO REPAY CONTRIBUTIONS FROM LANDOWNERS).
W69-04369 06E

SEABOARD AIR LINE RAILROAD CO V SARASOTA-FRUITVILLE DRAINAGE DISTRICT (DRAINAGE WATER DAMAGES).
W69-04682 04A

NVECTION
CONVECTIVE FLOW AND ITS EFFECT ON TEMPERATURE LOGGING IN SMALL-DIAMETER WELLS,
W69-04601 02F

NVENTION HALL PIER
CONSTRUCTION OF CONVENTION HALL PIER.
W69-04412 04A

OLING
THERMAL POLLUTION HOT ISSUE FOR INDUSTRY,
W69-04325 05C

THERMAL POLLUTION OF WATER.
W69-04349 05C

OLING TOWER
'WATER DEMAND FOR STEAM ELECTRIC GENERATION',
W69-04461 06D

OLING TOWERS
STATEMENT.
W69-04342 05G

WATER USE AND RELATED COSTS WITH COOLING TOWERS,
W69-04443 06C

A COOLING POND PROVES CHEAPER,
W69-04447 05C

OLING WATER
1965 SURVEY ON DISPOSAL OF SEWAGE AND INDUSTRIAL WASTES BY FEDERAL INSTALLATIONS.
W69-04507 05D

RPS OF ENGINEERS
WATER RESOURCES DEVELOPMENT BY THE U S ARMY CORPS OF ENGINEERS IN FLORIDA.
W69-04643 04A

ST ANALYSIS
INDUSTRIAL WASTEWATER RECLAMATION,
W69-04226 05D

TECHNOLOGY ADDING BILLIONS TO RESERVES.
W69-04348 06B

NUTRIENTS,
W69-04448 05C

COMPARISONS OF METHODS FOR RECREATION EVALUATION,
W69-04474 06B

STEAM-ELECTRIC PLANT CONSTRUCTION COST AND ANNUAL PRODUCTION EXPENSES--1965.
W69-04503 08B

ST COMPARISONS
A COOLING POND PROVES CHEAPER,
W69-04447 05C

FLOOD AND POLLUTION CONTROL A DEEP TUNNEL PLAN FOR THE CHICAGOLAND AREA.
W69-04630 04A

COST SHARING
A 'BALAS' ALGORITHM FOR ZONED UNIFORM TREATMENT,
W69-04281 05D

COSTS
MAN AND THE ESTUARY.
W69-04283 06B

POLLUTIONAL EFFECTS OF PULP AND PAPER MILL WASTES IN PUGET SOUND.
W69-04319 05G

ESTIMATED COST OF DESALTING THREE FLORIDA BRACKISH WATERS,
W69-04441 03A

WATER USE AND RELATED COSTS WITH COOLING TOWERS,
W69-04443 06C

SALINE WATER CONVERSION REPORT.
W69-04498 03A

WATER DESALINATION PROPOSALS FOR A COSTING PROCEDURE AND RELATED TECHNICAL AND ECONOMIC CONSIDERATIONS.
W69-04513 03A

COST-BENEFIT ANALYSIS
RECREATION,
W69-04458 06B

BENEFIT-COST ANALYSIS ITS RELEVANCE TO PUBLIC INVESTMENT DECISIONS,
W69-04479 06B

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS,
W69-04482 06B

COST-BENEFIT ANALYSIS A SURVEY,
W69-04492 06B

THE POLITICAL ECONOMY OF EFFICIENCY COST-BENEFIT ANALYSIS, SYSTEMS ANALYSIS, AND PROGRAM BUDGETING,
W69-04519 06B

BENEFIT-COST ANALYSIS FOR WATER RESOURCES PROJECTS A SELECTED ANNOTATED BIBLIOGRAPHY.
W69-04629 06B

COST-BENEFIT RATIO
A CALL FOR ACTION,
W69-04352 06B

ON THE USES AND ABUSES OF ECONOMIC SCIENCE IN EVALUATING PUBLIC OUTDOOR RECREATION,
W69-04500 06B

WATER QUALITY IMPROVEMENT PROGRAMMING PROBLEMS,
W69-04502 05G

COUNTY ORDINANCES
HOUSEBOATS, SANITATION AND LOCATION.
W69-04388 05G

CULLING
ROUGH CULL LAW.
W69-04433 06E

CULTIVATION
LAND RECLAMATION IN THE PO RIVER DELTA OF ITALY,
W69-04518 04A

CULTURAL CONTROL
ADVANCES IN THE OFF-BOTTOM CULTURE OF OYSTERS,
W69-04339 06B

CULVERTS
FRYE V PENNSYLVANIA RAILROAD CO (RAILROAD'S LIABILITY FOR NEGLIGENTLY MAINTAINING CULVERT THROUGH RIGHT-OF-WAY).
W69-04683 06E

CURRENTS(WATER)
CURRENTS IN AN INTEROCEANIC CANAL,
W69-04557 02E

SALINITY INTRUSION EFFECTS IN ESTUARY SHOALING,
W69-04558 02L

DISPERSION AND FLUSHING OF POLLUTANTS IN ESTUARIES,
W69-04559 02L

CYCLING NUTRIENTS
A DIRECT DEMONSTRATION OF THE PHOSPHORUS CYCLE IN A SMALL LAKE,
W69-04520 02H

DAM CONSTRUCTION
THE ZUYDERZEE WORKS.
W69-04365 04A

PUBLIC UTILITIES - CONSTRUCTION AND OPERATION OF DAMS.
W69-04406 04A

TOWN OF GREENWICH V GREENWICH WATER CO (PUBLIC UTILITY RIVER DIVERSION).
W69-04688 06D

DAMAGES
STATEMENT ON LIVING MARINE RESOURCES OF WETLANDS AND ESTUARIES,
W69-04356 06B

RIDDLE V CITY OF GREENVILLE (RIGHT TO COLLECT DAMAGES FROM POLLUTION OF STREAMS).
W69-04372 05B

DAVIES V SHAFFER (OBSTRUCTION OF DRAINAGE DITCHES).
W69-04684 04A

SMITH V WAGNER (ARTIFICIAL CONCENTRATION OF DRAINAGE ON NEIGHBOR'S LAND).
W69-04685 04A

DAMS
HARRIS V UNITED STATES (NEGLIGENCE OF TVA UNDER FEDERAL TORT CLAIMS ACT).
W69-04370 06E

PUBLIC UTILITIES - CONSTRUCTION AND OPERATION OF DAMS.
W69-04406 04A

AGRICULTURAL DEVELOPMENT AND EXPANSION IN THE NILE BASIN PROGRAMS, PRODUCTION AND IMPLICATIONS FOR U. S. AGRICULTURE,
W69-04641 03F

LITTLE V UNITED STATES (WRONGFUL DEATH LIABILITY FOR DAM MAINTENANCE).
W69-04666 06E

DATA COLLECTIONS
MOISTURE-TENSION DATA FOR SELECTED SOILS ON EXPERIMENTAL WATERSHEDS,
W69-04266 02G

PORTS OF THE WORLD, 1967.
W69-04320 06C

GROUND-WATER CONDITIONS IN UTAH, SPRING OF 1968,
W69-04561 02F

COMPILATION OF HYDROLOGIC DATA, WALLER AND WILBARGER CREEKS, COLORADO RIVER BASIN, TEXAS-1966.
W69-04599 02E

DATA PROCESSING
A COMPUTER-ORIENTED GROUND-WATER INFORMATION STORAGE AND RETRIEVAL SYSTEM,
W69-04624 07C

DATA STORAGE AND RETRIEVAL
A COMPUTER-ORIENTED GROUND-WATER INFORMATION STORAGE AND RETRIEVAL SYSTEM,
W69-04624 07C

DECIDUOUS FORESTS
A SUBSTITUTE FOR 2,4,5-T IN EASTERN HARDWOOD SPROUT AND BRUSH CONTROL,
W69-04633 03B

DEEP TUNNEL PLAN
FLOOD AND POLLUTION CONTROL A DEEP TUNNEL PLAN FOR THE CHICAGOLAND AREA.
W69-04630 04A

DELAWARE
RECENT RESULTS FROM A MATHEMATICAL MODEL OF WATER POLLUTION CONTROL IN THE DELAWARE ESTUARY,
W69-04509 05G

DELAWARE RIVER
ISLANDS IN DELAWARE RIVER.
W69-04430 06E

DELAWARE RIVER MODEL STUDY REPORT NO. 2 - SALINITY TESTS OF EXISTING CHANNEL.
W69-04466 02L

ESTUARINE DISTRIBUTION OF NONCONSERVATIVE SUBSTANCES,
W69-04489 05G

DELAWARE RIVER.
W69-04699 06E

DELAWARE RIVER BASIN COMMISSION
INTERSTATE COOPERATION FOR CONSERVATION AND PROTECTION OF WATER RESOURCES.
W69-04427 03D

DEMANDS
WHEN DOES A FISHERY BECOME UNECONOMIC,
W69-04485 06B

DEPTH
UNITED STATES V REPUBLIC STEEL CORP (INJUNCTION TO FORCE COMPANY TO RESTORE RIVER TO ORIGINAL DEPTH).
W69-04671 06E

DEPTH-AREA-DURATION ANALYSIS
GENERALIZED RAINFALL-DURATION-FREQUENCY RELATIONSHIPS,
W69-04549 02A

DESALINATION
EFFECTS OF WASTE DISCHARGE FROM POINT LOMA SALINE WATER CONVERSION PLANT ON INTERTIDAL MARINE LIFE,
W69-04280 05C

OCEANOGRAPHY--THE EMERGING SCIENCE OF THE SEA.
W69-04305 06B

ESTIMATED COST OF DESALTING THREE FLORIDA BRACKISH WATERS,
W69-04441 03A

THE PROSPECTS FOR DUAL-PURPOSE PLANTS,
W69-04463 03A

SALINE WATER CONVERSION REPORT.
W69-04498 03A

WATER DESALINATION PROPOSALS FOR A COSTING PROCEDURE AND RELATED TECHNICAL AND ECONOMIC CONSIDERATIONS.
W69-04513 03A

THE CONSTRUCTION BY FRANCE OF A MIXED PLANT FOR PRODUCTION OF ELECTRIC POWER AND OF SOFT WATER,
W69-04595 03A

DESALINATION PLANTS
THE ECONOMICS OF WATER PRODUCTION USING NUCLEAR ENERGY,
W69-04483 03A

DESIGN
STATEMENT BEFORE THE SUBCOMMITTEE ON AIR AND WATER POLLUTION, APRIL 17, 1968,
W69-04293 05B

PORT INFORMATION SOURCES.
W69-04491 08A

DESIGN CRITERIA
OCEAN OUTFALL DESIGN FOR ECONOMY OF CONSTRUCTION,
W69-04313 05E

DIAGENESIS
MIGRATION OF IRON AND SULFUR WITHIN ANAEROBIC SEDIMENTS DURING EARLY DIAGENESIS,
W69-04572 02K

DIFFUSION
CONVECTIVE DIFFUSION IN CLAY SYSTEMS,
W69-04261 02F

DIFFUSION OF SEWAGE EFFLUENT IN AN OCEAN-CURRENT,
W69-04452 05B

DIFFUSIVITY
SOIL-WATER DIFFUSIVITY VALUES BASED UPON TIME DEPENDENT SOIL WATER CONTENT DISTRIBUTIONS,
W69-04603 02G

DIGITAL COMPUTERS
DIGITAL SIMULATION OF NATURAL ANIMAL COMMUNITIES,
W69-04312 06G

DIKES
LAND RECLAMATION IN THE PO RIVER DELTA OF ITALY,
W69-04518 04A

DISASTERS
MARINE, ESTUARIAN, AND RIPARIAN POLLUTION DISASTERS AND THEIR CONSEQUENCES.
W69-04285 05G

OIL SPILLAGE STUDY LITERATURE SEARCH AND CRITICAL EVALUATION FOR SELECTION OF PROMISING TECHNIQUES TO CONTROL AND PREVENT DAMAGE.
W69-04309 05G

SPILL POLLUTION - ITS EFFECTS AND CONTROL,
W69-04322 05G

PROTECTION AND RESTORATION OF BEACHES DURING AND AFTER OIL SPILLS,
W69-04350 05G

DISCHARGE
THE DISCHARGE OF SEWAGE AND OTHER MATTER INTO CERTAIN WATERS IS PROHIBITED.
W69-04391 05B

DISCHARGE MEASUREMENT
1965 SURVEY ON DISPOSAL OF SEWAGE AND INDUSTRIAL WASTES BY FEDERAL INSTALLATIONS.
W69-04507 05D

MEASUREMENT OF DISCHARGE BY THE MOVING-BOAT METHOD,
W69-04547 07B

DISCHARGE(WATER)
MEASUREMENT OF DISCHARGE BY THE MOVING-BOAT METHOD,
W69-04547 07B

BEATTY V FLAIL (ARTIFICIAL CHANNEL OF SURFACE WATER WASHED ONTO ADJOINING LAND).
W69-04686 04A

DISSOLVED OXYGEN
A PROBABILISTIC ANALYSIS OF DISSOLVED OXYGEN-BIOCHEMICAL OXYGEN DEMAND RELATIONSHIP IN STREAMS,
W69-04247 05C

ESTUARINE POLLUTION OF THE CHAO PHRAYA RIVER AT BANGKOK, THAILAND,
W69-04279 05B

THE DEVELOPMENT AND APPLICATION OF A TIME-VARYING DISSOLVED OXYGEN MODEL,
W69-04315 05G

RESPONSE TO POLLUTION OF NEW YORK HARBOR AND THAMES ESTUARY,
W69-04351 05B

SOME CONSIDERATIONS OF OXYGEN UTILIZATION RATES IN PUGET SOUND,

W69-04439 05B

ANALYSIS OF A STREAM'S CAPACITY FOR ASSIMILATING POLLUTION,
W69-04456 05C

RECENT RESULTS FROM A MATHEMATICAL MODEL OF WATER POLLUTION CONTROL IN THE DELAWARE ESTUARY,
W69-04509 05G

SSOLVED SOLIDS
THE FUTURE OF AN ESTUARY,
W69-04290 05G

STRICT OF COLUMBIA
PROTECTING THE POTOMAC AT WASHINGTON,
W69-04437 05G

'WASTE DISPOSAL AND WATER SUPPLY',
W69-04438 05G

TCHES
DAVIES V SHAFFER (OBSTRUCTION OF DRAINAGE DITCHES).
W69-04684 04A

URNAL DISTRIBUTION
VARIATIONS OF EVAPORATION IN TIME AND SPACE PART 1 AND PART 2,
W69-04618 02D

VERSION
TIDEWATER NAVIGATION.
W69-04398 04A

BRIDGES OVER CERTAIN TIDAL WATERS CHANGING COURSE OF STREAM.
W69-04417 04A

A PRELIMINARY ESTIMATE OF THE EFFECT OF DIVERSION OF FLOW FROM THE SUSQUEHANNA RIVER ON THE SALINITY OF THE UPPER CHESAPEAKE BAY,
W69-04493 02L

VERSION STRUCTURES
SMITH V WAGNER (ARTIFICIAL CONCENTRATION OF DRAINAGE ON NEIGHBOR'S LAND).
W69-04685 04A

CKS
WHARVES AND FISH WEIRS.
W69-04379 04A

WATER FRONT IMPROVEMENTS.
W69-04692 04A

CUMENTATION
NATIONAL ESTUARINE INVENTORY HANDBOOK OF DESCRIPTORS,
W69-04358 10

A PRELIMINARY BIBLIOGRAPHY WITH KWIC INDEX ON THE ECOLOGY OF ESTUARIES AND COASTAL AREAS OF THE EASTERN UNITED STATES,
W69-04477 06G

RAINAGE
STORM DRAINAGE PRACTICES OF THIRTY-TWO CITIES,
W69-04551 02E

POWERS OF CITIES.
W69-04657 06E

BILL OF RIGHTS.
W69-04658 04A

RAINAGE DISTRICTS
SEABOARD AIR LINE RAILROAD CO V SARASOTA-FRUITVILLE DRAINAGE DISTRICT (DRAINAGE WATER DAMAGES).
W69-04682 04A

RAINAGE PROGRAMS
CHICAGO TUNNEL DRAINAGE PROJECT PRELIMINARY EVALUATION OF FEASIBILITY.
W69-04631 04A

RAINAGE SYSTEMS
STORMWATER SEWERS FOR COUNTY ROADS MUNICIPAL COOPERATION.
W69-04418 04C

STERKX V GRAVITY DRAINAGE DISTRICT NO 1 OF RAPIDES PARISH (VALUE OF PROPERTY CONFISCATED FOR DRAINAGE PURPOSES).
W69-04650 04A

KERHONKSON LODGE INC V STATE OF NEW YORK (ACTION FOR DAMAGE FROM SURFACE WATER DISCHARGE).
W69-04673 04C

RANDALL V CLIFFORD (POLLUTION AND DESTRUCTION OF WATER SUPPLY).
W69-04678 05G

RAINAGE WATER
STORM DRAINAGE PRACTICES OF THIRTY-TWO CITIES,
W69-04551 02E

SMITH V WAGNER (ARTIFICIAL CONCENTRATION OF DRAINAGE ON NEIGHBOR'S LAND).
W69-04685 04A

RAINS
HOPLER V MORRIS HILLS REGIONAL DISTRICT (LIABILITY FOR DISCHARGING SURFACE WATERS).
W69-04429 04A

DRAWDOWN
PUMPING TESTS ON OPEN WELLS IN PALAR ALLUVIUM, NEAR MADRAS CITY, INDIA, AN APPLICATION OF THE PAPADOPULOS-COOPER METHOD,
W69-04573 02F

DREDGING
PRACTICES AFFECTING SOUTH ATLANTIC AND GULF COAST MARSHES AND ESTUARIES - DREDGING AND FILLING,
W69-04288 04A

1967 PROCEEDINGS OF WODCON.
W69-04321 04A

TESTIMONY - NATIONAL SAND AND GRAVEL ASSOCIATION,
W69-04340 04A

NEEDED--A COASTWISE COMPREHENSIVE PROGRAM FOR DEVELOPMENT OF ESTUARIES,
W69-04499 06B

CHANNEL SEDIMENTATION AND DREDGING PROBLEMS, MISSISSIPPI RIVER AND LOUISIANA GULF COAST ACCESS CHANNELS,
W69-04501 04D

OPTIMUM DREDGING AND DISPOSAL PRACTICES IN ESTUARIES,
W69-04581 02L

UNITED STATES V REPUBLIC STEEL CORP (INJUNCTION TO FORCE COMPANY TO RESTORE RIVER TO ORIGINAL DEPTH).
W69-04671 06E

CAMPBELL BROWN CO, INC V ELKINS (RIVERBED OWNERSHIP).
W69-04691 06E

DRILLING
PROBLEMS OF A DRILLING CONTRACTOR,
W69-04275 06C

WORLD OFFSHORE RIG FLEET TO BALLOON AGAIN IN 1968,
W69-04328 06B

DRYING
THE DRYING THROUGH THE TOP SURFACE OF A VERTICAL POROUS COLUMN,
W69-04602 02G

DURATION CURVES
GENERALIZED RAINFALL-DURATION-FREQUENCY RELATIONSHIPS,
W69-04549 02A

DYE RELEASES
DELTA-SUISUN BAY WATER QUALITY INVESTIGATION,
W69-04291 02L

EASEMENTS
EQUITABLE GAS CO V ROCCA (RIGHTS OF LANDOWNER TO CONSTRUCT A RESERVOIR OVER AN EASEMENT ON THAT LAND).
W69-04700 06E

ECOLOGY
SOME ASPECTS OF POLLUTION, PARASITISM, AND INLET RESTRICTION IN THREE NEW JERSEY ESTUARIES,
W69-04304 05C

STATEMENT,
W69-04306 05D

POLLUTION AND MARINE ECOLOGY.
W69-04310 05G

DIGITAL SIMULATION OF NATURAL ANIMAL COMMUNITIES,
W69-04312 06G

STATEMENT BEFORE THE SUBCOMMITTEE ON AIR AND WATER POLLUTION,
W69-04314 06G

COMMON MISUNDERSTANDINGS ABOUT HEATED DISCHARGES,
W69-04364 05C

AN ECOLOGICAL SURVEY OF THE HOUSTON SHIP CHANNEL AND ADJACENT BAYS,
W69-04454 05C

A PRELIMINARY BIBLIOGRAPHY WITH KWIC INDEX ON THE ECOLOGY OF ESTUARIES AND COASTAL AREAS OF THE EASTERN UNITED STATES,
W69-04477 06G

THE MARINE ENVIRONMENT IN THE VICINITY OF THE ORANGE COUNTY SANITATION DISTRICTS OCEAN OUTFALL,
W69-04511 05C

ECONOMIC EFFICIENCY
MAN AND THE ESTUARY.
W69-04283 06B

ECONOMIC FEASIBILITY
ESTIMATED COST OF DESALTING THREE FLORIDA BRACKISH WATERS,
W69-04441 03A

THE PROSPECTS FOR DUAL-PURPOSE PLANTS,
W69-04463 03A

THE ECONOMICS OF WATER PRODUCTION USING NUCLEAR ENERGY,
W69-04483 03A

ECONOMIC IMPACT
MEASURING THE IMPACT OF THE WATERBORNE COMMERCE OF THE PORTS OF VIRGINIA ON EMPLOYMENT, WAGES, AND OTHER KEY INDICES OF THE VIRGINIA ECONOMY, 1953-1965.

W69-04295 06B

REMARKS BY BRIGADIER GENERAL JOHN A. B. DILLARD, DIVISION ENGINEER, SOUTH PACIFIC.
W69-04324 04A

ECONOMIC IMPACT OF MARINE-ORIENTED ACTIVITIES--A STUDY OF THE SOUTHERN NEW ENGLAND MARINE REGION,
W69-04330 06B

STATEMENT,
W69-04338 06B

THE CONTRIBUTION OF THE AMERICAN MERCHANT MARINE TO THE U. S. BALANCE OF PAYMENTS.
W69-04460 06C

A STUDY OF THE U. S. COAST AND GEODETIC SURVEY'S PRODUCTS AND SERVICES AS RELATED TO ECONOMIC ACTIVITY IN THE U. S. CONTINENTAL SHELF REGIONS.
W69-04505 06B

THE IMPACT OF THE PORT OF JACKSONVILLE ON THE ECONOMY OF THE COMMUNITY,
W69-04517 06B

ECONOMIC PREDICTION
OCEANOGRAPHY--THE EMERGING SCIENCE OF THE SEA.
W69-04305 06B

SUMMARY ECONOMIC BASE STUDY CHESAPEAKE BAY DRAINAGE BASINS.
W69-04346 06B

ECOSYSTEMS
THE URGENT NEED FOR LANDSCAPE ZONING OF THE ESTUARINE REGION ACCORDING TO ECO-SYSTEM PRINCIPLES,
W69-04307 06F

ON QUESTIONS OF PRODUCTION AND PRODUCTIVITY IN ECOLOGY,
W69-04524 02K

EEL RIVER
SURFACE-WATER HYDROLOGY OF CALIFORNIA COASTAL BASINS BETWEEN SAN FRANCISCO BAY AND EEL RIVER,
W69-04273 03B

EFFLUENT
A NOTE ON THE ASYMMETRY BETWEEN FEES AND PAYMENTS,
W69-04446 05G

ELECTRIC POWER
'WATER DEMAND FOR STEAM ELECTRIC GENERATION',
W69-04461 06D

ELECTRIC POWER INDUSTRY
STATEMENT BEFORE THE SUBCOMMITTEE ON AIR AND WATER POLLUTION, APRIL 17, 1968,
W69-04293 05B

ELECTRIC POWERPLANTS
STATEMENT BEFORE THE SUBCOMMITTEE ON AIR AND WATER POLLUTION,
W69-04314 06G

REPORT ON WATER QUALITY CRITERIA FOR TEXAS.
W69-04327 05G

STEAM-ELECTRIC PLANT CONSTRUCTION COST AND ANNUAL PRODUCTION EXPENSES--1965.
W69-04503 08B

ELECTRICAL STUDIES
ON INDUCED ELECTRICAL POLARIZATION AND GROUNDWATER,
W69-04606 02F

EMERGENCY WATER SUPPLY
STATE SANITARY CODE.
W69-04395 05G

EMINENT DOMAIN
FLOOD CONTROL PROJECTS - LAND ACQUISITION, MAINTENANCE AND OPERATION.
W69-04403 04A

STERKX V GRAVITY DRAINAGE DISTRICT NO 1 OF RAPIDES PARISH (VALUE OF PROPERTY CONFISCATED FOR DRAINAGE PURPOSES).
W69-04650 04A

BILL OF RIGHTS.
W69-04658 04A

ENCROACHMENT
SALINITY INTRUSION EFFECTS IN ESTUARY SHOALING,
W69-04558 02L

ENERGY TRANSFER
POLLUTION AND MARINE ECOLOGY.
W69-04310 05G

THE CONSTRUCTION BY FRANCE OF A MIXED PLANT FOR PRODUCTION OF ELECTRIC POWER AND OF SOFT WATER,
W69-04595 03A

ENFORCEMENT
HOUSEBOATS, SANITATION AND LOCATION.
W69-04388 05G

ENVIRONMENTAL EFFECTS
POLLUTION AND MARINE ECOLOGY.
W69-04310 05G

THE ROLE OF RESEARCH IN THE PRESERVATION OF ESTUARIES,
W69-04347 04A

A CALL FOR ACTION,
W69-04352 06B

NATURAL AND ALTERED ESTUARINE HABITATS OF PENAEID SHRIMP,
W69-04484 02L

ENVIRONMENTAL SANITATION
HOUSEBOATS, SANITATION AND LOCATION.
W69-04388 05G

DRINKING WATER SUPPLIES.
W69-04394 05F

SANITARY QUALITY OF WATER IN SWIMMING POOLS AND AT BATHING BEACHES.
W69-04396 05G

EROSION
MAN, VEGETATION AND THE SEDIMENT YIELDS OF RIVERS,
W69-04269 02E

GENERAL POWERS OF THE BOARD OF TRUSTEES.
W69-04393 04A

RIVER METAMORPHOSIS,
W69-04583 02E

EROSION CONTROL
WATER FRONT IMPROVEMENTS.
W69-04407 06E

PROTECTION OF ROADS NEAR TIDEWATER ACQUISITION OF LANDS.
W69-04419 06E

CITY OF TREASURE ISLAND V STRONG (ASSESSMENTS FOR EROSION CONTROL GROIN SYSTEM).
W69-04653 04D

ESTIMATED COSTS
WATER QUALITY AND POLLUTION CONTROL STUDY - JAMES RIVER BASIN.
W69-04359 05G

PUBLIC WORK NEEDS - MARINE PORT FACILITIES.
W69-04495 06B

WATER POLLUTION CONTROL FACTS.
W69-04515 05G

FLOOD AND POLLUTION CONTROL A DEEP TUNNEL PLAN FOR THE CHICAGOLAND AREA.
W69-04630 04A

ESTIMATING
RECREATION BENEFITS FROM WATER POLLUTION CONTROL,
W69-04504 05G

GROUND WATER OF THE PIEDMONT AND BLUE RIDGE PROVINCES IN THE SOUTHEASTERN STATES,
W69-04615 02F

ESTUARIES
SEDIMENT TRANSPORT IN ESTUARINE AREAS,
W69-04240 02L

PATUXENT THERMAL STUDIES - SUMMARY AND RECOMMENDATIONS,
W69-04244 02L

FISHERIES PROTECTING AND ENHANCEMENT WITH WATER DEVELOPMENT OF THE SACRAMENTO-SAN JOAQUIN ESTUARY,
W69-04472 06B

SALINITY INTRUSION EFFECTS IN ESTUARY SHOALING,
W69-04558 02L

DISPERSION AND FLUSHING OF POLLUTANTS IN ESTUARIES,
W69-04559 02L

USE OF MODELS IN RESOLVING TIDAL PROBLEMS,
W69-04580 02L

ESTUARINE ENVIRONMENT
SOME ASPECTS OF POLLUTION, PARASITISM, AND INLET RESTRICTION IN THREE NEW JERSEY ESTUARIES,
W69-04304 05C

ECONOMIC IMPACT OF MARINE-ORIENTED ACTIVITIES--A STUDY OF THE SOUTHERN NEW ENGLAND MARINE REGION,
W69-04330 06B

TESTIMONY - NATIONAL SAND AND GRAVEL ASSOCIATION,
W69-04340 04A

A CALL FOR ACTION,
W69-04352 06B

STATEMENT ON LIVING MARINE RESOURCES OF WETLANDS AND ESTUARIES,
W69-04356 06B

NATIONAL ESTUARINE INVENTORY HANDBOOK OF DESCRIPTORS,
W69-04358 10

EFFECTS OF HEATED EFFLUENTS UPON MARINE AND ESTUARINE ORGANISMS,
W69-04486 05C

MAINTAINING AND ENHANCING THE ESTUARINE ENVIRONMENT,

W69-04512 06F

TUARINE ENVIRONMENTS
VIRAL POLLUTION OF SHELLFISH IN ESTUARY WATERS,
W69-04296 05C

TUARINE FISHERIES
ESTUARIES,
W69-04278 02L

ESTUARINE NEKTON,
W69-04292 02L

STATEMENT ON LIVING MARINE RESOURCES OF WETLANDS AND ESTUARIES,
W69-04356 06B

MANAGEMENT OF ESTUARINE FISHERIES,
W69-04481 06B

NEEDED--A COASTWISE COMPREHENSIVE PROGRAM FOR DEVELOPMENT OF ESTUARIES,
W69-04499 06B

TROPHICATION
WATER POLLUTION PROBLEMS AND IMPROVEMENT NEEDS, LAKE ONTARIO AND ST. LAWRENCE RIVER BASINS.
W69-04223 05B

NUTRIENTS,
W69-04448 05C

ALUATION
WATER USE AND RELATED COSTS WITH COOLING TOWERS,
W69-04443 06C

RECENT DEVELOPMENTS IN EVALUATING RECREATIONAL BENEFITS,
W69-04453 06B

APORATION
WATER MOVEMENT IN POROUS MATERIALS - III. EVAPORATION OF WATER FROM SOIL,
W69-04242 02G

VARIATIONS OF EVAPORATION IN TIME AND SPACE PART 1 AND PART 2,
W69-04618 02D

APORIMETERS
VARIATIONS OF EVAPORATION IN TIME AND SPACE PART 1 AND PART 2,
W69-04618 02D

PENDITURES
RECENT DEVELOPMENTS IN EVALUATING RECREATIONAL BENEFITS,
W69-04453 06B

WHEN DOES A FISHERY BECOME UNECONOMIC,
W69-04485 06B

PERIMENTAL WATERSHEDS
A SUBSTITUTE FOR 2,4,5-T IN EASTERN HARDWOOD SPROUT AND BRUSH CONTROL,
W69-04633 03B

WATERSHED CALIBRATION METHODS,
W69-04634 03B

EFFECTS OF ABANDONED FARMLAND ON STREAMFLOW,
W69-04635 03B

EFFECT ON STREAMFLOW OF FOUR FOREST PRACTICES IN THE MOUNTAINS OF WEST VIRGINIA,
W69-04636 03B

XPLORATION
SEISMIC EXPLORATION AT SEA,
W69-04294 07B

TEMPERATURE PROSPECTING FOR SHALLOW GLACIAL AND ALLUVIAL AQUIFERS IN ILLINOIS,
W69-04585 02F

ACILITIES
PORTS OF THE WORLD, 1967.
W69-04320 06C

EDERAL BUDGETS
A TEN-YEAR PROGRAM OF FEDERAL WATER RESOURCES RESEARCH.
W69-04473 06B

EDERAL GOVERNMENT
MARINE SCIENCE AFFAIRS...A YEAR OF TRANSITION.
W69-04286 06E

A REPORT ON POLLUTION OF THE NATION'S WATER BY OIL AND OTHER HAZARDOUS SUBSTANCES.
W69-04326 05G

WASTE FROM WATERCRAFT.
W69-04357 05G

WATER RESOURCES RESEARCH CATALOG.
W69-04360 09D

POLITICS AND THE MARINE FISHERIES,
W69-04455 06E

SALINE WATER CONVERSION REPORT.
W69-04498 03A

A STUDY OF THE U. S. COAST AND GEODETIC SURVEY'S PRODUCTS AND SERVICES AS RELATED TO ECONOMIC ACTIVITY IN THE U. S. CONTINENTAL SHELF REGIONS.
W69-04505 06B

1965 SURVEY ON DISPOSAL OF SEWAGE AND INDUSTRIAL WASTES BY FEDERAL INSTALLATIONS.
W69-04507 05D

WATER RESOURCES DEVELOPMENT BY THE U S ARMY CORPS OF ENGINEERS IN FLORIDA.
W69-04643 04A

LITTLE V UNITED STATES (WRONGFUL DEATH LIABILITY FOR DAM MAINTENANCE).
W69-04666 06E

DEPARTMENT OF HIGHWAYS OF LOUISIANA V UNITED STATES (REVOCATION OF BRIDGE PERMIT).
W69-04670 06E

FEDERAL JURISDICTION
A PERSPECTIVE OF REGIONAL AND STATE MARINE ENVIRONMENTAL ACTIVITIES, A QUESTIONNAIRE SURVEY, STATISTICS AND OBSERVATIONS,
W69-04289 06E

FEDERAL TORT CLAIMS ACT
HARRIS V UNITED STATES (NEGLIGENCE OF TVA UNDER FEDERAL TORT CLAIMS ACT).
W69-04370 06E

FEDERAL-STATE WATER RIGHTS CONFLICTS
A PERSPECTIVE OF REGIONAL AND STATE MARINE ENVIRONMENTAL ACTIVITIES, A QUESTIONNAIRE SURVEY, STATISTICS AND OBSERVATIONS,
W69-04289 06E

FILTERS
COARSE FILTER MEDIA FOR ARTIFICIAL RECHARGE,
W69-04563 04B

CONDITIONS FOR BETTER FILTERED WATER,
W69-04591 05D

FILTRATION
CONDITIONS FOR BETTER FILTERED WATER,
W69-04591 05D

FINANCIAL FEASIBILITY
THE POLITICAL ECONOMY OF EFFICIENCY COST-BENEFIT ANALYSIS, SYSTEMS ANALYSIS, AND PROGRAM BUDGETING,
W69-04519 06B

FINANCING
ACQUISITION OF LANDS BORDERING AND ADJACENT TO THE OCEAN.
W69-04411 06E

WATER FRONT IMPROVEMENTS.
W69-04692 04A

FISH
PRACTICES AFFECTING SOUTH ATLANTIC AND GULF COAST MARSHES AND ESTUARIES - DREDGING AND FILLING,
W69-04288 04A

THE ANIMAL FOOD FISHERY IN CALIFORNIA, 1961-1962,
W69-04487 06B

FISH CONSERVATION
A PERSPECTIVE OF REGIONAL AND STATE MARINE ENVIRONMENTAL ACTIVITIES, A QUESTIONNAIRE SURVEY, STATISTICS AND OBSERVATIONS,
W69-04289 06E

ATLANTIC STATES MARINE FISHERIES COMMISSION.
W69-04426 06E

FISH FARMING
ADVANCES IN THE OFF-BOTTOM CULTURE OF OYSTERS,
W69-04339 06B

FISH HANDLING FACILITIES
FISH PROTEIN CONCENTRATE SEEN POSSIBLE NEW INDUSTRY,
W69-04299 06B

STATEMENT,
W69-04338 06B

FISH HARVEST
A SUMMARY REPORT ON MARYLAND'S COMMERCIAL FISHERIES, 1957-1966,
W69-04284 06B

ESTUARINE NEKTON,
W69-04292 02L

FISH MANAGEMENT
ATLANTIC STATES MARINE FISHERIES COMMISSION.
W69-04426 06E

WHEN DOES A FISHERY BECOME UNECONOMIC,
W69-04485 06B

FISH POPULATIONS
AN ECOLOGICAL SURVEY OF THE HOUSTON SHIP CHANNEL AND ADJACENT BAYS,
W69-04454 05C

FISH STOCKING
BOARD OF GAME AND FISH COMMISSIONERS POWERS AND DUTIES.

W69-04435 06E

FISHERIES
THE ANIMAL FOOD FISHERY IN CALIFORNIA, 1961-1962,
W69-04487 06B

FLASH DISTILLATION
THE CONSTRUCTION BY FRANCE OF A MIXED PLANT FOR PRODUCTION OF ELECTRIC POWER AND OF SOFT WATER,
W69-04595 03A

FLOATING
LITTERING AND OBSTRUCTIONS,
W69-04450 06E

FLOOD CONTROL
RIVER IMPROVEMENT.
W69-04401 04A

FLOOD CONTROL PROJECTS - LAND ACQUISITION, MAINTENANCE AND OPERATION.
W69-04403 04A

USE OF MULTI-PURPOSE STORAGE DAMS IN THE DEVELOPMENT OF THE SEINE BASIN,
W69-04596 04A

FLOOD AND POLLUTION CONTROL A DEEP TUNNEL PLAN FOR THE CHICAGOLAND AREA.
W69-04630 04A

KEY SALES CO V SOUTH CAROLINA ELECTRIC AND GAS CO (DAM OPERATOR'S DUTY OF CARE IN REGARD TO FLOODING OF DOWNSTREAM PROPERTY).
W69-04665 04A

FLOOD DAMAGE
FLOOD PLAIN INFORMATION, CALCASIEU RIVER, OAKDALE, LOUISIANA.
W69-04215 04A

FLOOD PLAIN INFORMATION, KERN RIVER, KERNVILLE, CALIFORNIA.
W69-04216 04A

FLOOD PLAIN INFORMATION, LAS CHOLLAS CREEK, SAN DIEGO COUNTY, CALIFORNIA.
W69-04217 04A

FLOOD PLAIN INFORMATION, FEATHER AND YUBA RIVERS, MARYSVILLE YUBA CITY, CALIFORNIA.
W69-04218 04A

FLOOD PLAIN INFORMATION, PAYETTE RIVER, PAYETTE, IDAHO AND VICINITY.
W69-04219 04A

FLOOD PLAIN INFORMATION, SANTA CLARA RIVER (SATICOY TO PACIFIC OCEAN), VENTURA COUNTY, CALIFORNIA.
W69-04220 04A

FLOOD PLAIN INFORMATION, JOHNSON CREEK, ARLINGTON AND GRAND PRAIRIE, TEXAS.
W69-04221 04A

GENERAL POWERS OF THE BOARD OF TRUSTEES.
W69-04393 04A

FLOOD PLAIN INFORMATION, RED CEDAR RIVER, INGHAM COUNTY, MICHIGAN.
W69-04529 04A

FLOOD PLAIN INFORMATION, SNAPPINGER CREEK, DEKALB COUNTY, GEORGIA.
W69-04530 04A

FLOOD PLAIN INFORMATION, CLEARWATER RIVER, OROFINO AND RIVERSIDE, IDAHO.
W69-04531 04A

FLOOD PLAIN INFORMATION, MILL RIVER, HAMDEN, CONNECTICUT.
W69-04532 04A

FLOOD PLAIN INFORMATION, TULE RIVER, SPRINGVILLE, CALIFORNIA.
W69-04533 04A

FLOOD PLAIN INFORMATION, WALNUT RIVER, WHITEWATER RIVER, KANSAS.
W69-04534 04A

FLOOD PLAIN INFORMATION, CUMBERLAND RIVER AND CLEAR FORK, WILLIAMSBURG, KENTUCKY.
W69-04535 04A

FLOOD PLAIN INFORMATION, HALLS MILL CREEK, MOBILE, ALABAMA.
W69-04536 04A

FLOOD PLAIN INFORMATION, MERAMEC RIVER, BRUSH CREEK AND FOX CREEK, PACIFIC, MISSOURI.
W69-04537 04A

FLOOD PLAIN INFORMATION, ROANOKE RIVER, AND ROANOKE AND SALEM, VIRGINIA.
W69-04538 04A

FLOOD PLAIN INFORMATION, BLACK RIVER, TOWN AND MANSKER CREEKS, POCAHONTAS, ARKANSAS.
W69-04539 04A

FLOOD PLAIN INFORMATION, OHIO RIVER AND TRIBUTARIES, MC CRACKEN COUNTY, KENTUCKY.
W69-04540 04A

FLOOD PLAIN INFORMATION, ARKANSAS RIVER, NORTH LITTLE ROCK, ARKANSAS.
W69-04541 04A

FLOOD PLAIN INFORMATION ON CAMP CREEK AND NORTH FORK CAMP CREEK, METROPOLITAN ATLANTA, GEORGIA.
W69-04542 04A

FLOOD PLAIN INFORMATION, MILL CREEK, FORT SMITH, ARKANSAS.
W69-04543 04A

FLOOD PLAIN INFORMATION, BROOKLYN CREEK, ATHENS, GEORGIA.
W69-04544 04A

FLOOD PLAIN INFORMATION ON SHOAL CREEK, DEKALB COUNTY, GEORGIA.
W69-04545 04A

FLOOD PLAIN INFORMATION, PISCATAWAY CREEK, PRINCE GEORGES COUNTY, MARYLAND.
W69-04546 04A

FLOOD PLAIN INFORMATION, POST OAK CREEK AND TRIBUTARIES, SHERMAN, TEXAS.
W69-04576 04A

FLOOD FORECASTING
PEAK FLOOD DISCHARGE CONFIDENCE LIMITS,
W69-04582 02E

FLOOD PLAINS
FLOODS IN WOODSTOCK QUADRANGLE, NORTHEASTERN ILLINOIS,
W69-04249 04A

FLOOD PROTECTION
CHICAGO TUNNEL DRAINAGE PROJECT PRELIMINARY EVALUATION OF FEASIBILITY.
W69-04631 04A

FLOODS
FLOOD PLAIN INFORMATION, CALCASIEU RIVER, OAKDALE, LOUISIANA.
W69-04215 04A

FLOOD PLAIN INFORMATION, KERN RIVER, KERNVILLE, CALIFORNIA.
W69-04216 04A

FLOOD PLAIN INFORMATION, LAS CHOLLAS CREEK, SAN DIEGO COUNTY, CALIFORNIA.
W69-04217 04A

FLOOD PLAIN INFORMATION, FEATHER AND YUBA RIVERS, MARYSVILLE YUBA CITY, CALIFORNIA.
W69-04218 04A

FLOOD PLAIN INFORMATION, PAYETTE RIVER, PAYETTE, IDAHO AND VICINITY.
W69-04219 04A

FLOOD PLAIN INFORMATION, SANTA CLARA RIVER (SATICOY TO PACIFIC OCEAN), VENTURA COUNTY, CALIFORNIA.
W69-04220 04A

FLOOD PLAIN INFORMATION, JOHNSON CREEK, ARLINGTON AND GRAND PRAIRIE, TEXAS.
W69-04221 04A

CENTRAL MONTANA RAINSTORMS AND FLOODS, JUNE 6-15, 1967,
W69-04237 02B

FLOODS IN WOODSTOCK QUADRANGLE, NORTHEASTERN ILLINOIS,
W69-04249 04A

FLOOD PLAIN INFORMATION, RED CEDAR RIVER, INGHAM COUNTY, MICHIGAN.
W69-04529 04A

FLOOD PLAIN INFORMATION, SNAPPINGER CREEK, DEKALB COUNTY, GEORGIA.
W69-04530 04A

FLOOD PLAIN INFORMATION, CLEARWATER RIVER, OROFINO AND RIVERSIDE, IDAHO.
W69-04531 04A

FLOOD PLAIN INFORMATION, MILL RIVER, HAMDEN, CONNECTICUT.
W69-04532 04A

FLOOD PLAIN INFORMATION, TULE RIVER, SPRINGVILLE, CALIFORNIA.
W69-04533 04A

FLOOD PLAIN INFORMATION, WALNUT RIVER, WHITEWATER RIVER, KANSAS.
W69-04534 04A

FLOOD PLAIN INFORMATION, CUMBERLAND RIVER AND CLEAR FORK, WILLIAMSBURG, KENTUCKY.
W69-04535 04A

FLOOD PLAIN INFORMATION, HALLS MILL CREEK, MOBILE, ALABAMA.
W69-04536 04A

FLOOD PLAIN INFORMATION, MERAMEC RIVER, BRUSH CREEK AND FOX CREEK, PACIFIC, MISSOURI.
W69-04537 04A

FLOOD PLAIN INFORMATION, ROANOKE RIVER, AND ROANOKE AND SALEM, VIRGINIA.

69-04538 04A

LOOD PLAIN INFORMATION, BLACK RIVER, TOWN AND MANSKER REEKS, POCAHONTAS, ARKANSAS.
69-04539 04A

LOOD PLAIN INFORMATION, OHIO RIVER AND TRIBUTARIES, MC RACKEN COUNTY, KENTUCKY.
69-04540 04A

LOOD PLAIN INFORMATION, ARKANSAS RIVER, NORTH LITTLE ROCK, RKANSAS.
69-04541 04A

LOOD PLAIN INFORMATION ON CAMP CREEK AND NORTH FORK CAMP REEK, METROPOLITAN ATLANTA, GEORGIA.
69-04542 04A

LOOD PLAIN INFORMATION, MILL CREEK, FORT SMITH, ARKANSAS.
69-04543 04A

LOOD PLAIN INFORMATION, BROOKLYN CREEK, ATHENS, GEORGIA.
69-04544 04A

LOOD PLAIN INFORMATION ON SHOAL CREEK, DEKALB COUNTY, EORGIA.
69-04545 04A

LOOD PLAIN INFORMATION, PISCATAWAY CREEK, PRINCE GEORGES OUNTY, MARYLAND.
69-04546 04A

LOOD PLAIN INFORMATION, POST OAK CREEK AND TRIBUTARIES, HERMAN, TEXAS.
69-04576 04A

LOOD INFORMATION FOR FLOOD-PLAIN PLANNING,
69-04616 02E

ORIDA
RACTICES AFFECTING SOUTH ATLANTIC AND GULF COAST MARSHES ND ESTUARIES - DREDGING AND FILLING,
69-04288 04A

AXSON V COLLINS (TITLE TO ACCRETION AND RELICTION).
69-04368 06E

NTERNAL IMPROVEMENT FUND OF STATE OF FLORIDA V NOWAK (USE OF MEANDER LINES IN SETTING BOUNDARIES OF RIPARIAN PROPERTY).
69-04374 06E

STIMATED COST OF DESALTING THREE FLORIDA BRACKISH WATERS,
69-04441 03A

HE IMPACT OF THE PORT OF JACKSONVILLE ON THE ECONOMY OF THE OMMUNITY,
69-04517 06B

ATER RESOURCES DEVELOPMENT BY THE U S ARMY CORPS OF NGINEERS IN FLORIDA.
69-04643 04A

URGESS V PINE ISLAND CORP (LAND SEPARATED FROM ISLAND BY ON-NAVIGABLE STREAM NOT AN ISLAND).
69-04652 06E

ITY OF TREASURE ISLAND V STRONG (ASSESSMENTS FOR EROSION ONTROL GROIN SYSTEM).
69-04653 04D

OWN OF PALM BEACH SHORES V COLONNADES, INC (OCEAN OLLUTION).
69-04668 05G

EABOARD AIR LINE RAILROAD CO V SARASOTA-FRUITVILLE DRAINAGE ISTRICT (DRAINAGE WATER DAMAGES).
69-04682 04A

OW
VISCOUS DRAG AND SECONDARY FLOW IN GRANULAR BEDS,
69-04243 02F

FREE-SURFACE FLOW THROUGH HETEROGENEOUS POROUS MEDIA,
69-04552 02F

THE INFLUENCE OF GROUNDWATER FLOW SYSTEMS ON PAVEMENT STABILITY IN HIGHWAY CUTS,
69-04621 02F

OW AUGMENTATION
'WASTE DISPOSAL AND WATER SUPPLY',
69-04438 05G

OW CHARACTERISTICS
VISCOUS DRAG AND SECONDARY FLOW IN GRANULAR BEDS,
69-04243 02F

OW CONTROL
ORGANIZATION FOR THE REGULATION OF LAKE ONTARIO,
69-04648 06E

OW MEASUREMENT
TIME OF TRAVEL OF WATER IN THE GREAT MIAMI RIVER, DAYTON TO LEVES, OHIO,
69-04598 02E

OW SEPARATION
PROTECTING THE POTOMAC AT WASHINGTON,
69-04437 05G

FLUID FRICTION
VISCOUS DRAG AND SECONDARY FLOW IN GRANULAR BEDS,
W69-04243 02F

FOODS
FISH PROTEIN CONCENTRATE SEEN POSSIBLE NEW INDUSTRY,
W69-04299 06B

FORECASTING
STATEMENT BEFORE THE SUBCOMMITTEE ON AIR AND WATER POLLUTION, APRIL 17, 1968,
W69-04293 05B

TESTIMONY - NATIONAL SAND AND GRAVEL ASSOCIATION,
W69-04340 04A

PAST, PRESENT AND FUTURE OF SPORT FISHING IN TEXAS WATERS,
W69-04362 06B

PREDICTING THE CONDITION OF A POLLUTED ESTUARY,
W69-04469 05B

ON THE PREDICTION OF THE DISTRIBUTION OF EXCESS TEMPERATURE FROM A HEATED DISCHARGE IN AN ESTUARY,
W69-04494 05C

FOREIGN COUNTRIES
ESTUARINE POLLUTION OF THE CHAO PHRAYA RIVER AT BANGKOK, THAILAND,
W69-04279 05B

RESPONSE TO POLLUTION OF NEW YORK HARBOR AND THAMES ESTUARY,
W69-04351 05B

THE ZUYDERZEE WORKS.
W69-04365 04A

PREDICTING THE CONDITION OF A POLLUTED ESTUARY,
W69-04469 05B

LAND RECLAMATION IN THE PO RIVER DELTA OF ITALY,
W69-04518 04A

FOREIGN WATERS
ESTUARIES,
W69-04278 02L

THE EFFECT OF POLLUTION BY SEWAGE UPON THE WATERS OF THE OSLO-FJORD,
W69-04445 05C

FOREST MANAGEMENT
OBSERVATIONS OF SNOWPACK ACCUMULATION, MELT, AND RUNOFF ON A SMALL ARIZONA WATERSHED,
W69-04253 02C

FOREST SOILS
EFFECTS OF SOIL FREEZING ON WATER YIELDS,
W69-04251 02C

FRANCE
ONE EXAMPLE OF MULTIPURPOSE DEVELOPMENT PROGRAM THE RHONE,
W69-04592 04A

A RIVER HARNESSED THE DURANCE, A SOURCE OF POWER AND AGRICULTURAL PLENITUDE,
W69-04594 04A

FREE ENERGY
ALUMINUM IONS IN AQUEOUS SOLUTIONS,
W69-04575 02K

FRENCH WEST AFRICA
ORGANIZATION OF SURVEYS AND HYDROLOGICAL RESEARCH IN DEVELOPING COUNTRIES,
W69-04614 06E

FRESH WATER
EXPERIMENTS ON THE UTILIZATION OF NITROGEN IN FRESH WATER,
W69-04521 05C

FROST
EFFECTS OF SOIL FREEZING ON WATER YIELDS,
W69-04251 02C

FROZEN GROUND
EFFECTS OF SOIL FREEZING ON WATER YIELDS,
W69-04251 02C

FURBEARERS
THE ANIMAL FOOD FISHERY IN CALIFORNIA, 1961-1962,
W69-04487 06B

FUTURE PLANNING(PROJECTED)
WEST COAST OIL FUTURE IS BRIGHT.
W69-04363 06B

A TEN-YEAR PROGRAM OF FEDERAL WATER RESOURCES RESEARCH.
W69-04473 06B

GAS CHROMATOGRAPHY
IDENTIFICATION OF PETROLEUM PRODUCTS IN ESTUARINE WATERS,
W69-04282 05A

GATES
HARRIS V UNITED STATES (NEGLIGENCE OF TVA UNDER FEDERAL TORT CLAIMS ACT).
W69-04370 06E

OWNERS OF MARSH AND MEADOW LANDS.
W69-04431 06E

GEOCHEMISTRY
GEOCHEMISTRY OF EPIGENESIS,
W69-04274 02K

GEOCHEMISTRY OF NATURAL WATERS,
W69-04562 02K

ASSOCIATION OF RADIUM AND URANIUM AND PEAT,
W69-04612 02K

GEOHYDROLOGIC UNITS
THE HYDROLOGIC AND GEOLOGIC ASPECTS OF A PERCHING LAYER-SAN JOAQUIN VALLEY, WESTERN FRESNO COUNTY, CALIFORNIA,
W69-04619 02F

GEOLOGIC INVESTIGATION
THE HYDROLOGIC AND GEOLOGIC ASPECTS OF A PERCHING LAYER-SAN JOAQUIN VALLEY, WESTERN FRESNO COUNTY, CALIFORNIA,
W69-04619 02F

TEST HOLE IN AQUIFER WITH MANY WATER-BEARING ZONES AT JACKSONVILLE, FLORIDA,
W69-04620 02F

GEOMORPHOLOGY
GEOMORPHIC GROUPING OF SOILS IN WATERSHED ENGINEERING,
W69-04207 02E

TOPOLOGICAL SIGNIFICANCE OF STREAM METHODS,
W69-04571 02E

GEOPHYSICAL STUDIES
THE HYDROLOGIC AND GEOLOGIC ASPECTS OF A PERCHING LAYER-SAN JOAQUIN VALLEY, WESTERN FRESNO COUNTY, CALIFORNIA,
W69-04619 02F

GEOPHYSICS
SEISMIC EXPLORATION AT SEA,
W69-04294 07B

ON INDUCED ELECTRICAL POLARIZATION AND GROUNDWATER,
W69-04606 02F

GEORGIA
WATER REQUIREMENTS OF SELECTED NORTH GEORGIA MANUFACTURING INDUSTRIES,
W69-04205 06D

STATEMENT,
W69-04306 05D

MECHANISMS MAINTAINING HIGH PRODUCTIVITY IN GEORGIA ESTUARIES,
W69-04334 02L

STATEMENT,
W69-04338 06B

UTILIZATION OF THE ESTUARINE ZONE IN GEORGIA--A STATEMENT BY BIOLOGISTS FROM THE DIVISION OF BIOLOGICAL SCIENCES OF THE UNIVERSITY OF GEORGIA.
W69-04353 05G

STATEMENT,
W69-04354 05G

METROPOLITAN PLANNING AND RIVER BASIN PLANNING SOME INTERRELATIONSHIPS,
W69-04566 06A

GEOTHERMAL STUDIES
TEMPERATURE PROSPECTING FOR SHALLOW GLACIAL AND ALLUVIAL AQUIFERS IN ILLINOIS,
W69-04585 02F

GLACIAL DRIFT
TEMPERATURE PROSPECTING FOR SHALLOW GLACIAL AND ALLUVIAL AQUIFERS IN ILLINOIS,
W69-04585 02F

GLACIERS
GLACIERS AND WATER SUPPLY,
W69-04255 02C

GOVERNMENTS
A MODEL LAND DEVELOPMENT CODE.
W69-04301 06E

STATE AND LOCAL GOVERNMENT ACTIVITIES AND ROLES IN MARINE SCIENCE, ENGINEERING AND DEVELOPMENT. A BRIEFLY ANNOTATED CATALOG OF PUBLISHED STUDIES AND REPORTS ON SUCH ORGANIZATIONAL ARRANGEMENTS AND ACTIVITIES IN THE COASTAL STATES AND IN THOSE BORDERING ON THE GREAT LAKES.
W69-04341 06E

PROBLEMS OF CONSERVATION IN THE ATLANTIC ESTUARINE ZONE,
W69-04355 06B

GRAVELS
TESTIMONY - NATIONAL SAND AND GRAVEL ASSOCIATION,
W69-04340 04A

GREAT LAKES
ANNEXATION OF SUBMERGED LANDS.
W69-04387 06E

GREAT LAKES REGION
STATE AND LOCAL GOVERNMENT ACTIVITIES AND ROLES IN MARINE SCIENCE, ENGINEERING AND DEVELOPMENT. A BRIEFLY ANNOTATED CATALOG OF PUBLISHED STUDIES AND REPORTS ON SUCH ORGANIZATIONAL ARRANGEMENTS AND ACTIVITIES IN THE COASTAL STATES AND IN THOSE BORDERING ON THE GREAT LAKES.
W69-04341 06E

GREAT PLAINS
WATER INTAKE ON MIDCONTINENTAL RANGELANDS AS INFLUENCED BY SOIL AND PLANT COVER,
W69-04640 02G

GROUNDWATER
HYDROLOGIC ATLAS OF UTAH,
W69-04209 02A

SCIENTIFIC OR RULE-OF-THUMB TECHNIQUES OF GROUND-WATER MANAGEMENT - WHICH WILL PREVAIL,
W69-04231 04B

ILLINOIS GROUND WATER POLLUTION,
W69-04256 05B

DEVELOPMENT OF GROUND-WATER SUPPLIES AT MISSISSIPPI TEST FACILITY, HANCOCK COUNTY, MISSISSIPPI,
W69-04268 02F

EFFECT OF HIGH TEMPERATURES ON THE CHEMICAL COMPOSITION OF GROUND WATERS,
W69-04271 02K

GROUND-WATER CONDITIONS IN UTAH, SPRING OF 1968,
W69-04561 02F

GROUND WATER IN GOGEBIC COUNTY, MICHIGAN,
W69-04564 02F

TEMPERATURE PROSPECTING FOR SHALLOW GLACIAL AND ALLUVIAL AQUIFERS IN ILLINOIS,
W69-04585 02F

WATER RESOURCES OF THE SYCAMORE CREEK WATERSHED, MARICOPA COUNTY, ARIZONA,
W69-04587 02E

ON INDUCED ELECTRICAL POLARIZATION AND GROUNDWATER,
W69-04606 02F

SALINE GROUND WATER IN LOUISIANA,
W69-04608 02F

GEOHYDROLOGY OF THE COASTAL PLAIN AQUIFERS OF ARKANSAS,
W69-04609 02F

RECONNAISSANCE OF THE GROUND-WATER RESOURCES OF THE MISSOURI RIVER ALLUVIUM BETWEEN ST. CHARLES AND JEFFERSON CITY, MISSOURI,
W69-04610 02F

TEST HOLE IN AQUIFER WITH MANY WATER-BEARING ZONES AT JACKSONVILLE, FLORIDA,
W69-04620 02F

THE INFLUENCE OF GROUNDWATER FLOW SYSTEMS ON PAVEMENT STABILITY IN HIGHWAY CUTS,
W69-04621 02F

TRANSMISSIBILITY DETERMINATION FROM VARIABLE DISCHARGE PUMPING TESTS,
W69-04622 02F

DESIGNING PUMPED WELL CHARACTERISTICS INTO ELECTRIC ANALOG MODELS,
W69-04623 06B

A COMPUTER-ORIENTED GROUND-WATER INFORMATION STORAGE AND RETRIEVAL SYSTEM,
W69-04624 07C

GROUND-WATER OVERDRAFT
FUTURE DEVELOPMENT OF THE GROUND-WATER RESOURCE IN THE LOWER GREAT MIAMI RIVER VALLEY, OHIO - PROBLEMS AND ALTERNATIVE SOLUTIONS,
W69-04206 02F

GROUND-WATER RECHARGE
FUTURE DEVELOPMENT OF THE GROUND-WATER RESOURCE IN THE LOWER GREAT MIAMI RIVER VALLEY, OHIO - PROBLEMS AND ALTERNATIVE SOLUTIONS,
W69-04206 02F

GROUND-WATER SAFE YIELD
FUTURE DEVELOPMENT OF THE GROUND-WATER RESOURCE IN THE LOWER GREAT MIAMI RIVER VALLEY, OHIO - PROBLEMS AND ALTERNATIVE SOLUTIONS,
W69-04206 02F

GROWTH RATES
EFFECTS OF HEATED EFFLUENTS UPON MARINE AND ESTUARINE ORGANISMS,
W69-04486 05C

GULF COASTAL PLAIN
GEOHYDROLOGY OF THE COASTAL PLAIN AQUIFERS OF ARKANSAS,
W69-04609 02F

GULF OF MEXICO
IMPORTANCE OF GULF ESTUARIES AND PROBLEMS FACING OUR FISHERY RESOURCES,
W69-04300 06B

HABITAT IMPROVEMENT
VANISHING TIDELANDS,
W69-04323 06E

ITATS
AST, PRESENT AND FUTURE OF SPORT FISHING IN TEXAS WATERS,
69-04362 06B

ATURAL AND ALTERED ESTUARINE HABITATS OF PENAEID SHRIMP,
69-04484 02L

BORS
ARITIME AGENCY STATUS, CHANNEL PROBLEMS CREATED BY HUGE
HIPS CONCERNS OF AAPA.
69-04287 04A

EASURING THE IMPACT OF THE WATERBORNE COMMERCE OF THE PORTS
F VIRGINIA ON EMPLOYMENT, WAGES, AND OTHER KEY INDICES OF
HE VIRGINIA ECONOMY, 1953-1965.
69-04295 06B

ORTS OF THE WORLD, 1967.
69-04320 06C

ESPONSE TO POLLUTION OF NEW YORK HARBOR AND THAMES ESTUARY,
69-04351 05B

ARBOR AND WATER FRONT COMMISSION BEACH EROSION CONTROL
ISTRICT.
69-04414 06E

HE PRINCIPLES OF WATERFRONT RENEWAL A SUMMARY OF
XPERIENCE IN FIFTY AMERICAN CITIES,
69-04476 06B

ORT INFORMATION SOURCES.
69-04491 08A

UBLIC WORK NEEDS - MARINE PORT FACILITIES.
69-04495 06B

HE IMPACT OF THE PORT OF JACKSONVILLE ON THE ECONOMY OF THE
OMMUNITY,
69-04517 06B

T BALANCE
EAT EXCHANGE IN THE ENVIRONMENT,
69-04467 02A

T TRANSFER
EAT EXCHANGE IN THE ENVIRONMENT,
69-04467 02A

TED WATER
OMMON MISUNDERSTANDINGS ABOUT HEATED DISCHARGES,
69-04364 05C

RBICIDES
NFLUENCE OF WATER FLUX AND POROUS MATERIAL ON THE MOVEMENT
F SELECTED HERBICIDES,
69-04258 05B

A SUBSTITUTE FOR 2,4,5-T IN EASTERN HARDWOOD SPROUT AND
BRUSH CONTROL,
69-04633 03B

GHWAYS
HE INFLUENCE OF GROUNDWATER FLOW SYSTEMS ON PAVEMENT
TABILITY IN HIGHWAY CUTS,
69-04621 02F

STORIC FLOOD
CENTRAL MONTANA RAINSTORMS AND FLOODS, JUNE 6-15, 1967,
69-04237 02B

STORY
SOME ASPECTS OF POLLUTION, PARASITISM, AND INLET RESTRICTION
IN THREE NEW JERSEY ESTUARIES,
69-04304 05C

CHESAPEAKE BAY, A PICTORIAL MARITIME HISTORY,
69-04449 06B

COST-BENEFIT ANALYSIS A SURVEY,
69-04492 06B

USEBOATS
HOUSEBOATS, SANITATION AND LOCATION.
69-04388 05G

DSON RIVER
HE HUDSON RIVER ESTUARY HYDROLOGY, SEDIMENTS AND
POLLUTION,
69-04480 05A

POLLUTION OF THE HUDSON RIVER AND ITS TRIBUTARIES.
69-04490 05G

MAN RESOURCES
POLLUTION AND MARINE ECOLOGY.
69-04310 05G

DRAULIC CONDUCTIVITY
HYDROLOGIC PROPERTIES OF PEAT FROM A WYOMING MOUNTAIN BOG,
69-04234 02G

FACTORS IMPORTANT IN THE CALCULATION OF HYDRAULIC
CONDUCTIVITY,
69-04604 02G

SUBSURFACE STORMFLOW FROM FORESTED SLOPES,
69-04637 02G

THEORY AND MECHANICS OF SUBSURFACE STORMFLOW,
69-04638 02G

HYDRAULIC MODELS
USE OF HYDRAULIC AND MATHEMATICAL MODELS FOR DETERMINING
EFFLUENT DIFFUSION IN SOUTH SAN FRANCISCO BAY,
69-04277 05B

THE ROLE OF THE PHYSICAL HYDRAULIC MODEL OF SAN FRANCISCO
BAY AND DELTA IN POLLUTION STUDIES,
69-04329 05B

USE OF MODELS IN RESOLVING TIDAL PROBLEMS,
69-04580 02L

HYDRODAT COMPUTER-ORIENTED SYSTEM
A COMPUTER-ORIENTED GROUND-WATER INFORMATION STORAGE AND
RETRIEVAL SYSTEM,
69-04624 07C

HYDRODYNAMICS
HEAT EXCHANGE IN THE ENVIRONMENT,
69-04467 02A

HYDROELECTRIC PLANTS
COMMON MISUNDERSTANDINGS ABOUT HEATED DISCHARGES,
69-04364 05C

CONSERVATION OF THE NATURAL RESOURCES OF NEW ENGLAND, THE
PASSAMAQUODDY TIDAL POWER PROJECT AND UPPER SAINT JOHN RIVER
HYDROELECTRIC DEVELOPMENT.
69-04459 08C

HYDROELECTRIC POWER
ONE EXAMPLE OF MULTIPURPOSE DEVELOPMENT PROGRAM THE RHONE,
69-04592 04A

HYDROGEN ION CONCENTRATION
A GEOCHEMICAL CLASSIFICATION OF NATURAL WATERS,
69-04626 02K

HYDROGEOLOGY
RESISTIVITY INVESTIGATIONS OF LIMESTONE AQUIFERS IN JAMAICA,
69-04600 02F

GEOHYDROLOGY OF THE COASTAL PLAIN AQUIFERS OF ARKANSAS,
69-04609 02F

GEOLOGY AND GROUND-WATER RESOURCES OF GREENE COUNTY,
ALABAMA,
69-04625 02F

HYDROGRAPH ANALYSIS
A DISSIPATIVE RIVER FLOW MODEL,
69-04232 02A

GENERALIZED RAINFALL-DURATION-FREQUENCY RELATIONSHIPS,
69-04549 02A

EVALUATION OF SEGMENTED IUH FROM DERIVATIVES,
69-04553 02A

HYDROGRAPHS
EVALUATION OF SEGMENTED IUH FROM DERIVATIVES,
69-04553 02A

HYDROLOGIC ANALYSIS
WATERSHED CALIBRATION METHODS,
69-04634 03B

HYDROLOGIC ASPECTS
HYDROLOGY FOR URBAN LAND PLANNING-A GUIDEBOOK ON THE
HYDROLOGIC EFFECTS OF URBAN LAND USE,
69-04548 04C

TEST HOLE IN AQUIFER WITH MANY WATER-BEARING ZONES AT
JACKSONVILLE, FLORIDA,
69-04620 02F

HYDROLOGIC BUDGET
HYDROLOGY OF CRATER, EAST AND DAVIS LAKES, OREGON,
69-04574 02H

HYDROLOGIC PROPERTIES
SUBSURFACE STORMFLOW FROM FORESTED SLOPES,
69-04637 02G

THEORY AND MECHANICS OF SUBSURFACE STORMFLOW,
69-04638 02G

HYDROLOGY
HYDROLOGIC ATLAS OF UTAH,
69-04209 02A

EFFECT OF URBAN DEVELOPMENT ON FLOOD DISCHARGES-CURRENT
KNOWLEDGE AND FUTURE NEEDS,
69-04560 04C

THE TEACHING AND RESEARCH PROGRAMS IN HYDROLOGY AT FACULTY
OF PHYSICAL AND MATHEMATICAL SCIENCES OF THE UNIVERSITY OF
CHILE,
69-04611 09A

HYETOGRAPHS
A DISSIPATIVE RIVER FLOW MODEL,
69-04232 02A

EVALUATION OF SEGMENTED IUH FROM DERIVATIVES,
69-04553 02A

ILLINOIS
FLOODS IN WOODSTOCK QUADRANGLE, NORTHEASTERN ILLINOIS,

W69-04249 04A

ILLINOIS GROUND WATER POLLUTION,
W69-04256 05B

CLARK V LINDSAY LIGHT AND CHEMICAL COMPANY (INJUNCTION FOR POLLUTION ABATEMENT).
W69-04382 05G

INCOME
RELATIONS BETWEEN SPORT AND COMMERCIAL FISHERMEN,
W69-04302 06B

INDIANS
CHEROKEE NATION OR TRIBE OF INDIANS IN OKLAHOMA V OKLAHOMA (RIGHT TO RIVERBEDS OF ARKANSAS RIVER).
W69-04651 06E

INDUSTRIAL EFFLUENTS
ANAEROBIC DIGESTION OF PINEAPPLE MILL WASTES,
W69-04527 05D

INDUSTRIAL PLANTS
WATERSIDE SITE PLANT LOCATIONS AND EXPANSIONS 1966.
W69-04361 04A

OPERATING COSTS OF WASTE TREATMENT IN GENERAL MOTORS,
W69-04451 05D

INDUSTRIAL WASTEWATER CONTROL,
W69-04471 05D

INDUSTRIAL POLLUTION
A NOTE ON THE ASYMMETRY BETWEEN FEES AND PAYMENTS,
W69-04446 05G

INDUSTRIAL WASTES
INDUSTRIAL WASTEWATER RECLAMATION,
W69-04226 05D

ORGANIC CARBON-ORGANIC NITROGEN RATIOS OF SEDIMENTS IN A POLLUTED ESTUARY,
W69-04248 05C

RIDDLE V CITY OF GREENVILLE (RIGHT TO COLLECT DAMAGES FROM POLLUTION OF STREAMS).
W69-04372 05B

CLARK V LINDSAY LIGHT AND CHEMICAL COMPANY (INJUNCTION FOR POLLUTION ABATEMENT).
W69-04382 05G

INDUSTRIAL WASTEWATER CONTROL,
W69-04471 05D

1965 SURVEY ON DISPOSAL OF SEWAGE AND INDUSTRIAL WASTES BY FEDERAL INSTALLATIONS.
W69-04507 05D

UNITED STATES V REPUBLIC STEEL CORP (INJUNCTION TO FORCE COMPANY TO RESTORE RIVER TO ORIGINAL DEPTH).
W69-04671 06E

INDUSTRIAL WATER
INDUSTRIAL WASTEWATER RECLAMATION,
W69-04226 05D

WATER IN INDUSTRY A SURVEY OF WATER USE IN INDUSTRY.
W69-04514 05D

INDUSTRIAL WATER UTILIZATION
WATER REQUIREMENTS OF SELECTED NORTH GEORGIA MANUFACTURING INDUSTRIES,
W69-04205 06D

INDUSTRIES
ECONOMIC IMPACT OF MARINE-ORIENTED ACTIVITIES--A STUDY OF THE SOUTHERN NEW ENGLAND MARINE REGION,
W69-04330 06B

INFILTRATION
EFFECTS OF SOIL FREEZING ON WATER YIELDS,
W69-04251 02C

INFORMATION RETRIEVAL
NATIONAL ESTUARINE INVENTORY HANDBOOK OF DESCRIPTORS,
W69-04358 10

INFRARED RADIATION
INFRARED IMAGING FOR WATER RESOURCES STUDIES,
W69-04556 07B

INJECTION WELLS
SOME BASIC FACTORS IN THE CONSIDERATION AND INSTALLATION OF DEEP WELL DISPOSAL SYSTEMS,
W69-04228 05E

INSECT CONTROL
MOSQUITO EXTERMINATION.
W69-04421 06E

INSECTICIDES
EXTRACTION OF ORGANOCHLORINE AND ORGANOPHOSPHATE INSECTICIDES FROM LAKE WATERS,
W69-04523 05A

LINDANE ADSORPTION BY LAKE SEDIMENTS,
W69-04525 05G

INSPECTION
DECLARATION AND ABATEMENT OF NUISANCES.
W69-04425 05G

INSTRUMENTATION
A SHIELDED THERMISTOR PROBE WITH PORTABLE INSTRUMENT FOR MEASURING SNOWPACK TEMPERATURES,
W69-04252 07B

INTAKES
WATER INTAKE ON MIDCONTINENTAL RANGELANDS AS INFLUENCED BY SOIL AND PLANT COVER,
W69-04640 02G

INTERNATIONAL JOINT COMMISSION
ORGANIZATION FOR THE REGULATION OF LAKE ONTARIO,
W69-04648 06E

INTERSTATE COMMISSIONS
ATLANTIC STATES MARINE FISHERIES COMMISSION.
W69-04426 06E

INTERSTATE COMPACTS
ATLANTIC STATES MARINE FISHERIES COMMISSION.
W69-04426 06E

DELAWARE RIVER.
W69-04699 06E

INTERTIDAL AREAS
EFFECTS OF WASTE DISCHARGE FROM POINT LOMA SALINE WATER CONVERSION PLANT ON INTERTIDAL MARINE LIFE,
W69-04280 05C

INVESTMENT
BENEFIT-COST ANALYSIS ITS RELEVANCE TO PUBLIC INVESTMENT DECISIONS,
W69-04479 06B

WATER DESALINATION PROPOSALS FOR A COSTING PROCEDURE AND RELATED TECHNICAL AND ECONOMIC CONSIDERATIONS.
W69-04513 03A

ION EXCHANGE
EFFECT OF HIGH TEMPERATURES ON THE CHEMICAL COMPOSITION OF GROUND WATERS,
W69-04271 02K

ION TRANSPORT
CONVECTIVE DIFFUSION IN CLAY SYSTEMS,
W69-04261 02F

MIGRATION OF IRON AND SULFUR WITHIN ANAEROBIC SEDIMENTS DURING EARLY DIAGENESIS,
W69-04572 02K

IONS
ALUMINUM IONS IN AQUEOUS SOLUTIONS,
W69-04575 02K

IRON
MIGRATION OF IRON AND SULFUR WITHIN ANAEROBIC SEDIMENTS DURING EARLY DIAGENESIS,
W69-04572 02K

IDENTIFICATION AND SOLUBILITY OF IRON SULFIDE IN ANAEROBIC LAKE SEDIMENT,
W69-04590 02K

IRRIGATION
YOUNG V CITY OF ASHEVILLE (RIPARIAN RIGHTS).
W69-04378 06E

IRRIGATION SYSTEMS
IRRIGATION SYSTEMS (ESTABLISHING IRRIGATION SYSTEMS IN NEW JERSEY COUNTIES).
W69-04416 03F

ISLANDS
LONG ISLAND BEACH BUGGY ASS'N V TOWN OF ISLIP (BEACH EROSION).
W69-04389 04D

ISLANDS IN DELAWARE RIVER.
W69-04430 06E

BURGESS V PINE ISLAND CORP (LAND SEPARATED FROM ISLAND BY NON-NAVIGABLE STREAM NOT AN ISLAND).
W69-04652 06E

WAGNER V CITY OF BALTIMORE (NAVIGABLE RIVER BEDS).
W69-04679 06E

JAMAICA
RESISTIVITY INVESTIGATIONS OF LIMESTONE AQUIFERS IN JAMAICA,
W69-04600 02F

JETTIES
MARINE SPORTFISHING SURVEY OF SOUTHERN CALIFORNIA PIERS AND JETTIES, 1963,
W69-04316 06B

PHENOMENA AFFECTING IMPROVEMENT OF THE LOWER COLUMBIA ESTUARY AND ENTRANCE,
W69-04478 02L

JUDICIAL DECISIONS
FARELLY LAKE LEVEE DISTRICT OF JEFFERSON AND ARKANSAS COUNTIES V HAMPTON (RATIFICATION OF CONTRACT TO REPAY CONTRIBUTIONS FROM LANDOWNERS).
W69-04369 06E

HAMBURG REALTY COMPANY V WOODS (OWNERSHIP OF LAND FORMED IN

IVER).
69-04375 06E

TATE OF TEXAS V CHUOKE (OWNERSHIP OF SUBMERGED LANDS).
69-04383 06E

ZORGE V BEAVARK, INC (LAKE NAVIGABILITY FOR ADMIRALTY URPOSES).
69-04384 06E

ORTH JERSEY DIST WATER SUPPLY COMM'N V CITY OF NEWARK RESCISSION OF WATER SUPPLY CONTRACTS).
69-04408 06E

EPARTMENT OF HEALTH V PASSAIC VALLEY SEWERAGE COMMISSION DEPARTMENT OF HEALTH'S AUTHORITY OF DISCHARGE OF SEWERAGE).
69-04664 05G

EATTY V PLAIL (ARTIFICIAL CHANNEL OF SURFACE WATER WASHED NTO ADJOINTNG LAND).
69-04686 04A

ST
ESISTIVITY INVESTIGATIONS OF LIMESTONE AQUIFERS IN JAMAICA,
69-04600 02F

E BEDS
K ROY, INC V BOARD OF COMM'RS (EXTENT OF LEVEE DISTRICT PPROPRIATION POWER).
69-04689 04A

E MENDOTA(WIS)
ULFUR METABOLISM AND SEDIMENTARY ENVIRONMENT LAKE ENDOTA, WISCONSIN,
69-04526 05C

E METABOLISM
ULFUR METABOLISM AND SEDIMENTARY ENVIRONMENT LAKE ENDOTA, WISCONSIN,
69-04526 05C

E ONTARIO
ATER POLLUTION PROBLEMS AND IMPROVEMENT NEEDS, LAKE ONTARIO ND ST. LAWRENCE RIVER BASINS.
69-04223 05B

RGANIZATION FOR THE REGULATION OF LAKE ONTARIO,
69-04648 06E

E STAGES
EOLOGY OF GLACIAL LAKE AGASSIZ,
69-04617 02H

E TYPOLOGY
HE THERMAL CLASSIFICATION OF LAKES,
69-04522 02H

ES
DIRECT DEMONSTRATION OF THE PHOSPHORUS CYCLE IN A SMALL AKE,
69-04520 02H

HE THERMAL CLASSIFICATION OF LAKES,
69-04522 02H

XTRACTION OF ORGANOCHLORINE AND ORGANOPHOSPHATE NSECTICIDES FROM LAKE WATERS,
69-04523 05A

LINDANE ADSORPTION BY LAKE SEDIMENTS,
69-04525 05G

YDROLOGY OF CRATER, EAST AND DAVIS LAKES, OREGON,
69-04574 02H

ENERALIZED HYDROLOGY OF PRAIRIE POTHOLES ON THE COTEAU DU ISSOURI, NORTH DAKOTA,
69-04597 02H

ND DEVELOPMENT
A MODEL LAND DEVELOPMENT CODE.
69-04301 06E

LAND RECLAMATION IN THE PO RIVER DELTA OF ITALY,
69-04518 04A

CAPITAL V PORT WASHINGTON YACHT CLUB (ACTION FOR LATERAL SUPPORT OF LAND, WITH ADDITIONAL CLAIMS FOR SURFACE WATER DAMAGE).
69-04672 06E

ND MANAGEMENT
THE ROLE OF RESEARCH IN THE PRESERVATION OF ESTUARIES,
69-04347 04A

ND RECLAMATION
THE ZUYDERZEE WORKS.
69-04365 04A

A SUPPLEMENTARY REPORT ON THE COASTAL WETLANDS INVENTORY OF LONG ISLAND, NEW YORK.
69-04506 07B

MAINTAINING AND ENHANCING THE ESTUARINE ENVIRONMENT,
69-04512 06F

LAND RECLAMATION IN THE PO RIVER DELTA OF ITALY,
69-04518 04A

ND SUBSIDENCE
FINLEY V TEETER STONE INC (ACTION FOR DAMAGES DUE TO PUMPING PERCOLATING WATERS).
69-04371 04C

LAND USE
MAN, VEGETATION AND THE SEDIMENT YIELDS OF RIVERS,
69-04269 02E

FLOOD INFORMATION FOR FLOOD-PLAIN PLANNING,
69-04616 02E

BLUE V CHARLES P HAYES AND ASSOCIATES, INC (ACTION FOR DAMAGES DUE TO FLOW OF OIL WASTES).
69-04654 05B

LANDFILLS
HYDROLOGY OF THE VALLEY-FILL AND CARBONATE-ROCK RESERVOIRS PAHRUMP VALLEY NEVADA-CALIFORNIA,
69-04267 03D

PRACTICES AFFECTING SOUTH ATLANTIC AND GULF COAST MARSHES AND ESTUARIES - DREDGING AND FILLING,
69-04288 04A

THE ROLE OF RESEARCH IN THE PRESERVATION OF ESTUARIES,
69-04347 04A

HEALTH AND VITAL STATISTICS COUNTY BOARD OF HEALTH.
69-04420 05G

LEACHING
EFFECT OF HIGH TEMPERATURES ON THE CHEMICAL COMPOSITION OF GROUND WATERS,
69-04271 02K

NITRIFICATION IMPORTANCE TO NUTRIENT LOSSES FROM A CUTOVER FORESTED ECOSYSTEM,
69-04584 02K

LEGAL ASPECTS
NATIONAL WATER LAWS AND ADMINISTRATION AS ELEMENTS OF WATER DEVELOPMENT,
69-04644 06E

LEGISLATION
MARINE SCIENCE AFFAIRS...A YEAR OF TRANSITION.
69-04286 06E

A MODEL LAND DEVELOPMENT CODE.
69-04301 06E

VANISHING TIDELANDS,
69-04323 06E

A REPORT ON POLLUTION OF THE NATION'S WATER BY OIL AND OTHER HAZARDOUS SUBSTANCES.
69-04326 05G

ESTUARINE WATER QUALITY MANAGEMENT IN THE SACRAMENTO-SAN JOAQUIN DELTA,
69-04331 05G

RULES ON VESSEL POLLUTION PROPOSED BY SENATOR MUSKIE.
69-04332 05G

A CALL FOR ACTION,
69-04352 06B

STATEMENT,
69-04354 05G

WASTE FROM WATERCRAFT.
69-04357 05G

WHARVES AND FISH WEIRS.
69-04379 04A

MUNICIPALITIES.
69-04380 04D

STATE LAND NEEDED BY U S.
69-04385 06E

COUNTY ZONING.
69-04386 06E

ABANDONMENT OF CANAL LANDS.
69-04402 06E

WATER FRONT IMPROVEMENTS.
69-04407 06E

HARBOR AND WATER FRONT COMMISSION BEACH EROSION CONTROL DISTRICT.
69-04414 06E

COUNTY SEWERAGE AUTHORITIES.
69-04415 05G

HEALTH AND VITAL STATISTICS COUNTY BOARD OF HEALTH.
69-04420 05G

ISLANDS IN DELAWARE RIVER.
69-04430 06E

OWNERS OF MARSH AND MEADOW LANDS.
69-04431 06E

TIME, MANNER AND PURPOSE OF TAKING SHELLFISH.
69-04432 06E

ROUGH CULL LAW.

W69-04433 06E

GENERAL POWERS AND DUTIES.
W69-04434 06E

LITTERING AND OBSTRUCTIONS,
W69-04450 06E

POLITICS AND THE MARINE FISHERIES,
W69-04455 06E

MAINTAINING AND ENHANCING THE ESTUARINE ENVIRONMENT,
W69-04512 06F

NATIONAL WATER LAWS AND ADMINISTRATION AS ELEMENTS OF WATER DEVELOPMENT,
W69-04644 06E

DISPOSITION OF CANALS AND CANAL PROPERTIES PROHIBITED.
W69-04656 04A

INTERFERING WITH NAVIGATION.
W69-04661 06E

WILLFUL INJURIES TO THE CANALS AND DRAWING WATER FROM THE CANALS.
W69-04662 04A

COMMERCE AND NAVIGATION.
W69-04663 04A

WATER-WORKS.
W69-04693 04A

PUBLIC UTILITIES METHODS OF SUPPLYING WATER.
W69-04695 03D

PUBLIC UTILITIES MUNICIPALITY AND ITS EXCLUSIVE RIGHT TO SUPPLY WATER.
W69-04696 03D

WATER SUPPLY.
W69-04697 03D

STATE BEACH EROSION COMMISSION.
W69-04698 04D

DELAWARE RIVER.
W69-04699 06E

LEVEES
FARELLY LAKE LEVEE DISTRICT OF JEFFERSON AND ARKANSAS COUNTIES V HAMPTON (RATIFICATION OF CONTRACT TO REPAY CONTRIBUTIONS FROM LANDOWNERS).
W69-04369 06E

LINDANE
LINDANE ADSORPTION BY LAKE SEDIMENTS,
W69-04525 05G

LINSLEY POND(CONN)
A DIRECT DEMONSTRATION OF THE PHOSPHORUS CYCLE IN A SMALL LAKE,
W69-04520 02H

LITTORAL
POLLUTION AND MARINE ECOLOGY.
W69-04310 05G

LOCAL GOVERNMENTS
COUNTY ZONING.
W69-04386 06E

LOGGING(FOREST)
EFFECT OF A COMMERCIAL CLEARCUTTING IN WEST VIRGINIA ON OVERLAND FLOW AND STORM RUNOFF,
W69-04632 04C

LONG-TERM PLANNING
FORMULA FOR WATER RESOURCES MANAGEMENT IN NEW YORK STATE,
W69-04646 06B

LOUISIANA
CHANNEL SEDIMENTATION AND DREDGING PROBLEMS, MISSISSIPPI RIVER AND LOUISIANA GULF COAST ACCESS CHANNELS,
W69-04501 04D

SALINE GROUND WATER IN LOUISIANA,
W69-04608 02F

STERLY V GRAVITY DRAINAGE DISTRICT NO 1 OF RAPIDES PARISH (VALUE OF PROPERTY CONFISCATED FOR DRAINAGE PURPOSES).
W69-04650 04A

LITTLE V UNITED STATES (WRONGFUL DEATH LIABILITY FOR DAM MAINTENANCE).
W69-04666 06E

HUNTER V CITY OF SHREVEPORT (BRIDGE CONSTRUCTION).
W69-04667 06E

A F ROY, INC V BOARD OF COMM'RS (EXTENT OF LEVEE DISTRICT APPROPRIATION POWER).
W69-04689 04A

EVAPORATION
VARIATIONS OF EVAPORATION IN TIME AND SPACE PART 1 AND PART 2,
W69-04618 02D

MAINE

M

WHARVES AND FISH WEIRS.
W69-04379 04A

MUNICIPALITIES.
W69-04380 04D

SOIL AND WATER CONSERVATION DISTRICTS.
W69-04381 06E

THE PUBLIC INTEREST IN PRESERVING NATURAL AREAS,
W69-04475 06D

MANPOWER
SEAFARING EMPLOYMENT.
W69-04336 06B

MARINE ANIMALS
THE EFFECT OF POLLUTION BY SEWAGE UPON THE WATERS OF THE OSLO-FJORD,
W69-04445 05C

THE MARINE ENVIRONMENT IN THE VICINITY OF THE ORANGE COUNTY SANITATION DISTRICTS OCEAN OUTFALL,
W69-04511 05C

MARINE FISHERIES
POLITICS AND THE MARINE FISHERIES,
W69-04455 06E

MARINE MICROORGANISMS
NUTRIENT AND POLLUTANT RESPONSE OF ESTUARINE BIOTAS,
W69-04276 05C

MARKET VALUE
A SUMMARY REPORT ON MARYLAND'S COMMERCIAL FISHERIES, 1957-1966,
W69-04284 06B

ESTUARINE NEKTON,
W69-04292 02L

MARKOV PROCESSES
MARKOV CHAINS OF ORDER GREATER THAN ONE,
W69-04238 02B

MARSHES
PRACTICES AFFECTING SOUTH ATLANTIC AND GULF COAST MARSHES AND ESTUARIES - DREDGING AND FILLING,
W69-04288 04A

MARYLAND
A SUMMARY REPORT ON MARYLAND'S COMMERCIAL FISHERIES, 1957-1966,
W69-04284 06B

STATEMENT BEFORE THE SUBCOMMITTEE ON AIR AND WATER POLLUTION, APRIL 17, 1968,
W69-04293 05B

STATEMENT BEFORE THE SUBCOMMITTEE ON AIR AND WATER POLLUTION,
W69-04314 06G

FINLEY V TEETER STONE INC (ACTION FOR DAMAGES DUE TO PUMPING PERCOLATING WATERS).
W69-04371 04C

CHESAPEAKE BAY, A PICTORIAL MARITIME HISTORY,
W69-04449 06B

LITTERING AND OBSTRUCTIONS,
W69-04450 06E

RECREATION,
W69-04458 06B

TEMPERATURE AND WATER-QUALITY CONDITIONS FOR THE PERIOD JULY, 1963, TO DECEMBER, 1965, PATUXENT RIVER ESTUARY, MARYLAND,
W69-04462 05B

GENERAL WATER QUALITY CRITERIA AND SPECIFIC WATER QUALITY STANDARDS.
W69-04470 05G

ON THE PREDICTION OF THE DISTRIBUTION OF EXCESS TEMPERATURE FROM A HEATED DISCHARGE IN AN ESTUARY,
W69-04494 05C

WAGNER V CITY OF BALTIMORE (NAVIGABLE RIVER BEDS).
W69-04679 06E

BATTISTO V PERKINS (ACTION FOR DAMAGE FROM INCREASED SURFACE WATER FLOW).
W69-04680 04C

MATHEMATICAL MODELS
USE OF HYDRAULIC AND MATHEMATICAL MODELS FOR DETERMINING EFFLUENT DIFFUSION IN SOUTH SAN FRANCISCO BAY,
W69-04277 05B

ESTUARINE POLLUTION OF THE CHAO PHRAYA RIVER AT BANGKOK, THAILAND,
W69-04279 05B

A 'BALAS' ALGORITHM FOR ZONED UNIFORM TREATMENT,
W69-04281 05D

THE FUTURE OF AN ESTUARY,
W69-04290 05G

LTA-SUISUN BAY WATER QUALITY INVESTIGATION,
9-04291 02L

THEMATICAL MODELING OF WATER QUALITY IN ESTUARIAL SYSTEMS,
9-04311 05B

E DEVELOPMENT AND APPLICATION OF A TIME-VARYING DISSOLVED
YGEN MODEL,
9-04315 05G

EDICTING THE CONDITION OF A POLLUTED ESTUARY,
9-04469 05B

TUARINE DISTRIBUTION OF NONCONSERVATIVE SUBSTANCES,
9-04489 05G

TER QUALITY IMPROVEMENT PROGRAMMING PROBLEMS,
9-04502 05G

CENT RESULTS FROM A MATHEMATICAL MODEL OF WATER POLLUTION
NTROL IN THE DELAWARE ESTUARY,
9-04509 05G

RRENTS IN AN INTEROCEANIC CANAL,
9-04557 02E

E EXTREME VALUES OF PRECIPITATION PHENOMENA,
9-04567 02B

MODERN STATISTICAL STUDY OF MONTHLY LEVELS OF THE ORINOCO
VER,
9-04568 02E

EMATICAL STUDIES
E OF HYDRAULIC AND MATHEMATICAL MODELS FOR DETERMINING
FFLUENT DIFFUSION IN SOUTH SAN FRANCISCO BAY,
9-04277 05B

E MIXING PROCESSES IN A TIDAL ESTUARY,
9-04444 02L

ALUATION OF SEGMENTED IUH FROM DERIVATIVES,
9-04553 02A

DERS
TERNAL IMPROVEMENT FUND OF STATE OF FLORIDA V NOWAK (USE
MEANDER LINES IN SETTING BOUNDARIES OF RIPARIAN
OPERTY).
9-04374 06E

TING
ACIERS AND WATER SUPPLY,
69-04255 02C

COROLOGY
MOSPHERIC WATER VAPOR TRANSPORT AND THE WATER BALANCE OF
ORTH AMERICA- 2. LARGE-SCALE WATER BALANCE INVESTIGATIONS,
9-04246 02A

EAT EXCHANGE IN THE ENVIRONMENT,
69-04467 02A

MI RIVER VALLEY(OHIO)
TURE DEVELOPMENT OF THE GROUND-WATER RESOURCE IN THE LOWER
REAT MIAMI RIVER VALLEY, OHIO - PROBLEMS AND ALTERNATIVE
OLUTIONS,
69-04206 02F

HIGAN
TATE LAND NEEDED BY U S.
69-04385 06E

OUNTY ZONING.
69-04386 06E

NNEXATION OF SUBMERGED LANDS.
69-04387 06E

OUSEBOATS, SANITATION AND LOCATION.
69-04388 05G

ATER-WORKS.
69-04693 04A

RATION
IGRATION OF IRON AND SULFUR WITHIN ANAEROBIC SEDIMENTS
URING EARLY DIAGENESIS,
69-04572 02K

E WASTES
OLLUTION OF THE INTERSTATE WATERS OF THE COLORADO RIVER AND
TS TRIBUTARIES....
69-04272 05E

IMUM FLOW
NTERSTATE COOPERATION FOR CONSERVATION AND PROTECTION OF
ATER RESOURCES.
69-04427 03D

ING
967 PROCEEDINGS OF WODCON.
69-04321 04A

SISSIPPI
TATEMENT.
69-04342 05G

LUP V CHARLES F HAYES AND ASSOCIATES, INC (ACTION FOR
AMAGES DUE TO FLOW OF OIL WASTES).
69-04654 05B

MISSISSIPPI RIVER
CHANNEL SEDIMENTATION AND DREDGING PROBLEMS, MISSISSIPPI
RIVER AND LOUISIANA GULF COAST ACCESS CHANNELS,
W69-04501 04D

MISSOURI
HAMBURG REALTY COMPANY V WOODS (OWNERSHIP OF LAND FORMED IN
RIVER).
W69-04375 06E

RECONNAISSANCE OF THE GROUND-WATER RESOURCES OF THE MISSOURI
RIVER ALLUVIUM BETWEEN ST. CHARLES AND JEFFERSON CITY,
MISSOURI,
W69-04610 02F

MISSOURI RIVER
RECONNAISSANCE OF THE GROUND-WATER RESOURCES OF THE MISSOURI
RIVER ALLUVIUM BETWEEN ST. CHARLES AND JEFFERSON CITY,
MISSOURI,
W69-04610 02F

ORGANIZATION ARRANGEMENT FOR DEVELOPMENT AND OPERATION OF
THE MISSOURI RIVER BASIN PROJECTS,
W69-04645 06E

MISSOURI RIVER ALLUVIUM
RECONNAISSANCE OF THE GROUND-WATER RESOURCES OF THE MISSOURI
RIVER ALLUVIUM BETWEEN ST. CHARLES AND JEFFERSON CITY,
MISSOURI,
W69-04610 02F

MIXING
THE MIXING PROCESSES IN A TIDAL ESTUARY,
W69-04444 02L

MODEL STUDIES
USE OF HYDRAULIC AND MATHEMATICAL MODELS FOR DETERMINING
EFFLUENT DIFFUSION IN SOUTH SAN FRANCISCO BAY,
W69-04277 05B

DIGITAL SIMULATION OF NATURAL ANIMAL COMMUNITIES,
W69-04312 06G

THE DEVELOPMENT AND APPLICATION OF A TIME-VARYING DISSOLVED
OXYGEN MODEL,
W69-04315 05G

DELAWARE RIVER MODEL STUDY REPORT NO. 2 - SALINITY TESTS OF
EXISTING CHANNEL.
W69-04466 02L

DESIGNING PUMPED WELL CHARACTERISTICS INTO ELECTRIC ANALOG
MODELS,
W69-04623 06B

MODEL STUDY
A PRELIMINARY ESTIMATE OF THE EFFECT OF DIVERSION OF FLOW
FROM THE SUSQUEHANNA RIVER ON THE SALINITY OF THE UPPER
CHESAPEAKE BAY,
W69-04493 02L

MOISTURE TENSION
HYDROLOGIC PROPERTIES OF PEAT FROM A WYOMING MOUNTAIN BOG,
W69-04234 02G

MOISTURE-TENSION DATA FOR SELECTED SOILS ON EXPERIMENTAL
WATERSHEDS,
W69-04266 02G

INFLUENCE OF SOIL STRUCTURE ON WATER RELATIONS IN LOW
HUMIDIC LATOSOLS 1. WATER RETENTION,
W69-04588 02G

MONTANA
CENTRAL MONTANA RAINSTORMS AND FLOODS, JUNE 6-15, 1967,
W69-04237 02B

MOSQUITO CONTROL
MOSQUITO EXTERMINATION.
W69-04421 06E

MOSQUITOES
MOSQUITO EXTERMINATION.
W69-04421 06E

NUISANCES AFFECTING HEALTH.
W69-04424 05G

MULTIPLE PURPOSE
THE URGENT NEED FOR LANDSCAPE ZONING OF THE ESTUARINE REGION
ACCORDING TO ECO-SYSTEM PRINCIPLES,
W69-04307 06F

MULTIPLE-PURPOSE PROJECTS
THE PROSPECTS FOR DUAL-PURPOSE PLANTS,
W69-04463 03A

ONE EXAMPLE OF MULTIPURPOSE DEVELOPMENT PROGRAM THE RHONE,
W69-04592 04A

A RIVER HARNESSED THE DURANCE, A SOURCE OF POWER AND
AGRICULTURAL PLENITUDE,
W69-04594 04A

USE OF MULTI-PURPOSE STORAGE DAMS IN THE DEVELOPMENT OF THE
SEINE BASIN,
W69-04596 04A

MUNICIPAL WASTES
ORGANIC CARBON-ORGANIC NITROGEN RATIOS OF SEDIMENTS IN A
POLLUTED ESTUARY,

W69-04248 05C

SHIRLEY V NEW HAMPSHIRE WATER POLLUTION COMMISSION (VALIDITY OF ORDER TO DESIST SEWAGE DEPOSIT INTO RIVER).
W69-04366 05B

WATER POLLUTION CONTROL FACTS.
W69-04515 05G

MUNICIPAL WATER
CHEMICAL CHARACTERIZATION OF PUBLIC SUPPLY,
W69-04245 02K

NATIONAL PARKS
BENEATH THE SURFACE,
W69-04497 06B

NATURAL FLOW
BATTISTO V PERKINS (ACTION FOR DAMAGE FROM INCREASED SURFACE WATER FLOW).
W69-04680 04C

NATURAL FLOW DOCTRINE
HUEY V KELLER (RIGHTS OF UPPER RIPARIAN OWNER).
W69-04373 04A

LAWRENCE V BEHNCKE (INTERFERENCE WITH NATURAL WATER COURSE).
W69-04674 04A

NATURAL RESOURCES
'NATURAL RESOURCES AND THE QUALITY OF LIFE'
W69-04440 06B

THE PUBLIC INTEREST IN PRESERVING NATURAL AREAS,
W69-04475 06D

NAVIGABLE RIVERS
CAMPBELL BROWN CO, INC V ELKINS (RIVERBED OWNERSHIP).
W69-04691 06E

NAVIGABLE WATERS
WASTE FROM WATERCRAFT.
W69-04357 05G

STATE LAND NEEDED BY U S.
W69-04385 06E

NAVIGABLE WATERS OF THE STATE.
W69-04397 04A

RIVERS AND STREAMS AS PUBLIC HIGHWAYS.
W69-04399 06E

BRIDGES OVER CERTAIN TIDAL WATERS CHANGING COURSE OF STREAM.
W69-04417 04A

INTERFERING WITH NAVIGATION.
W69-04661 06E

DEPARTMENT OF HIGHWAYS OF LOUISIANA V UNITED STATES (REVOCATION OF BRIDGE PERMIT).
W69-04670 06E

WATER FRONT IMPROVEMENTS.
W69-04692 04A

NAVIGATION
MUNICIPALITIES.
W69-04380 04D

NAVIGABLE WATERS OF THE STATE.
W69-04397 04A

TIDEWATER NAVIGATION.
W69-04398 04A

RIVERS AND STREAMS AS PUBLIC HIGHWAYS.
W69-04399 06E

BRIDGES TO CONFORM TO WHARF LINES.
W69-04423 04A

ONE EXAMPLE OF MULTIPURPOSE DEVELOPMENT PROGRAM THE RHONE,
W69-04592 04A

POWERS OF CITIES.
W69-04657 06E

PUBLIC NUISANCE DEFINED.
W69-04660 06E

INTERFERING WITH NAVIGATION.
W69-04661 06E

WILLFUL INJURIES TO THE CANALS AND DRAWING WATER FROM THE CANALS.
W69-04662 04A

COMMERCE AND NAVIGATION.
W69-04663 04A

NEGLIGENCE
HARRIS V UNITED STATES (NEGLIGENCE OF TVA UNDER FEDERAL TORT CLAIMS ACT).
W69-04470 06E

NEKTON
ESTUARIES,
W69-04278 02L

ESTUARINE NEKTON,
W69-04292 02L

NETWORKS
TOPOLOGICAL SIGNIFICANCE OF STREAM METHODS,
W69-04571 02E

NEW ENGLAND
ECONOMIC IMPACT OF MARINE-ORIENTED ACTIVITIES--A STUDY OF THE SOUTHERN NEW ENGLAND MARINE REGION,
W69-04330 06B

CONSERVATION OF THE NATURAL RESOURCES OF NEW ENGLAND, THE PASSAMAQUODDY TIDAL POWER PROJECT AND UPPER SAINT JOHN RIVER HYDROELECTRIC DEVELOPMENT.
W69-04459 08C

NEW HAMPSHIRE
SHIRLEY V NEW HAMPSHIRE WATER POLLUTION COMMISSION (VALIDITY OF ORDER TO DESIST SEWAGE DEPOSIT INTO RIVER).
W69-04366 05B

POIRE V SEBRA (INJUNCTION PROHIBITING THE FILLING IN OF A RIVER).
W69-04376 06E

NEW JERSEY
SOME ASPECTS OF POLLUTION, PARASITISM, AND INLET RESTRICTION IN THREE NEW JERSEY ESTUARIES,
W69-04304 05C

CANAL COMPANIES - POWERS AND DUTIES.
W69-04405 04A

PUBLIC UTILITIES - CONSTRUCTION AND OPERATION OF DAMS.
W69-04406 04A

WATER FRONT IMPROVEMENTS.
W69-04407 06E

NORTH JERSEY DIST WATER SUPPLY COMM'N V CITY OF NEWARK (RESCISSION OF WATER SUPPLY CONTRACTS).
W69-04408 06E

BEACH CONTROL RULES AND REGULATIONS.
W69-04409 06E

LAND BORDERING ON AND ADJACENT TO OCEAN MAY BE ACQUIRED FOR PLACES OF PUBLIC RESORT. REFERENDUM OF QUESTION OF ADOPTION OF ACT.
W69-04410 06E

ACQUISITION OF LANDS BORDERING AND ADJACENT TO THE OCEAN.
W69-04411 06E

CONSTRUCTION OF CONVENTION HALL PIER.
W69-04412 04A

BOARD OF PUBLIC WORKS.
W69-04413 06E

HARBOR AND WATER FRONT COMMISSION BEACH EROSION CONTROL DISTRICT.
W69-04414 06E

COUNTY SEWERAGE AUTHORITIES.
W69-04415 05G

IRRIGATION SYSTEMS (ESTABLISHING IRRIGATION SYSTEMS IN NEW JERSEY COUNTIES).
W69-04416 03F

BRIDGES OVER CERTAIN TIDAL WATERS CHANGING COURSE OF STREAM.
W69-04417 04A

STORMWATER SEWERS FOR COUNTY ROADS MUNICIPAL COOPERATION.
W69-04418 04C

PROTECTION OF ROADS NEAR TIDEWATER ACQUISITION OF LANDS.
W69-04419 06E

HEALTH AND VITAL STATISTICS COUNTY BOARD OF HEALTH.
W69-04420 05G

MOSQUITO EXTERMINATION.
W69-04421 06E

PUBLIC SWIMMING POOLS AND PLACES.
W69-04422 06E

BRIDGES TO CONFORM TO WHARF LINES.
W69-04423 04A

NUISANCES AFFECTING HEALTH.
W69-04424 05G

DECLARATION AND ABATEMENT OF NUISANCES.
W69-04425 05G

INTERSTATE COOPERATION FOR CONSERVATION AND PROTECTION OF WATER RESOURCES.
W69-04427 03D

LOCAL BOARDS OF HEALTH - GENERAL POWERS AND DUTIES.
W69-04428 05G

ISLANDS IN DELAWARE RIVER.
W69-04430 06E

OWNERS OF MARSH AND MEADOW LANDS.

9-04431 06E

ME, MANNER AND PURPOSE OF TAKING SHELLFISH.
9-04432 06E

UGH CULL LAW.
9-04433 06E

NERAL POWERS AND DUTIES.
9-04434 06E

ARD OF GAME AND FISH COMMISSIONERS POWERS AND DUTIES.
9-04435 06E

MMERCE AND NAVIGATION.
9-04663 04A

PARTMENT OF HEALTH V PASSAIC VALLEY SEWERAGE COMMISSION EPARTMENT OF HEALTH'S AUTHORITY OF DISCHARGE OF SEWERAGE).
9-04664 05G

ROUGH OF WESTVILLE V WHITNEY HOME BUILDERS (SEWAGE FLUENTS FLOWING INTO CITY RECREATION AREA LAKE).
9-04677 05G

BLIC UTILITIES METHODS OF SUPPLYING WATER.
9-04695 03D

BLIC UTILITIES MUNICIPALITY AND ITS EXCLUSIVE RIGHT TO PPLY WATER.
9-04696 03D

TER SUPPLY.
9-04697 03D

TE BEACH EROSION COMMISSION.
9-04698 04D

LAWARE RIVER.
9-04699 06E

MEXICO
TER RESOURCES OF NEW MEXICO, OCCURRENCE, DEVELOPMENT AND E,
9-04627 02E

YORK
TER POLLUTION PROBLEMS AND IMPROVEMENT NEEDS, LAKE ONTARIO ND ST. LAWRENCE RIVER BASINS.
9-04223 05B

SPONSE TO POLLUTION OF NEW YORK HARBOR AND THAMES ESTUARY,
9-04351 05B

NG ISLAND BEACH BUGGY ASS'N V TOWN OF ISLIP (BEACH OSION).
9-04389 04D

WAGE REMOVAL OR PURIFICATION AND CONDEMNATION OF PROPERTY.
9-04390 05G

E DISCHARGE OF SEWAGE AND OTHER MATTER INTO CERTAIN WATERS S PROHIBITED.
9-04391 05B

UBLIC HEALTH LAW (CLASSIFICATION OF WATERS AND PREVENTION F POLLUTION).
9-04392 05G

ENERAL POWERS OF THE BOARD OF TRUSTEES.
9-04393 04A

RINKING WATER SUPPLIES.
9-04394 05F

ANITARY QUALITY OF WATER IN SWIMMING POOLS AND AT BATHING EACHES.
9-04396 05G

AVIGABLE WATERS OF THE STATE.
9-04397 04A

IDEWATER NAVIGATION.
9-04398 04A

IVERS AND STREAMS AS PUBLIC HIGHWAYS.
9-04399 06E

ONSERVATION LAW.
9-04400 05G

IVER IMPROVEMENT.
9-04401 04A

BANDONMENT OF CANAL LANDS.
9-04402 06E

LOOD CONTROL PROJECTS - LAND ACQUISITION, MAINTENANCE AND PERATION.
9-04403 04A

WATER QUALITY MANAGEMENT AND CONTROL.
9-04404 05G

FORMULA FOR WATER RESOURCES MANAGEMENT IN NEW YORK STATE,
9-04646 06B

WATER DISTRICTS.
9-04655 04A

DISPOSITION OF CANALS AND CANAL PROPERTIES PROHIBITED.
W69-04656 04A

POWERS OF CITIES.
W69-04657 06E

BILL OF RIGHTS.
W69-04658 04A

THROWING GAS TAR OR REFUSE INTO PUBLIC WATERS AND WILLFULLY POISONING FOOD.
W69-04659 05G

PUBLIC NUISANCE DEFINED.
W69-04660 06E

INTERFERING WITH NAVIGATION.
W69-04661 06E

WILLFUL INJURIES TO THE CANALS AND DRAWING WATER FROM THE CANALS.
W69-04662 04A

TOWN OF HEMPSTEAD, LIDO BEACH, NASSAU COUNTY (CONDEMNATION AWARDS).
W69-04669 06E

CAPITAL V PORT WASHINGTON YACHT CLUB (ACTION FOR LATERAL SUPPORT OF LAND, WITH ADDITIONAL CLAIMS FOR SURFACE WATER DAMAGE).
W69-04672 06E

KERHONKSON LODGE INC V STATE OF NEW YORK (ACTION FOR DAMAGE FROM SURFACE WATER DISCHARGE).
W69-04673 04C

LAWRENCE V BEHNCKE (INTERFERENCE WITH NATURAL WATER COURSE).
W69-04674 04A

MALONE V CUSTOM MANOR (PRIVATE WATER LINES).
W69-04675 06E

GELLIS V TOWN OF HARRISON (INCREASED SURFACE RUNOFF).
W69-04676 04C

DECLARATION OF POLICY.
W69-04694 06E

NEW YORK STATE BARGE
DISPOSITION OF CANALS AND CANAL PROPERTIES PROHIBITED.
W69-04656 04A

NEW YORK STATE BARGE CANAL
ABANDONMENT OF CANAL LANDS.
W69-04402 06E

NILE BASIN
AGRICULTURAL DEVELOPMENT AND EXPANSION IN THE NILE BASIN PROGRAMS, PRODUCTION AND IMPLICATIONS FOR U. S. AGRICULTURE,
W69-04641 03F

NITRIFICATION
NITRIFICATION IMPORTANCE TO NUTRIENT LOSSES FROM A CUTOVER FORESTED ECOSYSTEM,
W69-04584 02K

NITROGEN
THE FUTURE OF AN ESTUARY,
W69-04290 05G

NUTRIENTS,
W69-04448 05C

NITROGEN COMPOUNDS
EXPERIMENTS ON THE UTILIZATION OF NITROGEN IN FRESH WATER,
W69-04521 05C

NITROGEN UTILIZATION
EXPERIMENTS ON THE UTILIZATION OF NITROGEN IN FRESH WATER,
W69-04521 05C

NON-NAVIGABLE WATERS
GEORGE V BEAVARK, INC (LAKE NAVIGABILITY FOR ADMIRALTY PURPOSES).
W69-04384 06E

BURGESS V PINE ISLAND CORP (LAND SEPARATED FROM ISLAND BY NON-NAVIGABLE STREAM NOT AN ISLAND).
W69-04652 06E

NORTH CAROLINA
YOUNG V CITY OF ASHEVILLE (RIPARIAN RIGHTS).
W69-04378 06E

DEPARTMENT OF WATER AND AIR RESOURCES ORGANIZATION AND POWERS GENERALLY CONTROL OF POLLUTION.
W69-04687 05G

NUCLEAR POWERPLANTS
THERMAL POLLUTION HOT ISSUE FOR INDUSTRY,
W69-04325 05C

THE PROSPECTS FOR DUAL-PURPOSE PLANTS,
W69-04463 03A

THE ECONOMICS OF WATER PRODUCTION USING NUCLEAR ENERGY,
W69-04483 03A

NUTRIENTS
NUTRIENT AND POLLUTANT RESPONSE OF ESTUARINE BIOTAS,
W69-04276 05C

NUTRIENTS,
W69-04448 05C

OBSTRUCTION TO FLOW
HUEY V KELLER (RIGHTS OF UPPER RIPARIAN OWNER).
W69-04373 04A

CAPITAL V PORT WASHINGTON YACHT CLUB (ACTION FOR LATERAL SUPPORT OF LAND, WITH ADDITIONAL CLAIMS FOR SURFACE WATER DAMAGE).
W69-04672 06E

LAWRENCE V BEHNCKE (INTERFERENCE WITH NATURAL WATER COURSE).
W69-04674 04A

FRYE V PENNSYLVANIA RAILROAD CO (RAILROAD'S LIABILITY FOR NEGLIGENTLY MAINTAINING CULVERT THROUGH RIGHT-OF-WAY).
W69-04683 06E

DAVIES V SHAFFER (OBSTRUCTION OF DRAINAGE DITCHES).
W69-04684 04A

OBSTRUCTION TO NAVIGATION
RIVERS AND STREAMS AS PUBLIC HIGHWAYS.
W69-04399 06E

OWNERS OF MARSH AND MEADOW LANDS.
W69-04431 06E

OCEAN CURRENTS
DIFFUSION OF SEWAGE EFFLUENT IN AN OCEAN-CURRENT,
W69-04452 05B

OCEAN WAVES
SEA CLIFF RETREAT NEAR SANTA BARBARA, CALIFORNIA,
W69-04241 02L

OCEANOGRAPHY
OCEANOGRAPHY--THE EMERGING SCIENCE OF THE SEA.
W69-04305 06B

POLITICS AND THE MARINE FISHERIES,
W69-04455 06E

OFFSHORE PLATFORMS
PROBLEMS OF A DRILLING CONTRACTOR,
W69-04275 06C

WORLD OFFSHORE RIG FLEET TO BALLOON AGAIN IN 1968,
W69-04328 06B

OIL FIELDS
WEST COAST OIL FUTURE IS BRIGHT.
W69-04363 06B

OIL INDUSTRY
OCEANOGRAPHY--THE EMERGING SCIENCE OF THE SEA.
W69-04305 06B

OIL SPILL RELIEF SEEN SOON.
W69-04308 05B

POLICING THE OIL INDUSTRY.
W69-04318 05B

WORLD OFFSHORE RIG FLEET TO BALLOON AGAIN IN 1968,
W69-04328 06B

WHAT'S AHEAD IN OIL RECOVERY,
W69-04335 05G

TECHNOLOGY ADDING BILLIONS TO RESERVES.
W69-04348 06B

WEST COAST OIL FUTURE IS BRIGHT.
W69-04363 06B

OIL RESERVOIRS
WHAT'S AHEAD IN OIL RECOVERY,
W69-04335 05G

OIL WASTES
IDENTIFICATION OF PETROLEUM PRODUCTS IN ESTUARINE WATERS,
W69-04282 05A

OIL SPILL RELIEF SEEN SOON.
W69-04308 05B

BLUE V CHARLES P HAYES AND ASSOCIATES, INC (ACTION FOR DAMAGES DUE TO FLOW OF OIL WASTES).
W69-04654 05B

OIL WELLS
PROBLEMS OF A DRILLING CONTRACTOR,
W69-04275 06C

OILY WATER
OIL SPILLAGE STUDY LITERATURE SEARCH AND CRITICAL EVALUATION FOR SELECTION OF PROMISING TECHNIQUES TO CONTROL AND PREVENT DAMAGE.
W69-04309 05G

PROTECTION AND RESTORATION OF BEACHES DURING AND AFTER OIL SPILLS,
W69-04450 05G

OKLAHOMA
CHEROKEE NATION OR TRIBE OF INDIANS IN OKLAHOMA V OKLAHOMA (RIGHT TO RIVERBEDS OF ARKANSAS RIVER).
W69-04651 06E

OPEN CHANNEL FLOW
SOME TURBULENCE MEASUREMENTS IN OPEN-CHANNEL FLOW,
W69-04555 02E

OPERATING COSTS
PROBLEMS OF A DRILLING CONTRACTOR,
W69-04275 06C

FISH PROTEIN CONCENTRATE SEEN POSSIBLE NEW INDUSTRY,
W69-04299 06B

OPERATING COSTS OF WASTE TREATMENT IN GENERAL MOTORS,
W69-04451 05D

DEEDS AND DATA.
W69-04465 05D

WATER IN INDUSTRY A SURVEY OF WATER USE IN INDUSTRY.
W69-04514 05D

OPERATIONS
PORT INFORMATION SOURCES.
W69-04491 08A

OPTIMUM DEVELOPMENT PLANS
A RIVER HARNESSED THE DURANCE, A SOURCE OF POWER AND AGRICULTURAL PLENITUDE,
W69-04594 04A

OREGON
PHENOMENA AFFECTING IMPROVEMENT OF THE LOWER COLUMBIA ESTUARY AND ENTRANCE,
W69-04478 02L

ORGANIC WASTES
PREDICTING THE CONDITION OF A POLLUTED ESTUARY,
W69-04469 05B

ORGANIZATIONS
ORGANIZATION OF SURVEYS AND HYDROLOGICAL RESEARCH IN DEVELOPING COUNTRIES,
W69-04614 06E

ORGANOCHLORINES
EXTRACTION OF ORGANOCHLORINE AND ORGANOPHOSPHATE INSECTICIDES FROM LAKE WATERS,
W69-04523 05A

ORGANOPHOSPHORUS COMPOUNDS
EXTRACTION OF ORGANOCHLORINE AND ORGANOPHOSPHATE INSECTICIDES FROM LAKE WATERS,
W69-04523 05A

OUTLET WORKS
OCEAN OUTFALL DESIGN FOR ECONOMY OF CONSTRUCTION,
W69-04313 05E

OWNERSHIP OF BEDS
STATE OF TEXAS V CHUOKE (OWNERSHIP OF SUBMERGED LANDS).
W69-04383 06E

CHEROKEE NATION OR TRIBE OF INDIANS IN OKLAHOMA V OKLAHOMA (RIGHT TO RIVERBEDS OF ARKANSAS RIVER).
W69-04651 06E

WAGNER V CITY OF BALTIMORE (NAVIGABLE RIVER BEDS).
W69-04679 06E

A K ROY, INC V BOARD OF COMM'RS (EXTENT OF LEVEE DISTRICT APPROPRIATION POWER).
W69-04689 04A

CAMPBELL BROWN CO, INC V ELKINS (RIVERBED OWNERSHIP).
W69-04691 06E

OXIDATION-REDUCTION POTENTIAL
A GEOCHEMICAL CLASSIFICATION OF NATURAL WATERS,
W69-04626 02K

OXYGEN
SOME CONSIDERATIONS OF OXYGEN UTILIZATION RATES IN PUGET SOUND,
W69-04439 05B

OYSTERS
VIRAL POLLUTION OF SHELLFISH IN ESTUARY WATERS,
W69-04296 05C

SOME ASPECTS OF POLLUTION, PARASITISM, AND INLET RESTRICTION IN THREE NEW JERSEY ESTUARIES,
W69-04304 05C

ADVANCES IN THE OFF-BOTTOM CULTURE OF OYSTERS,
W69-04339 06B

ROUGH CULL LAW.
W69-04433 06E

THE CALIFORNIA OYSTER INDUSTRY,
W69-04442 06B

CHESAPEAKE BAY WATER SUPPLY NEEDS - THE BIOLOGICAL POINT OF VIEW,
W69-04464 03C

OZONE
OZONE IN WATER TREATMENT AND WASTEWATER RENOVATION,
W69-04230 05D

PACIFIC COAST REGION
OCEAN OUTFALL DESIGN FOR ECONOMY OF CONSTRUCTION,

W69-04313 05E

LEOHYDROLOGY
GEOLOGY OF GLACIAL LAKE AGASSIZ,
W69-04617 02H

LEOLIMNOLOGY
LIMNOLOGICAL HYPOTHESIS OF THE ORIGIN OF HOT BRINES IN THE RED SEA,
W69-04254 02K

PADOPULOS-COOPER METHOD
PUMPING TESTS ON OPEN WELLS IN PALAR ALLUVIUM, NEAR MADRAS CITY, INDIA, AN APPLICATION OF THE PAPADOPULOS-COOPER METHOD,
W69-04573 02F

RASITISM
SOME ASPECTS OF POLLUTION, PARASITISM, AND INLET RESTRICTION IN THREE NEW JERSEY ESTUARIES,
W69-04304 05C

RKS
PLAN DEVELOPING FOR UNDERWATER PARKS.
W69-04317 06B

CONSTRUCTION OF CONVENTION HALL PIER.
W69-04412 04A

TENTS
WAGNER V CITY OF BALTIMORE (NAVIGABLE RIVER BEDS).
W69-04679 06E

TH OF POLLUTANTS
INFLUENCE OF WATER FLUX AND POROUS MATERIAL ON THE MOVEMENT OF SELECTED HERBICIDES,
W69-04258 05B

DISPERSION AND FLUSHING OF POLLUTANTS IN ESTUARIES,
W69-04559 02L

VING
THE INFLUENCE OF GROUNDWATER FLOW SYSTEMS ON PAVEMENT STABILITY IN HIGHWAY CUTS,
W69-04621 02F

AT
HYDROLOGIC PROPERTIES OF PEAT FROM A WYOMING MOUNTAIN BOG,
W69-04234 02G

ASSOCIATION OF RADIUM AND URANIUM AND PEAT,
W69-04612 02K

NNSYLVANIA
HUEY V KELLER (RIGHTS OF UPPER RIPARIAN OWNER).
W69-04373 04A

BURP V ADAM EIDEMILLER, INC (SUBSURFACE POLLUTION OF WATER SUPPLY).
W69-04681 05G

FRYE V PENNSYLVANIA RAILROAD CO (RAILROAD'S LIABILITY FOR NEGLIGENTLY MAINTAINING CULVERT THROUGH RIGHT-OF-WAY).
W69-04683 06E

DAVIES V SHAFFER (OBSTRUCTION OF DRAINAGE DITCHES).
W69-04684 04A

SMITH V WAGNER (ARTIFICIAL CONCENTRATION OF DRAINAGE ON NEIGHBOR'S LAND).
W69-04685 04A

BEATTY V PLAIL (ARTIFICIAL CHANNEL OF SURFACE WATER WASHED ONTO ADJOINING LAND).
W69-04686 04A

RCOLATING WATER
FINLEY V TEETER STONE INC (ACTION FOR DAMAGES DUE TO PUMPING PERCOLATING WATERS).
W69-04371 04C

JONES V OZ-ARK-VAL POULTRY CO (RIGHT TO THE USE OF SUBTERRANEAN WATERS).
W69-04690 06D

RIODIC OBSERVATIONS
GROUND-WATER CONDITIONS IN UTAH, SPRING OF 1968,
W69-04561 02F

RMEABILITY
THEORY AND MECHANICS OF SUBSURFACE STORMFLOW,
W69-04638 02G

RMITS
DECLARATION AND ABATEMENT OF NUISANCES.
W69-04425 05G

NEEDED--A COASTWISE COMPREHENSIVE PROGRAM FOR DEVELOPMENT OF ESTUARIES,
W69-04499 06B

DEPARTMENT OF HIGHWAYS OF LOUISIANA V UNITED STATES (REVOCATION OF BRIDGE PERMIT).
W69-04670 06E

DEPARTMENT OF WATER AND AIR RESOURCES ORGANIZATION AND POWERS GENERALLY CONTROL OF POLLUTION.
W69-04687 05G

WATER FRONT IMPROVEMENTS.
W69-04692 04A

PESTICIDES
EXTRACTION OF ORGANOCHLORINE AND ORGANOPHOSPHATE INSECTICIDES FROM LAKE WATERS,
W69-04523 05A

PHOSPHORUS
NUTRIENTS,
W69-04448 05C

PHOSPHORUS COMPOUNDS
A DIRECT DEMONSTRATION OF THE PHOSPHORUS CYCLE IN A SMALL LAKE,
W69-04520 02H

EXTRACTION OF ORGANOCHLORINE AND ORGANOPHOSPHATE INSECTICIDES FROM LAKE WATERS,
W69-04523 05A

PHYSICAL PROPERTIES
TEMPERATURE AND WATER-QUALITY CONDITIONS FOR THE PERIOD JULY, 1963, TO DECEMBER, 1965, PATUXENT RIVER ESTUARY, MARYLAND,
W69-04462 05B

PIERS
MARINE SPORTFISHING SURVEY OF SOUTHERN CALIFORNIA PIERS AND JETTIES, 1963,
W69-04316 06B

CONSTRUCTION OF CONVENTION HALL PIER.
W69-04412 04A

PIPE FLOW
JONES V OZ-ARK-VAL POULTRY CO (RIGHT TO THE USE OF SUBTERRANEAN WATERS).
W69-04690 06D

PIPES
GELLIS V TOWN OF HARRISON (INCREASED SURFACE RUNOFF).
W69-04676 04C

PIT RECHARGE
COARSE FILTER MEDIA FOR ARTIFICIAL RECHARGE,
W69-04563 04B

PLANNING
ECONOMIC AND ENGINEERING ASPECTS OF WATER IN DELAWARE'S AGRI BUSINESS INDUSTRY,
W69-04204 03F

A MODEL LAND DEVELOPMENT CODE.
W69-04301 06E

ESTUARINE WATER QUALITY MANAGEMENT IN THE SACRAMENTO-SAN JOAQUIN DELTA,
W69-04331 05G

A CALL FOR ACTION,
W69-04352 06B

CONSERVATION LAW.
W69-04400 05G

PUBLIC WORK NEEDS - MARINE PORT FACILITIES.
W69-04495 06B

METROPOLITAN PLANNING AND RIVER BASIN PLANNING SOME INTERRELATIONSHIPS,
W69-04566 06A

MANAGING WATER QUALITY ECONOMICS, TECHNOLOGY, INSTITUTIONS,
W69-04578 05G

POISONS
THROWING GAS TAR OR REFUSE INTO PUBLIC WATERS AND WILLFULLY POISONING FOOD.
W69-04659 05G

POLITICAL ASPECTS
POLITICS AND THE MARINE FISHERIES,
W69-04455 06E

THE POLITICAL ECONOMY OF EFFICIENCY COST-BENEFIT ANALYSIS, SYSTEMS ANALYSIS, AND PROGRAM BUDGETING,
W69-04519 06B

POLLUTANT IDENTIFICATION
IDENTIFICATION OF PETROLEUM PRODUCTS IN ESTUARINE WATERS,
W69-04282 05A

THE HUDSON RIVER ESTUARY HYDROLOGY, SEDIMENTS AND POLLUTION,
W69-04480 05A

POLLUTANTS
NUTRIENT AND POLLUTANT RESPONSE OF ESTUARINE BIOTAS,
W69-04276 05C

POLLUTION
SEWAGE REMOVAL OR PURIFICATION AND CONDEMNATION OF PROPERTY.
W69-04390 05G

THE DISCHARGE OF SEWAGE AND OTHER MATTER INTO CERTAIN WATERS IS PROHIBITED.
W69-04391 05B

NAVIGABLE WATERS OF THE STATE.
W69-04397 04A

HUNTER V CITY OF SHREVEPORT (BRIDGE CONSTRUCTION).
W69-04667 06E

POLLUTION ABATEMENT
PROTECTING THE POTOMAC AT WASHINGTON,
W69-04437 05G

FLOOD AND POLLUTION CONTROL A DEEP TUNNEL PLAN FOR THE CHICAGOLAND AREA.
W69-04630 04A

PONDS
A COOLING POND PROVES CHEAPER,
W69-04447 05C

POROUS MEDIA
WATER MOVEMENT IN POROUS MATERIALS - III. EVAPORATION OF WATER FROM SOIL,
W69-04242 02G

VISCOUS DRAG AND SECONDARY FLOW IN GRANULAR BEDS,
W69-04243 02F

FREE-SURFACE FLOW THROUGH HETEROGENEOUS POROUS MEDIA,
W69-04552 02F

THE DRYING THROUGH THE TOP SURFACE OF A VERTICAL POROUS COLUMN,
W69-04602 02G

POTHOLES
GENERALIZED HYDROLOGY OF PRAIRIE POTHOLES ON THE COTEAU DU MISSOURI, NORTH DAKOTA,
W69-04597 02H

POWERPLANTS
STATEMENT.
W69-04342 05G

TEMPERATURE AND WATER-QUALITY CONDITIONS FOR THE PERIOD JULY, 1963, TO DECEMBER, 1965, PATUXENT RIVER ESTUARY, MARYLAND,
W69-04462 05B

EFFECTS OF HEATED EFFLUENTS UPON MARINE AND ESTUARINE ORGANISMS,
W69-04486 05C

PRAIRIE POTHOLES
GENERALIZED HYDROLOGY OF PRAIRIE POTHOLES ON THE COTEAU DU MISSOURI, NORTH DAKOTA,
W69-04597 02H

PRECIPITABLE WATER
WORLD DISTRIBUTION OF MEAN MONTHLY AND ANNUAL PRECIPITABLE WATER,
W69-04239 02B

PRECIPITATION
HYDROLOGIC ATLAS OF UTAH,
W69-04209 02A

SURFACE-WATER HYDROLOGY OF CALIFORNIA COASTAL BASINS BETWEEN SAN FRANCISCO BAY AND EEL RIVER,
W69-04273 03B

PRECIPITATION EXCESS
BATTISTO V PERKINS (ACTION FOR DAMAGE FROM INCREASED SURFACE WATER FLOW).
W69-04680 04C

PRECIPITATION(ATMOSPHERIC)
CENTRAL MONTANA RAINSTORMS AND FLOODS, JUNE 6-15, 1967,
W69-04237 02B

MARKOV CHAINS OF ORDER GREATER THAN ONE,
W69-04238 02B

WORLD DISTRIBUTION OF MEAN MONTHLY AND ANNUAL PRECIPITABLE WATER,
W69-04239 02B

PROBABILITY
THE EXTREME VALUES OF PRECIPITATION PHENOMENA,
W69-04567 02B

PROCEDURE
STATE OF TEXAS V CHUOKE (OWNERSHIP OF SUBMERGED LANDS).
W69-04383 06E

PRODUCTION
ON QUESTIONS OF PRODUCTION AND PRODUCTIVITY IN ECOLOGY,
W69-04524 02K

PRODUCTIVITY
MECHANISMS MAINTAINING HIGH PRODUCTIVITY IN GEORGIA ESTUARIES,
W69-04334 02L

ADVANCES IN THE OFF-BOTTOM CULTURE OF OYSTERS,
W69-04339 06B

ON QUESTIONS OF PRODUCTION AND PRODUCTIVITY IN ECOLOGY,
W69-04524 02K

PROJECT BENEFITS
BENEFIT-COST ANALYSIS FOR WATER RESOURCES PROJECTS A SELECTED ANNOTATED BIBLIOGRAPHY.
W69-04629 06B

PROJECT FEASIBILITY
CONSERVATION OF THE NATURAL RESOURCES OF NEW ENGLAND, THE PASSAMAQUODDY TIDAL POWER PROJECT AND UPPER SAINT JOHN RIVER HYDROELECTRIC DEVELOPMENT.
W69-04459 08C

PROJECT PLANNING
CHICAGO TUNNEL DRAINAGE PROJECT PRELIMINARY EVALUATION OF FEASIBILITY.
W69-04631 04A

WATER RESOURCES DEVELOPMENT BY THE U S ARMY CORPS OF ENGINEERS IN FLORIDA.
W69-04643 04A

PROJECTS
FLOOD CONTROL PROJECTS - LAND ACQUISITION, MAINTENANCE AND OPERATION.
W69-04403 04A

PROTEINS
FISH PROTEIN CONCENTRATE SEEN POSSIBLE NEW INDUSTRY,
W69-04299 06B

PUBLIC BENEFITS
GENERAL POWERS OF THE BOARD OF TRUSTEES.
W69-04393 04A

BENEFIT-COST ANALYSIS ITS RELEVANCE TO PUBLIC INVESTMENT DECISIONS,
W69-04479 06B

DECLARATION OF POLICY.
W69-04694 06E

PUBLIC HEALTH
COLIFORM-FECAL COLIFORM BACTERIA IN TIDAL WATERS,
W69-04344 05G

SHIRLEY V NEW HAMPSHIRE WATER POLLUTION COMMISSION (VALIDITY OF ORDER TO DESIST SEWAGE DEPOSIT INTO RIVER).
W69-04366 05B

PUBLIC HEALTH LAW (CLASSIFICATION OF WATERS AND PREVENTION OF POLLUTION).
W69-04392 05G

SANITARY QUALITY OF WATER IN SWIMMING POOLS AND AT BATHING BEACHES.
W69-04396 05G

LAND BORDERING ON AND ADJACENT TO OCEAN MAY BE ACQUIRED FOR PLACES OF PUBLIC RESORT. REFERENDUM OF QUESTION OF ADOPTION OF ACT.
W69-04410 06E

ACQUISITION OF LANDS BORDERING AND ADJACENT TO THE OCEAN.
W69-04411 06E

MOSQUITO EXTERMINATION.
W69-04421 06E

NUISANCES AFFECTING HEALTH.
W69-04424 05G

DECLARATION AND ABATEMENT OF NUISANCES.
W69-04425 05G

LOCAL BOARDS OF HEALTH - GENERAL POWERS AND DUTIES.
W69-04428 05G

PUBLIC NUISANCE DEFINED.
W69-04660 06E

PUBLIC LANDINGS
WATER FRONT IMPROVEMENTS.
W69-04692 04A

PUBLIC POLICY
DECLARATION OF POLICY.
W69-04694 06E

PUBLIC RESORT
CONSTRUCTION OF CONVENTION HALL PIER.
W69-04412 04A

PUBLIC UTILITIES
PUBLIC UTILITIES - CONSTRUCTION AND OPERATION OF DAMS.
W69-04406 04A

MALONE V CUSTOM MANOR (PRIVATE WATER LINES).
W69-04675 06E

TOWN OF GREENWICH V GREENWICH WATER CO (PUBLIC UTILITY RIVER DIVERSION).
W69-04688 06D

PUBLIC WORKS
BOARD OF PUBLIC WORKS.
W69-04413 06E

PUBLICATIONS
FLOOD INFORMATION FOR FLOOD-PLAIN PLANNING,
W69-04616 02E

PULP AND PAPER INDUSTRY
POLLUTIONAL EFFECTS OF PULP AND PAPER MILL WASTES IN PUGET SOUND.
W69-04319 05G

STATEMENT,
W69-04354 05G

MP TESTING
TRANSMISSIBILITY DETERMINATION FROM VARIABLE DISCHARGE PUMPING TESTS,
W69-04622 02F

MPING
DESIGNING PUMPED WELL CHARACTERISTICS INTO ELECTRIC ANALOG MODELS,
W69-04623 06B

ALITY CONTROL
WATER QUALITY CRITERIA--STREAM VERSUS EFFLUENT STANDARDS.
W69-04516 05G

DIOACTIVE DATING
GEOLOGY OF GLACIAL LAKE AGASSIZ,
W69-04617 02H

DIOACTIVE WASTE DISPOSAL
TREATMENT AND DISPOSAL OF RADIOACTIVE WASTES,
W69-04229 05E

POLLUTION OF THE INTERSTATE WATERS OF THE COLORADO RIVER AND ITS TRIBUTARIES....
W69-04272 05E

DIOACTIVITY
THE HUDSON RIVER ESTUARY HYDROLOGY, SEDIMENTS AND POLLUTION,
W69-04480 05A

DIOACTIVITY EFFECTS
THE HUDSON RIVER ESTUARY HYDROLOGY, SEDIMENTS AND POLLUTION,
W69-04480 05A

DIUM RADIOISOTOPES
ASSOCIATION OF RADIUM AND URANIUM AND PEAT,
W69-04612 02K

INFALL DISPOSITION
THE EXTREME VALUES OF PRECIPITATION PHENOMENA,
W69-04567 02B

INFALL-RUNOFF RELATIONSHIPS
GENERALIZED RAINFALL-DURATION-FREQUENCY RELATIONSHIPS,
W69-04549 02A

THE GENERATION OF SPRING PEAK FLOWS BY SHORT-TERM METEOROLOGICAL EVENTS,
W69-04570 02E

EFFECT OF A COMMERCIAL CLEARCUTTING IN WEST VIRGINIA ON OVERLAND FLOW AND STORM RUNOFF,
W69-04632 04C

WATERSHED CALIBRATION METHODS,
W69-04634 03B

EFFECTS OF ABANDONED FARMLAND ON STREAMFLOW,
W69-04635 03B

EFFECT ON STREAMFLOW OF FOUR FOREST PRACTICES IN THE MOUNTAINS OF WEST VIRGINIA,
W69-04636 03B

ERATION
EFFECT OF WATER TEMPERATURE ON STREAM REAERATION,
W69-04468 05G

THE AERATION CAPACITY OF STREAMS,
W69-04628 02E

ASONABLE USE
POIRE V SERRA (INJUNCTION PROHIBITING THE FILLING IN OF A RIVER).
W69-04376 06E

CAPITAL V PORT WASHINGTON YACHT CLUB (ACTION FOR LATERAL SUPPORT OF LAND, WITH ADDITIONAL CLAIMS FOR SURFACE WATER DAMAGE).
W69-04672 06E

BOROUGH OF WESTVILLE V WHITNEY HOME BUILDERS (SEWAGE EFFLUENTS FLOWING INTO CITY RECREATION AREA LAKE).
W69-04677 05G

JONES V OZ-ARK-VAL POULTRY CO (RIGHT TO THE USE OF SUBTERRANEAN WATERS).
W69-04690 06D

EQUITABLE GAS CO V ROCCA (RIGHTS OF LANDOWNER TO CONSTRUCT A RESERVOIR OVER AN EASEMENT ON THAT LAND).
W69-04700 06E

CLAMATION
1967 PROCEEDINGS OF WODCON.
W69-04321 04A

CREATION
STATEMENT,
W69-04303 06B

LAND BORDERING ON AND ADJACENT TO OCEAN MAY BE ACQUIRED FOR PLACES OF PUBLIC RESORT. REFERENDUM OF QUESTION OF ADOPTION OF ACT.
W69-04410 06E

ACQUISITION OF LANDS BORDERING AND ADJACENT TO THE OCEAN.
W69-04411 06E

RECREATION,
W69-04458 06B

POLLUTION OF THE HUDSON RIVER AND ITS TRIBUTARIES.
W69-04490 05G

BENEATH THE SURFACE,
W69-04497 06B

RECREATION BENEFITS FROM WATER POLLUTION CONTROL,
W69-04504 05G

TOURISM AND RECREATION.
W69-04510 06B

RECREATION DEMAND
RECENT DEVELOPMENTS IN EVALUATING RECREATIONAL BENEFITS,
W69-04453 06B

COMPARISONS OF METHODS FOR RECREATION EVALUATION,
W69-04474 06B

ON THE USES AND ABUSES OF ECONOMIC SCIENCE IN EVALUATING PUBLIC OUTDOOR RECREATION,
W69-04500 06B

RECREATION FACILITIES
PROBLEMS OF CONSERVATION IN THE ATLANTIC ESTUARINE ZONE,
W69-04355 06B

RECENT DEVELOPMENTS IN EVALUATING RECREATIONAL BENEFITS,
W69-04453 06B

RECREATION WASTES
STATEMENT,
W69-04303 06B

RECREATIONAL FACILITIES
CONSTRUCTION OF CONVENTION HALL PIER.
W69-04412 04A

REGIONAL ANALYSIS
SUMMARY ECONOMIC BASE STUDY CHESAPEAKE BAY DRAINAGE BASINS.
W69-04346 06B

REGIONAL LIMNOLOGY
THE THERMAL CLASSIFICATION OF LAKES,
W69-04522 02H

REGULATION
PUBLIC SWIMMING POOLS AND PLACES.
W69-04422 06E

RELATIVE RIGHTS
WATER RIGHTS AND REGULATION IN THE EASTERN UNITED STATES,
W69-04649 06E

REMOTE SENSING
INFRARED IMAGING FOR WATER RESOURCES STUDIES,
W69-04556 07B

REPULSION(LEGAL ASPECTS)
HOPLER V MORRIS HILLS REGIONAL DISTRICT (LIABILITY FOR DISCHARGING SURFACE WATERS).
W69-04429 04A

RESEARCH AND DEVELOPMENT
THE ROLE OF RESEARCH IN THE PRESERVATION OF ESTUARIES,
W69-04347 04A

WATER RESOURCES RESEARCH CATALOG.
W69-04360 09D

RESERVOIR CONSTRUCTION
EQUITABLE GAS CO V ROCCA (RIGHTS OF LANDOWNER TO CONSTRUCT A RESERVOIR OVER AN EASEMENT ON THAT LAND).
W69-04700 06E

RESERVOIR OPERATION
KEY SALES CO V SOUTH CAROLINA ELECTRIC AND GAS CO (DAM OPERATOR'S DUTY OF CARE IN REGARD TO FLOODING OF DOWNSTREAM PROPERTY).
W69-04665 04A

RESERVOIR STORAGE
ALLOCATION AND REALLOCATION OF WATER RESOURCES,
W69-04647 05G

RESERVOIRS
STORAGE REQUIREMENTS FOR ARKANSAS STREAMS,
W69-04250 02E

RESISTIVITY
RESISTIVITY INVESTIGATIONS OF LIMESTONE AQUIFERS IN JAMAICA,
W69-04600 02F

RESORTS
LAND BORDERING ON AND ADJACENT TO OCEAN MAY BE ACQUIRED FOR PLACES OF PUBLIC RESORT. REFERENDUM OF QUESTION OF ADOPTION OF ACT.
W69-04410 06E

ACQUISITION OF LANDS BORDERING AND ADJACENT TO THE OCEAN.
W69-04411 06E

RESOURCE ALLOCATION
'NATURAL RESOURCES AND THE QUALITY OF LIFE',
W69-04440 06B

REVENUE BONDS

WATER FRONT IMPROVEMENTS.
W69-04692 04A

REVIEWS
NEW HORIZONS IN THE FIELD OF TIDAL HYDRAULICS,
W69-04579 02L

RHONE
ONE EXAMPLE OF MULTIPURPOSE DEVELOPMENT PROGRAM THE RHONE,
W69-04592 04A

RIDDANCE(LEGAL ASPECTS)
HOPLER V MORRIS HILLS REGIONAL DISTRICT (LIABILITY FOR DISCHARGING SURFACE WATERS).
W69-04429 04A

RIGHT-OF-WAY
SEABOARD AIR LINE RAILROAD CO V SARASOTA-FRUITVILLE DRAINAGE DISTRICT (DRAINAGE WATER DAMAGES).
W69-04682 04A

EQUITABLE GAS CO V ROCCA (RIGHTS OF LANDOWNER TO CONSTRUCT A RESERVOIR OVER AN EASEMENT ON THAT LAND).
W69-04700 06E

RIPARIAN RIGHTS
PAXSON V COLLINS (TITLE TO ACCRETION AND RELICTION).
W69-04368 06E

HUEY V KELLER (RIGHTS OF UPPER RIPARIAN OWNER).
W69-04373 04A

POIRE V SERRA (INJUNCTION PROHIBITING THE FILLING IN OF A RIVER).
W69-04376 06E

YOUNG V CITY OF ASHEVILLE (RIPARIAN RIGHTS).
W69-04378 06E

CLARK V LINDSAY LIGHT AND CHEMICAL COMPANY (INJUNCTION FOR POLLUTION ABATEMENT).
W69-04382 05G

WATER RIGHTS AND REGULATION IN THE EASTERN UNITED STATES,
W69-04649 06E

KEY SALES CO V SOUTH CAROLINA ELECTRIC AND GAS CO (DAM OPERATOR'S DUTY OF CARE IN REGARD TO FLOODING OF DOWNSTREAM PROPERTY).
W69-04665 04A

BOROUGH OF WESTVILLE V WHITNEY HOME BUILDERS (SEWAGE EFFLUENTS FLOWING INTO CITY RECREATION AREA LAKE).
W69-04677 05G

RIVER BASIN COMMISSIONS
ORGANIZATION ARRANGEMENT FOR DEVELOPMENT AND OPERATION OF THE MISSOURI RIVER BASIN PROJECTS,
W69-04645 06E

RIVER BASIN DEVELOPMENT
METROPOLITAN PLANNING AND RIVER BASIN PLANNING SOME INTERRELATIONSHIPS,
W69-04566 06A

ONE EXAMPLE OF MULTIPURPOSE DEVELOPMENT PROGRAM THE RHONE,
W69-04592 04A

A RIVER HARNESSED THE DURANCE, A SOURCE OF POWER AND AGRICULTURAL PLENITUDE,
W69-04594 04A

LOA RIVER BASIN WATER RESOURCES AND THEIR DISTRIBUTION,
W69-04613 04A

ORGANIZATION ARRANGEMENT FOR DEVELOPMENT AND OPERATION OF THE MISSOURI RIVER BASIN PROJECTS,
W69-04645 06E

RIVER BASINS
WATER QUALITY AND POLLUTION CONTROL STUDY - JAMES RIVER BASIN.
W69-04359 05G

RIVER BEDS
CHEROKEE NATION OR TRIBE OF INDIANS IN OKLAHOMA V OKLAHOMA (RIGHT TO RIVERBEDS OF ARKANSAS RIVER).
W69-04651 06E

RIVER FLOW
CHESAPEAKE BAY WATER SUPPLY NEEDS - THE BIOLOGICAL POINT OF VIEW,
W69-04464 03C

A PRELIMINARY ESTIMATE OF THE EFFECT OF DIVERSION OF FLOW FROM THE SUSQUEHANNA RIVER ON THE SALINITY OF THE UPPER CHESAPEAKE BAY,
W69-04493 02L

DISCHARGE IN THE LOWER COLUMBIA RIVER BASIN, 1928-65,
W69-04577 02E

RIVER METAMORPHOSIS
RIVER METAMORPHOSIS,
W69-04583 02E

RIVER REGULATION
TIDEWATER NAVIGATION.
W69-04398 04A

RIVER IMPROVEMENT.
W69-04401 04A

RIVER SYSTEMS
TOPOLOGICAL SIGNIFICANCE OF STREAM METHODS,
W69-04571 02E

RIVERS
INTERNAL IMPROVEMENT FUND OF STATE OF FLORIDA V MOWAK (USE OF MEANDER LINES IN SETTING BOUNDARIES OF RIPARIAN PROPERTY).
W69-04374 06E

TEMPERATURE AND WATER-QUALITY CONDITIONS FOR THE PERIOD JULY, 1963, TO DECEMBER, 1965, PATUXENT RIVER ESTUARY, MARYLAND,
W69-04462 05B

TIME OF TRAVEL OF WATER IN THE GREAT MIAMI RIVER, DAYTON TO CLEVES, OHIO,
W69-04598 02E

RIVER-BASIN DEVELOPMENT
USE OF MULTI-PURPOSE STORAGE DAMS IN THE DEVELOPMENT OF THE SEINE BASIN,
W69-04596 04A

ROAD CONSTRUCTION
THE INFLUENCE OF GROUNDWATER FLOW SYSTEMS ON PAVEMENT STABILITY IN HIGHWAY CUTS,
W69-04621 02F

ROADS
STORMWATER SEWERS FOR COUNTY ROADS MUNICIPAL COOPERATION.
W69-04418 04C

ROUTING
A DISSIPATIVE RIVER FLOW MODEL,
W69-04232 02A

RUNOFF
HYDROLOGIC ATLAS OF UTAH,
W69-04209 02A

GLACIERS AND WATER SUPPLY,
W69-04255 02C

SURFACE-WATER HYDROLOGY OF CALIFORNIA COASTAL BASINS BETWEE SAN FRANCISCO BAY AND EEL RIVER,
W69-04273 03B

NITRIFICATION IMPORTANCE TO NUTRIENT LOSSES FROM A CUTOVE FORESTED ECOSYSTEM,
W69-04584 02K

SAFETY
PUBLIC SWIMMING POOLS AND PLACES.
W69-04422 06E

PUBLIC NUISANCE DEFINED.
W69-04660 06E

SALINE WATER
SALINE GROUND WATER IN LOUISIANA,
W69-04608 02F

SALINE WATER INTRUSION
DELAWARE RIVER MODEL STUDY REPORT NO. 2 - SALINITY TESTS OF EXISTING CHANNEL.
W69-04466 02L

SALINITY INTRUSION EFFECTS IN ESTUARY SHOALING,
W69-04558 02L

SALINE WATER RESOURCES
SALINE GROUND WATER IN LOUISIANA,
W69-04608 02F

SALINE WATER-FRESHWATER INTERFACES
A NOTE ON THE GHYBEN-HERZBERG FORMULA,
W69-04569 02F

SALINITY
CHESAPEAKE BAY WATER SUPPLY NEEDS - THE BIOLOGICAL POINT OF VIEW,
W69-04464 03C

A PRELIMINARY ESTIMATE OF THE EFFECT OF DIVERSION OF FLOW FROM THE SUSQUEHANNA RIVER ON THE SALINITY OF THE UPPER CHESAPEAKE BAY,
W69-04493 02L

SAMPLING
1967 PROCEEDINGS OF WODCON.
W69-04321 04A

SAN FRANCISCO BAY
SURFACE-WATER HYDROLOGY OF CALIFORNIA COASTAL BASINS BETWEE SAN FRANCISCO BAY AND EEL RIVER,
W69-04273 03B

SANDS
TESTIMONY - NATIONAL SAND AND GRAVEL ASSOCIATION,
W69-04340 04A

SANITARY ENGINEERING
STATE SANITARY CODE.
W69-04395 05G

SATURATION
WATER MOVEMENT IN POROUS MATERIALS - III. EVAPORATION OF WATER FROM SOIL,

W69-04242 02G

CENERY
THE BUFFALO SCENIC RIVERWAY.
W69-04201 06B

EA LEVEL
LOW-FREQUENCY SEA LEVEL BEHAVIOR AND CONTINENTAL SHELF WAVES OFF NORTH CAROLINA,
W69-04224 02A

LIMNOLOGICAL HYPOTHESIS OF THE ORIGIN OF HOT BRINES IN THE RED SEA,
W69-04254 02K

EA WATER
LIMNOLOGICAL HYPOTHESIS OF THE ORIGIN OF HOT BRINES IN THE RED SEA,
W69-04254 02K

ECONDARY RECOVERY(OIL)
WHAT'S AHEAD IN OIL RECOVERY,
W69-04335 05G

EDIMENT DISCHARGE
DEFINITIVE COMPUTATIONS OF SAND DISCHARGE IN RIVERS,
W69-04554 02J

EDIMENT TRANSPORT
SEDIMENT TRANSPORT IN ESTUARINE AREAS,
W69-04240 02L

EDIMENT YIELD
MAN, VEGETATION AND THE SEDIMENT YIELDS OF RIVERS,
W69-04269 02E

EDIMENTARY ENVIRONMENT
SULFUR METABOLISM AND SEDIMENTARY ENVIRONMENT LAKE MENDOTA, WISCONSIN,
W69-04526 05C

EDIMENTATION
SEDIMENT TRANSPORT IN ESTUARINE AREAS,
W69-04240 02L

CHANNEL SEDIMENTATION AND DREDGING PROBLEMS, MISSISSIPPI RIVER AND LOUISIANA GULF COAST ACCESS CHANNELS,
W69-04501 04D

SULFUR METABOLISM AND SEDIMENTARY ENVIRONMENT LAKE MENDOTA, WISCONSIN,
W69-04526 05C

DEFINITIVE COMPUTATIONS OF SAND DISCHARGE IN RIVERS,
W69-04554 02J

RIVER METAMORPHOSIS,
W69-04583 02E

DIMENTS
1967 PROCEEDINGS OF WODCON.
W69-04321 04A

THE HUDSON RIVER ESTUARY HYDROLOGY, SEDIMENTS AND POLLUTION,
W69-04480 05A

LINDANE ADSORPTION BY LAKE SEDIMENTS,
W69-04525 05G

ISMIC STUDIES
SEISMIC EXPLORATION AT SEA,
W69-04294 07B

REFRACTION DETERMINATION OF WATER TABLE DEPTH AND ALLUVIUM THICKNESS,
W69-04607 02E

TBACK LINES
COUNTY ZONING.
W69-04386 06E

WAGE
RESPONSE TO POLLUTION OF NEW YORK HARBOR AND THAMES ESTUARY,
W69-04351 05B

PUBLIC HEALTH LAW (CLASSIFICATION OF WATERS AND PREVENTION OF POLLUTION).
W69-04392 05G

COUNTY SEWERAGE AUTHORITIES.
W69-04415 05G

THE EFFECT OF POLLUTION BY SEWAGE UPON THE WATERS OF THE OSLO-FJORD,
W69-04445 05C

DEPARTMENT OF HEALTH V PASSAIC VALLEY SEWERAGE COMMISSION (DEPARTMENT OF HEALTH'S AUTHORITY OF DISCHARGE OF SEWERAGE).
W69-04664 05G

WAGE DISPOSAL
OCEAN OUTFALL DESIGN FOR ECONOMY OF CONSTRUCTION,
W69-04313 05E

DIFFUSION OF SEWAGE EFFLUENT IN AN OCEAN-CURRENT,
W69-04452 05B

1965 SURVEY ON DISPOSAL OF SEWAGE AND INDUSTRIAL WASTES BY FEDERAL INSTALLATIONS.
W69-04507 05D

BOROUGH OF WESTVILLE V WHITNEY HOME BUILDERS (SEWAGE EFFLUENTS FLOWING INTO CITY RECREATION AREA LAKE).
W69-04677 05G

SEWAGE DISTRICTS
COUNTY SEWERAGE AUTHORITIES.
W69-04415 05G

SEWAGE EFFLUENTS
THE MARINE ENVIRONMENT IN THE VICINITY OF THE ORANGE COUNTY SANITATION DISTRICTS OCEAN OUTFALL,
W69-04511 05C

SEWAGE SYSTEMS
BOARD OF PUBLIC WORKS.
W69-04413 06E

SEWAGE TREATMENT
STATEMENT,
W69-04306 05D

DEEDS AND DATA.
W69-04465 05D

SEWERS
PROTECTING THE POTOMAC AT WASHINGTON,
W69-04437 05G

WATER POLLUTION CONTROL FACTS.
W69-04515 05G

SHELLFISH
VIRAL POLLUTION OF SHELLFISH IN ESTUARY WATERS,
W69-04296 05C

COLIFORM-FECAL COLIFORM BACTERIA IN TIDAL WATERS,
W69-04344 05G

OWNERS OF MARSH AND MEADOW LANDS.
W69-04431 06E

GENERAL POWERS AND DUTIES.
W69-04434 06E

GENERAL WATER QUALITY CRITERIA AND SPECIFIC WATER QUALITY STANDARDS.
W69-04470 05G

SHIPS
MARITIME AGENCY STATUS, CHANNEL PROBLEMS CREATED BY HUGE SHIPS CONCERNS OF AAPA.
W69-04287 04A

REMARKS BY BRIGADIER GENERAL JOHN A. B. DILLARD, DIVISION ENGINEER, SOUTH PACIFIC.
W69-04324 04A

RULES ON VESSEL POLLUTION PROPOSED BY SENATOR MUSKIE.
W69-04332 05G

SEAFARING EMPLOYMENT.
W69-04336 06B

WASTE FROM WATERCRAFT.
W69-04357 05G

THE CONTRIBUTION OF THE AMERICAN MERCHANT MARINE TO THE U. S. BALANCE OF PAYMENTS.
W69-04460 06C

POLLUTION OF THE HUDSON RIVER AND ITS TRIBUTARIES.
W69-04490 05G

SHORES
THE PRINCIPLES OF WATERFRONT RENEWAL A SUMMARY OF EXPERIENCE IN FIFTY AMERICAN CITIES,
W69-04476 06B

SHRIMP
NATURAL AND ALTERED ESTUARINE HABITATS OF PENAEID SHRIMP,
W69-04484 02L

SILICA
SILICA IN ALKALINE BRINES,
W69-04270 02K

SILICA IN STREAMS AND GROUND WATER OF HAWAII,
W69-04528 02G

SILTING
OPTIMUM DREDGING AND DISPOSAL PRACTICES IN ESTUARIES,
W69-04581 02L

SIMULATION ANALYSIS
DIGITAL SIMULATION OF NATURAL ANIMAL COMMUNITIES,
W69-04312 06G

SINKS
FINLEY V TEETER STONE INC (ACTION FOR DAMAGES DUE TO PUMPING PERCOLATING WATERS).
W69-04371 04C

SITES
WATERSIDE SITE PLANT LOCATIONS AND EXPANSIONS 1966.
W69-04361 04A

SIZE
RELATIONS BETWEEN SPORT AND COMMERCIAL FISHERMEN,
W69-04302 06B

SLUDGE
ORGANIC CARBON-ORGANIC NITROGEN RATIOS OF SEDIMENTS IN A POLLUTED ESTUARY,
W69-04248 05C

SLUSH PITS
BLUE V CHARLES F HAYES AND ASSOCIATES, INC (ACTION FOR DAMAGES DUE TO FLOW OF OIL WASTES).
W69-04654 05B

SNOW MANAGEMENT
OBSERVATIONS OF SNOWPACK ACCUMULATION, MELT, AND RUNOFF ON A SMALL ARIZONA WATERSHED,
W69-04253 02C

SNOWMELT
THE GENERATION OF SPRING PEAK FLOWS BY SHORT-TERM METEOROLOGICAL EVENTS,
W69-04570 02E

SNOWPACKS
A SHIELDED THERMISTOR PROBE WITH PORTABLE INSTRUMENT FOR MEASURING SNOWPACK TEMPERATURES,
W69-04252 07B

OBSERVATIONS OF SNOWPACK ACCUMULATION, MELT, AND RUNOFF ON A SMALL ARIZONA WATERSHED,
W69-04253 02C

SOCIAL VALUES
'NATURAL RESOURCES AND THE QUALITY OF LIFE',
W69-04440 06B

WATER QUALITY, A PROBLEM FOR THE ECONOMIST,
W69-04457 05G

SOIL ANALYSIS
A TECHNIQUE FOR OBTAINING UNDISTURBED SOIL SAMPLES BY FREEZING IN-SITU,
W69-04639 02G

SOIL AND WATER CONSERVATION DISTRICTS
SOIL AND WATER CONSERVATION DISTRICTS.
W69-04381 06E

SOIL CHEMISTRY
GEOCHEMISTRY OF EPIGENESIS,
W69-04274 02K

SOIL CONSERVATION
SOIL AND WATER CONSERVATION DISTRICTS.
W69-04381 06E

SOIL INVESTIGATIONS
A TECHNIQUE FOR OBTAINING UNDISTURBED SOIL SAMPLES BY FREEZING IN-SITU,
W69-04639 02G

SOIL LEACHING
SILICA IN STREAMS AND GROUND WATER OF HAWAII,
W69-04528 02G

SOIL MOISTURE
MOISTURE-TENSION DATA FOR SELECTED SOILS ON EXPERIMENTAL WATERSHEDS,
W69-04266 02G

SOIL PHYSICAL PROPERTIES
THEORY AND MECHANICS OF SUBSURFACE STORMFLOW,
W69-04638 02G

A TECHNIQUE FOR OBTAINING UNDISTURBED SOIL SAMPLES BY FREEZING IN-SITU,
W69-04639 02G

SOIL STRUCTURE
INFLUENCE OF SOIL STRUCTURE ON WATER RELATIONS IN LOW HUMIDIC LATOSOLS 1. WATER RETENTION,
W69-04588 02G

INFLUENCE OF SOIL STRUCTURE ON WATER RELATIONS IN LOW HUMIC LATOSOLS 2. WATER MOVEMENT,
W69-04589 02G

A TECHNIQUE FOR OBTAINING UNDISTURBED SOIL SAMPLES BY FREEZING IN-SITU,
W69-04639 02G

SOIL TEXTURE
A TECHNIQUE FOR OBTAINING UNDISTURBED SOIL SAMPLES BY FREEZING IN-SITU,
W69-04639 02G

SOIL WATER
INFLUENCE OF SOIL STRUCTURE ON WATER RELATIONS IN LOW HUMIDIC LATOSOLS 1. WATER RETENTION,
W69-04588 02G

SOIL WATER MOVEMENT
WATER MOVEMENT IN POROUS MATERIALS - III. EVAPORATION OF WATER FROM SOIL,
W69-04242 02G

INFLUENCE OF WATER FLUX AND POROUS MATERIAL ON THE MOVEMENT OF SELECTED HERBICIDES,
W69-04258 05B

INFLUENCE OF SOIL STRUCTURE ON WATER RELATIONS IN LOW HUMIC LATOSOLS 2. WATER MOVEMENT,
W69-04589 02G

SOIL-WATER DIFFUSIVITY VALUES BASED UPON TIME DEPENDENT SOIL WATER CONTENT DISTRIBUTIONS,
W69-04603 02G

SOIL-WATER-PLANT RELATIONS
WATER INTAKE ON MIDCONTINENTAL RANGELANDS AS INFLUENCED BY SOIL AND PLANT COVER,
W69-04640 02G

SOLUBILITY
ALUMINUM IONS IN AQUEOUS SOLUTIONS,
W69-04575 02K

IDENTIFICATION AND SOLUBILITY OF IRON SULFIDE IN ANAEROBIC LAKE SEDIMENT,
W69-04590 02K

SOUTH CAROLINA
RIDDLE V CITY OF GREENVILLE (RIGHT TO COLLECT DAMAGES FROM POLLUTION OF STREAMS).
W69-04372 05B

SPATIAL DISTRIBUTION
VARIATIONS OF EVAPORATION IN TIME AND SPACE PART 1 AND PART 2,
W69-04618 02D

SPECTROPHOTOMETRY
IDENTIFICATION OF PETROLEUM PRODUCTS IN ESTUARINE WATERS,
W69-04282 05A

SPORT FISHING
IMPORTANCE OF GULF ESTUARIES AND PROBLEMS FACING OUR FISHERY RESOURCES,
W69-04300 06B

RELATIONS BETWEEN SPORT AND COMMERCIAL FISHERMEN,
W69-04302 06B

STATEMENT,
W69-04303 06B

MARINE SPORTFISHING SURVEY OF SOUTHERN CALIFORNIA PIERS AND JETTIES, 1963,
W69-04316 06B

PAST, PRESENT AND FUTURE OF SPORT FISHING IN TEXAS WATERS,
W69-04362 06B

MANAGEMENT OF ESTUARINE FISHERIES,
W69-04481 06B

RECREATION BENEFITS FROM WATER POLLUTION CONTROL,
W69-04504 05G

SPRINGS
RANDALL V CLIFFORD (POLLUTION AND DESTRUCTION OF WATER SUPPLY).
W69-04678 05G

STABILITY
THE INFLUENCE OF GROUNDWATER FLOW SYSTEMS ON PAVEMENT STABILITY IN HIGHWAY CUTS,
W69-04621 02F

STANDARDS
A REVIEW OF CHEMICAL MEASUREMENTS IN WATER POLLUTION CONTROL,
W69-04222 05A

WATER QUALITY, A PROBLEM FOR THE ECONOMIST,
W69-04457 05G

GENERAL WATER QUALITY CRITERIA AND SPECIFIC WATER QUALITY STANDARDS.
W69-04470 05G

WATER QUALITY CRITERIA--STREAM VERSUS EFFLUENT STANDARDS.
W69-04516 05G

DEPARTMENT OF WATER AND AIR RESOURCES ORGANIZATION AND POWERS GENERALLY CONTROL OF POLLUTION.
W69-04687 05G

STATE JURISDICTION
A PERSPECTIVE OF REGIONAL AND STATE MARINE ENVIRONMENTAL ACTIVITIES, A QUESTIONNAIRE SURVEY, STATISTICS AND OBSERVATIONS,
W69-04289 06E

STATISTICAL METHODS
A PROBABILISTIC ANALYSIS OF DISSOLVED OXYGEN-BIOCHEMICAL OXYGEN DEMAND RELATIONSHIP IN STREAMS,
W69-04247 05C

PEAK FLOOD DISCHARGE CONFIDENCE LIMITS,
W69-04582 02E

STATISTICS
STATE AND LOCAL GOVERNMENT ACTIVITIES AND ROLES IN MARINE SCIENCE, ENGINEERING AND DEVELOPMENT. A BRIEFLY ANNOTATED CATALOG OF PUBLISHED STUDIES AND REPORTS ON SUCH ORGANIZATIONAL ARRANGEMENTS AND ACTIVITIES IN THE COASTAL STATES AND IN THOSE BORDERING ON THE GREAT LAKES.
W69-04341 06E

WATERSIDE SITE PLANT LOCATIONS AND EXPANSIONS 1966.
W69-04361 04A

BENEATH THE SURFACE,
W69-04497 06B

WATER POLLUTION CONTROL FACTS.
W69-04515 05G

STATUTES
SOIL AND WATER CONSERVATION DISTRICTS.
W69-04381 06E

STEAM TURBINES
STEAM-ELECTRIC PLANT CONSTRUCTION COST AND ANNUAL PRODUCTION EXPENSES--1965.
W69-04503 08B

STOCHASTIC PROCESSES
THE EXTREME VALUES OF PRECIPITATION PHENOMENA,
W69-04567 02B

STORAGE
STORAGE REQUIREMENTS FOR ARKANSAS STREAMS,
W69-04250 02E

STORM DRAINS
STORM DRAINAGE PRACTICES OF THIRTY-TWO CITIES,
W69-04551 02E

STREAM CHANNELS
TRANSIENT FLOW INVESTIGATIONS FOR TVA'S BROWNS FERRY GENERATING STATION.
W69-04203 02E

STREAM TURBINES
THERMAL POLLUTION OF WATER.
W69-04349 05C

STREAMFLOW
STORAGE REQUIREMENTS FOR ARKANSAS STREAMS,
W69-04250 02E

WATER RESOURCES DATA FOR IOWA, 1968--PART 1. SURFACE WATER RECORDS, PART 2. WATER QUALITY RECORDS.
W69-04565 02E

A MODERN STATISTICAL STUDY OF MONTHLY LEVELS OF THE ORINOCO RIVER,
W69-04568 02E

DISCHARGE IN THE LOWER COLUMBIA RIVER BASIN, 1928-65,
W69-04577 02E

COMPILATION OF HYDROLOGIC DATA, WALLER AND WILBARGER CREEKS, COLORADO RIVER BASIN, TEXAS-1966.
W69-04599 02E

STREAMFLOW ESTIMATION
DISCHARGE IN THE LOWER COLUMBIA RIVER BASIN, 1928-65,
W69-04577 02E

STREAMFLOW FORECASTING
DISCHARGE IN THE LOWER COLUMBIA RIVER BASIN, 1928-65,
W69-04577 02E

STREAMS
WATER QUALITY CRITERIA--STREAM VERSUS EFFLUENT STANDARDS.
W69-04516 05G

STRYE V PENNSYLVANIA RAILROAD CO (RAILROAD'S LIABILITY FOR NEGLIGENTLY MAINTAINING CULVERT THROUGH RIGHT-OF-WAY).
W69-04683 06E

SUBMERGED ISLANDS
ANNEXATION OF SUBMERGED LANDS.
W69-04387 06E

SUBMERGED LANDS
ANNEXATION OF SUBMERGED LANDS.
W69-04387 06E

SUBSURFACE DRAINAGE
DURR V ADAM EIDEMILLER, INC (SUBSURFACE POLLUTION OF WATER SUPPLY).
W69-04681 05G

SUBSURFACE FLOW
SUBSURFACE STORMFLOW FROM FORESTED SLOPES,
W69-04637 02G

THEORY AND MECHANICS OF SUBSURFACE STORMFLOW,
W69-04638 02G

SUBSURFACE RUNOFF
SILICA IN STREAMS AND GROUND WATER OF HAWAII,
W69-04528 02G

SUBSURFACE STORMFLOW FROM FORESTED SLOPES,
W69-04637 02G

THEORY AND MECHANICS OF SUBSURFACE STORMFLOW,
W69-04638 02G

DURR V ADAM EIDEMILLER, INC (SUBSURFACE POLLUTION OF WATER SUPPLY).
W69-04681 05G

SULFIDES
MIGRATION OF IRON AND SULFUR WITHIN ANAEROBIC SEDIMENTS DURING EARLY DIAGENESIS,
W69-04572 02K

IDENTIFICATION AND SOLUBILITY OF IRON SULFIDE IN ANAEROBIC LAKE SEDIMENT,
W69-04590 02K

SULFUR
SULFUR METABOLISM AND SEDIMENTARY ENVIRONMENT LAKE MENDOTA, WISCONSIN,
W69-04526 05C

SULFUR COMPOUNDS
SULFUR METABOLISM AND SEDIMENTARY ENVIRONMENT LAKE MENDOTA, WISCONSIN,
W69-04526 05C

SUPERVISORY CONTROL
HEALTH AND VITAL STATISTICS COUNTY BOARD OF HEALTH.
W69-04420 05G

SUPPLY CONTRACTS
NORTH JERSEY DIST WATER SUPPLY COMM'N V CITY OF NEWARK (RESCISSION OF WATER SUPPLY CONTRACTS).
W69-04408 06E

SURFACE DRAINAGE
GELLIS V TOWN OF HARRISON (INCREASED SURFACE RUNOFF).
W69-04676 04C

SURFACE RUNOFF
SILICA IN STREAMS AND GROUND WATER OF HAWAII,
W69-04528 02G

GELLIS V TOWN OF HARRISON (INCREASED SURFACE RUNOFF).
W69-04676 04C

BATTISTO V PERKINS (ACTION FOR DAMAGE FROM INCREASED SURFACE WATER FLOW).
W69-04680 04C

SURFACE WATER
WATER RESOURCES OF THE SYCAMORE CREEK WATERSHED, MARICOPA COUNTY, ARIZONA,
W69-04587 02E

SURFACE WATERS
SURFACE-WATER HYDROLOGY OF CALIFORNIA COASTAL BASINS BETWEEN SAN FRANCISCO BAY AND EEL RIVER,
W69-04273 03B

WATER RESOURCES DATA FOR IOWA, 1968--PART 1. SURFACE WATER RECORDS, PART 2. WATER QUALITY RECORDS.
W69-04565 02E

RECONNAISSANCE OF THE CHEMICAL QUALITY OF SURFACE WATERS OF THE SULFUL RIVER AND CYPRESS CREEK BASINS, TEXAS,
W69-04586 02K

RECONNAISSANCE OF THE CHEMICAL QUALITY OF SURFACE WATERS OF THE CANADIAN RIVER BASIN, TEXAS,
W69-04593 02E

KERHONKSON LODGE INC V STATE OF NEW YORK (ACTION FOR DAMAGE FROM SURFACE WATER DISCHARGE).
W69-04673 04C

SURVEYS
STATE AND LOCAL GOVERNMENT ACTIVITIES AND ROLES IN MARINE SCIENCE, ENGINEERING AND DEVELOPMENT. A BRIEFLY ANNOTATED CATALOG OF PUBLISHED STUDIES AND REPORTS ON SUCH ORGANIZATIONAL ARRANGEMENTS AND ACTIVITIES IN THE COASTAL STATES AND IN THOSE BORDERING ON THE GREAT LAKES.
W69-04341 06E

COST-BENEFIT ANALYSIS A SURVEY,
W69-04492 06B

A STUDY OF THE U. S. COAST AND GEODETIC SURVEY'S PRODUCTS AND SERVICES AS RELATED TO ECONOMIC ACTIVITY IN THE U. S. CONTINENTAL SHELF REGIONS.
W69-04505 06B

A SUPPLEMENTARY REPORT ON THE COASTAL WETLANDS INVENTORY OF LONG ISLAND, NEW YORK.
W69-04506 07B

WATER IN INDUSTRY A SURVEY OF WATER USE IN INDUSTRY.
W69-04514 05D

RESISTIVITY INVESTIGATIONS OF LIMESTONE AQUIFERS IN JAMAICA,
W69-04600 02F

ORGANIZATION OF SURVEYS AND HYDROLOGICAL RESEARCH IN DEVELOPING COUNTRIES,
W69-04614 06E

SWAMPS
BILL OF RIGHTS.
W69-04658 04A

SWIMMING POOLS
PUBLIC SWIMMING POOLS AND PLACES.
W69-04422 06E

TOWN OF PALM BEACH SHORES V COLONNADES, INC (OCEAN POLLUTION).
W69-04668 05G

SYNOPTIC ANALYSIS
WORLD DISTRIBUTION OF MEAN MONTHLY AND ANNUAL PRECIPITABLE WATER,
W69-04239 02B

ATMOSPHERIC WATER VAPOR TRANSPORT AND THE WATER BALANCE OF NORTH AMERICA- 2. LARGE-SCALE WATER BALANCE INVESTIGATIONS,
W69-04246 02A

SYNTHETIC HYDROLOGY
A MODERN STATISTICAL STUDY OF MONTHLY LEVELS OF THE ORINOCO RIVER,
W69-04568 02E

SYSTEMS ANALYSIS
INDUSTRIAL WASTEWATER RECLAMATION,
W69-04226 05D

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS,
W69-04482 06B

RECENT RESULTS FROM A MATHEMATICAL MODEL OF WATER POLLUTION CONTROL IN THE DELAWARE ESTUARY,
W69-04509 05G

THE POLITICAL ECONOMY OF EFFICIENCY COST-BENEFIT ANALYSIS, SYSTEMS ANALYSIS, AND PROGRAM BUDGETING,
W69-04519 06B

TECHNOLOGY
TECHNOLOGY ADDING BILLIONS TO RESERVES.
W69-04348 06B

TEMPERATURE
HYDROLOGIC ATLAS OF UTAH,
W69-04209 02A

A SHIELDED THERMISTOR PROBE WITH PORTABLE INSTRUMENT FOR MEASURING SNOWPACK TEMPERATURES,
W69-04252 07B

TENNESSEE VALLEY AUTHORITY PROJECT
HARRIS V UNITED STATES (NEGLIGENCE OF TVA UNDER FEDERAL TORT CLAIMS ACT).
W69-04370 06E

TERTIARY TREATMENT
OZONE IN WATER TREATMENT AND WASTEWATER RENOVATION,
W69-04230 05D

TEXAS
REPORT ON WATER QUALITY CRITERIA FOR TEXAS.
W69-04327 05G

PAST, PRESENT AND FUTURE OF SPORT FISHING IN TEXAS WATERS,
W69-04362 06B

MARINE RESOURCES OF THE CORPUS CHRISTI AREA,
W69-04436 06B

RECONNAISSANCE OF THE CHEMICAL QUALITY OF SURFACE WATERS OF THE SULFUL RIVER AND CYPRESS CREEK BASINS, TEXAS,
W69-04586 02K

RECONNAISSANCE OF THE CHEMICAL QUALITY OF SURFACE WATERS OF THE CANADIAN RIVER BASIN, TEXAS,
W69-04593 02E

THERMAL POLLUTION
THERMAL POLLUTION AND AQUATIC LIFE,
W69-04235 05A

PATUXENT THERMAL STUDIES - SUMMARY AND RECOMMENDATIONS,
W69-04244 02L

STATEMENT BEFORE THE SUBCOMMITTEE ON AIR AND WATER POLLUTION, APRIL 17, 1968,
W69-04293 05B

ON POSSIBLE CONSTRUCTIVE USES OF THERMAL ADDITIONS TO ESTUARIES,
W69-04297 05C

THERMAL POLLUTION HOT ISSUE FOR INDUSTRY,
W69-04325 05C

STATEMENT.
W69-04342 05G

THERMAL POLLUTION OF WATER,
W69-04345 05C

THERMAL POLLUTION OF WATER.
W69-04349 05C

COMMON MISUNDERSTANDINGS ABOUT HEATED DISCHARGES,
W69-04364 05C

'WATER DEMAND FOR STEAM ELECTRIC GENERATION',
W69-04461 06D

TEMPERATURE AND WATER-QUALITY CONDITIONS FOR THE PERIOD JULY, 1963, TO DECEMBER, 1965, PATUXENT RIVER ESTUARY, MARYLAND,
W69-04462 05B

PREDICTING THE CONDITION OF A POLLUTED ESTUARY,
W69-04469 05B

EFFECTS OF HEATED EFFLUENTS UPON MARINE AND ESTUARINE ORGANISMS,
W69-04486 05C

ON THE PREDICTION OF THE DISTRIBUTION OF EXCESS TEMPERATURE FROM A HEATED DISCHARGE IN AN ESTUARY,
W69-04494 05C

THERMAL POWERPLANTS
PATUXENT THERMAL STUDIES - SUMMARY AND RECOMMENDATIONS,
W69-04244 02L

THERMAL POLLUTION HOT ISSUE FOR INDUSTRY,
W69-04325 05C

THERMAL POLLUTION OF WATER.
W69-04349 05C

THERMAL PROPERTIES
THERMAL POLLUTION AND AQUATIC LIFE,
W69-04235 05A

THERMAL STRATIFICATION
THE THERMAL CLASSIFICATION OF LAKES,
W69-04522 02H

THERMAL WATER
EFFECT OF HIGH TEMPERATURES ON THE CHEMICAL COMPOSITION OF GROUND WATERS,
W69-04271 02K

THERMOMETERS
A SHIELDED THERMISTOR PROBE WITH PORTABLE INSTRUMENT FOR MEASURING SNOWPACK TEMPERATURES,
W69-04252 07B

TIDAL EFFECTS
CURRENTS IN AN INTEROCEANIC CANAL,
W69-04557 02E

NEW HORIZONS IN THE FIELD OF TIDAL HYDRAULICS,
W69-04579 02L

USE OF MODELS IN RESOLVING TIDAL PROBLEMS,
W69-04580 02L

TIDAL ENERGY
CONSERVATION OF THE NATURAL RESOURCES OF NEW ENGLAND, THE PASSAMAQUODDY TIDAL POWER PROJECT AND UPPER SAINT JOHN RIVE HYDROELECTRIC DEVELOPMENT.
W69-04459 08C

TIDAL MARSHES
NEEDED--A COASTWISE COMPREHENSIVE PROGRAM FOR DEVELOPMENT O ESTUARIES,
W69-04499 06B

TIDAL POWERPLANTS
CONSERVATION OF THE NATURAL RESOURCES OF NEW ENGLAND, THE PASSAMAQUODDY TIDAL POWER PROJECT AND UPPER SAINT JOHN RIVE HYDROELECTRIC DEVELOPMENT.
W69-04459 08C

TIDAL WATERS
PROTECTION OF ROADS NEAR TIDEWATER ACQUISITION OF LANDS.
W69-04419 06E

THE MIXING PROCESSES IN A TIDAL ESTUARY,
W69-04444 02L

TIMBER HARVEST
EFFECT OF A COMMERCIAL CLEARCUTTING IN WEST VIRGINIA ON OVERLAND FLOW AND STORM RUNOFF,
W69-04632 04C

EFFECT ON STREAMFLOW OF FOUR FOREST PRACTICES IN THE MOUNTAINS OF WEST VIRGINIA,
W69-04636 03B

TOURISM
TOURISM AND RECREATION.
W69-04510 06B

TRACE ELEMENTS
VANADIUM CONCENTRATIONS IN COLORADO RIVER BASIN WATERS,
W69-04264 02K

TRACERS
DELTA-SUISUN BAY WATER QUALITY INVESTIGATION,
W69-04291 02L

TRAINING
THE TEACHING AND RESEARCH PROGRAMS IN HYDROLOGY AT FACULTY OF PHYSICAL AND MATHEMATICAL SCIENCES OF THE UNIVERSITY OF CHILE,
W69-04611 09A

TRANSMISSIVITY
A COMPUTER-ORIENTED GROUND-WATER INFORMATION STORAGE AND RETRIEVAL SYSTEM,
W69-04624 07C

TRANSPORTATION
LONG ISLAND BEACH BUGGY ASS'N V TOWN OF ISLIP (BEACH EROSION).
W69-04389 04D

THE CONTRIBUTION OF THE AMERICAN MERCHANT MARINE TO THE U. S. BALANCE OF PAYMENTS.
W69-04460 06C

TRAWLING
THE ANIMAL FOOD FISHERY IN CALIFORNIA, 1961-1962,
W69-04487 06B

TREATIES
ORGANIZATION FOR THE REGULATION OF LAKE ONTARIO,
W69-04648 06E

TURBINE GASES
THE CONSTRUCTION BY FRANCE OF A MIXED PLANT FOR PRODUCTION

OF ELECTRIC POWER AND OF SOFT WATER,
W69-04595 03A

RBINES
THE CONSTRUCTION BY FRANCE OF A MIXED PLANT FOR PRODUCTION OF ELECTRIC POWER AND OF SOFT WATER,
W69-04595 03A

RBULENCE
EFFECT OF WATER TEMPERATURE ON STREAM REAERATION,
W69-04468 05G

SOME TURBULENCE MEASUREMENTS IN OPEN-CHANNEL FLOW,
W69-04555 02E

DERGROUND STORAGE
FLOOD AND POLLUTION CONTROL A DEEP TUNNEL PLAN FOR THE CHICAGOLAND AREA.
W69-04630 04A

CHICAGO TUNNEL DRAINAGE PROJECT PRELIMINARY EVALUATION OF FEASIBILITY.
W69-04631 04A

DERWATER
PLAN DEVELOPING FOR UNDERWATER PARKS.
W69-04317 06B

T HYDROGRAPHS
DISSIPATIVE RIVER FLOW MODEL,
W69-04232 02A

VALUATION OF SEGMENTED IUH FROM DERIVATIVES,
W69-04553 02A

TED STATES
ATIONAL ESTUARINE INVENTORY HANDBOOK OF DESCRIPTORS,
W69-04358 10

ARRIS V UNITED STATES (NEGLIGENCE OF TVA UNDER FEDERAL TORT CLAIMS ACT).
W69-04370 06E

NITED STATES V REPUBLIC STEEL CORP (INJUNCTION TO FORCE COMPANY TO RESTORE RIVER TO ORIGINAL DEPTH).
W69-04671 06E

VERSITIES
HE TEACHING AND RESEARCH PROGRAMS IN HYDROLOGY AT FACULTY OF PHYSICAL AND MATHEMATICAL SCIENCES OF THE UNIVERSITY OF CHILE,
W69-04611 09A

NIUM RADIOISOTOPES
SSOCIATION OF RADIUM AND URANIUM AND PEAT,
W69-04612 02K

AN HYDROLOGY BIBLIOGRAPHY
FFECT OF URBAN DEVELOPMENT ON FLOOD DISCHARGES-CURRENT NOWLEDGE AND FUTURE NEEDS,
W69-04560 04C

ANIZATION
MPORTANCE OF GULF ESTUARIES AND PROBLEMS FACING OUR FISHERY ESOURCES,
W69-04300 06B

YDROLOGY FOR URBAN LAND PLANNING-A GUIDEBOOK ON THE YDROLOGIC EFFECTS OF URBAN LAND USE,
W69-04548 04C

FFECT OF URBAN DEVELOPMENT ON FLOOD DISCHARGES-CURRENT NOWLEDGE AND FUTURE NEEDS,
W69-04560 04C

TROPOLITAN PLANNING AND RIVER BASIN PLANNING SOME NTERRELATIONSHIPS,
W69-04566 06A

MPILATION OF HYDROLOGIC DATA, WALLER AND WILBARGER CREEKS, OLORADO RIVER BASIN, TEXAS-1966.
W69-04599 02E

PESTICIDES
NFLUENCE OF WATER FLUX AND POROUS MATERIAL ON THE MOVEMENT SELECTED HERBICIDES,
W69-04258 05B

OUND-WATER CONDITIONS IN UTAH, SPRING OF 1968,
W69-04561 02F

ITIES
ARD OF PUBLIC WORKS.
W69-04413 06E

E
PORTANCE OF GULF ESTUARIES AND PROBLEMS FACING OUR FISHERY SOURCES,
W69-04300 06B

ILIZATION OF THE ESTUARINE ZONE IN GEORGIA--A STATEMENT BY OLOGISTS FROM THE DIVISION OF BIOLOGICAL SCIENCES OF THE IVERSITY OF GEORGIA.
W69-04353 05G

RINE RESOURCES OF THE CORPUS CHRISTI AREA,
W69-04436 06B

NAGEMENT OF ESTUARINE FISHERIES,
W69-04481 06B

VANADIUM
VANADIUM CONCENTRATIONS IN COLORADO RIVER BASIN WATERS,
W69-04264 02K

VEGETATION EFFECTS
MAN, VEGETATION AND THE SEDIMENT YIELDS OF RIVERS,
W69-04269 02E

VERMONT
RANDALL V CLIFFORD (POLLUTION AND DESTRUCTION OF WATER SUPPLY).
W69-04678 05G

VILLAGES
GENERAL POWERS OF THE BOARD OF TRUSTEES.
W69-04393 04A

VIOLATIONS
HOUSEBOATS, SANITATION AND LOCATION.
W69-04388 05G

VIRGIN ISLANDS
BENEATH THE SURFACE,
W69-04497 06B

VIRGINIA
STATEMENT BEFORE THE SUBCOMMITTEE ON AIR AND WATER POLLUTION, APRIL 17, 1968,
W69-04293 05B

MEASURING THE IMPACT OF THE WATERBORNE COMMERCE OF THE PORTS OF VIRGINIA ON EMPLOYMENT, WAGES, AND OTHER KEY INDICES OF THE VIRGINIA ECONOMY, 1953-1965.
W69-04295 06B

STATEMENT BEFORE THE SUBCOMMITTEE ON AIR AND WATER POLLUTION,
W69-04314 06G

THE SEAFOOD INDUSTRY, A LOCAL ANALYSIS.
W69-04337 06B

CHESAPEAKE BAY, A PICTORIAL MARITIME HISTORY,
W69-04449 06B

LITTERING AND OBSTRUCTIONS,
W69-04450 06E

RECREATION,
W69-04458 06B

WASHINGTON
POLLUTIONAL EFFECTS OF PULP AND PAPER MILL WASTES IN PUGET SOUND.
W69-04319 05G

SOME CONSIDERATIONS OF OXYGEN UTILIZATION RATES IN PUGET SOUND,
W69-04439 05B

WASHOUTS
KERHONKSON LODGE INC V STATE OF NEW YORK (ACTION FOR DAMAGE FROM SURFACE WATER DISCHARGE).
W69-04673 04C

WASTE ASSIMILATIVE CAPACITY
USE OF HYDRAULIC AND MATHEMATICAL MODELS FOR DETERMINING EFFLUENT DIFFUSION IN SOUTH SAN FRANCISCO BAY,
W69-04277 05B

ESTUARINE POLLUTION OF THE CHAO PHRAYA RIVER AT BANGKOK, THAILAND,
W69-04279 05B

ANALYSIS OF A STREAM'S CAPACITY FOR ASSIMILATING POLLUTION,
W69-04456 05C

PREDICTING THE CONDITION OF A POLLUTED ESTUARY,
W69-04469 05B

ESTUARINE DISTRIBUTION OF NONCONSERVATIVE SUBSTANCES,
W69-04489 05G

WASTE DILUTION
USE OF HYDRAULIC AND MATHEMATICAL MODELS FOR DETERMINING EFFLUENT DIFFUSION IN SOUTH SAN FRANCISCO BAY,
W69-04277 05B

DIFFUSION OF SEWAGE EFFLUENT IN AN OCEAN-CURRENT,
W69-04452 05B

WASTE DISPOSAL
SOME BASIC FACTORS IN THE CONSIDERATION AND INSTALLATION OF DEEP WELL DISPOSAL SYSTEMS,
W69-04228 05E

EFFECTS OF WASTE DISCHARGE FROM POINT LOMA SALINE WATER CONVERSION PLANT ON INTERTIDAL MARINE LIFE,
W69-04280 05C

A 'BALAS' ALGORITHM FOR ZONED UNIFORM TREATMENT,
W69-04281 05D

HOUSEBOATS, SANITATION AND LOCATION.
W69-04388 05G

'WASTE DISPOSAL AND WATER SUPPLY',
W69-04438 05G

OPTIMUM DREDGING AND DISPOSAL PRACTICES IN ESTUARIES,

W69-04581 02L

WASTE DUMPS
POLLUTION OF THE INTERSTATE WATERS OF THE COLORADO RIVER AND ITS TRIBUTARIES....
W69-04272 05E

WASTE TREATMENT
TREATMENT AND DISPOSAL OF RADIOACTIVE WASTES,
W69-04229 05E

A 'BALAS' ALGORITHM FOR ZONED UNIFORM TREATMENT,
W69-04281 05D

WASTE WATER DISPOSAL
STORM DRAINAGE PRACTICES OF THIRTY-TWO CITIES,
W69-04551 02E

WASTE WATER TREATMENT
WATER REUSE FOR PUBLIC SUPPLY,
W69-04265 05D

OPERATING COSTS OF WASTE TREATMENT IN GENERAL MOTORS,
W69-04451 05D

INDUSTRIAL WASTEWATER CONTROL,
W69-04471 05D

WATER IN INDUSTRY A SURVEY OF WATER USE IN INDUSTRY.
W69-04514 05D

ANAEROBIC DIGESTION OF PINEAPPLE MILL WASTES,
W69-04527 05D

STORM DRAINAGE PRACTICES OF THIRTY-TWO CITIES,
W69-04551 02E

WASTES
WASTE FROM WATERCRAFT.
W69-04357 05G

THE DISCHARGE OF SEWAGE AND OTHER MATTER INTO CERTAIN WATERS IS PROHIBITED.
W69-04391 05B

LITTERING AND OBSTRUCTIONS,
W69-04450 06E

WATER ANALYSIS
IDENTIFICATION OF PETROLEUM PRODUCTS IN ESTUARINE WATERS,
W69-04282 05A

WATER CHEMISTRY
CHEMICAL CHARACTERIZATION OF PUBLIC SUPPLY,
W69-04245 02K

EFFECT OF HIGH TEMPERATURES ON THE CHEMICAL COMPOSITION OF GROUND WATERS,
W69-04271 02K

GEOCHEMISTRY OF EPIGENESIS,
W69-04274 02K

GEOCHEMISTRY OF NATURAL WATERS,
W69-04562 02K

A GEOCHEMICAL CLASSIFICATION OF NATURAL WATERS,
W69-04626 02K

WATER CONSERVATION
SOIL AND WATER CONSERVATION DISTRICTS.
W69-04381 06E

DEPARTMENT OF WATER AND AIR RESOURCES ORGANIZATION AND POWERS GENERALLY CONTROL OF POLLUTION.
W69-04687 05G

DECLARATION OF POLICY.
W69-04694 06E

WATER CONTRACTS
MALONE V CUSTOM MANOR (PRIVATE WATER LINES).
W69-04675 06E

WATER CONVEYANCE
MALONE V CUSTOM MANOR (PRIVATE WATER LINES).
W69-04675 06E

WATER COOLING
A COOLING POND PROVES CHEAPER,
W69-04447 05C

WATER DEMAND
ECONOMIC AND ENGINEERING ASPECTS OF WATER IN DELAWARE'S AGRI BUSINESS INDUSTRY,
W69-04204 03F

'WATER DEMAND FOR STEAM ELECTRIC GENERATION',
W69-04461 06D

WATER DISTRIBUTION(APPLIED)
LOA RIVER BASIN WATER RESOURCES AND THEIR DISTRIBUTION,
W69-04613 04A

TOWN OF GREENWICH V GREENWICH WATER CO (PUBLIC UTILITY RIVER DIVERSION).
W69-04688 06D

WATER DISTRICTS
WATER DISTRICTS.
W69-04655 04A

WATER LAW
GENERAL WATER QUALITY CRITERIA AND SPECIFIC WATER QUALITY STANDARDS.
W69-04470 05G

WATER RIGHTS AND REGULATION IN THE EASTERN UNITED STATES,
W69-04649 06E

WATER LEVEL FLUCTUATIONS
KEY SALES CO V SOUTH CAROLINA ELECTRIC AND GAS CO (DAM OPERATOR'S DUTY OF CARE IN REGARD TO FLOODING OF DOWNSTREAM PROPERTY).
W69-04665 04A

WATER LEVELS
HYDROLOGY OF THE VALLEY-FILL AND CARBONATE-ROCK RESERVOIRS PAHRUMP VALLEY NEVADA-CALIFORNIA,
W69-04267 03D

WATER MANAGEMENT
WATER QUALITY MANAGEMENT AND CONTROL.
W69-04404 05G

NEEDED--A COASTWISE COMPREHENSIVE PROGRAM FOR DEVELOPMENT OF ESTUARIES,
W69-04499 06B

WATER MANAGEMENT(APPLIED)
SCIENTIFIC OR RULE-OF-THUMB TECHNIQUES OF GROUND-WATER MANAGEMENT - WHICH WILL PREVAIL,
W69-04231 04B

MANAGING WATER QUALITY ECONOMICS, TECHNOLOGY, INSTITUTIONS,
W69-04578 05G

WATER POLICY
NATIONAL WATER LAWS AND ADMINISTRATION AS ELEMENTS OF WATER DEVELOPMENT,
W69-04644 06E

ALLOCATION AND REALLOCATION OF WATER RESOURCES,
W69-04647 05G

WATER POLLUTION
WATER POLLUTION PROBLEMS AND IMPROVEMENT NEEDS, LAKE ONTARI AND ST. LAWRENCE RIVER BASINS.
W69-04223 05B

A PROBABILISTIC ANALYSIS OF DISSOLVED OXYGEN-BIOCHEMICAL OXYGEN DEMAND RELATIONSHIP IN STREAMS,
W69-04247 05C

ILLINOIS GROUND WATER POLLUTION,
W69-04256 05B

ESTUARIES,
W69-04278 02L

ESTUARINE POLLUTION OF THE CHAO PHRAYA RIVER AT BANGKOK, THAILAND,
W69-04279 05B

MARINE, ESTUARIAN, AND RIPARIAN POLLUTION DISASTERS AND THEIR CONSEQUENCES.
W69-04285 05G

A PERSPECTIVE OF REGIONAL AND STATE MARINE ENVIRONMENTAL ACTIVITIES, A QUESTIONNAIRE SURVEY, STATISTICS AND OBSERVATIONS,
W69-04289 06E

VIRAL POLLUTION OF SHELLFISH IN ESTUARY WATERS,
W69-04296 05C

IMPORTANCE OF GULF ESTUARIES AND PROBLEMS FACING OUR FISHER RESOURCES,
W69-04300 06B

STATEMENT,
W69-04303 06B

OIL SPILLAGE STUDY LITERATURE SEARCH AND CRITICAL EVALUATION FOR SELECTION OF PROMISING TECHNIQUES TO CONTROL AND PREVENT DAMAGE.
W69-04309 05G

POLLUTION AND MARINE ECOLOGY.
W69-04310 05G

VANISHING TIDELANDS,
W69-04323 06E

A REPORT ON POLLUTION OF THE NATION'S WATER BY OIL AND OTHE HAZARDOUS SUBSTANCES.
W69-04326 05G

THE ROLE OF THE PHYSICAL HYDRAULIC MODEL OF SAN FRANCISCO BAY AND DELTA IN POLLUTION STUDIES,
W69-04329 05B

COLIFORM-FECAL COLIFORM BACTERIA IN TIDAL WATERS,
W69-04344 05G

RESPONSE TO POLLUTION OF NEW YORK HARBOR AND THAMES ESTUAR
W69-04351 05B

WASTE FROM WATERCRAFT.
W69-04357 05G

ATIONAL ESTUARINE INVENTORY HANDBOOK OF DESCRIPTORS,
69-04358 10

IDDLE V CITY OF GREENVILLE (RIGHT TO COLLECT DAMAGES FROM OLLUTION OF STREAMS).
69-04372 05B

OUNG V CITY OF ASHEVILLE (RIPARIAN RIGHTS).
69-04378 06E

LARK V LINDSAY LIGHT AND CHEMICAL COMPANY (INJUNCTION FOR OLLUTION ABATEMENT).
69-04382 05G

N ECOLOGICAL SURVEY OF THE HOUSTON SHIP CHANNEL AND DJACENT BAYS,
69-04454 05C

ENERAL WATER QUALITY CRITERIA AND SPECIFIC WATER QUALITY TANDARDS.
69-04470 05G

OLLUTION OF THE HUDSON RIVER AND ITS TRIBUTARIES.
69-04490 05G

IBLIOGRAPHY ON AIR AND WATER POLLUTION,
69-04496 05G

PTIMUM DREDGING AND DISPOSAL PRACTICES IN ESTUARIES,
69-04581 02L

LUE V CHARLES F HAYES AND ASSOCIATES, INC (ACTION FOR AMAGES DUE TO FLOW OF OIL WASTES).
69-04654 05B

HROWING GAS TAR OR REFUSE INTO PUBLIC WATERS AND WILLFULLY OISONING FOOD.
69-04659 05G

OWN OF PALM BEACH SHORES V COLONNADES, INC (OCEAN OLLUTION).
69-04668 05G

ANDALL V CLIFFORD (POLLUTION AND DESTRUCTION OF WATER UPPLY).
69-04678 05G

URR V ADAM EIDEMILLER, INC (SUBSURFACE POLLUTION OF WATER UPPLY).
69-04681 05G

TER POLLUTION CONTROL
OIL SPILL RELIEF SEEN SOON.
69-04308 05B

POLLUTIONAL EFFECTS OF PULP AND PAPER MILL WASTES IN PUGET SOUND.
69-04319 05G

A REPORT ON POLLUTION OF THE NATION'S WATER BY OIL AND OTHER HAZARDOUS SUBSTANCES.
69-04326 05G

RULES ON VESSEL POLLUTION PROPOSED BY SENATOR MUSKIE.
69-04332 05G

SAVING OUR ESTUARIES.
69-04333 05G

WATER QUALITY AND POLLUTION CONTROL STUDY - JAMES RIVER BASIN.
69-04359 05G

SHIRLEY V NEW HAMPSHIRE WATER POLLUTION COMMISSION (VALIDITY OF ORDER TO DESIST SEWAGE DEPOSIT INTO RIVER).
69-04366 05B

WATER IMPROVEMENT COMMISSION.
69-04377 05G

PUBLIC HEALTH LAW (CLASSIFICATION OF WATERS AND PREVENTION OF POLLUTION).
69-04392 05G

NUISANCES AFFECTING HEALTH.
69-04424 05G

LOCAL BOARDS OF HEALTH - GENERAL POWERS AND DUTIES.
69-04428 05G

'WASTE DISPOSAL AND WATER SUPPLY',
69-04438 05G

A NOTE ON THE ASYMMETRY BETWEEN FEES AND PAYMENTS,
69-04446 05G

INDUSTRIAL WASTEWATER CONTROL,
69-04471 05D

RECREATION BENEFITS FROM WATER POLLUTION CONTROL,
69-04504 05G

1965 SURVEY ON DISPOSAL OF SEWAGE AND INDUSTRIAL WASTES BY FEDERAL INSTALLATIONS.
69-04507 05D

RECENT RESULTS FROM A MATHEMATICAL MODEL OF WATER POLLUTION CONTROL IN THE DELAWARE ESTUARY,
69-04509 05G

WATER POLLUTION CONTROL FACTS.
69-04515 05G

OPTIMUM DREDGING AND DISPOSAL PRACTICES IN ESTUARIES,
69-04581 02L

ALLOCATION AND REALLOCATION OF WATER RESOURCES,
69-04647 05G

DEPARTMENT OF HEALTH V PASSAIC VALLEY SEWERAGE COMMISSION (DEPARTMENT OF HEALTH'S AUTHORITY OF DISCHARGE OF SEWERAGE).
69-04664 05G

WATER POLLUTION EFFECTS
EFFECTS OF WASTE DISCHARGE FROM POINT LOMA SALINE WATER CONVERSION PLANT ON INTERTIDAL MARINE LIFE,
69-04280 05C

SOME ASPECTS OF POLLUTION, PARASITISM, AND INLET RESTRICTION IN THREE NEW JERSEY ESTUARIES,
69-04304 05C

SPILL POLLUTION - ITS EFFECTS AND CONTROL,
69-04322 05G

THERMAL POLLUTION OF WATER,
69-04345 05C

UTILIZATION OF THE ESTUARINE ZONE IN GEORGIA--A STATEMENT BY BIOLOGISTS FROM THE DIVISION OF BIOLOGICAL SCIENCES OF THE UNIVERSITY OF GEORGIA.
69-04353 05G

THE EFFECT OF POLLUTION BY SEWAGE UPON THE WATERS OF THE OSLO-FJORD,
69-04445 05C

ANALYSIS OF A STREAM'S CAPACITY FOR ASSIMILATING POLLUTION,
69-04456 05C

THE MARINE ENVIRONMENT IN THE VICINITY OF THE ORANGE COUNTY SANITATION DISTRICTS OCEAN OUTFALL,
69-04511 05C

WATER POLLUTION IDENTIFICATION
EXTRACTION OF ORGANOCHLORINE AND ORGANOPHOSPHATE INSECTICIDES FROM LAKE WATERS,
69-04523 05A

WATER POLLUTION SOURCES
CHARACTERISTICS OF WATER TREATMENT PLANT WASTES,
69-04227 05B

OIL SPILL RELIEF SEEN SOON.
69-04308 05B

POLICING THE OIL INDUSTRY.
69-04318 05B

WATER POLLUTION TREATMENT
A 'BALAS' ALGORITHM FOR ZONED UNIFORM TREATMENT,
69-04281 05D

MARINE, ESTUARIAN, AND RIPARIAN POLLUTION DISASTERS AND THEIR CONSEQUENCES.
69-04285 05G

SPILL POLLUTION - ITS EFFECTS AND CONTROL,
69-04322 05G

WATER PROPERTIES
ESTUARIES,
69-04278 02L

WATER PURIFICATION
SEWAGE REMOVAL OR PURIFICATION AND CONDEMNATION OF PROPERTY.
69-04390 05G

STATE SANITARY CODE.
69-04395 05G

WATER QUALITY
A REVIEW OF CHEMICAL MEASUREMENTS IN WATER POLLUTION CONTROL,
69-04222 05A

FRESH WATER,
69-04225 03B

VANADIUM CONCENTRATIONS IN COLORADO RIVER BASIN WATERS,
69-04264 02K

DEVELOPMENT OF GROUND-WATER SUPPLIES AT MISSISSIPPI TEST FACILITY, HANCOCK COUNTY, MISSISSIPPI,
69-04268 02F

THE FUTURE OF AN ESTUARY,
69-04290 05G

MATHEMATICAL MODELING OF WATER QUALITY IN ESTUARIAL SYSTEMS,
69-04311 05B

REPORT ON WATER QUALITY CRITERIA FOR TEXAS.
69-04327 05G

STATEMENT,
69-04354 05G

WATER QUALITY AND POLLUTION CONTROL STUDY - JAMES RIVER BASIN.
69-04359 05G

SANITARY QUALITY OF WATER IN SWIMMING POOLS AND AT BATHING BEACHES.
W69-04396 05G

WATER QUALITY MANAGEMENT AND CONTROL.
W69-04404 05G

NUTRIENTS,
W69-04448 05C

WATER QUALITY, A PROBLEM FOR THE ECONOMIST,
W69-04457 05G

CHESAPEAKE BAY WATER SUPPLY NEEDS - THE BIOLOGICAL POINT OF VIEW,
W69-04464 03C

GENERAL WATER QUALITY CRITERIA AND SPECIFIC WATER QUALITY STANDARDS.
W69-04470 05G

ESTUARINE DISTRIBUTION OF NONCONSERVATIVE SUBSTANCES,
W69-04489 05G

WATER QUALITY CRITERIA--STREAM VERSUS EFFLUENT STANDARDS.
W69-04516 05G

WATER RESOURCES DATA FOR IOWA, 1968--PART 1. SURFACE WATER RECORDS, PART 2. WATER QUALITY RECORDS.
W69-04565 02E

HYDROLOGY OF CRATER, EAST AND DAVIS LAKES, OREGON,
W69-04574 02H

RECONNAISSANCE OF THE CHEMICAL QUALITY OF SURFACE WATERS OF THE SULPUL RIVER AND CYPRESS CREEK BASINS, TEXAS,
W69-04586 02K

RECONNAISSANCE OF THE CHEMICAL QUALITY OF SURFACE WATERS OF THE CANADIAN RIVER BASIN, TEXAS,
W69-04593 02E

WATER QUALITY CONTROL
THE FUTURE OF AN ESTUARY,
W69-04290 05G

DELTA-SUISUN BAY WATER QUALITY INVESTIGATION,
W69-04291 02L

STATEMENT,
W69-04306 05D

ESTUARINE WATER QUALITY MANAGEMENT IN THE SACRAMENTO-SAN JOAQUIN DELTA,
W69-04331 05G

THERMAL POLLUTION OF WATER,
W69-04345 05C

WATER IMPROVEMENT COMMISSION.
W69-04377 05G

CONSERVATION LAW.
W69-04400 05G

WATER QUALITY IMPROVEMENT PROGRAMMING PROBLEMS,
W69-04502 05G

MANAGING WATER QUALITY ECONOMICS, TECHNOLOGY, INSTITUTIONS,
W69-04578 05G

ALLOCATION AND REALLOCATION OF WATER RESOURCES,
W69-04647 05G

WATER REQUIREMENTS
ECONOMIC AND ENGINEERING ASPECTS OF WATER IN DELAWARE'S AGRI BUSINESS INDUSTRY,
W69-04204 03F

WATER REQUIREMENTS OF SELECTED NORTH GEORGIA MANUFACTURING INDUSTRIES,
W69-04205 06D

WATER RESOURCES
FRESH WATER,
W69-04225 03B

REMOTE SENSOR SURVEILLANCE OF WATER QUALITY,
W69-04343 05G

MARINE RESOURCES OF THE CORPUS CHRISTI AREA,
W69-04416 06B

GROUND-WATER CONDITIONS IN UTAH, SPRING OF 1968,
W69-04561 02F

GROUND WATER IN GOGEBIC COUNTY, MICHIGAN,
W69-04564 02F

WATER RESOURCES OF THE SYCAMORE CREEK WATERSHED, MARICOPA COUNTY, ARIZONA,
W69-04587 02E

GEOHYDROLOGY OF THE COASTAL PLAIN AQUIFERS OF ARKANSAS,
W69-04609 02F

RECONNAISSANCE OF THE GROUND-WATER RESOURCES OF THE MISSOURI RIVER ALLUVIUM BETWEEN ST. CHARLES AND JEFFERSON CITY, MISSOURI,
W69-04610 02F

WATER RESOURCES OF NEW MEXICO, OCCURRENCE, DEVELOPMENT AND USE,
W69-04627 02E

DECLARATION OF POLICY.
W69-04694 06E

WATER RESOURCES DEVELOPMENT
FRESH WATER,
W69-04225 03B

PROBLEMS OF CONSERVATION IN THE ATLANTIC ESTUARINE ZONE,
W69-04355 06B

WATER RESOURCES RESEARCH CATALOG.
W69-04360 09D

CONSERVATION LAW.
W69-04400 05G

INTERSTATE COOPERATION FOR CONSERVATION AND PROTECTION OF WATER RESOURCES.
W69-04427 03D

FISHERIES PROTECTING AND ENHANCEMENT WITH WATER DEVELOPMENT OF THE SACRAMENTO-SAN JOAQUIN ESTUARY,
W69-04472 06B

A TEN-YEAR PROGRAM OF FEDERAL WATER RESOURCES RESEARCH.
W69-04473 06B

METROPOLITAN PLANNING AND RIVER BASIN PLANNING SOME INTERRELATIONSHIPS,
W69-04566 06A

MANAGING WATER QUALITY ECONOMICS, TECHNOLOGY, INSTITUTIONS,
W69-04578 05G

LOA RIVER BASIN WATER RESOURCES AND THEIR DISTRIBUTION,
W69-04613 04A

WATER RESOURCES DEVELOPMENT BY THE U S ARMY CORPS OF ENGINEERS IN FLORIDA.
W69-04643 04A

FORMULA FOR WATER RESOURCES MANAGEMENT IN NEW YORK STATE,
W69-04646 06B

WATER RESOURCES PLANNING
FORMULA FOR WATER RESOURCES MANAGEMENT IN NEW YORK STATE,
W69-04646 06B

WATER RETENTION
INFLUENCE OF SOIL STRUCTURE ON WATER RELATIONS IN LOW HUMIDIC LATOSOLS 1. WATER RETENTION,
W69-04588 02G

WATER REUSE
INDUSTRIAL WASTEWATER RECLAMATION,
W69-04226 05D

WATER REUSE FOR PUBLIC SUPPLY,
W69-04265 05D

WATER USE AND RELATED COSTS WITH COOLING TOWERS,
W69-04443 06C

WATER RIGHTS
WATER RIGHTS AND REGULATION IN THE EASTERN UNITED STATES,
W69-04649 06E

WATER SOURCES
GLACIERS AND WATER SUPPLY,
W69-04255 02C

DRINKING WATER SUPPLIES.
W69-04394 05F

IRRIGATION SYSTEMS (ESTABLISHING IRRIGATION SYSTEMS IN NEW JERSEY COUNTIES).
W69-04416 03F

SALINE WATER CONVERSION REPORT.
W69-04498 03A

WATER SPORTS
BENEATH THE SURFACE,
W69-04497 06B

WATER SUPPLY
STORAGE REQUIREMENTS FOR ARKANSAS STREAMS,
W69-04250 02E

WATERWORKS AND WATER SUPPLIES.
W69-04367 04A

STATE SANITARY CODE.
W69-04395 05G

INTERSTATE COOPERATION FOR CONSERVATION AND PROTECTION OF WATER RESOURCES.
W69-04427 03D

LOCAL BOARDS OF HEALTH - GENERAL POWERS AND DUTIES.
W69-04428 05G

GENERAL WATER QUALITY CRITERIA AND SPECIFIC WATER QUALITY STANDARDS.
W69-04470 05G

SALINE WATER CONVERSION REPORT.
W69-04498 03A

WATER DISTRICTS.
W69-04655 04A

HUNTER V CITY OF SHREVEPORT (BRIDGE CONSTRUCTION).
W69-04667 06E

PUBLIC UTILITIES METHODS OF SUPPLYING WATER.
W69-04695 03D

PUBLIC UTILITIES MUNICIPALITY AND ITS EXCLUSIVE RIGHT TO SUPPLY WATER.
W69-04696 03D

WATER SUPPLY.
W69-04697 03D

TER SUPPLY COMMISSION
WATER SUPPLY.
W69-04697 03D

TER TABLE
REFRACTION DETERMINATION OF WATER TABLE DEPTH AND ALLUVIUM THICKNESS,
W69-04607 02E

TER TEMPERATURE
TEMPERATURE AND WATER-QUALITY CONDITIONS FOR THE PERIOD JULY, 1963, TO DECEMBER, 1965, PATUXENT RIVER ESTUARY, MARYLAND,
W69-04462 05B

EFFECT OF WATER TEMPERATURE ON STREAM REAERATION,
W69-04468 05G

WATER TEMPERATURES IN THE LOWER COLUMBIA RIVER,
W69-04605 02E

TER TREATMENT
CHARACTERISTICS OF WATER TREATMENT PLANT WASTES,
W69-04227 05B

OZONE IN WATER TREATMENT AND WASTEWATER RENOVATION,
W69-04230 05D

DRINKING WATER SUPPLIES.
W69-04394 05F

STATE SANITARY CODE.
W69-04395 05G

WATER QUALITY IMPROVEMENT PROGRAMMING PROBLEMS,
W69-04502 05G

TER USERS
WATER REQUIREMENTS OF SELECTED NORTH GEORGIA MANUFACTURING INDUSTRIES,
W69-04205 06D

TER UTILIZATION
MAJOR USES OF LAND AND WATER IN THE U. S. WITH SPECIAL REFERENCE TO AGRICULTURE, 1964,
W69-04208 03F

DEVELOPMENT OF GROUND-WATER SUPPLIES AT MISSISSIPPI TEST FACILITY, HANCOCK COUNTY, MISSISSIPPI,
W69-04268 02F

STATEMENT BEFORE THE SUBCOMMITTEE ON AIR AND WATER POLLUTION, APRIL 17, 1968,
W69-04293 05B

REPORT ON WATER QUALITY CRITERIA FOR TEXAS.
W69-04327 05G

STATEMENT.
W69-04342 05G

UTILIZATION OF THE ESTUARINE ZONE IN GEORGIA--A STATEMENT BY BIOLOGISTS FROM THE DIVISION OF BIOLOGICAL SCIENCES OF THE UNIVERSITY OF GEORGIA.
W69-04353 05G

STATEMENT,
W69-04354 05G

WATER IN INDUSTRY A SURVEY OF WATER USE IN INDUSTRY.
W69-04514 05D

TER VALUES
MARINE RESOURCES OF THE CORPUS CHRISTI AREA,
W69-04436 06B

TER VAPOR
ATMOSPHERIC WATER VAPOR TRANSPORT AND THE WATER BALANCE OF NORTH AMERICA- 2. LARGE-SCALE WATER BALANCE INVESTIGATIONS,
W69-04246 02A

TER WELLS
PUMPING TESTS ON OPEN WELLS IN PALAR ALLUVIUM, NEAR MADRAS CITY, INDIA, AN APPLICATION OF THE PAPADOPULOS-COOPER METHOD,
W69-04573 02F

GROUND WATER OF THE PIEDMONT AND BLUE RIDGE PROVINCES IN THE SOUTHEASTERN STATES,
W69-04615 02F

WATER WORKS
SEWAGE REMOVAL OR PURIFICATION AND CONDEMNATION OF PROPERTY.
W69-04390 05G

WATER DISTRICTS.
W69-04655 04A

WATER-WORKS.
W69-04693 04A

WATER YIELD
GROUND WATER OF THE PIEDMONT AND BLUE RIDGE PROVINCES IN THE SOUTHEASTERN STATES,
W69-04615 02F

WATER YIELD IMPROVEMENT
OBSERVATIONS OF SNOWPACK ACCUMULATION, MELT, AND RUNOFF ON A SMALL ARIZONA WATERSHED,
W69-04253 02C

A SUBSTITUTE FOR 2,4,5-T IN EASTERN HARDWOOD SPROUT AND BRUSH CONTROL,
W69-04633 03B

WATERSHED CALIBRATION METHODS,
W69-04634 03B

WATERCOURSES(LEGAL)
LAWRENCE V BEHNCKE (INTERFERENCE WITH NATURAL WATER COURSE).
W69-04674 04A

WATERFRONT
WATER FRONT IMPROVEMENTS.
W69-04692 04A

WATERSHED MANAGEMENT
EFFECTS OF ABANDONED FARMLAND ON STREAMFLOW,
W69-04635 03B

WATERSHEDS(BASINS)
SUMMARY ECONOMIC BASE STUDY CHESAPEAKE BAY DRAINAGE BASINS.
W69-04346 06B

WATERWORKS
WATERWORKS AND WATER SUPPLIES.
W69-04367 04A

WAVES(WATER)
LOW-FREQUENCY SEA LEVEL BEHAVIOR AND CONTINENTAL SHELF WAVES OFF NORTH CAROLINA,
W69-04224 02A

SEA CLIFF RETREAT NEAR SANTA BARBARA, CALIFORNIA,
W69-04241 02L

WEATHER
VARIATIONS OF EVAPORATION IN TIME AND SPACE PART 1 AND PART 2,
W69-04618 02D

WEATHERING
GEOCHEMISTRY OF EPIGENESIS,
W69-04274 02K

SILICA IN STREAMS AND GROUND WATER OF HAWAII,
W69-04528 02G

WEIRS
WHARVES AND FISH WEIRS.
W69-04379 04A

WELLS
CONVECTIVE FLOW AND ITS EFFECT ON TEMPERATURE LOGGING IN SMALL-DIAMETER WELLS,
W69-04601 02F

WEST VIRGINIA
CAMPBELL BROWN CO, INC V ELKINS (RIVERBED OWNERSHIP).
W69-04691 06E

WETLANDS
STATEMENT ON LIVING MARINE RESOURCES OF WETLANDS AND ESTUARIES,
W69-04356 06B

A SUPPLEMENTARY REPORT ON THE COASTAL WETLANDS INVENTORY OF LONG ISLAND, NEW YORK.
W69-04506 07B

WILDLIFE CONSERVATION
VANISHING TIDELANDS,
W69-04323 06E

BOARD OF GAME AND FISH COMMISSIONERS POWERS AND DUTIES.
W69-04435 06E

WILDLIFE MANAGEMENT
BOARD OF GAME AND FISH COMMISSIONERS POWERS AND DUTIES.
W69-04435 06E

WRONGFUL DEATH
LITTLE V UNITED STATES (WRONGFUL DEATH LIABILITY FOR DAM MAINTENANCE).
W69-04666 06E

ZONING
STATEMENT,
W69-04306 05D

THE URGENT NEED FOR LANDSCAPE ZONING OF THE ESTUARINE REGION ACCORDING TO ECO-SYSTEM PRINCIPLES,

W69-04307 06F

COUNTY ZONING.
W69-04386 06E

MAINTAINING AND ENHANCING THE ESTUARINE ENVIRONMENT,
W69-04512 06F

AUTHOR INDEX

LLEN, HOWARD E.
FLOODS IN WOODSTOCK QUADRANGLE, NORTHEASTERN ILLINOIS,
W69-04249 04A

NDERSON, ARVID A.
MARINE RESOURCES OF THE CORPUS CHRISTI AREA,
W69-04436 06B

RDIS, COLBY V.
STORM DRAINAGE PRACTICES OF THIRTY-TWO CITIES,
W69-04551 02E

RMSTRONG, D. E.
EXTRACTION OF ORGANOCHLORINE AND ORGANOPHOSPHATE INSECTICIDES FROM LAKE WATERS,
W69-04523 05A

SHCROFT, GAYLEN L.
HYDROLOGIC ATLAS OF UTAH,
W69-04209 02A

UBERTIN, GERALD H.
A TECHNIQUE FOR OBTAINING UNDISTURBED SOIL SAMPLES BY FREEZING IN-SITU,
W69-04639 02G

ULD, DAVID V.
PROTECTING THE POTOMAC AT WASHINGTON,
W69-04437 05G

'WASTE DISPOSAL AND WATER SUPPLY',
W69-04438 05G

AGLEY, JAY M.
HYDROLOGIC ATLAS OF UTAH,
W69-04209 02A

ALLANCE, W. C.
WATER RESOURCES OF NEW MEXICO, OCCURRENCE, DEVELOPMENT AND USE,
W69-04627 02E

ALLINGER, D. G.
A REVIEW OF CHEMICAL MEASUREMENTS IN WATER POLLUTION CONTROL,
W69-04222 05A

ARNES, C. A.
SOME CONSIDERATIONS OF OXYGEN UTILIZATION RATES IN PUGET SOUND,
W69-04439 05B

ARNETT, HAROLD J.
'NATURAL RESOURCES AND THE QUALITY OF LIFE',
W69-04440 06B

ARNETT, PAUL R.
CHEMICAL CHARACTERIZATION OF PUBLIC SUPPLY,
W69-04245 02K

ARNHILL, K. G.
ESTIMATED COST OF DESALTING THREE FLORIDA BRACKISH WATERS,
W69-04441 03A

ARRETT, ELINORE M.
THE CALIFORNIA OYSTER INDUSTRY,
W69-04442 06B

ARRETT, M. J.
PREDICTING THE CONDITION OF A POLLUTED ESTUARY,
W69-04469 05B

ASILIO, ESPILDORA C.
THE TEACHING AND RESEARCH PROGRAMS IN HYDROLOGY AT FACULTY OF PHYSICAL AND MATHEMATICAL SCIENCES OF THE UNIVERSITY OF CHILE,
W69-04611 09A

AUER, DANIEL P.
TIME OF TRAVEL OF WATER IN THE GREAT MIAMI RIVER, DAYTON TO CLEVES, OHIO,
W69-04598 02E

EG, I. R.
SEDIMENT TRANSPORT IN ESTUARINE AREAS,
W69-04240 02L

ELL, FREDERICK C.
GENERALIZED RAINFALL-DURATION-FREQUENCY RELATIONSHIPS,
W69-04549 02A

ERG, B.
WATER USE AND RELATED COSTS WITH COOLING TOWERS,
W69-04443 06C

ERNER, ROBERT A.
MIGRATION OF IRON AND SULFUR WITHIN ANAEROBIC SEDIMENTS DURING EARLY DIAGENESIS,
W69-04572 02K

IANCHI, W. C.
THE HYDROLOGIC AND GEOLOGIC ASPECTS OF A PERCHING LAYER-SAN JOAQUIN VALLEY, WESTERN FRESNO COUNTY, CALIFORNIA,
W69-04619 02F

IGGAR, J. W.
SOIL-WATER DIFFUSIVITY VALUES BASED UPON TIME DEPENDENT SOIL WATER CONTENT DISTRIBUTIONS,
W69-04603 02G

BJORKLUND, L. J.
GROUND-WATER CONDITIONS IN UTAH, SPRING OF 1968,
W69-04561 02F

BLEVINS, ROBERT L.
A TECHNIQUE FOR OBTAINING UNDISTURBED SOIL SAMPLES BY FREEZING IN-SITU,
W69-04639 02G

BODMER, RENE
ON INDUCED ELECTRICAL POLARIZATION AND GROUNDWATER,
W69-04606 02F

BORMANN, F. H.
NITRIFICATION IMPORTANCE TO NUTRIENT LOSSES FROM A CUTOVER FORESTED ECOSYSTEM,
W69-04584 02K

BORTON, R. L.
WATER RESOURCES OF NEW MEXICO, OCCURRENCE, DEVELOPMENT AND USE,
W69-04627 02E

BOWDEN, K. F.
THE MIXING PROCESSES IN A TIDAL ESTUARY,
W69-04444 02L

BOWEN, VAUGHAN T.
A DIRECT DEMONSTRATION OF THE PHOSPHORUS CYCLE IN A SMALL LAKE,
W69-04520 02H

BOWER, BLAIR T.
MANAGING WATER QUALITY ECONOMICS, TECHNOLOGY, INSTITUTIONS,
W69-04578 05G

BRAARUD, T.
THE EFFECT OF POLLUTION BY SEWAGE UPON THE WATERS OF THE OSLO-FJORD,
W69-04445 05C

BRAMHALL, DAVID F.
A NOTE ON THE ASYMMETRY BETWEEN FEES AND PAYMENTS,
W69-04446 05G

BRASWELL, R. W.
A COOLING POND PROVES CHEAPER,
W69-04447 05C

BREHMER, MORRIS L.
NUTRIENTS,
W69-04448 05C

BREWINGTON, M. V.
CHESAPEAKE BAY, A PICTORIAL MARITIME HISTORY,
W69-04449 06B

BRIDGES, WAYNE W.
LITTERING AND OBSTRUCTIONS,
W69-04450 06E

BRINK, ROBERT J.
OPERATING COSTS OF WASTE TREATMENT IN GENERAL MOTORS,
W69-04451 05D

BROOKS, NORMAN H.
DIFFUSION OF SEWAGE EFFLUENT IN AN OCEAN-CURRENT,
W69-04452 05B

BROUSSE, R.
THE CONSTRUCTION BY FRANCE OF A MIXED PLANT FOR PRODUCTION OF ELECTRIC POWER AND OF SOFT WATER,
W69-04595 03A

BUEHLER, B.
TRANSIENT FLOW INVESTIGATIONS FOR TVA'S BROWNS FERRY GENERATING STATION.
W69-04203 02E

BUE, CONRAD D.
FLOOD INFORMATION FOR FLOOD-PLAIN PLANNING,
W69-04616 02E

BURBANK, NATHAN C., JR.
ANAEROBIC DIGESTION OF PINEAPPLE MILL WASTES,
W69-04527 05D

BURGESS, FREDRICK J.
POLLUTION AND MARINE ECOLOGY.
W69-04310 05G

BUTLER, R. G.
GROUND-WATER CONDITIONS IN UTAH, SPRING OF 1968,
W69-04561 02F

CABLE, CARL C.
OPTIMUM DREDGING AND DISPOSAL PRACTICES IN ESTUARIES,
W69-04581 02L

CAMPBELL, C. J.
A SHIELDED THERMISTOR PROBE WITH PORTABLE INSTRUMENT FOR MEASURING SNOWPACK TEMPERATURES,
W69-04252 07B

CAMPBELL, JOHN
A SUBSTITUTE FOR 2,4,5-T IN EASTERN HARDWOOD SPROUT AND BRUSH CONTROL,
W69-04633 03B

CANO, GUILLERMO J.
NATIONAL WATER LAWS AND ADMINISTRATION AS ELEMENTS OF WATER DEVELOPMENT,
W69-04644 06E

CAREY, OMER L.
RECENT DEVELOPMENTS IN EVALUATING RECREATIONAL BENEFITS,
W69-04453 06B

CARTER, H. H.
ON THE PREDICTION OF THE DISTRIBUTION OF EXCESS TEMPERATURE FROM A HEATED DISCHARGE IN AN ESTUARY,
W69-04494 05C

CARTWRIGHT, KEROS
TEMPERATURE PROSPECTING FOR SHALLOW GLACIAL AND ALLUVIAL AQUIFERS IN ILLINOIS,
W69-04585 02F

CASSEL, D. K.
SOIL-WATER DIFFUSIVITY VALUES BASED UPON TIME DEPENDENT SOIL WATER CONTENT DISTRIBUTIONS,
W69-04603 02G

CHAMBERS, G. V.
AN ECOLOGICAL SURVEY OF THE HOUSTON SHIP CHANNEL AND ADJACENT BAYS,
W69-04454 05C

CHAPMAN, W. M.
POLITICS AND THE MARINE FISHERIES,
W69-04455 06E

CHESTERS, GORDON
LINDANE ADSORPTION BY LAKE SEDIMENTS,
W69-04525 05G

CHESTERS, G.
EXTRACTION OF ORGANOCHLORINE AND ORGANOPHOSPHATE INSECTICIDES FROM LAKE WATERS,
W69-04523 05A

CHRISTIE, E. R.
A PERSPECTIVE OF REGIONAL AND STATE MARINE ENVIRONMENTAL ACTIVITIES, A QUESTIONNAIRE SURVEY, STATISTICS AND OBSERVATIONS,
W69-04289 06E

CHURCHILL, M. A.
ANALYSIS OF A STREAM'S CAPACITY FOR ASSIMILATING POLLUTION,
W69-04456 05C

CIRIACY-WANTRUP, S. V.
WATER QUALITY, A PROBLEM FOR THE ECONOMIST,
W69-04457 05G

CLARK, JOHN R.
THERMAL POLLUTION AND AQUATIC LIFE,
W69-04235 05A

CLAWSON, MARION
RECREATION,
W69-04458 06B

COCKS, C. A.
ORGANIZATION ARRANGEMENT FOR DEVELOPMENT AND OPERATION OF THE MISSOURI RIVER BASIN PROJECTS,
W69-04645 06E

COHN, MORRIS M.
FORMULA FOR WATER RESOURCES MANAGEMENT IN NEW YORK STATE,
W69-04646 06B

COLLEYPRIEST, C.
SEDIMENT TRANSPORT IN ESTUARINE AREAS,
W69-04240 02L

COLLIAS, E. E.
SOME CONSIDERATIONS OF OXYGEN UTILIZATION RATES IN PUGET SOUND,
W69-04439 05B

COOTNER, P. H.
'WATER DEMAND FOR STEAM ELECTRIC GENERATION',
W69-04461 06D

CORDOVA, R. M.
GROUND-WATER CONDITIONS IN UTAH, SPRING OF 1968,
W69-04561 02F

CORY, ROBERT L.
TEMPERATURE AND WATER-QUALITY CONDITIONS FOR THE PERIOD JULY, 1963, TO DECEMBER, 1965, PATUXENT RIVER ESTUARY, MARYLAND,
W69-04462 05B

COULOMB, RENE
USE OF MULTI-PURPOSE STORAGE DAMS IN THE DEVELOPMENT OF THE SEINE BASIN,
W69-04596 04A

CRAVER, F. E.
THE PROSPECTS FOR DUAL-PURPOSE PLANTS,
W69-04463 03A

CRONIN, E. L.
CHESAPEAKE BAY WATER SUPPLY NEEDS - THE BIOLOGICAL POINT OF VIEW,
W69-04464 03C

DAVENPORT, DAVID C.
VARIATIONS OF EVAPORATION IN TIME AND SPACE PART 1 AND PART 2,
W69-04618 02D

DAVIDSON, J. M.
INFLUENCE OF WATER FLUX AND POROUS MATERIAL ON THE MOVEMENT OF SELECTED HERBICIDES,
W69-04258 05B

DAVIES, DELWYN
FRESH WATER,
W69-04225 03B

DAVIS, CHARLES C.
ON QUESTIONS OF PRODUCTION AND PRODUCTIVITY IN ECOLOGY,
W69-04524 02K

DAVIS, ROBERT K.
COMPARISONS OF METHODS FOR RECREATION EVALUATION,
W69-04474 06B

DAVIS, STANLEY N.
SILICA IN STREAMS AND GROUND WATER OF HAWAII,
W69-04528 02G

DEGREMONT, G.
CONDITIONS FOR BETTER FILTERED WATER,
W69-04591 05D

DEGUERRERO, L. C.
NATIONAL ESTUARINE INVENTORY HANDBOOK OF DESCRIPTORS,
W69-04358 10

DICKASON, CLIFFORD
MAJOR USES OF LAND AND WATER IN THE U. S. WITH SPECIAL REFERENCE TO AGRICULTURE, 1964,
W69-04208 03F

DIGHTMAN, R. A.
CENTRAL MONTANA RAINSTORMS AND FLOODS, JUNE 6-15, 1967,
W69-04237 02B

DISKIN, MORDECHAI H.
EVALUATION OF SEGMENTED IUH FROM DERIVATIVES,
W69-04553 02A

DOONAN, C. J.
GROUND WATER IN GOGEBIC COUNTY, MICHIGAN,
W69-04564 02F

DOUGLAS, IAN
MAN, VEGETATION AND THE SEDIMENT YIELDS OF RIVERS,
W69-04269 02E

DOUGLAS, P. A.
THERMAL POLLUTION OF WATER,
W69-04345 05C

DOYLE, ROGER W.
IDENTIFICATION AND SOLUBILITY OF IRON SULFIDE IN ANAEROBIC LAKE SEDIMENT,
W69-04590 02K

DUEKER, KENNETH J.
STORM DRAINAGE PRACTICES OF THIRTY-TWO CITIES,
W69-04551 02E

DUGUID, JAMES OTTO
REFRACTION DETERMINATION OF WATER TABLE DEPTH AND ALLUVIUM THICKNESS,
W69-04607 02E

DURUM, W. H.
THE AERATION CAPACITY OF STREAMS,
W69-04628 02E

DYKSTERHUIS, E. J.
WATER INTAKE ON MIDCONTINENTAL RANGELANDS AS INFLUENCED BY SOIL AND PLANT COVER,
W69-04640 02G

EBERT, E. E.
THE MARINE ENVIRONMENT IN THE VICINITY OF THE ORANGE COUNTY SANITATION DISTRICTS OCEAN OUTFALL,
W69-04511 05C

EDEN, EDWIN W., JR.
CURRENTS IN AN INTEROCEANIC CANAL,
W69-04557 02E

EDINGER, JOHN E.
HEAT EXCHANGE IN THE ENVIRONMENT,
W69-04467 02A

EISENLOHR, W. S., JR.
GENERALIZED HYDROLOGY OF PRAIRIE POTHOLES ON THE COTEAU DU MISSOURI, NORTH DAKOTA,
W69-04597 02H

ELLIS, HAROLD H.
WATER RIGHTS AND REGULATION IN THE EASTERN UNITED STATES,
W69-04649 06E

ELMORE, H. L.
EFFECT OF WATER TEMPERATURE ON STREAM REAERATION,

W69-04468 05G

SON, JOHN A.
GEOLOGY OF GLACIAL LAKE AGASSIZ,
W69-04617 02H

METT, L. F.
RECONNAISSANCE OF THE GROUND-WATER RESOURCES OF THE MISSOURI RIVER ALLUVIUM BETWEEN ST. CHARLES AND JEFFERSON CITY, MISSOURI,
W69-04610 02F

GLAND, CHARLES B.
GEOMORPHIC GROUPING OF SOILS IN WATERSHED ENGINEERING,
W69-04207 02E

GLAND, C. B.
MOISTURE-TENSION DATA FOR SELECTED SOILS ON EXPERIMENTAL WATERSHEDS,
W69-04266 02G

CHNER, A. R.
EFFECT ON STREAMFLOW OF FOUR FOREST PRACTICES IN THE MOUNTAINS OF WEST VIRGINIA,
W69-04636 03B

GSTER, HANS P.
SILICA IN ALKALINE BRINES,
W69-04270 02K

ING, BEN B.
A PROBABILISTIC ANALYSIS OF DISSOLVED OXYGEN-BIOCHEMICAL OXYGEN DEMAND RELATIONSHIP IN STREAMS,
W69-04247 05C

RRELL, J. F.
ECONOMIC IMPACT OF MARINE-ORIENTED ACTIVITIES--A STUDY OF THE SOUTHERN NEW ENGLAND MARINE REGION,
W69-04330 06B

IGNER, K. D.
MATHEMATICAL MODELING OF WATER QUALITY IN ESTUARIAL SYSTEMS,
W69-04311 05B

OLLIOTT, PETER F.
OBSERVATIONS OF SNOWPACK ACCUMULATION, MELT, AND RUNOFF ON A SMALL ARIZONA WATERSHED,
W69-04253 02C

NGER, JAMES H.
ORGANIC CARBON-ORGANIC NITROGEN RATIOS OF SEDIMENTS IN A POLLUTED ESTUARY,
W69-04248 05C

Y, C. L.
WATER INTAKE ON MIDCONTINENTAL RANGELANDS AS INFLUENCED BY SOIL AND PLANT COVER,
W69-04640 02G

EY, H. THOMAS
MAJOR USES OF LAND AND WATER IN THE U. S. WITH SPECIAL REFERENCE TO AGRICULTURE, 1964,
W69-04208 03F

MESON, A. L. H.
PREDICTING THE CONDITION OF A POLLUTED ESTUARY,
W69-04469 05B

RRISON, J. M.
TRANSIENT FLOW INVESTIGATIONS FOR TVA'S BROWNS FERRY GENERATING STATION.
W69-04203 02E

NAEHLING, CLAUDE
ONE EXAMPLE OF MULTIPURPOSE DEVELOPMENT PROGRAM THE RHONE,
W69-04592 04A

YER, JOHN
HEAT EXCHANGE IN THE ENVIRONMENT,
W69-04467 02A

VEN, R. G.
THE MARINE ENVIRONMENT IN THE VICINITY OF THE ORANGE COUNTY SANITATION DISTRICTS OCEAN OUTFALL,
W69-04511 05C

OLSBY, D. A.
TEST HOLE IN AQUIFER WITH MANY WATER-BEARING ZONES AT JACKSONVILLE, FLORIDA,
W69-04620 02F

TTFRIED, G. J.
A SHIELDED THERMISTOR PROBE WITH PORTABLE INSTRUMENT FOR MEASURING SNOWPACK TEMPERATURES,
W69-04252 07B

AETZ, DONALD A.
LINDANE ADSORPTION BY LAKE SEDIMENTS,
W69-04525 05G

AHAM, K.
FACTORS IMPORTANT IN THE CALCULATION OF HYDRAULIC CONDUCTIVITY,
W69-04604 02G

EENBERG, ARNOLD E.
IDENTIFICATION OF PETROLEUM PRODUCTS IN ESTUARINE WATERS,
W69-04282 05A

RNHAM, FRED C.
INDUSTRIAL WASTEWATER CONTROL,
W69-04471 05D

GUTHRIE, DONALD
MARKOV CHAINS OF ORDER GREATER THAN ONE,
W69-04238 02B

HAMON, B. V.
LOW-FREQUENCY SEA LEVEL BEHAVIOR AND CONTINENTAL SHELF WAVES OFF NORTH CAROLINA,
W69-04224 02A

HANEY, PAUL D.
WATER REUSE FOR PUBLIC SUPPLY,
W69-04265 05D

HANSEN, EDWARD A.
OBSERVATIONS OF SNOWPACK ACCUMULATION, MELT, AND RUNOFF ON A SMALL ARIZONA WATERSHED,
W69-04253 02C

HANSEN, J. A.
MARINE SPORTFISHING SURVEY OF SOUTHERN CALIFORNIA PIERS AND JETTIES, 1963,
W69-04316 06B

HARLEMAN, DONALD R. F.
SALINITY INTRUSION EFFECTS IN ESTUARY SHOALING,
W69-04558 02L

HARRIS, HOWARD S.
THE FUTURE OF AN ESTUARY,
W69-04290 05G

HASKELL, E. E., JR.
THE HYDROLOGIC AND GEOLOGIC ASPECTS OF A PERCHING LAYER-SAN JOAQUIN VALLEY, WESTERN FRESNO COUNTY, CALIFORNIA,
W69-04619 02F

HAUG, LESTER A.
OCEAN OUTFALL DESIGN FOR ECONOMY OF CONSTRUCTION,
W69-04313 05E

HAUPT, HAROLD F.
THE GENERATION OF SPRING PEAK FLOWS BY SHORT-TERM METEOROLOGICAL EVENTS,
W69-04570 02E

HELLER, J. P.
THE DRYING THROUGH THE TOP SURFACE OF A VERTICAL POROUS COLUMN,
W69-04602 02G

HENDRICKSON, G. E.
GROUND WATER IN GOGEBIC COUNTY, MICHIGAN,
W69-04564 02F

HERBERT, L. R.
GROUND-WATER CONDITIONS IN UTAH, SPRING OF 1968,
W69-04561 02F

HILLER, D. E.
SALINE GROUND WATER IN LOUISIANA,
W69-04608 02F

HOLOWAYCHUK, NICHOLAS
A TECHNIQUE FOR OBTAINING UNDISTURBED SOIL SAMPLES BY FREEZING IN-SITU,
W69-04639 02G

HOLTAN, H. N.
GEOMORPHIC GROUPING OF SOILS IN WATERSHED ENGINEERING,
W69-04207 02E

MOISTURE-TENSION DATA FOR SELECTED SOILS ON EXPERIMENTAL WATERSHEDS,
W69-04266 02G

HORNBECK, JAMES W.
EFFECTS OF ABANDONED FARMLAND ON STREAMFLOW,
W69-04635 03B

HOSMAN, R. L.
GEOHYDROLOGY OF THE COASTAL PLAIN AQUIFERS OF ARKANSAS,
W69-04609 02F

HUBER, A. LEON
HYDROLOGIC ATLAS OF UTAH,
W69-04209 02A

HUTCHINSON, G. EVELYN
A DIRECT DEMONSTRATION OF THE PHOSPHORUS CYCLE IN A SMALL LAKE,
W69-04520 02H

HUTCHINSON, G. E.
THE THERMAL CLASSIFICATION OF LAKES,
W69-04522 02H

IPPEN, ARTHUR T.
SALINITY INTRUSION EFFECTS IN ESTUARY SHOALING,
W69-04558 02L

JACKSON, DONALD R.
A DISSIPATIVE RIVER FLOW MODEL,
W69-04232 02A

JEFFERY, H. G.
RECONNAISSANCE OF THE GROUND-WATER RESOURCES OF THE MISSOURI RIVER ALLUVIUM BETWEEN ST. CHARLES AND JEFFERSON CITY, MISSOURI,
W69-04610 02F

JEGLIC, JOHN M.
THE DEVELOPMENT AND APPLICATION OF A TIME-VARYING DISSOLVED OXYGEN MODEL,
W69-04315 05G

JEPPSON, ROLAND W.
HYDROLOGIC ATLAS OF UTAH,
W69-04209 02A

FREE-SURFACE FLOW THROUGH HETEROGENEOUS POROUS MEDIA,
W69-04552 02F

JOHNSON, NOYE M.
NITRIFICATION IMPORTANCE TO NUTRIENT LOSSES FROM A CUTOVER FORESTED ECOSYSTEM,
W69-04584 02K

JONES, BLAIR F.
SILICA IN ALKALINE BRINES,
W69-04270 02K

JONES, W. M.
VISCOUS DRAG AND SECONDARY FLOW IN GRANULAR BEDS,
W69-04243 02F

KELLER, W. D.
ALUMINUM IONS IN AQUEOUS SOLUTIONS,
W69-04575 02K

KELLEY, D. W.
FISHERIES PROTECTING AND ENHANCEMENT WITH WATER DEVELOPMENT OF THE SACRAMENTO-SAN JOAQUIN ESTUARY,
W69-04472 06B

KELNHOFER, GUY J., JR.
METROPOLITAN PLANNING AND RIVER BASIN PLANNING SOME INTERRELATIONSHIPS,
W69-04566 06A

KIRBY, R.
SEDIMENT TRANSPORT IN ESTUARINE AREAS,
W69-04240 02L

KISSIN, I. G.
EFFECT OF HIGH TEMPERATURES ON THE CHEMICAL COMPOSITION OF GROUND WATERS,
W69-04271 02K

KLEMMER, HOWARD W.
ANAEROBIC DIGESTION OF PINEAPPLE MILL WASTES,
W69-04527 05D

KLOHN, WULF
LOA RIVER BASIN WATER RESOURCES AND THEIR DISTRIBUTION,
W69-04613 04A

KNEESE, ALLEN V.
MANAGING WATER QUALITY ECONOMICS, TECHNOLOGY, INSTITUTIONS,
W69-04578 05G

KNETSCH, JACK L.
COMPARISONS OF METHODS FOR RECREATION EVALUATION,
W69-04474 06B

KONRAD, J. G.
EXTRACTION OF ORGANOCHLORINE AND ORGANOPHOSPHATE INSECTICIDES FROM LAKE WATERS,
W69-04523 05A

KOTHANDARAMAN, V.
A PROBABILISTIC ANALYSIS OF DISSOLVED OXYGEN-BIOCHEMICAL OXYGEN DEMAND RELATIONSHIP IN STREAMS,
W69-04247 05C

KRAUSE, ORVILLE E.
MAJOR USES OF LAND AND WATER IN THE U. S. WITH SPECIAL REFERENCE TO AGRICULTURE, 1964,
W69-04208 03F

KRUGER, PAUL
VANADIUM CONCENTRATIONS IN COLORADO RIVER BASIN WATERS,
W69-04264 02K

KRUTILLA, J. V.
THE PUBLIC INTEREST IN PRESERVING NATURAL AREAS,
W69-04475 06D

KUNZE, H. L.
RECONNAISSANCE OF THE CHEMICAL QUALITY OF SURFACE WATERS OF THE CANADIAN RIVER BASIN, TEXAS,
W69-04593 02E

KUNZE, R. J.
FACTORS IMPORTANT IN THE CALCULATION OF HYDRAULIC CONDUCTIVITY,
W69-04604 02G

KVASOV, D. C.
LIMNOLOGICAL HYPOTHESIS OF THE ORIGIN OF HOT BRINES IN THE RED SEA,
W69-04254 02K

LABORDE, ALDEN J.
PROBLEMS OF A DRILLING CONTRACTOR,
W69-04275 06C

LACKEY, JAMES B.
NUTRIENT AND POLLUTANT RESPONSE OF ESTUARINE BIOTAS,
W69-04276 05C

LAGER, JOHN A.
USE OF HYDRAULIC AND MATHEMATICAL MODELS FOR DETERMINING EFFLUENT DIFFUSION IN SOUTH SAN FRANCISCO BAY,
W69-04277 05B

LAMPE, H. C.
ECONOMIC IMPACT OF MARINE-ORIENTED ACTIVITIES--A STUDY OF THE SOUTHERN NEW ENGLAND MARINE REGION,
W69-04330 06B

LANE, R. W.
WATER USE AND RELATED COSTS WITH COOLING TOWERS,
W69-04443 06C

LANGBEIN, W. B.
THE AERATION CAPACITY OF STREAMS,
W69-04628 02E

LARSON, T. C.
WATER USE AND RELATED COSTS WITH COOLING TOWERS,
W69-04443 06C

LAUFF, GEORGE H.
ESTUARIES,
W69-04278 02L

LAU, L. STEPHEN
ANAEROBIC DIGESTION OF PINEAPPLE MILL WASTES,
W69-04527 05D

LAWHEAD, HARLEY F.
ORGANIZATION FOR THE REGULATION OF LAKE ONTARIO,
W69-04648 06E

LAWLESS, G. P.
MOISTURE-TENSION DATA FOR SELECTED SOILS ON EXPERIMENTAL WATERSHEDS,
W69-04266 02G

LEE, GERHARD B.
LINDANE ADSORPTION BY LAKE SEDIMENTS,
W69-04525 05G

LEE, J. N.
RECONNAISSANCE OF THE CHEMICAL QUALITY OF SURFACE WATERS OF THE CANADIAN RIVER BASIN, TEXAS,
W69-04593 02E

LEFFEL, ERNEST R.
ESTUARINE POLLUTION OF THE CHAO PHRAYA RIVER AT BANGKOK, THAILAND,
W69-04279 05B

LEGRAND, H. E.
GROUND WATER OF THE PIEDMONT AND BLUE RIDGE PROVINCES IN THE SOUTHEASTERN STATES,
W69-04615 02F

LEHMANN, RICHARD A.
THE PRINCIPLES OF WATERFRONT RENEWAL A SUMMARY OF EXPERIENCE IN FIFTY AMERICAN CITIES,
W69-04476 06B

LEIPESTE, DONALD K.
RECONNAISSANCE OF THE CHEMICAL QUALITY OF SURFACE WATERS OF THE SULFUL RIVER AND CYPRESS CREEK BASINS, TEXAS,
W69-04586 02K

LEIGHTON, D.
EFFECTS OF WASTE DISCHARGE FROM POINT LOMA SALINE WATER CONVERSION PLANT ON INTERTIDAL MARINE LIFE,
W69-04280 05C

LENZ, ARNO T.
STORM DRAINAGE PRACTICES OF THIRTY-TWO CITIES,
W69-04551 02E

LEOPOLD, LUNA B.
HYDROLOGY FOR URBAN LAND PLANNING-A GUIDEBOOK ON THE HYDROLOGIC EFFECTS OF URBAN LAND USE,
W69-04548 04C

LEVE, G. W.
TEST HOLE IN AQUIFER WITH MANY WATER-BEARING ZONES AT JACKSONVILLE, FLORIDA,
W69-04620 02F

LEVIEL, R.
CONDITIONS FOR BETTER FILTERED WATER,
W69-04591 05D

LIEBMAN, JON C.
A 'BALAS' ALGORITHM FOR ZONED UNIFORM TREATMENT,
W69-04281 05D

LIKENS, GENE E.
NITRIFICATION IMPORTANCE TO NUTRIENT LOSSES FROM A CUTOVER FORESTED ECOSYSTEM,
W69-04584 02K

LINSTEDT, K. DANIEL
VANADIUM CONCENTRATIONS IN COLORADO RIVER BASIN WATERS,
W69-04264 02K

LIVINGSTONE, ROBERT, JR.
A PRELIMINARY BIBLIOGRAPHY WITH KWIC INDEX ON THE ECOLOGY OF ESTUARIES AND COASTAL AREAS OF THE EASTERN UNITED STATES,
W69-04477 06G

LOCKETT, JOHN B.

HENOMENA AFFECTING IMPROVEMENT OF THE LOWER COLUMBIA
STUARY AND ENTRANCE,
69-04478 02L

FLER, H.
HE THERMAL CLASSIFICATION OF LAKES,
69-04522 02H

, G. O.
WATER DEMAND FOR STEAM ELECTRIC GENERATION',
69-04461 06D

SE, ERIK G.
INDANE ADSORPTION BY LAKE SEDIMENTS,
69-04525 05G

RY, WILLIAM P.
ARKOV CHAINS OF ORDER GREATER THAN ONE,
69-04238 02B

N, WALTER R.
EAK FLOOD DISCHARGE CONFIDENCE LIMITS,
69-04582 02E

SS, ARTHUR
ENEFIT-COST ANALYSIS ITS RELEVANCE TO PUBLIC INVESTMENT
ECISIONS,
69-04479 06B

E, ARNETT C., JR.
FFECTS OF SOIL FREEZING ON WATER YIELDS,
69-04251 02C

HLER, CLAUDE Z.
DENTIFICATION OF PETROLEUM PRODUCTS IN ESTUARINE WATERS,
69-04282 05A

LBERG, GLENN T.
YDROLOGY OF THE VALLEY-FILL AND CARBONATE-ROCK RESERVOIRS
AHRUMP VALLEY NEVADA-CALIFORNIA,
69-04267 03D

MING, J. H.
A SUMMARY REPORT ON MARYLAND'S COMMERCIAL FISHERIES, 1957-
1966,
W69-04284 06B

KS, DAVID H.
A 'BALAS' ALGORITHM FOR ZONED UNIFORM TREATMENT,
69-04281 05D

RSHALL, A. R.
PRACTICES AFFECTING SOUTH ATLANTIC AND GULF COAST MARSHES
AND ESTUARIES - DREDGING AND FILLING,
W69-04288 04A

RSHALL, NELSON
ECONOMIC IMPACT OF MARINE-ORIENTED ACTIVITIES--A STUDY OF
THE SOUTHERN NEW ENGLAND MARINE REGION,
W69-04330 06B

TON, GILBERT L.
A PERSPECTIVE OF REGIONAL AND STATE MARINE ENVIRONMENTAL
ACTIVITIES, A QUESTIONNAIRE SURVEY, STATISTICS AND
OBSERVATIONS,
W69-04289 06E

CARTY, JAMES C.
THE FUTURE OF AN ESTUARY,
W69-04290 05G

CRONE, A. W.
THE HUDSON RIVER ESTUARY HYDROLOGY, SEDIMENTS AND
POLLUTION,
W69-04480 05A

CULLOUGH, C. A.
DELTA-SUISUN BAY WATER QUALITY INVESTIGATION,
W69-04291 02L

FARLAND, S. W.
THE IMPACT OF THE PORT OF JACKSONVILLE ON THE ECONOMY OF THE
COMMUNITY,
W69-04517 06B

GREGOR, JOHN R.
WATER REQUIREMENTS OF SELECTED NORTH GEORGIA MANUFACTURING
INDUSTRIES,
W69-04205 06D

GUINNESS, C. L.
SCIENTIFIC OR RULE-OF-THUMB TECHNIQUES OF GROUND-WATER
MANAGEMENT - WHICH WILL PREVAIL,
W69-04231 04B

HUGH, J. L.
ESTUARINE NEKTON,
W69-04292 02L

MANAGEMENT OF ESTUARINE FISHERIES,
W69-04481 06B

KEAN, R. N.
EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS,
W69-04482 06B

KEE, PAUL W.
STATEMENT BEFORE THE SUBCOMMITTEE ON AIR AND WATER
POLLUTION, APRIL 17, 1968,
W69-04293 05B

MCMORROW, MARTIN J. K.
ANAEROBIC DIGESTION OF PINEAPPLE MILL WASTES,
W69-04527 05D

MCNATT, E. M.
SEISMIC EXPLORATION AT SEA,
W69-04294 07B

MCQUIVEY, R. S.
SOME TURBULENCE MEASUREMENTS IN OPEN-CHANNEL FLOW,
W69-04555 02E

MEIER, MARK F.
GLACIERS AND WATER SUPPLY,
W69-04255 02C

METCALF, T. G.
VIRAL POLLUTION OF SHELLFISH IN ESTUARY WATERS,
W69-04296 05C

MIHURSKY, JOSEPH A.
PATUXENT THERMAL STUDIES - SUMMARY AND RECOMMENDATIONS,
W69-04244 02L

MIHURSKY, J. A.
ON POSSIBLE CONSTRUCTIVE USES OF THERMAL ADDITIONS TO
ESTUARIES,
W69-04297 05C

MILLER, KENNETH J.
CHEMICAL CHARACTERIZATION OF PUBLIC SUPPLY,
W69-04245 02K

MILLIMAN, J. W.
THE ECONOMICS OF WATER PRODUCTION USING NUCLEAR ENERGY,
W69-04483 03A

MILLS, EDWIN S.
A NOTE ON THE ASYMMETRY BETWEEN FEES AND PAYMENTS,
W69-04446 05G

MITCHELL, C. L.
FISH PROTEIN CONCENTR)TE SEEN POSSIBLE NEW INDUSTRY,
W69-04299 06B

MOCK, CORNELIUS R.
NATURAL AND ALTERED ESTUARINE HABITATS OF PENAEID SHRIMP,
W69-04484 02L

MOCK, C.
IMPORTANCE OF GULF ESTUARIES AND PROBLEMS FACING OUR FISHERY
RESOURCES,
W69-04300 06B

MOORE, A. M.
WATER TEMPERATURES IN THE LOWER COLUMBIA RIVER,
W69-04605 02E

MORGAN, ELMO R.
ALLOCATION AND REALLOCATION OF WATER RESOURCES,
W69-04647 05G

MORGAN, ROBERT
WHEN DOES A FISHERY BECOME UNECONOMIC,
W69-04485 06B

MORRISON, H. F.
ON INDUCED ELECTRICAL POLARIZATION AND GROUNDWATER,
W69-04606 02F

MORSE, CHANDLER
'NATURAL RESOURCES AND THE QUALITY OF LIFE',
W69-04440 06B

MOSS, F.
RELATIONS BETWEEN SPORT AND COMMERCIAL FISHERMEN,
W69-04302 06B

MOURANT, W. A.
WATER RESOURCES OF NEW MEXICO, OCCURRENCE, DEVELOPMENT AND
USE,
W69-04627 02E

MOWER, R. W.
GROUND-WATER CONDITIONS IN UTAH, SPRING OF 1968,
W69-04561 02F

MULFORD, S.
EFFECTS OF WASTE DISCHARGE FROM POINT LOMA SALINE WATER
CONVERSION PLANT ON INTERTIDAL MARINE LIFE,
W69-04280 05C

MURPHY, EARL FINBAR
THE ROLE OF LAW IN A SYSTEM FOR LAKES ERIE AND ONTARIO,
W69-04212 06E

MYSAK, L. A.
LOW-FREQUENCY SEA LEVEL BEHAVIOR AND CONTINENTAL SHELF WAVES
OFF NORTH CAROLINA,
W69-04224 02A

NAPIER, JEFF W.
STATEMENT,
W69-04303 06B

NARASIMHAN, T. N.
PUMPING TESTS ON OPEN WELLS IN PALAR ALLUVIUM, NEAR MADRAS
CITY, INDIA, AN APPLICATION OF THE PAPADOPULOS-COOPER
METHOD,
W69-04573 02F

NAUMAN, JOHN W.
TEMPERATURE AND WATER-QUALITY CONDITIONS FOR THE PERIOD JULY, 1963, TO DECEMBER, 1965, PATUXENT RIVER ESTUARY, MARYLAND,
W69-04462 05B

NAYLOR, E.
EFFECTS OF HEATED EFFLUENTS UPON MARINE AND ESTUARINE ORGANISMS,
W69-04486 05C

NELSON, THURLOW C.
SOME ASPECTS OF POLLUTION, PARASITISM, AND INLET RESTRICTION IN THREE NEW JERSEY ESTUARIES,
W69-04304 05C

NEWCOME, ROY, JR.
DEVELOPMENT OF GROUND-WATER SUPPLIES AT MISSISSIPPI TEST FACILITY, HANCOCK COUNTY, MISSISSIPPI,
W69-04268 02F

NEWLAND, LEO W.
LINDANE ADSORPTION BY LAKE SEDIMENTS,
W69-04525 05G

NIELSEN, D. R.
SOIL-WATER DIFFUSIVITY VALUES BASED UPON TIME DEPENDENT SOIL WATER CONTENT DISTRIBUTIONS,
W69-04603 02G

NITSOS, R. J.
THE ANIMAL FOOD FISHERY IN CALIFORNIA, 1961-1962,
W69-04487 06B

NORRIS, ROBERT M.
SEA CLIFF RETREAT NEAR SANTA BARBARA, CALIFORNIA,
W69-04241 02L

NOVAK, CHARLES E.
MEASUREMENT OF DISCHARGE BY THE MOVING-BOAT METHOD,
W69-04547 07B

NRIAGU, JEROME O.
SULFUR METABOLISM AND SEDIMENTARY ENVIRONMENT LAKE MENDOTA, WISCONSIN,
W69-04526 05C

NUSBAUM, I.
EFFECTS OF WASTE DISCHARGE FROM POINT LOMA SALINE WATER CONVERSION PLANT ON INTERTIDAL MARINE LIFE,
W69-04280 05C

ODUM, EUGENE P.
STATEMENT,
W69-04306 05D

THE URGENT NEED FOR LANDSCAPE ZONING OF THE ESTUARINE REGION ACCORDING TO ECO-SYSTEM PRINCIPLES,
W69-04307 06F

MECHANISMS MAINTAINING HIGH PRODUCTIVITY IN GEORGIA ESTUARIES,
W69-04334 02L

OLSON, THEOLDORE A.
POLLUTION AND MARINE ECOLOGY.
W69-04310 05G

OREM, HOLLIS M.
DISCHARGE IN THE LOWER COLUMBIA RIVER BASIN, 1928-65,
W69-04577 02E

ORLOB, G. T.
MATHEMATICAL MODELING OF WATER QUALITY IN ESTUARIAL SYSTEMS,
W69-04311 05B

OVERMAN, ALLEN R.
CONVECTIVE DIFFUSION IN CLAY SYSTEMS,
W69-04261 02F

O'CONNOR, J. D.
ESTUARINE DISTRIBUTION OF NONCONSERVATIVE SUBSTANCES,
W69-04489 05G

PAKHOMOV, S. I.
EFFECT OF HIGH TEMPERATURES ON THE CHEMICAL COMPOSITION OF GROUND WATERS,
W69-04271 02K

PANLIK, G. J.
DIGITAL SIMULATION OF NATURAL ANIMAL COMMUNITIES,
W69-04312 06G

PARKHURST, JOHN D.
OCEAN OUTFALL DESIGN FOR ECONOMY OF CONSTRUCTION,
W69-04313 05E

PATRICK, RUTH
STATEMENT BEFORE THE SUBCOMMITTEE ON AIR AND WATER POLLUTION,
W69-04314 06G

PATRIC, J. H.
A SUBSTITUTE FOR 2,4,5-T IN EASTERN HARDWOOD SPROUT AND BRUSH CONTROL,
W69-04644 03B

PATTERSON, JAMES L.
STORAGE REQUIREMENTS FOR ARKANSAS STREAMS,
W69-04256 02E

PAVLOV, A. N.
A GEOCHEMICAL CLASSIFICATION OF NATURAL WATERS,
W69-04626 02K

PENCE, GEORGE D., JR.
THE DEVELOPMENT AND APPLICATION OF A TIME-VARYING DISSOLVED OXYGEN MODEL,
W69-04315 05G

PENNINGTON, WINIFRED
EXPERIMENTS ON THE UTILIZATION OF NITROGEN IN FRESH WATER,
W69-04521 05C

PEREL'MAN, ALEKSANDR I.
GEOCHEMISTRY OF EPIGENESIS,
W69-04274 02K

PHILLIPS, KENNETH N.
HYDROLOGY OF CRATER, EAST AND DAVIS LAKES, OREGON,
W69-04574 02H

PICKETT, E. E.
ALUMINUM IONS IN AQUEOUS SOLUTIONS,
W69-04575 02K

PINCUS, L.
MARINE SPORTFISHING SURVEY OF SOUTHERN CALIFORNIA PIERS AND JETTIES, 1963,
W69-04316 06B

PIONKE, H. B.
EXTRACTION OF ORGANOCHLORINE AND ORGANOPHOSPHATE INSECTICIDES FROM LAKE WATERS,
W69-04523 05A

PLICHON, J. M.
A RIVER HARNESSED THE DURANCE, A SOURCE OF POWER AND AGRICULTURAL PLENITUDE,
W69-04594 04A

PREDDY, W. S.
PREDICTING THE CONDITION OF A POLLUTED ESTUARY,
W69-04469 05B

PRENTICE, J. E.
SEDIMENT TRANSPORT IN ESTUARINE AREAS,
W69-04240 02L

PREST, A. R.
COST-BENEFIT ANALYSIS A SURVEY,
W69-04492 06B

PRICE, J. T.
TRANSIENT FLOW INVESTIGATIONS FOR TVA'S BROWNS FERRY GENERATING STATION.
W69-04203 02E

PRICKETT, T. A.
DESIGNING PUMPED WELL CHARACTERISTICS INTO ELECTRIC ANALOG MODELS,
W69-04623 06B

PRITCHARD, DONALD W.
DISPERSION AND FLUSHING OF POLLUTANTS IN ESTUARIES,
W69-04559 02L

PRITCHARD, D. W.
A PRELIMINARY ESTIMATE OF THE EFFECT OF DIVERSION OF FLOW FROM THE SUSQUEHANNA RIVER ON THE SALINITY OF THE UPPER CHESAPEAKE BAY,
W69-04493 02L

ON THE PREDICTION OF THE DISTRIBUTION OF EXCESS TEMPERATURE FROM A HEATED DISCHARGE IN AN ESTUARY,
W69-04494 05C

RADEMACHER, J. M.
SPILL POLLUTION - ITS EFFECTS AND CONTROL,
W69-04322 05G

RAMBOW, CARL A.
INDUSTRIAL WASTEWATER RECLAMATION,
W69-04226 05D

RANALLI, G.
TOPOLOGICAL SIGNIFICANCE OF STREAM METHODS,
W69-04571 02E

RANTZ, S. E.
SURFACE-WATER HYDROLOGY OF CALIFORNIA COASTAL BASINS BETWEEN SAN FRANCISCO BAY AND EEL RIVER,
W69-04273 03B

RASMUSSON, EUGENE M.
ATMOSPHERIC WATER VAPOR TRANSPORT AND THE WATER BALANCE OF NORTH AMERICA- 2. LARGE-SCALE WATER BALANCE INVESTIGATIONS,
W69-04246 02A

RAUZI, FRANK
WATER INTAKE ON MIDCONTINENTAL RANGELANDS AS INFLUENCED BY SOIL AND PLANT COVER,
W69-04640 02G

REDFORD, POLLY
VANISHING TIDELANDS,
W69-04323 06E

REED, P. H.
THE ANIMAL FOOD FISHERY IN CALIFORNIA, 1961-1962,
W69-04487 06B

MAN, A. L.
OMINUM IONS IN AQUEOUS SOLUTIONS,
9-04575 02K

HART, KENNETH G.
FECT OF A COMMERCIAL CLEARCUTTING IN WEST VIRGINIA ON
ERLAND FLOW AND STORM RUNOFF,
9-04632 04C

TERSHED CALIBRATION METHODS,
9-04634 03B

HART, K. G.
FECT ON STREAMFLOW OF FOUR FOREST PRACTICES IN THE
UNTAINS OF WEST VIRGINIA,
9-04636 03B

REZ, RAUL
ERMAL POLLUTION HOT ISSUE FOR INDUSTRY,
9-04325 05C

IG, SHIRLEY L.
LICA IN ALKALINE BRINES,
9-04270 02K

ARDSON, EVERETT V.
ME TURBULENCE MEASUREMENTS IN OPEN-CHANNEL FLOW,
9-04555 02E

ARDSON, MARIE S.
BLIOGRAPHY ON AIR AND WATER POLLUTION,
9-04496 05G

K, C. E.
FLUENCE OF WATER FLUX AND POROUS MATERIAL ON THE MOVEMENT
SELECTED HERBICIDES,
9-04258 05B

ER, J. A.
GANIZATION OF SURVEYS AND HYDROLOGICAL RESEARCH IN
VELOPING COUNTRIES,
9-04614 06E

IQUEZ-ITURBE, IGNACIO
MODERN STATISTICAL STUDY OF MONTHLY LEVELS OF THE ORINOCO
VER,
9-04568 02E

RS, LESLIE C.
RLD OFFSHORE RIG FLEET TO BALLOON AGAIN IN 1968,
9-04328 06B

R, HARRY MCK., JR.
E ROLE OF THE PHYSICAL HYDRAULIC MODEL OF SAN FRANCISCO
Y AND DELTA IN POLLUTION STUDIES,
9-04329 05B

OLM, NIELS
ONOMIC IMPACT OF MARINE-ORIENTED ACTIVITIES--A STUDY OF
E SOUTHERN NEW ENGLAND MARINE REGION,
9-04330 06B

NBERGER, RICHARD L.
TUARINE WATER QUALITY MANAGEMENT IN THE SACRAMENTO-SAN
AQUIN DELTA,
9-04331 05G

, D. A.
TER MOVEMENT IN POROUS MATERIALS - III. EVAPORATION OF
TER FROM SOIL,
9-04242 02G

FUSS, EDWIN L.
NEATH THE SURFACE,
9-04497 06B

ELMANN, HEINZ B.
ARACTERISTICS OF WATER TREATMENT PLANT WASTES,
9-04227 05B

EL, EDWARD A.
NVECTIVE FLOW AND ITS EFFECT ON TEMPERATURE LOGGING IN
ALL-DIAMETER WELLS,
9-04601 02F

ELMANN, P. W.
FLUENCE OF WATER FLUX AND POROUS MATERIAL ON THE MOVEMENT
SELECTED HERBICIDES,
9-04258 05B

I, PIERRE
E EXAMPLE OF MULTIPURPOSE DEVELOPMENT PROGRAM THE RHONE,
9-04592 04A

IDEGGER, A. E.
POLOGICAL SIGNIFICANCE OF STREAM METHODS,
9-04571 02E

LAKE, CLAIRE L.
CHANISMS MAINTAINING HIGH PRODUCTIVITY IN GEORGIA
TUARIES,
9-04334 02L

IDT, RALPH A.
EDED--A COASTWISE COMPREHENSIVE PROGRAM FOR DEVELOPMENT OF
TUARIES,
9-04499 06B

NAKER, G. A.
ISTURE-TENSION DATA FOR SELECTED SOILS ON EXPERIMENTAL
TERSHEDS,
W69-04266 02G

SCHUMANN, H. H.
WATER RESOURCES OF THE SYCAMORE CREEK WATERSHED, MARICOPA
COUNTY, ARIZONA,
W69-04587 02E

SCHUMM, STANLEY A.
RIVER METAMORPHOSIS,
W69-04583 02E

SCOTT, JOHN
WHAT'S AHEAD IN OIL RECOVERY,
W69-04335 05G

SEARS, HOWARD J.
STATEMENT,
W69-04338 06B

SECKLER, DAVID W.
ON THE USES AND ABUSES OF ECONOMIC SCIENCE IN EVALUATING
PUBLIC OUTDOOR RECREATION,
W69-04500 06B

SHANE, RICHARD M.
PEAK FLOOD DISCHARGE CONFIDENCE LIMITS,
W69-04582 02E

SHARMA, M. L.
INFLUENCE OF SOIL STRUCTURE ON WATER RELATIONS IN LOW
HUMIDIC LATOSOLS 1. WATER RETENTION,
W69-04588 02G

INFLUENCE OF SOIL STRUCTURE ON WATER RELATIONS IN LOW HUMIC
LATOSOLS 2. WATER MOVEMENT,
W69-04589 02G

SHAW, WILLIAM N.
ADVANCES IN THE OFF-BOTTOM CULTURE OF OYSTERS,
W69-04339 06B

SHEMYAKIN, V. N.
A GEOCHEMICAL CLASSIFICATION OF NATURAL WATERS,
W69-04626 02K

SHINDALA, ADNAN
TREATMENT AND DISPOSAL OF RADIOACTIVE WASTES,
W69-04229 05E

SHUBINSKI, R. P.
MATHEMATICAL MODELING OF WATER QUALITY IN ESTUARIAL SYSTEMS,
W69-04311 05B

SIMMONS, HENRY B.
USE OF MODELS IN RESOLVING TIDAL PROBLEMS,
W69-04580 02L

SKOGERBOE, GAYLORD V.
HYDROLOGIC ATLAS OF UTAH,
W69-04209 02A

SKOUGSTAD, MARVIN W.
CHEMICAL CHARACTERIZATION OF PUBLIC SUPPLY,
W69-04245 02K

SLEASE, CLYDE H.
TESTIMONY - NATIONAL SAND AND GRAVEL ASSOCIATION,
W69-04340 04A

SLOAN, C. E.
GENERALIZED HYDROLOGY OF PRAIRIE POTHOLES ON THE COTEAU DU
MISSOURI, NORTH DAKOTA,
W69-04597 02H

SMITH, AUSTIN B.
CHANNEL SEDIMENTATION AND DREDGING PROBLEMS, MISSISSIPPI
RIVER AND LOUISIANA GULF COAST ACCESS CHANNELS,
W69-04501 04D

SMITH, H. F.
EFFECT OF URBAN DEVELOPMENT ON FLOOD DISCHARGES-CURRENT
KNOWLEDGE AND FUTURE NEEDS,
W69-04560 04C

SMITH, RAYMOND C.
ECONOMIC AND ENGINEERING ASPECTS OF WATER IN DELAWARE'S AGRI
BUSINESS INDUSTRY,
W69-04204 03F

SMOOT, GEORGE F.
MEASUREMENT OF DISCHARGE BY THE MOVING-BOAT METHOD,
W69-04547 07B

SOBEL, MATTHEW J.
WATER QUALITY IMPROVEMENT PROGRAMMING PROBLEMS,
W69-04502 05G

SORENSON, EARL F.
WATER RESOURCES OF NEW MEXICO, OCCURRENCE, DEVELOPMENT AND
USE,
W69-04627 02E

SPARKS, A. K.
AN ECOLOGICAL SURVEY OF THE HOUSTON SHIP CHANNEL AND
ADJACENT BAYS,
W69-04454 05C

SPEIKER, ANDREW M.
FUTURE DEVELOPMENT OF THE GROUND-WATER RESOURCE IN THE LOWER
GREAT MIAMI RIVER VALLEY, OHIO - PROBLEMS AND ALTERNATIVE
SOLUTIONS,

W69-04206 02F

STERNBERG, Y. M.
TRANSMISSIBILITY DETERMINATION FROM VARIABLE DISCHARGE PUMPING TESTS,
W69-04622 02F

STEVENS, JOE B.
RECREATION BENEFITS FROM WATER POLLUTION CONTROL,
W69-04504 05G

STILES, W. C.
VIRAL POLLUTION OF SHELLFISH IN ESTUARY WATERS,
W69-04296 05C

STINGELIN, RONALD W.
INFRARED IMAGING FOR WATER RESOURCES STUDIES,
W69-04556 07B

STOLLMAN, ISRAEL
A CITY AND REGIONAL PLANNING APPROACH TO A SYSTEMS APPROACH TO WATER QUALITY IN LAKE ERIE AND LAKE ONTARIO,
W69-04214 06E

STRANDBERG, CARL H.
REMOTE SENSOR SURVEILLANCE OF WATER QUALITY,
W69-04343 05G

STROBEL, GERALD A.
COLIFORM-FECAL COLIFORM BACTERIA IN TIDAL WATERS,
W69-04344 05G

STROUD, R. H.
THERMAL POLLUTION OF WATER,
W69-04345 05C

STURGES, DAVID L.
HYDROLOGIC PROPERTIES OF PEAT FROM A WYOMING MOUNTAIN BOG,
W69-04234 02G

SUTCLIFFE, P. J. C.
SEDIMENT TRANSPORT IN ESTUARINE AREAS,
W69-04240 02L

SYKES, JAMES E.
THE ROLE OF RESEARCH IN THE PRESERVATION OF ESTUARIES,
W69-04347 04A

TALBOT, J. S.
SOME BASIC FACTORS IN THE CONSIDERATION AND INSTALLATION OF DEEP WELL DISPOSAL SYSTEMS,
W69-04228 05E

TAYLOR, JAMES I.
INFRARED IMAGING FOR WATER RESOURCES STUDIES,
W69-04556 07B

TCHOBANOGLOUS, GEORGE
USE OF HYDRAULIC AND MATHEMATICAL MODELS FOR DETERMINING EFFLUENT DIFFUSION IN SOUTH SAN FRANCISCO BAY,
W69-04277 05B

TENZER, M. J.
A PERSPECTIVE OF REGIONAL AND STATE MARINE ENVIRONMENTAL ACTIVITIES, A QUESTIONNAIRE SURVEY, STATISTICS AND OBSERVATIONS,
W69-04289 06E

THIRUMURTHI, D.
OZONE IN WATER TREATMENT AND WASTEWATER RENOVATION,
W69-04230 05D

THOMANN, ROBERT V.
THE DEVELOPMENT AND APPLICATION OF A TIME-VARYING DISSOLVED OXYGEN MODEL,
W69-04315 05G

THOMANN, R. V.
RECENT RESULTS FROM A MATHEMATICAL MODEL OF WATER POLLUTION CONTROL IN THE DELAWARE ESTUARY,
W69-04509 05G

THOMAS, J. C.
MARINE SPORTFISHING SURVEY OF SOUTHERN CALIFORNIA PIERS AND JETTIES, 1963,
W69-04316 06B

THOMAS, ROGER L.
COARSE FILTER MEDIA FOR ARTIFICIAL RECHARGE,
W69-04563 04B

THOMPSON, T. H.
SURFACE-WATER HYDROLOGY OF CALIFORNIA COASTAL BASINS BETWEEN SAN FRANCISCO BAY AND EEL RIVER,
W69-04273 03B

THOMSEN, B. W.
WATER RESOURCES OF THE SYCAMORE CREEK WATERSHED, MARICOPA COUNTY, ARIZONA,
W69-04587 02E

TITAYEVA, N. A.
ASSOCIATION OF RADIUM AND URANIUM AND PEAT,
W69-04612 02K

TITUS, F. B.
WATER RESOURCES OF NEW MEXICO, OCCURRENCE, DEVELOPMENT AND USE,
W69-04627 02E

TOBIAS, LEO
PROTECTION AND RESTORATION OF BEACHES DURING AND AFTER OIL SPILLS,
W69-04350 05G

TODOROVIC, PETAR
THE EXTREME VALUES OF PRECIPITATION PHENOMENA,
W69-04567 02B

TOFFALETI, FRED B.
DEFINITIVE COMPUTATIONS OF SAND DISCHARGE IN RIVERS,
W69-04554 02J

TORPEY, WILBUR N.
RESPONSE TO POLLUTION OF NEW YORK HARBOR AND THAMES ESTUARY,
W69-04351 05B

TRAIN, RUSSELL E.
A CALL FOR ACTION,
W69-04352 06B

TRIMBLE, G. R., JR.
EFFECT ON STREAMFLOW OF FOUR FOREST PRACTICES IN THE MOUNTAINS OF WEST VIRGINIA,
W69-04636 03B

TROENDLE, CHARLES A.
EFFECTS OF ABANDONED FARMLAND ON STREAMFLOW,
W69-04635 03B

TULLER, STANTON E.
WORLD DISTRIBUTION OF MEAN MONTHLY AND ANNUAL PRECIPITABLE WATER,
W69-04239 02B

TURCAN, A. N., JR.
SALINE GROUND WATER IN LOUISIANA,
W69-04608 02F

TURNER, C. H.
THE MARINE ENVIRONMENT IN THE VICINITY OF THE ORANGE COUNTY SANITATION DISTRICTS OCEAN OUTFALL,
W69-04511 05C

TURNER, JERRY L.
FISHERIES PROTECTING AND ENHANCEMENT WITH WATER DEVELOPMENT OF THE SACRAMENTO-SAN JOAQUIN ESTUARY,
W69-04472 06B

TURNER, WM. R.
A COMPUTER-ORIENTED GROUND-WATER INFORMATION STORAGE AND RETRIEVAL SYSTEM,
W69-04624 07C

TURVEY, R.
COST-BENEFIT ANALYSIS A SURVEY,
W69-04492 06B

UEHARA, G.
INFLUENCE OF SOIL STRUCTURE ON WATER RELATIONS IN LOW HUMIDIC LATOSOLS 1. WATER RETENTION,
W69-04588 02G

INFLUENCE OF SOIL STRUCTURE ON WATER RELATIONS IN LOW HUMIC LATOSOLS 2. WATER MOVEMENT,
W69-04589 02G

FACTORS IMPORTANT IN THE CALCULATION OF HYDRAULIC CONDUCTIVITY,
W69-04604 02G

UNDERHILL, A. H.
MAINTAINING AND ENHANCING THE ESTUARINE ENVIRONMENT,
W69-04512 06F

VALYASHKO, M. G.
GEOCHEMISTRY OF NATURAL WATERS,
W69-04562 02K

VAN DENBURGH, A. S.
HYDROLOGY OF CRATER, EAST AND DAVIS LAKES, OREGON,
W69-04574 02H

VAYDER, J. D.
DELTA-SUISUN BAY WATER QUALITY INVESTIGATION,
W69-04291 02L

VERROSS, WILLIAM J.
STATEMENT,
W69-04354 05G

VERRUIJT, ARNOLD
A NOTE ON THE GHYBEN-HERZBERG FORMULA,
W69-04569 02F

VINCENZ, S. A.
RESISTIVITY INVESTIGATIONS OF LIMESTONE AQUIFERS IN JAMAICA,
W69-04600 02F

WAARA, T.
ORGANIZATION ARRANGEMENT FOR DEVELOPMENT AND OPERATION OF THE MISSOURI RIVER BASIN PROJECTS,
W69-04645 06E

WAHL, KENNETH D.
GEOLOGY AND GROUND-WATER RESOURCES OF GREENE COUNTY, ALABAMA,
W69-04625 02F

WALFORD, LIONEL
PROBLEMS OF CONSERVATION IN THE ATLANTIC ESTUARINE ZONE,
W69-04355 06B

STATEMENT ON LIVING MARINE RESOURCES OF WETLANDS AND ESTUARIES,
W69-04356 06B

LKER, WILLIAM H.
ILLINOIS GROUND WATER POLLUTION,
W69-04256 05B

LSH, RAYMOND
ESTUARINE WATER QUALITY MANAGEMENT IN THE SACRAMENTO-SAN JOAQUIN DELTA,
W69-04331 05G

RD, S. H.
ON INDUCED ELECTRICAL POLARIZATION AND GROUNDWATER,
W69-04606 02F

RREN, CLINE J.
AGRICULTURAL DEVELOPMENT AND EXPANSION IN THE NILE BASIN PROGRAMS, PRODUCTION AND IMPLICATIONS FOR U. S. AGRICULTURE,
W69-04641 03F

RRICK, A. W.
SOIL-WATER DIFFUSIVITY VALUES BASED UPON TIME DEPENDENT SOIL WATER CONTENT DISTRIBUTIONS,
W69-04603 02G

STLER, T. ALLEN
ORGANIC CARBON-ORGANIC NITROGEN RATIOS OF SEDIMENTS IN A POLLUTED ESTUARY,
W69-04248 05C

STLER, T. A.
NATIONAL ESTUARINE INVENTORY HANDBOOK OF DESCRIPTORS,
W69-04358 10

IL, M. H.
PAST, PRESENT AND FUTURE OF SPORT FISHING IN TEXAS WATERS,
W69-04362 06B

IS, M. E.
THE IMPACT OF THE PORT OF JACKSONVILLE ON THE ECONOMY OF THE COMMUNITY,
W69-04517 06B

ST, W. F.
EFFECT OF WATER TEMPERATURE ON STREAM REAERATION,
W69-04468 05G

WHEELER, D. L.
LAND RECLAMATION IN THE PO RIVER DELTA OF ITALY,
W69-04518 04A

WHIPKEY, RONALD Z.
SUBSURFACE STORMFLOW FROM FORESTED SLOPES,
W69-04637 02G

THEORY AND MECHANICS OF SUBSURFACE STORMFLOW,
W69-04638 02G

WHITT, MALCOLM L.
OCEAN OUTFALL DESIGN FOR ECONOMY OF CONSTRUCTION,
W69-04313 05E

WICKER, CLARENCE F.
NEW HORIZONS IN THE FIELD OF TIDAL HYDRAULICS,
W69-04579 02L

WILDAVSKY, AARON
THE POLITICAL ECONOMY OF EFFICIENCY COST-BENEFIT ANALYSIS, SYSTEMS ANALYSIS, AND PROGRAM BUDGETING,
W69-04519 06B

WILLIAMS, R. E.
THE INFLUENCE OF GROUNDWATER FLOW SYSTEMS ON PAVEMENT STABILITY IN HIGHWAY CUTS,
W69-04621 02F

WINSLOW, A. G.
SALINE GROUND WATER IN LOUISIANA,
W69-04608 02F

WURTZ, C. B.
COMMON MISUNDERSTANDINGS ABOUT HEATED DISCHARGES,
W69-04364 05C

YOUNG, REGINALD H. F.
ANAEROBIC DIGESTION OF PINEAPPLE MILL WASTES,
W69-04527 05D

ZELEWNASIC, EMIR
THE EXTREME VALUES OF PRECIPITATION PHENOMENA,
W69-04567 02B

ORGANIZATIONAL INDEX

ICULTURAL RESEARCH SERVICE, BELTSVILLE, MD.
DISTURE-TENSION DATA FOR SELECTED SOILS ON EXPERIMENTAL
ATERSHEDS,
59-04266 02G

ICULTURAL RESEARCH SERVICE, BELTSVILLE, MD. SOIL AND
ER CONSERVATION RESEARCH DIV.
ZOMORPHIC GROUPING OF SOILS IN WATERSHED ENGINEERING,
59-04207 02E

ICULTURAL RESEARCH SERVICE, BELTSVILLE, MD. SOIL AND
ER CONSERVATION RESEARCH DIV. WYOMING AGRICULTURAL
ERIMENT STATION, LARAMIE.
ATER INTAKE ON MIDCONTINENTAL RANGELANDS AS INFLUENCED BY
OIL AND PLANT COVER,
59-04640 02G

ICULTURAL RESEARCH SERVICE, FRESNO, CALIF. SOIL AND
ER CONSERVATION RESEARCH DIV.
HE HYDROLOGIC AND GEOLOGIC ASPECTS OF A PERCHING LAYER-SAN
AQUIN VALLEY, WESTERN FRESNO COUNTY, CALIFORNIA,
59-04619 02F

DEMIYA NAUK SSSR, LENINGRAD.
MNOLOGICAL HYPOTHESIS OF THE ORIGIN OF HOT BRINES IN THE
ED SEA,
59-04254 02K

DEMIYA NAUK SSSR. INSTITUT GEOLOGII RUDNYKH
TOROZHDENII, PETROGRAFII, MINERALOGII I GEOKHIMII.
ZOCHEMISTRY OF EPIGENESIS,
59-04274 02K

RICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE,
HINGTON, D. C.
STUARIES,
59-04278 02L

STUARINE NEKTON,
59-04292 02L

RICAN FISHERIES SOCIETY, ATLANTIC CITY, NEW JERSEY.
ANAGEMENT OF ESTUARINE FISHERIES,
59-04481 06B

RICAN SOCIETY OF CIVIL ENGINEERS, NEW YORK.
FFECT OF URBAN DEVELOPMENT ON FLOOD DISCHARGES-CURRENT
NOWLEDGE AND FUTURE NEEDS,
59-04560 04C

RICAN WATER WORKS ASSOCIATION, NEW YORK.
LLOCATION AND REALLOCATION OF WATER RESOURCES,
59-04647 05G

TELLE MEMORIAL INSTITUTE, PACIFIC NORTHWEST LABORATORIES,
HLAND, WASHINGTON.
IL SPILLAGE STUDY LITERATURE SEARCH AND CRITICAL
VALUATION FOR SELECTION OF PROMISING TECHNIQUES TO CONTROL
ND PREVENT DAMAGE.
59-04309 05G

TELLE MEMORIAL INST., COLUMBUS, OHIO.
STUDY OF THE U. S. COAST AND GEODETIC SURVEY'S PRODUCTS
ND SERVICES AS RELATED TO ECONOMIC ACTIVITY IN THE U. S.
ONTINENTAL SHELF REGIONS.
59-04505 06B

CK AND VEATCH, KANSAS CITY, MO.
ATER REUSE FOR PUBLIC SUPPLY,
59-04265 05D

TISH COLUMBIS UNIV., VANCOUVER. DEPT. OF MATHEMATICS
TISH COLUMBIA UNIV., VANCOUVER. INST. OF OCEANOGRAPHY
COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH
ANIZATION, CRONULLA (AUSTRALIA). DIV. OF FISHERIES AND
ANOGRAPHY.
OW-FREQUENCY SEA LEVEL BEHAVIOR AND CONTINENTAL SHELF WAVES
FF NORTH CAROLINA,
59-04224 02A

EAU OF SPORT FISHERIES AND WILDLIFE, HIGHLANDS, N. J.
DY HOOK MARINE LAB.
HERMAL POLLUTION AND AQUATIC LIFE,
59-04235 05A

EAU OF SPORT FISHERIES AND WILDLIFE, VERO BEACH, FLA.
RACTICES AFFECTING SOUTH ATLANTIC AND GULF COAST MARSHES
ND ESTUARIES - DREDGING AND FILLING,
59-04288 04A

IFORNIA UNIV., BERKELEY. DEPT. OF MINERAL TECHNOLOGY.
N INDUCED ELECTRICAL POLARIZATION AND GROUNDWATER,
59-04606 02F

IFORNIA UNIV., DAVIS. DEPT. OF WATER SCIENCE AND
INEERING.
OIL-WATER DIFFUSIVITY VALUES BASED UPON TIME DEPENDENT SOIL
ATER CONTENT DISTRIBUTIONS,
59-04603 02G

IFORNIA UNIV., LOS ANGELES. DEPT. OF GEOGRAPHY.
ORLD DISTRIBUTION OF MEAN MONTHLY AND ANNUAL PRECIPITABLE
ATER,
59-04239 02B

IFORNIA UNIV., SANTA BARBARA.
EA CLIFF RETREAT NEAR SANTA BARBARA, CALIFORNIA,
W69-04241 02L

CARNIGIE-MELLON UNIV., PITTSBURGH, PA. DEPT. OF CIVIL
ENGINEERING.
PEAK FLOOD DISCHARGE CONFIDENCE LIMITS,
W69-04582 02E

CHILE UNIV., SANTIAGO.
THE TEACHING AND RESEARCH PROGRAMS IN HYDROLOGY AT FACULTY
OF PHYSICAL AND MATHEMATICAL SCIENCES OF THE UNIVERSITY OF
CHILE,
W69-04611 09A

COLORADO STATE UNIV., FORT COLLINS AND FOREST SERVICE,
WASHINGTON, D. C.
EFFECTS OF SOIL FREEZING ON WATER YIELDS,
W69-04251 02C

A SHIELDED THERMISTOR PROBE WITH PORTABLE INSTRUMENT FOR
MEASURING SNOWPACK TEMPERATURES,
W69-04252 07B

OBSERVATIONS OF SNOWPACK ACCUMULATION, MELT, AND RUNOFF ON A
SMALL ARIZONA WATERSHED,
W69-04253 02C

COLORADO STATE UNIV., FORT COLLINS.
THE EXTREME VALUES OF PRECIPITATION PHENOMENA,
W69-04567 02B

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF GEOLOGY.
RIVER METAMORPHOSIS,
W69-04583 02E

COLORADO UNIV., BOULDER. DEPT. OF CIVIL ENGINEERING AND
STANFORD UNIV., CALIF., DEPT. OF CIVIL ENGINEERING.
VANADIUM CONCENTRATIONS IN COLORADO RIVER BASIN WATERS,
W69-04264 02K

COMMITTEE ON PUBLIC WORKS (U. S. SENATE).
STATEMENT BEFORE THE SUBCOMMITTEE ON AIR AND WATER
POLLUTION, APRIL 17, 1968,
W69-04293 05B

COMPAGNIE NATIONALE DU RHONE (FRANCE).
ONE EXAMPLE OF MULTIPURPOSE DEVELOPMENT PROGRAM THE RHONE,
W69-04592 04A

CORPS OF ENGINEERS, ATLANTA, GA. SOUTH ATLANTIC DIV.
WATER RESOURCES DEVELOPMENT BY THE U S ARMY CORPS OF
ENGINEERS IN FLORIDA.
W69-04643 04A

CORPS OF ENGINEERS, BALTIMORE, MD.
FLOOD PLAIN INFORMATION, PISCATAWAY CREEK, PRINCE GEORGES
COUNTY, MARYLAND.
W69-04546 04A

CORPS OF ENGINEERS, DETROIT, MICH.
FLOOD PLAIN INFORMATION, RED CEDAR RIVER, INGHAM COUNTY,
MICHIGAN.
W69-04529 04A

CORPS OF ENGINEERS, FORT WORTH, TEX.
FLOOD PLAIN INFORMATION, JOHNSON CREEK, ARLINGTON AND GRAND
PRAIRIE, TEXAS.
W69-04221 04A

CORPS OF ENGINEERS, JACKSONVILLE, FLA. INTEROCEANIC CANAL
STUDIES BRANCH.
CURRENTS IN AN INTEROCEANIC CANAL,
W69-04557 02E

CORPS OF ENGINEERS, LITTLE ROCK, ARK.
FLOOD PLAIN INFORMATION, BLACK RIVER, TOWN AND MANSKER
CREEKS, POCAHONTAS, ARKANSAS.
W69-04539 04A

FLOOD PLAIN INFORMATION, ARKANSAS RIVER, NORTH LITTLE ROCK,
ARKANSAS.
W69-04541 04A

CORPS OF ENGINEERS, LOS ANGELES, CALIF.
FLOOD PLAIN INFORMATION, LAS CHOLLAS CREEK, SAN DIEGO
COUNTY, CALIFORNIA.
W69-04217 04A

FLOOD PLAIN INFORMATION, SANTA CLARA RIVER (SATICOY TO
PACIFIC OCEAN), VENTURA COUNTY, CALIFORNIA.
W69-04220 04A

CORPS OF ENGINEERS, LOUISVILLE, KY.
FLOOD PLAIN INFORMATION, OHIO RIVER AND TRIBUTARIES, MC
CRACKEN COUNTY, KENTUCKY.
W69-04540 04A

CORPS OF ENGINEERS, MOBILE, ALA.
FLOOD PLAIN INFORMATION, HALLS MILL CREEK, MOBILE, ALABAMA.
W69-04536 04A

FLOOD PLAIN INFORMATION ON CAMP CREEK AND NORTH FORK CAMP
CREEK, METROPOLITAN ATLANTA, GEORGIA.
W69-04542 04A

CORPS OF ENGINEERS, NASHVILLE, TENN.
FLOOD PLAIN INFORMATION, CUMBERLAND RIVER AND CLEAR FORK,
WILLIAMSBURG, KENTUCKY.

W69-04535 04A

CORPS OF ENGINEERS, PHILADELPHIA, PA. OPERATIONS DIV.
OPTIMUM DREDGING AND DISPOSAL PRACTICES IN ESTUARIES,
W69-04581 02L

CORPS OF ENGINEERS, SACRAMENTO, CALIF.
FLOOD PLAIN INFORMATION, KERN RIVER, KERNVILLE, CALIFORNIA.
W69-04216 04A

FLOOD PLAIN INFORMATION, FEATHER AND YUBA RIVERS, MARYSVILLE YUBA CITY, CALIFORNIA.
W69-04218 04A

FLOOD PLAIN INFORMATION, TULE RIVER, SPRINGVILLE, CALIFORNIA.
W69-04533 04A

CORPS OF ENGINEERS, SAVANNAH, GA.
FLOOD PLAIN INFORMATION, SNAPPINGER CREEK, DEKALB COUNTY, GEORGIA.
W69-04530 04A

FLOOD PLAIN INFORMATION, BROOKLYN CREEK, ATHENS, GEORGIA.
W69-04544 04A

FLOOD PLAIN INFORMATION ON SHOAL CREEK, DEKALB COUNTY, GEORGIA.
W69-04545 04A

CORPS OF ENGINEERS, ST. LOUIS, MO.
FLOOD PLAIN INFORMATION, MERAMEC RIVER, BRUSH CREEK AND FOX CREEK, PACIFIC, MISSOURI.
W69-04537 04A

CORPS OF ENGINEERS, TULSA, OKLA.
FLOOD PLAIN INFORMATION, WALNUT RIVER, WHITEWATER RIVER, KANSAS.
W69-04534 04A

FLOOD PLAIN INFORMATION, MILL CREEK, FORT SMITH, ARKANSAS.
W69-04543 04A

FLOOD PLAIN INFORMATION, POST OAK CREEK AND TRIBUTARIES, SHERMAN, TEXAS.
W69-04576 04A

CORPS OF ENGINEERS, VICKSBURG, MISS.
DEFINITIVE COMPUTATIONS OF SAND DISCHARGE IN RIVERS,
W69-04554 02J

CORPS OF ENGINEERS, WALLA WALLA, WASH.
FLOOD PLAIN INFORMATION, PAYETTE RIVER, PAYETTE, IDAHO AND VICINITY.
W69-04219 04A

FLOOD PLAIN INFORMATION, CLEARWATER RIVER, OROFINO AND RIVERSIDE, IDAHO.
W69-04531 04A

CORPS OF ENGINEERS, WALTHAM, MASS.
FLOOD PLAIN INFORMATION, MILL RIVER, HAMDEN, CONNECTICUT.
W69-04532 04A

DARTMOUTH COLL., HANOVER, N. H. DEPT. OF BIOLOGICAL SCIENCES DARTMOUTH COLL., HANOVER, N. H., DEPT. OF EARTH SCIENCES AND YALE UNIV., NEW HAVEN, CONN. SCHOOL OF FORESTRY.
NITRIFICATION IMPORTANCE TO NUTRIENT LOSSES FROM A CUTOVER FORESTED ECOSYSTEM,
W69-04584 02K

DEGREMONT CO. (FRANCE).
CONDITIONS FOR BETTER FILTERED WATER,
W69-04591 05D

DEPARTMENT OF AGRICULTURE, WASHINGTON, D. C.
CHANNEL SEDIMENTATION AND DREDGING PROBLEMS, MISSISSIPPI RIVER AND LOUISIANA GULF COAST ACCESS CHANNELS,
W69-04501 04D

DOW CHEMICAL CO., MIDLAND, MICH.
SOME BASIC FACTORS IN THE CONSIDERATION AND INSTALLATION OF DEEP WELL DISPOSAL SYSTEMS,
W69-04228 05E

DUKE UNIV., DURHAM, N. C., DEPT. OF ZOOLOGY.
IDENTIFICATION AND SOLUBILITY OF IRON SULFIDE IN ANAEROBIC LAKE SEDIMENT,
W69-04590 02K

ECONOMIC RESEARCH SERVICE, WASHINGTON, D. C. FOREIGN REGIONAL ANALYSIS DIV.
AGRICULTURAL DEVELOPMENT AND EXPANSION IN THE NILE BASIN PROGRAMS, PRODUCTION AND IMPLICATIONS FOR U. S. AGRICULTURE,
W69-04641 03F

ECONOMIC RESEARCH SERVICE, WASHINGTON, D. C. NATURAL RESOURCE ECONOMICS DIV.
MAJOR USES OF LAND AND WATER IN THE U. S. WITH SPECIAL REFERENCE TO AGRICULTURE, 1964,
W69-04208 03F

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, CHICAGO, ILL. AND NEW YORK STATE DEPT. OF HEALTH, ALBANY.
WATER POLLUTION PROBLEMS AND IMPROVEMENT NEEDS, LAKE ONTARIO AND ST. LAWRENCE RIVER BASINS.
W69-04223 05B

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, DEPARTMENT OF INTERIOR, SOUTHEAST REGION, ATLANTA, GA.
THE URGENT NEED FOR LANDSCAPE ZONING OF THE ESTUARINE REGION ACCORDING TO ECO-SYSTEM PRINCIPLES,
W69-04307 06F

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, MIDDLE ATLANTIC REGION, CHARLOTTESVILLE, VA.
WATER QUALITY AND POLLUTION CONTROL STUDY - JAMES RIVER BASIN.
W69-04359 05G

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, SOUTHEAST REGION, ATLANTA, GA.
STATEMENT,
W69-04303 06B

W69-04306 05D

REPORT ON WATER QUALITY CRITERIA FOR TEXAS.
W69-04327 05G

MECHANISMS MAINTAINING HIGH PRODUCTIVITY IN GEORGIA ESTUARIES,
W69-04334 02L

STATEMENT,
W69-04338 06B

STATEMENT.
W69-04342 05G

UTILIZATION OF THE ESTUARINE ZONE IN GEORGIA--A STATEMENT B BIOLOGISTS FROM THE DIVISION OF BIOLOGICAL SCIENCES OF THE UNIVERSITY OF GEORGIA.
W69-04353 05G

STATEMENT,
W69-04354 05G

COMMON MISUNDERSTANDINGS ABOUT HEATED DISCHARGES,
W69-04364 05C

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, WASHINGTON, D. C. DIV. OF POLLUTION SURVEILLANCE.
A REVIEW OF CHEMICAL MEASUREMENTS IN WATER POLLUTION CONTROL,
W69-04222 05A

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, WASHINGTON, D. C.
POLLUTION OF THE INTERSTATE WATERS OF THE COLORADO RIVER AN ITS TRIBUTARIES....
W69-04272 05E

WASTE FROM WATERCRAFT.
W69-04357 05G

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, WASHINGTON, D. C. OFFICE OF ESTUARINE STUDIES.
NATIONAL ESTUARINE INVENTORY HANDBOOK OF DESCRIPTORS,
W69-04358 10

FOREST SERVICE (USDA) COLUMBUS, OHIO. NORTHEASTERN FOREST EXPERIMENT STATION.
SUBSURFACE STORMFLOW FROM FORESTED SLOPES,
W69-04637 02G

THEORY AND MECHANICS OF SUBSURFACE STORMFLOW,
W69-04638 02G

A TECHNIQUE FOR OBTAINING UNDISTURBED SOIL SAMPLES BY FREEZING IN-SITU,
W69-04639 02G

FOREST SERVICE (USDA) DURHAM, N. H. NORTHEASTERN FOREST EXPERIMENT STATION.
EFFECTS OF ABANDONED FARMLAND ON STREAMFLOW,
W69-04635 03B

FOREST SERVICE (USDA) PARSONS, WEST VA. NORTHEASTERN FOREST EXPERIMENT STATION.
A SUBSTITUTE FOR 2,4,5-T IN EASTERN HARDWOOD SPROUT AND BRUSH CONTROL,
W69-04633 03B

FOREST SERVICE (USDA) UPPER DARBY, PA. NORTHEASTERN FOREST EXPERIMENT STATION.
EFFECT OF A COMMERCIAL CLEARCUTTING IN WEST VIRGINIA ON OVERLAND FLOW AND STORM RUNOFF,
W69-04632 04C

WATERSHED CALIBRATION METHODS,
W69-04634 03B

EFFECT ON STREAMFLOW OF FOUR FOREST PRACTICES IN THE MOUNTAINS OF WEST VIRGINIA,
W69-04636 03B

FOREST SERVICE (USDA), FORT COLLINS, COLO. ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION.
HYDROLOGIC PROPERTIES OF PEAT FROM A WYOMING MOUNTAIN BOG,
W69-04234 02G

FORESTRY SCIENCES LABORATORY, MOSCOW, IDAHO.
THE GENERATION OF SPRING PEAK FLOWS BY SHORT-TERM METEOROLOGICAL EVENTS,
W69-04570 02E

FRESHWATER BIOLOGICAL ASSOCIATION, AMBLESIDE (ENGLAND).
EXPERIMENTS ON THE UTILIZATION OF NITROGEN IN FRESH WATER,
W69-04521 05C

LOGICAL SURVEY OF INDIA, HYDERABAD.
MPING TESTS ON OPEN WELLS IN PALAR ALLUVIUM, NEAR MADRAS ITY, INDIA, AN APPLICATION OF THE PAPADOPULOS-COOPER ETHOD,
69-04573 02F

LOGICAL SURVEY, AUSTIN, TEX.
ECONNAISSANCE OF THE CHEMICAL QUALITY OF SURFACE WATERS OF HE SULFUL RIVER AND CYPRESS CREEK BASINS, TEXAS,
69-04586 02K

ECONNAISSANCE OF THE CHEMICAL QUALITY OF SURFACE WATERS OF HE CANADIAN RIVER BASIN, TEXAS,
69-04593 02E

OMPILATION OF HYDROLOGIC DATA, WALLER AND WILBARGER CREEKS, OLORADO RIVER BASIN, TEXAS-1966.
69-04599 02E

LOGICAL SURVEY, DENVER, COLO.
ONVECTIVE FLOW AND ITS EFFECT ON TEMPERATURE LOGGING IN MALL-DIAMETER WELLS,
69-04601 02F

LOGICAL SURVEY, DENVER, COLO. AND DENVER BOARD OF WATER MISSIONERS, COLO.
HEMICAL CHARACTERIZATION OF PUBLIC SUPPLY,
69-04245 02K

LOGICAL SURVEY, FORT COLLINS, COLO.
OME TURBULENCE MEASUREMENTS IN OPEN-CHANNEL FLOW,
69-04555 02E

LOGICAL SURVEY, IOWA CITY, IOWA.
ATER RESOURCES DATA FOR IOWA, 1968--PART 1. SURFACE WATER ECORDS, PART 2. WATER QUALITY RECORDS.
69-04565 02E

OLOGICAL SURVEY, JACKSONVILLE, FLA., AND GEOLOGICAL VEY, OCALA, FLA.
EST HOLE IN AQUIFER WITH MANY WATER-BEARING ZONES AT ACKSONVILLE, FLORIDA,
69-04620 02F

OLOGICAL SURVEY, LANSING, MICH.
ROUND WATER IN GOGEBIC COUNTY, MICHIGAN,
69-04564 02F

OLOGICAL SURVEY, SALT LAKE CITY, UTAH.
ROUND-WATER CONDITIONS IN UTAH, SPRING OF 1968,
69-04561 02F

OLOGICAL SURVEY, TACOMA, WASH.
LACIERS AND WATER SUPPLY,
69-04255 02C

OLOGICAL SURVEY, UNIVERSITY, ALA.
EOLOGY AND GROUND-WATER RESOURCES OF GREENE COUNTY, LABAMA,
69-04625 02F

OLOGICAL SURVEY, WASHINGTON, D. C.
UTURE DEVELOPMENT OF THE GROUND-WATER RESOURCE IN THE LOWER REAT MIAMI RIVER VALLEY, OHIO - PROBLEMS AND ALTERNATIVE OLUTIONS,
69-04206 02F

SCIENTIFIC OR RULE-OF-THUMB TECHNIQUES OF GROUND-WATER ANAGEMENT - WHICH WILL PREVAIL,
69-04231 04B

FLOODS IN WOODSTOCK QUADRANGLE, NORTHEASTERN ILLINOIS,
69-04249 04A

STORAGE REQUIREMENTS FOR ARKANSAS STREAMS,
69-04250 02E

HYDROLOGY OF THE VALLEY-FILL AND CARBONATE-ROCK RESERVOIRS PAHRUMP VALLEY NEVADA-CALIFORNIA,
69-04267 03D

DEVELOPMENT OF GROUND-WATER SUPPLIES AT MISSISSIPPI TEST FACILITY, HANCOCK COUNTY, MISSISSIPPI,
69-04268 02F

SURFACE-WATER HYDROLOGY OF CALIFORNIA COASTAL BASINS BETWEEN SAN FRANCISCO BAY AND EEL RIVER,
69-04273 03B

MEASUREMENT OF DISCHARGE BY THE MOVING-BOAT METHOD,
69-04547 07B

HYDROLOGY FOR URBAN LAND PLANNING-A GUIDEBOOK ON THE HYDROLOGIC EFFECTS OF URBAN LAND USE,
69-04548 04C

HYDROLOGY OF CRATER, EAST AND DAVIS LAKES, OREGON,
69-04574 02H

DISCHARGE IN THE LOWER COLUMBIA RIVER BASIN, 1928-65,
69-04577 02E

WATER RESOURCES OF THE SYCAMORE CREEK WATERSHED, MARICOPA COUNTY, ARIZONA,
69-04587 02E

GENERALIZED HYDROLOGY OF PRAIRIE POTHOLES ON THE COTEAU DU MISSOURI, NORTH DAKOTA,
69-04597 02H

TIME OF TRAVEL OF WATER IN THE GREAT MIAMI RIVER, DAYTON TO CLEVES, OHIO,
69-04598 02E

WATER TEMPERATURES IN THE LOWER COLUMBIA RIVER,
69-04605 02E

SALINE GROUND WATER IN LOUISIANA,
69-04608 02F

GEOHYDROLOGY OF THE COASTAL PLAIN AQUIFERS OF ARKANSAS,
69-04609 02F

RECONNAISSANCE OF THE GROUND-WATER RESOURCES OF THE MISSOURI RIVER ALLUVIUM BETWEEN ST. CHARLES AND JEFFERSON CITY, MISSOURI,
69-04610 02F

GROUND WATER OF THE PIEDMONT AND BLUE RIDGE PROVINCES IN THE SOUTHEASTERN STATES,
69-04615 02F

FLOOD INFORMATION FOR FLOOD-PLAIN PLANNING,
69-04616 02E

THE AERATION CAPACITY OF STREAMS,
69-04628 02E

GEOLOGICAL SURVEY, WASHINGTON, D. C. AND JOHNS HOPKINS UNIV., BALTIMORE, MD., DEPT. OF GEOLOGY.
SILICA IN ALKALINE BRINES,
69-04270 02K

GEORGIA INST. OF TECH., ATLANTA. SCHOOL OF ARCHITECTURE.
METROPOLITAN PLANNING AND RIVER BASIN PLANNING SOME INTERRELATIONSHIPS,
69-04566 06A

GEORGIA UNIV., ATHENS. DEPT. OF GEOGRAPHY.
WATER REQUIREMENTS OF SELECTED NORTH GEORGIA MANUFACTURING INDUSTRIES,
69-04205 06D

GORNYI INSTITUT, LENINGRAD (USSR).
A GEOCHEMICAL CLASSIFICATION OF NATURAL WATERS,
69-04626 02K

HAWAII UNIV, HONOLULU. WATER RESOURCES RESEARCH CENTER AND HAWAII UNIV., HONOLULU. DEPT. OF AGRONOMY AND SOIL SCIENCE.
INFLUENCE OF SOIL STRUCTURE ON WATER RELATIONS IN LOW HUMIC LATOSOLS 2. WATER MOVEMENT,
69-04589 02G

HAWAII UNIV., HONOLULU.
ANAEROBIC DIGESTION OF PINEAPPLE MILL WASTES,
69-04527 05D

SILICA IN STREAMS AND GROUND WATER OF HAWAII,
69-04528 02G

HAWAII UNIV., HONOLULU. WATER RESOURCES RESEARCH CENTER AND HAWAII UNIV., HONOLULU, DEPT. OF AGRONOMY AND SOIL SCIENCE.
INFLUENCE OF SOIL STRUCTURE ON WATER RELATIONS IN LOW HUMIDIC LATOSOLS 1. WATER RETENTION,
69-04588 02G

HAYES, SEAY, MATTERN AND MATTERN, ROANOKE, VA.
FLOOD PLAIN INFORMATION, ROANOKE RIVER, AND ROANOKE AND SALEM, VIRGINIA.
69-04538 04A

HULL UNIV. (ENGLAND). DEPT. OF GEOGRAPHY.
MAN, VEGETATION AND THE SEDIMENT YIELDS OF RIVERS,
69-04269 02E

IDAHO UNIV., MOSCOW.
THE INFLUENCE OF GROUNDWATER FLOW SYSTEMS ON PAVEMENT STABILITY IN HIGHWAY CUTS,
69-04621 02F

ILLINOIS STATE GEOLOGICAL SURVEY, URBANA.
TEMPERATURE PROSPECTING FOR SHALLOW GLACIAL AND ALLUVIAL AQUIFERS IN ILLINOIS,
69-04585 02F

ILLINOIS STATE WATER SURVEY, PEORIA AND ILLINOIS UNIV., URBANA. WATER RESOURCES CENTER.
A PROBABILISTIC ANALYSIS OF DISSOLVED OXYGEN-BIOCHEMICAL OXYGEN DEMAND RELATIONSHIP IN STREAMS,
69-04247 05C

ILLINOIS STATE WATER SURVEY, URBANA.
ILLINOIS GROUND WATER POLLUTION,
69-04256 05B

COARSE FILTER MEDIA FOR ARTIFICIAL RECHARGE,
69-04563 04B

DESIGNING PUMPED WELL CHARACTERISTICS INTO ELECTRIC ANALOG MODELS,
69-04623 06B

ILLINOIS UNIV., URBANA.
TOPOLOGICAL SIGNIFICANCE OF STREAM METHODS,
69-04571 02E

ILLINOIS UNIV., URBANA. DEPT. OF AGRONOMY.
CONVECTIVE DIFFUSION IN CLAY SYSTEMS,
69-04261 02F

INDIANA UNIV., BLOOMINGTON. DEPT. OF GEOLOGY.

TRANSMISSIBILITY DETERMINATION FROM VARIABLE DISCHARGE PUMPING TESTS,
W69-04622 02F

INTERSTATE COMMISSION ON THE POTOMAC RIVER BASIN, WASHINGTON, D. C.
'WASTE DISPOSAL AND WATER SUPPLY',
W69-04438 05G

NUTRIENTS,
W69-04448 05C

LITTERING AND OBSTRUCTIONS,
W69-04450 06E

RECREATION,
W69-04458 06B

JACKSONVILLE UNIV., FLA. DIV. OF BUSINESS ADMINISTRATION.
THE IMPACT OF THE PORT OF JACKSONVILLE ON THE ECONOMY OF THE COMMUNITY,
W69-04517 06B

JOHNS HOPKINS UNIVERSITY, CHESAPEAKE BAY INSTITUTE.
ON THE PREDICTION OF THE DISTRIBUTION OF EXCESS TEMPERATURE FROM A HEATED DISCHARGE IN AN ESTUARY,
W69-04494 05C

JOHNS HOPKINS UNIV., BALTIMORE, MD. CHESAPEAKE BAY INST.
DISPERSION AND FLUSHING OF POLLUTANTS IN ESTUARIES,
W69-04559 02L

KING'S COLL., LONDON (ENGLAND) AND SIR JOHN CASS COLL., LONDON (ENGLAND).
SEDIMENT TRANSPORT IN ESTUARINE AREAS,
W69-04240 02L

LITTLE (ARTHUR D.), INC., CAMBRIDGE, MASS.
TOURISM AND RECREATION.
W69-04510 06B

MARYLAND UNIV., SOLOMONS. NATURAL RESOURCES INST. AND MARYLAND DEPT. OF NATURAL RESOURCES.
PATUXENT THERMAL STUDIES - SUMMARY AND RECOMMENDATIONS,
W69-04244 02L

MARYLAND WATER RESOURCES COMMISSION, ANNAPOLIS AND DEPARTMENT OF WATER RESOURCES, ANNAPOLIS, MD.
GENERAL WATER QUALITY CRITERIA AND SPECIFIC WATER QUALITY STANDARDS.
W69-04470 05G

MASSACHUSETTS INST. OF TECH., CAMBRIDGE. DEPT. OF CIVIL ENGINEERING.
SALINITY INTRUSION EFFECTS IN ESTUARY SHOALING,
W69-04558 02L

MCGILL UNIV., MONTREAL (QUEBEC).
GEOLOGY OF GLACIAL LAKE AGASSIZ,
W69-04617 02H

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO, ILL.
FLOOD AND POLLUTION CONTROL A DEEP TUNNEL PLAN FOR THE CHICAGOLAND AREA.
W69-04630 04A

CHICAGO TUNNEL DRAINAGE PROJECT PRELIMINARY EVALUATION OF FEASIBILITY.
W69-04631 04A

MIAMI UNIV., CORAL GABLES, FLA. DEPT. OF CIVIL ENGINEERING.
OZONE IN WATER TREATMENT AND WASTEWATER RENOVATION,
W69-04230 05D

MICHIGAN STATE UNIV., LANSING. DEPT. OF SOIL SCIENCE AND HAWAII UNIV., HONOLULU. DEPT. OF AGRONOMY AND SOIL SCIENCE.
FACTORS IMPORTANT IN THE CALCULATION OF HYDRAULIC CONDUCTIVITY,
W69-04604 02G

MID-CHESHIRE WATER BOARD (ENGLAND).
FRESH WATER,
W69-04225 03B

MISSISSIPPI STATE UNIV., STATE COLLEGE. DEPT. OF SANITARY ENGINEERING.
TREATMENT AND DISPOSAL OF RADIOACTIVE WASTES,
W69-04229 05E

MOBIL RESEARCH AND DEVELOPMENT CORP., DALLAS, TEX. FIELD RESEARCH LAB.
THE DRYING THROUGH THE TOP SURFACE OF A VERTICAL POROUS COLUMN,
W69-04602 02G

MONTGOMERY RESEARCH, INC., PASADENA, CALIF.
INDUSTRIAL WASTEWATER RECLAMATION,
W69-04226 05D

MOSCOW STATE UNIV. (USSR). DEPT. OF GEOCHEMISTRY.
GEOCHEMISTRY OF NATURAL WATERS,
W69-04562 02K

MOSCOW STATE UNIV., (USSR). DEPT. OF GEOCHEMISTRY.
ASSOCIATION OF RADIUM AND URANIUM AND PEAT,
W69-04612 02K

NATIONAL ASSOCIATION OF MANUFACTURERS, NEW YORK AND CHAMBER OF COMMERCE OF THE UNITED STATES, WASHINGTON, D. C.
WATER IN INDUSTRY A SURVEY OF WATER USE IN INDUSTRY.
W69-04514 05D

NATIONAL SECURITY INDUSTRIAL ASSOCIATION, WASHINGTON, D. C.
MARINE, ESTUARIAN, AND RIPARIAN POLLUTION DISASTERS AND THEIR CONSEQUENCES.
W69-04285 05G

SPILL POLLUTION - ITS EFFECTS AND CONTROL,
W69-04322 05G

REMOTE SENSOR SURVEILLANCE OF WATER QUALITY,
W69-04343 05G

PROTECTION AND RESTORATION OF BEACHES DURING AND AFTER OIL SPILLS,
W69-04350 05G

NEW SOUTH WALES UNIV., KENSINGTON (AUSTRALIA). SCHOOL OF CIVIL ENGINEERING.
GENERALIZED RAINFALL-DURATION-FREQUENCY RELATIONSHIPS,
W69-04549 02A

NEW YORK STATE DEPT. OF HEALTH, ALBANY.
CHARACTERISTICS OF WATER TREATMENT PLANT WASTES,
W69-04227 05B

NOTTINGHAM UNIV. (ENGLAND). SCHOOL OF AGRICULTURE.
VARIATIONS OF EVAPORATION IN TIME AND SPACE PART 1 AND PART 2,
W69-04618 02D

OFFICE FOR SCIENTIFIC AND TECHNICAL RESEARCH OVERSEAS, PARIS (FRANCE).
ORGANIZATION OF SURVEYS AND HYDROLOGICAL RESEARCH IN DEVELOPING COUNTRIES,
W69-04614 06E

OHIO STATE UNIV., COLUMBUS. WATER RESOURCES CENTER.
THE ROLE OF LAW IN A SYSTEM FOR LAKES ERIE AND ONTARIO,
W69-04212 06E

A CITY AND REGIONAL PLANNING APPROACH TO A SYSTEMS APPROACH TO WATER QUALITY IN LAKE ERIE AND LAKE ONTARIO,
W69-04214 06E

OKLAHOMA STATE UNIV., STILLWATER. DEPT. OF AGRONOMY.
INFLUENCE OF WATER FLUX AND POROUS MATERIAL ON THE MOVEMENT OF SELECTED HERBICIDES,
W69-04258 05B

OREGON STATE UNIV., CORVALLIS. DEPT. OF STATISTICS.
MARKOV CHAINS OF ORDER GREATER THAN ONE,
W69-04238 02B

PENNSYLVANIA STATE UNIV., UNIVERSITY PARK. DEPT. OF CIVIL ENGINEERING AND HRB-SINGER, INC., STATE COLLEGE, PA.
INFRARED IMAGING FOR WATER RESOURCES STUDIES,
W69-04556 07B

PITTSBURGH UNIV., PA. DEPT. OF CIVIL ENGINEERING.
A DISSIPATIVE RIVER FLOW MODEL,
W69-04232 02A

RESEARCH COUNCIL OF ALBERTA, EDMONTON.
A COMPUTER-ORIENTED GROUND-WATER INFORMATION STORAGE AND RETRIEVAL SYSTEM,
W69-04624 07C

RESOURCES FOR THE FUTURE, INC., WASHINGTON, D. C.
MANAGING WATER QUALITY ECONOMICS, TECHNOLOGY, INSTITUTIONS,
W69-04578 05G

ROTHAMSTED EXPERIMENTAL STATION, HARPENDEN (ENGLAND).
WATER MOVEMENT IN POROUS MATERIALS - III. EVAPORATION OF WATER FROM SOIL,
W69-04242 02G

SAINT LOUIS UNIV., ST. LOUIS, MO.
RESISTIVITY INVESTIGATIONS OF LIMESTONE AQUIFERS IN JAMAICA,
W69-04600 02F

SERVICES TECHNIQUES DE LA VILLE DE PARIS (FRANCE).
USE OF MULTI-PURPOSE STORAGE DAMS IN THE DEVELOPMENT OF THE SEINE BASIN,
W69-04596 04A

SOCIETE HISPANO-SUIZA, BOIS-COLOMBES (FRANCE).
THE CONSTRUCTION BY FRANCE OF A MIXED PLANT FOR PRODUCTION OF ELECTRIC POWER AND OF SOFT WATER,
W69-04595 03A

STANFORD UNIV., CALIF.
NUTRIENT AND POLLUTANT RESPONSE OF ESTUARINE BIOTAS,
W69-04276 05C

USE OF HYDRAULIC AND MATHEMATICAL MODELS FOR DETERMINING EFFLUENT DIFFUSION IN SOUTH SAN FRANCISCO BAY,
W69-04277 05B

ESTUARINE POLLUTION OF THE CHAO PHRAYA RIVER AT BANGKOK, THAILAND,
W69-04279 05B

A 'BALAS' ALGORITHM FOR ZONED UNIFORM TREATMENT,
W69-04281 05D

IDENTIFICATION OF PETROLEUM PRODUCTS IN ESTUARINE WATERS,
W69-04282 05A

THE FUTURE OF AN ESTUARY,
W69-04290 05G

ELTA-SUISUN BAY WATER QUALITY INVESTIGATION,
69-04291 02L

ATHEMATICAL MODELING OF WATER QUALITY IN ESTUARIAL SYSTEMS,
69-04311 05B

HE DEVELOPMENT AND APPLICATION OF A TIME-VARYING DISSOLVED
XYGEN MODEL,
69-04315 05G

HE ROLE OF THE PHYSICAL HYDRAULIC MODEL OF SAN FRANCISCO
AY AND DELTA IN POLLUTION STUDIES,
69-04329 05B

STUARINE WATER QUALITY MANAGEMENT IN THE SACRAMENTO-SAN
OAQUIN DELTA,
69-04331 05G

TE PLANNING OFFICE, SANTA FE, NEW MEX. AND GEOLOGICAL
VEY, WASHINGTON, D. C.
ATER RESOURCES OF NEW MEXICO, OCCURRENCE, DEVELOPMENT AND
SE,
69-04627 02E

TZER (ALBERT) AND ASSOCIATES, INC., BATON ROUGE, LA.
LOOD PLAIN INFORMATION, CALCASIEU RIVER, OAKDALE,
OUISIANA.
69-04215 04A

PA-HILLSBOROUGH BAY TECHNICAL ASSISTANCE PROJECT, TAMPA,
. AND FEDERAL WATER POLLUTION CONTROL ADMINISTRATION,
SHINGTON, D. C., OFFICE OF ESTUARINE STUDIES.
RGANIC CARBON-ORGANIC NITROGEN RATIOS OF SEDIMENTS IN A
OLLUTED ESTUARY,
69-04248 05C

CHNION - ISRAEL INST. OF TECH., HAIFA. DEPT. OF CIVIL
GINEERING.
VALUATION OF SEGMENTED IUH FROM DERIVATIVES,
69-04553 02A

CHNISCHE HOGESCHOOL, DELFT (NETHERLANDS).
NOTE ON THE GHYBEN-HERZBERG FORMULA,
69-04569 02F

NNESSEE VALLEY AUTHORITY, KNOXVILLE.
TRANSIENT FLOW INVESTIGATIONS FOR TVA'S BROWNS FERRY
GENERATING STATION.
69-04203 02E

BENEFIT-COST ANALYSIS FOR WATER RESOURCES PROJECTS A
SELECTED ANNOTATED BIBLIOGRAPHY.
69-04629 06B

NNESSEE VALLEY AUTHORITY, KNOXVILLE. DIV. OF RESERVOIR
OPERTIES.
THE BUFFALO SCENIC RIVERWAY.
69-04201 06B

NNESSEE VALLEY AUTHORITY, KNOXVILLE. DIV. OF WATER
NTROL PLANNING AND WISCONSIN UNIV., MADISON. DEPT. OF
VIL ENGINEERING.
STORM DRAINAGE PRACTICES OF THIRTY-TWO CITIES,
69-04551 02E

NNESSEE VALLEY AUTHORITY, KNOXVILLE. FISH AND WILDLIFE
ANCH.
EFFECTS OF FERTILIZER ON FOOD CHAIN ORGANISMS AND FISH
PRODUCTION IN NORRIS RESERVOIR, TENNESSEE.
69-04202 02I

OMPSON (JOHN I.) AND CO., WASHINGTON, D. C.
A PERSPECTIVE OF REGIONAL AND STATE MARINE ENVIRONMENTAL
ACTIVITIES, A QUESTIONNAIRE SURVEY, STATISTICS AND
OBSERVATIONS,
69-04289 06E

UNIVERSIDAD NACIONAL DEL ZULIA, MARACAIBO (VENEZUELA).
CIVIL ENGINEERING SCHOOL.
A MODERN STATISTICAL STUDY OF MONTHLY LEVELS OF THE ORINOCO
RIVER,
69-04568 02E

UNIVERSITY COLL. OF WALES, ABERYSTWYTH. DEPT. OF PHYSICS.
VISCOUS DRAG AND SECONDARY FLOW IN GRANULAR BEDS,
69-04243 02F

UTAH STATE UNIV., LOGAN. DEPT. OF CIVIL ENGINEERING.
FREE-SURFACE FLOW THROUGH HETEROGENEOUS POROUS MEDIA,
69-04552 02F

UTAH WATER RESEARCH LAB., LOGAN.
HYDROLOGIC ATLAS OF UTAH,
69-04209 02A

VANDERBILT UNIV., NASHVILLE, TENN. DEPT. OF GEOLOGY AND
MISSOURI UNIV., COLUMBIA. DEPT. OF AGRICULTURAL CHEMISTRY.
ALUMINUM IONS IN AQUEOUS SOLUTIONS,
69-04575 02K

WATERWAYS EXPERIMENT STATION, VICKSBURG, MISS.
USE OF MODELS IN RESOLVING TIDAL PROBLEMS,
69-04580 02L

WEATHER BUREAU, HELENA, MONT. AIRPORT STATION.
CENTRAL MONTANA RAINSTORMS AND FLOODS, JUNE 6-15, 1967,
69-04237 02B

WEATHER BUREAU, WASHINGTON, D. C. GEOPHYSICAL FLUID
DYNAMICS LAB.
ATMOSPHERIC WATER VAPOR TRANSPORT AND THE WATER BALANCE OF
NORTH AMERICA- 2. LARGE-SCALE WATER BALANCE INVESTIGATIONS,
69-04246 02A

WESTERN RESERVE UNIV., CLEVELAND, OHIO. DEPT. OF BIOLOGY.
ON QUESTIONS OF PRODUCTION AND PRODUCTIVITY IN ECOLOGY,
69-04524 02K

WISCONSIN UNIV., MADISON. DEPT. OF GEOLOGY.
SULFUR METABOLISM AND SEDIMENTARY ENVIRONMENT LAKE
MENDOTA, WISCONSIN,
69-04526 05C

WISCONSIN UNIV., MADISON. DEPT. OF SOIL SCIENCE.
EXTRACTION OF ORGANOCHLORINE AND ORGANOPHOSPHATE
INSECTICIDES FROM LAKE WATERS,
69-04523 05A

LINDANE ADSORPTION BY LAKE SEDIMENTS,
69-04525 05G

WYOMING UNIV., LARAMIE. MINUTEMAN SCHOOL OF CIVIL
ENGINEERING.
REFRACTION DETERMINATION OF WATER TABLE DEPTH AND ALLUVIUM
THICKNESS,
69-04607 02E

YALE UNIV., NEW HAVEN, CONN. DEPT. OF GEOLOGY.
MIGRATION OF IRON AND SULFUR WITHIN ANAEROBIC SEDIMENTS
DURING EARLY DIAGENESIS,
69-04572 02K

YALE UNIV., NEW HAVEN, CONN. OSBORN ZOOLOGICAL LAB AND
AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK.
A DIRECT DEMONSTRATION OF THE PHOSPHORUS CYCLE IN A SMALL
LAKE,
69-04520 02H

YALE UNIV., NEW HAVEN, CONN. OSBORN ZOOLOGICAL LAB.
THE THERMAL CLASSIFICATION OF LAKES,
69-04522 02H

ACCESSION NUMBER INDEX

-04201 06B
-04202 02I
-04203 02E
-04204 03F
-04205 06D
-04206 02F
-04207 02E
-04208 03F
-04209 02A
-04212 06E
-04214 06E
-04215 04A
-04216 04A
-04217 04A
-04218 04A
-04219 04A
-04220 04A
-04221 04A
-04222 05A
-04223 05B
-04224 02A
-04225 03B
-04226 05D
-04227 05B
-04228 05E
-04229 05E
-04230 05D
-04231 04B
-04232 02A
-04234 02G
-04235 05A
-04237 02B
-04238 02B
-04239 02B
-04240 02L
-04241 02L
-04242 02G
-04243 02F
-04244 02L
-04245 02K
-04246 02A
-04247 05C
-04248 05C
-04249 04A
-04250 02E
-04251 02C
-04252 07B
-04253 02C
-04254 02K
-04255 02C
-04256 05B
-04258 05B
-04261 02F
-04264 02K
-04265 05D
-04266 02G
-04267 03D
-04268 02F
-04269 02E
-04270 02K
-04271 02K
-04272 05E
-04273 03B
-04274 02K
-04275 06C
-04276 05C
-04277 05B
-04278 02L
-04279 05B
-04280 05C
-04281 05D
-04282 05A
-04283 06B
-04284 06B
-04285 05G
-04286 06E
-04287 04A
-04288 04A
-04289 06E
-04290 05G
-04291 02L
-04292 02L
-04293 05B
-04294 07B
-04295 06B
-04296 05C
-04297 05C
-04299 06B
-04300 06B
-04301 06E
-04302 06B
-04303 06B
-04304 05C
-04305 06B
-04306 05D
-04307 06F
-04308 05B
-04309 05G
-04310 05G
-04311 05B
-04312 06G
-04313 05E
-04314 06G
-04315 05G
-04316 06B
-04317 06B
-04318 05B

W69-04319 05G
W69-04320 06C
W69-04321 04A
W69-04322 05G
W69-04323 06E
W69-04324 04A
W69-04325 05C
W69-04326 05G
W69-04327 05G
W69-04328 06B
W69-04329 05B
W69-04330 06B
W69-04331 05G
W69-04332 05G
W69-04333 05G
W69-04334 02L
W69-04335 05G
W69-04336 06B
W69-04337 06B
W69-04338 06B
W69-04339 06B
W69-04340 04A
W69-04341 06E
W69-04342 05G
W69-04343 05G
W69-04344 05G
W69-04345 05C
W69-04346 06B
W69-04347 04A
W69-04348 06B
W69-04349 05C
W69-04350 05G
W69-04351 05B
W69-04352 06B
W69-04353 05G
W69-04354 05G
W69-04355 06B
W69-04356 06B
W69-04357 05G
W69-04358 10
W69-04359 05G
W69-04360 09D
W69-04361 04A
W69-04362 06B
W69-04363 06B
W69-04364 05C
W69-04365 04A
W69-04366 05B
W69-04367 04A
W69-04368 06E
W69-04369 06E
W69-04370 06E
W69-04371 04C
W69-04372 05B
W69-04373 04A
W69-04374 06E
W69-04375 06E
W69-04376 06E
W69-04377 05G
W69-04378 06E
W69-04379 04A
W69-04380 04D
W69-04381 06E
W69-04382 05G
W69-04383 06E
W69-04384 06E
W69-04385 06E
W69-04386 06E
W69-04387 06E
W69-04388 05G
W69-04389 04D
W69-04390 05G
W69-04391 05B
W69-04392 05G
W69-04393 04A
W69-04394 05F
W69-04395 05G
W69-04396 05G
W69-04397 04A
W69-04398 04A
W69-04399 06E
W69-04400 05G
W69-04401 04A
W69-04402 06E
W69-04403 04A
W69-04404 05G
W69-04405 04A
W69-04406 04A
W69-04407 06E
W69-04408 06E
W69-04409 06E
W69-04410 06E
W69-04411 06E
W69-04412 04A
W69-04413 06E
W69-04414 06E
W69-04415 05G
W69-04416 03F
W69-04417 04A
W69-04418 04C
W69-04419 06E
W69-04420 05G
W69-04421 06E
W69-04422 06E
W69-04423 04A
W69-04424 05G
W69-04425 05G

W69-04426 06E
W69-04427 03D
W69-04428 05G
W69-04429 04A
W69-04430 06E
W69-04431 06E
W69-04432 06E
W69-04433 06E
W69-04434 06E
W69-04435 06E
W69-04436 06B
W69-04437 05G
W69-04438 05G
W69-04439 05B
W69-04440 06B
W69-04441 03A
W69-04442 06B
W69-04443 06C
W69-04444 02L
W69-04445 05C
W69-04446 05G
W69-04447 05C
W69-04448 05C
W69-04449 06B
W69-04450 06E
W69-04451 05D
W69-04452 05B
W69-04453 06B
W69-04454 05C
W69-04455 06E
W69-04456 05C
W69-04457 05G
W69-04458 06B
W69-04459 08C
W69-04460 06C
W69-04461 06D
W69-04462 05B
W69-04463 03A
W69-04464 03C
W69-04465 05D
W69-04466 02L
W69-04467 02A
W69-04468 05G
W69-04469 05B
W69-04470 05G
W69-04471 05D
W69-04472 06B
W69-04473 06B
W69-04474 06B
W69-04475 06D
W69-04476 06B
W69-04477 06G
W69-04478 02L
W69-04479 06B
W69-04480 05A
W69-04481 06B
W69-04482 06B
W69-04483 03A
W69-04484 02L
W69-04485 06B
W69-04486 05C
W69-04487 06B
W69-04489 05G
W69-04490 05G
W69-04491 08A
W69-04492 06B
W69-04493 02L
W69-04494 05C
W69-04495 06B
W69-04496 05G
W69-04497 06B
W69-04498 03A
W69-04499 06B
W69-04500 06B
W69-04501 04D
W69-04502 05G
W69-04503 08B
W69-04504 05G
W69-04505 06B
W69-04506 07B
W69-04507 05D
W69-04509 05G
W69-04510 06B
W69-04511 05C
W69-04512 06P
W69-04513 03A
W69-04514 05D
W69-04515 05G
W69-04516 05G
W69-04517 06B
W69-04518 04A
W69-04519 06B
W69-04520 02H
W69-04521 05C
W69-04522 02H
W69-04523 05A
W69-04524 02K
W69-04525 05G
W69-04526 05C
W69-04527 05D
W69-04528 02G
W69-04529 04A
W69-04530 04A
W69-04531 04A
W69-04532 04A
W69-04533 04A
W69-04534 04A
W69-04535 04A
W69-04536 04A
W69-04537 04A
W69-04538 04A
W69-04539 04A
W69-04540 04A
W69-04541 04A
W69-04542 04A
W69-04543 04A
W69-04544 04A
W69-04545 04A
W69-04546 04A
W69-04547 07B
W69-04548 04C
W69-04549 02A
W69-04551 02E
W69-04552 02F
W69-04553 02A
W69-04554 02J
W69-04555 02E
W69-04556 07B
W69-04557 02E
W69-04558 02L
W69-04559 02L
W69-04560 04C
W69-04561 02P
W69-04562 02K
W69-04563 04B
W69-04564 02P
W69-04565 02E
W69-04566 06A
W69-04567 02B
W69-04568 02E
W69-04569 02F
W69-04570 02E
W69-04571 02E
W69-04572 02K
W69-04573 02P
W69-04574 02H
W69-04575 02K
W69-04576 04A
W69-04577 02E
W69-04578 05G
W69-04579 02L
W69-04580 02L
W69-04581 02L
W69-04582 02E
W69-04583 02E
W69-04584 02K
W69-04585 02P
W69-04586 02K
W69-04587 02E
W69-04588 02G
W69-04589 02G
W69-04590 02K
W69-04591 05D
W69-04592 04A
W69-04593 02E
W69-04594 04A
W69-04595 03A
W69-04596 04A
W69-04597 02H
W69-04598 02E
W69-04599 02E
W69-04600 02F
W69-04601 02F
W69-04602 02G
W69-04603 02G
W69-04604 02G
W69-04605 02E
W69-04606 02F
W69-04607 02E
W69-04608 02F
W69-04609 02F
W69-04610 02P
W69-04611 09A
W69-04612 02K
W69-04613 04A
W69-04614 06E
W69-04615 02F
W69-04616 02E
W69-04617 02H
W69-04618 02D
W69-04619 02P
W69-04620 02F
W69-04621 02P
W69-04622 02P
W69-04623 06B
W69-04624 07C
W69-04625 02F
W69-04626 02K
W69-04627 02E
W69-04628 02E
W69-04629 06B
W69-04630 04A
W69-04631 04A
W69-04632 04C
W69-04633 03B
W69-04634 03B
W69-04635 03B
W69-04636 03B
W69-04637 02G
W69-04638 02G
W69-04639 02G
W69-04640 02G
W69-04641 03P
W69-04643 04A
W69-04644 06E
W69-04645 06E
W69-04646 06B
W69-04647 05G
W69-04648 06E
W69-04649 06E
W69-04650 04A
W69-04651 06E

04652	06E
04653	04D
04654	05B
04655	04A
04656	04A
04657	06E
04658	04A
04659	05G
04660	06E
04661	06E
04662	04A
04663	04A
04664	05G
04665	04A
04666	06E
04667	06E
04668	05G
04669	06E
04670	06E
04671	06E
04672	06E
04673	04C
04674	04A
04675	06E
W69-04676	04C
W69-04677	05G
W69-04678	05G
W69-04679	06E
W69-04680	04C
W69-04681	05G
W69-04682	04A
W69-04683	06E
W69-04684	04A
W69-04685	04A
W69-04686	04A
W69-04687	05G
W69-04688	06D
W69-04689	04A
W69-04690	06D
W69-04691	06E
W69-04692	04A
W69-04693	04A
W69-04694	06E
W69-04695	03D
W69-04696	03D
W69-04697	03D
W69-04698	04D
W69-04699	06E
W69-04700	06E

Subject Fields

1 NATURE OF WATER

2 WATER CYCLE

3 WATER SUPPLY AUGMENTATION AND CONSERVATION

4 WATER QUANTITY MANAGEMENT AND CONTROL

5 WATER QUALITY MANAGEMENT AND PROTECTION

6 WATER RESOURCES PLANNING

7 RESOURCES DATA

8 ENGINEERING WORKS

9 MANPOWER, GRANTS, AND FACILITIES

10 SCIENTIFIC AND TECHNICAL INFORMATION

INDEXES

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF COMMERCE

LIBRARY RATE
PRINTED MATTER

U.S. DEPARTMENT OF COMMERCE
CLEARINGHOUSE FOR FEDERAL
SCIENTIFIC AND TECHNICAL INFORMATION
SPRINGFIELD, VA. 22151

OFFICIAL BUSINESS

6.33391
e48

UNIVERSITY OF ILLINOIS
AUG 29 1969
LIBRARY

SELECTED WATER RESOURCES ABSTRACTS

VOLUME 2, NUMBER 12
JUNE 15, 1969

W 69-04701 -- W 69-05200

Selected Water Resources Abstracts is published semimonthly for the Water Resources Scientific Information Center (WRSIC) by the Clearinghouse for Federal Scientific and Technical Information (CFSTI) of the Bureau of Standards, U. S. Department of Commerce. It is available to Federal agencies, contractors, or grantees in water resources upon request to: Manager, Water Resources Scientific Information Center, Office of Water Resources Research, U. S. Department of the Interior, Washington, D. C. 20240. Annual subscription is $22.00 (domestic), $27.50 (foreign), single copy price is $3.00. Certain documents abstracted in this journal can be purchased from the Clearinghouse at the prices indicated in the entry. Prepayment is required.

CLEARINGHOUSE
FOR FEDERAL SCIENTIFIC AND TECHNICAL INFORMATION

U.S. Department of Commerce, Springfield, Va., 22151

SELECTED
WATER RESOURCES ABSTRACTS

'A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

VOLUME 2, NUMBER 12
JUNE 15, 1969

W 69-04701 -- W 69-05200

se of funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources. WRSIC is not presently prepared to furnish loan or retention copies of the publications announced.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas. Centers, and their subject coverage, now in operation are:

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

CONTENTS

FOREWORD_____iii

SUBJECT FIELDS AND GROUPS

(Use Edge Index on back cover to Locate Subject Fields and Indexes in the journal.)

01 NATURE OF WATER
Includes the following Groups: Properties; Aqueous Solutions and Suspensions

02 WATER CYCLE
Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION
Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL
Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Non-Water Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION
Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING
Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA
Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS
Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS, AND FACILITIES
Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.

10 SCIENTIFIC AND TECHNICAL INFORMATION
Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

02. WATER CYCLE

2A. General

CAN WE CONTROL THE ARCTIC CLIMATE,
For primary bibliographic entry see Field 04A.
W69-04790

A SCALE MODEL STUDY OF SILTING IN THE VILAINE RIVER DUE TO THE ARZAL DAM (FRENCH),
French Central Hydraulic Lab, France.
C. Orgeron.
La Houille Blanche (Rev of French Hydrotech Soc), No 7, pp 621-630, 1968. 10 p, 6 fig, 2 photo, 2 tab.

Descriptors: *Model studies, *Sediment discharge, *Silts, *Physical properties, Dam construction, Hydraulic properties, Salinity, Estuaries, Estuarine environment, Precipitation, Discharge, Mud, Land management.
Identifiers: Vilaine river, Northwestern France.

The hydraulic and chemical environments and the industrial possibilities of the Vilaine river estuary were investigated by using two experimental models of 1:750 and 1:150 scales. The first model represented the estuary and its marine vicinity, and the second one represented the course of the Vilaine river. On the basis of data obtained from these experimental models and using the gage-station hydrologic data of several years, the author summarizes the results of the study of follows: 1. at present the river is in the conditions of quasi-equilibrium dynamics; 2. the alternating up-and-down river transport during the dry and rainy seasons is mainly responsible for the deposition of mud in the estuary; 3. the magnitudes of river discharge greatly modify the conditions of flocculation, salinity and mud deposition; 4. the construction of a dam would not accelerate the process of mud deposition; and 5. careful use of simple methods may be of value in maintaining, and even improving navigational conditions in the estuary. (Gabriel-USGS)
W69-04795

A LOW INTENSITY RAIN SIMULATOR FOR LONG DURATION RAIN-ON-SNOW EVENTS,
Nevada Univ., Reno. Desert Research Inst.
For primary bibliographic entry see Field 02B.
W69-04939

AN HOURLY WATER BALANCE MODEL AS A BASIS FOR CONTINUOUS WATER RESOURCES ASSESSMENT ON A WATERSHED,
Ontario Agricultural Coll., Guelph. School of Agricultural Engineering; Ceskoslovenska Akademie Ved, Prague. Inst. of Hydrodynamics.
H. D. Ayers, and J. Balek.
Int Ass Sci Hydrol Pub No 76, Symp on Hydrol Aspects of Util of Water, Bern, Sept 25-Oct 7, 1967, pp 227-234, 1968. 8 p, 3 fig, 7 ref.

Descriptors: *Model studies, *Hydrologic budget, *Watersheds (Basins), Hydrographs, Evapotranspiration, Storage, Groundwater movement, Ice, Streamflow, Meteorology, Climatology.
Identifiers: Hydrometeorology.

A mathematical model of the year-round hydrological regime has been developed. The model is based on various storage-accretion-depletion zones arranged vertically and two horizontally distributed regions corresponding to the alluvial and nonalluvial portions of the basin. The principles of the model structure and its application to a particular watershed are discussed. The model was tested by comparing observed and calculated hydrographs. (Knapp-USGS)
W69-04954

ESTIMATION OF MAXIMUM DISCHARGES AND HYDROGRAPHS OF FLOOD,
Gidrometeorologicheskii Institut, Leningrad (USSR).
For primary bibliographic entry see Field 02E.
W69-04955

INLET HYDROGRAPH ESTIMATION FOR LINEAR FLOW MODELS ACCORDING TO OUTLET HYDROGRAPH,
Hydrometeorological Centre (USSR).
L. S. Kuchment.
Int Ass Sci Hydrol Pub No 76, Symp on Hydrol Aspects of Util of Water, Bern, Sept 25-Oct 7, 1967, pp 292-299, 1968. 8 p, 3 fig, 1 tab, 6 ref.

Descriptors: Hydrograph analysis, *Routing, *Hydrographs, *Estimating, Mathematical studies, Analytical techniques, Approximation method, Rainfall-runoff relationships.
Identifiers: Duhamel's integral, Quasilinearization.

The problem of calculating the input hydrograph using the output hydrograph and Duhamel's integral is considered. Previously the problem was solved by using Volterra's equation of the first kind and is incorrect in the general case. In recent work in the USSR, Duhamel's integral was replaced by a system of linear algebraic equations solved approximately for the ordinates of the input hydrograph, assuming that input and output are equal. The method and procedure are described in detail. Examples of calculated hydrographs are compared with measured hydrographs. (Knapp-USGS)
W69-04961

RIVER POLLUTION II, CAUSES AND EFFECTS,
Louis Klein.
Washington: Butterworth and Company, 1962.

Descriptors: *Water pollution, *Rivers, *Foreign countries, Water pollution sources, Water pollution effects, Bodies of water, Running waters, Streams, Surface waters, Geographical regions, Regions.

The causes of river pollution and the nature of the various kinds of pollution and their effects upon rivers are described. The international chapter on river pollution is well-documented by the variety of countries from which these references emanate, namely: Great Britain, Germany, Holland, Belgium, France, Switzerland, Denmark, USSR, U.S.A., Argentina, Japan, South Africa, New Zealand, and Israel.
W69-05012

INTERRELATIONSHIP BETWEEN PHYSIOGRAPHY, HYDROLOGY, SEDIMENTATION, AND SALINIZATION OF THE LODDEN RIVER PLAINS, AUSTRALIA,
Geological Survey of Australia, Melbourne.
P. G. Macumber.
Jour of Hydrology, Vol 7, No 1, pp 39-57, 1969. 5 fig, 2 tab, 18 ref.

Descriptors: *Geomorphology, *Hydrology, *Sedimentation, *Saline water, *Quaternary period, Saline soils, Aquifers, Playas, Leaching, Flow rates, Streams, Semiarid climates, Salts, Irrigation effects, Winds, Climatology, Paleoclimatology.
Identifiers: *Lodden River Plains, Australia, Salinization, Plains, Playettes, Lunettes.

Salinization of the Lodden Plains was shown to be closely linked to fluvial and aeolian patterns of Quaternary sedimentation and hence strongly influenced by structural and geomorphic factors controlling sedimentation. The Lodden Plains have a semi-arid climate. Physiography of the Plains and development of playettes, playas and lunettes on the Plains were discussed. Salt content on the plain began to build up when flood control measures prevented regular seasonal flooding which leached salts down to the water table. Regular irrigation since 1884 has raised the water table to within 2 meters of the surface causing great loss in production of crops. (Affleck-Arizona)
W69-05079

EFFECTS OF HERBICIDES, BURNING, AND SEEDING DATE IN RESEEDING AN ARID RANGE.
Agricultural Research Service, Pullman, Wash. Crops Research Div.; Agricultural Research Service, Beltsville, Md. Crops Research Div.; Oregon State Univ., Corvallis.
W. C. Robocker, Dillard H. Gates, and Harold D. Kerr.
J. Range Management, Vol 18, No 3, pp 114-118, May 1965. 4 tab, 10 ref.

Descriptors: *Seeds, *Range grasses, *Revegetation, *Herbicides, *Burning, Range management, Planting management, Arid climates, Wheatgrasses, Brush control, Sagebrush, Bluegrasses, Crop response, Bromegrass, Washington.
Identifiers: *Reseeding, Seed bed, Perennial grasses, Climatic stress.

A study was conducted in the arid sagebrush-bluebunch wheatgrass association near Ephrata, Washington, to determine effectiveness both of burning and of several herbicides (Dalapon, 2, 3, 6-TBA, and CTPC) for seedbed preparation when seeding perennial grasses. The soil was a stony phase of Ephrata sandy loam. Neither the application of herbicides nor burning for control of downy brome and Sandberg's bluegrass before planting wheatgrass were effective in increasing stands of wheatgrass seedlings. In the study area, where dry summers and approximately 8 inches of annual precipitation were common, severe climatic stresses were primarily responsible in determing the establishment or failure of seedlings. (Blecker-Arizona)
W69-05082

FURTHER STUDY OF AQUIFER PERFORMANCE,
Illinois Univ., Urbana.
Walter Rose.
Illinois Water Resources Center, Research Report No 7, January 1967, i + 6 p, 7 ref. OWRR Project A-002-ILL.

Descriptors: *Aquifers, Boundaries, Darcys law, Diffusion, *Free surfaces, Groundwater, *Groundwater flow, Heat transfer, *Interfaces, Numerical analysis, Pores, Porosity, *Porous media.
Identifiers: Aquifer performance, *Boundary conditions, *Non-equilibrium thermodynamics, *Numerical methods, *Pore geometry.

The research objective was to develop a generalized treatment of reservoir engineering principles which underlie, describe, and control the performance of aquifers used for sources, storage and conduits of water. The work proceeded on three fronts: (a) new approaches to fluid transport, diffusion, dispersion, and heat transfer based on modern concepts of continuum mechanics and non-equilibrium thermodynamics, (b) characterization of microscopic details of pore geometry in aquifer systems, and (c) development of finite difference algorithms to model three-dimensional, unsteady fluid flow problems with free surface boundaries. Findings with respect to these areas include: (a) a general theory which holds for coupled processes where diffusion and heat transfer occur simultaneously, (b) suitable models to characterize pore space, and (c) a numerical difference scheme to model water motion with free surface boundary conditions as governed by the Navier-Stokes equations in the microscopic sense and by the Fourier diffusivity equation in the macroscopic sense. (Betchart-Ill)
W69-05149

2B. Precipitation

AREAL SPREAD OF THE EFFECT OF CLOUD SEEDING AT THE WHITETOP EXPERIMENT,
California Univ., Berkeley. Dept. of Statistics.
For primary bibliographic entry see Field 03B.
W69-04775

A LOW INTENSITY RAIN SIMULATOR FOR LONG DURATION RAIN-ON-SNOW EVENTS,
Nevada Univ., Reno. Desert Research Inst.
S. T. Timko, and C. M. Skau.
Water Resources Res Center Proj Rept No 12, Oct 1968. 9 p, 2 fig, 13 ref. OWRR Project B-012-NEV (1).

Descriptors: *Rainfall simultaors, *Artificial precipitation, *Rainfall runoff relationships, *Snowpacks, *Frozen ground, Infiltration, Runoff, Rainfall intensity, Simulated rainfall, Raindrops, Nevada.
Identifiers: Sierra Nevada, Rain-on-snow experiments.

A rain simulator was constructed to produce drop size distribution and intensity similar to those in winter storms on the east side of the Sierra Nevada. The simulator can independently regulate drop size from 0.1 to 1.5 mm and rainfall intensity from 0.03 to 1.5 in. per hr by using air jets concentric around water feed tubes to break up a regulated amount of water into drops of selected sizes. Intensity is regulated by varying the number of nozzles and the feed rate. Drop size is regulated by varying the airflow rate. Field trials were run in December and January in the Sierra Nevada above Carson City. The experiments were rain on snow and rain on frozen soil infiltration tests using bounded plots. Water equivalent, plot runoff, air temperature, soil temperature and soil moisture were measured while rainfall intensity was regulated. The apparatus worked satisfactorily but the data collection system needed further development, largely in automation because of the long time span of experiments and the rainfall simulator's demands on operator attention. (Knapp-USGS)
W69-04939

CHEMICAL CHARACTERISTICS OF BULK PRECIPITATION IN THE MOJAVE DESERT REGION, CALIFORNIA,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 02K.
W69-04982

PROBABLE MAXIMUM PRECIPITATION OVER SOUTH PLATTE RIVER, COLORADO AND MINNESOTA RIVER, MINNESOTA,
Weather Bureau, Silver Spring, Md.
For primary bibliographic entry see Field 04A.
W69-05158

CLIMATOLOGY OF SEVERE WINTER STORMS IN ILLINOIS,
Stanley A. Changnon, Jr.
Illinois State Water Survey, Urbana, Bulletin 53, 1969. 45 p, 38 fig, 32 tab, 29 ref.

Descriptors:
Identifiers: *Applied climatology, Blizzards, Design storms, *Glaze, Heavy snow, Hydrologic budget, Ice storms, *Illinois, Lake effect, *Severe storms, Sleet, *Snow, *Storm damages, Storm models, Synoptic climatology, Wind with glaze.

Severe winter storms, those producing 6 inches or more snowfall and/or damaging glaze, occur five times a year in Illinois, and cause more damage than other forms of severe weather. The climatology of all severe winter storms in 1900-1960, their damages, their synoptic weather conditions, and information applicable to design and operational considerations are presented. Storms centered most often in northwestern Illinois and averaged 6 inches of snow over 7500 square miles. Storm centers were elongated with an axial ratio of 3:1 and WSW-ENE orientations. Point snowfalls of 12 inches and glaze with a radial thickness of 2 inches have occurred in all parts of Illinois. Business losses resulting from winter storms are eight times the direct losses to property and vegetation, and the greatest direct loss was $12.4 million in a 1924 storm. Five synoptic weather types cause severe winter storms, and the Colorado low with a southerly track produced 45 percent of all storms.
W69-05159

2C. Snow, Ice, and Frost

PARTICLE SIZE AS A BASIS FOR PREDICTING FROST ACTION IN SOILS,
National Research Council of Canada, Ottawa (Ontario).
E. Penner.
Soils Found, Vol 8, No 4, pp 21-29, Dec 1968. 9 p, 3 fig, 7 ref.

Descriptors: *Grain sizes, *Frost action, *Frost heaving, Heaving, Ice pressures, Pores, Gradation, Clays, Soils, Soil mechanics, Permeability, Frost, Frozen soils, Gradation analysis, Lenses (Soils), *Ice-water interfaces, Foreign research, Particle size.
Identifiers: Pore size, Soil pore structure, Ice lenses, Ice forming, Suction, Canada.

Maximum heaving pressures caused by ice lens growth were determined experimentally for saturated specimens consisting of fragmental particles in several size ranges. The size of smaller particles in the soil for the range of particle size studied determines the magnitude of the heaving pressure developed because of their influence on the dimensions of the porous system. Frost action criteria, based on particle size, appear adequate for predicting frost susceptibility. Maximum heaving pressure develops after active frost penetration and rises to this maximum when the ice-water interface is essentially stationary. There does not appear to be sharp separation, based on particle or pore size, of frost-heaving from nonfrost-heaving soils. The experimental observation that smaller sizes are more influential in determining maximum heaving pressure indicates that on a microscopic scale an undulating ice-water interface exists. The undulating feature of the ice lens is possible in a porous system of varying pore sizes exposed to a thermal gradient regime. Both are essential features of the mechanism of ice lensing in nature and also simulated in these experiments. (USBR)
W69-04739

A LOW INTENSITY RAIN SIMULATOR FOR LONG DURATION RAIN-ON-SNOW EVENTS,
Nevada Univ., Reno. Desert Research Inst.
For primary bibliographic entry see Field 02B.
W69-04939

THE UNDERSIDE OF RIVER ICE, ST. CROIX RIVER, WISCONSIN,
Geological Survey, Madison, Wis.
Kevin L. Carey.
Geol. Surv Res 1967, Prof Pap 575-C, pp C195-C199, 1967. 5 p, 1 fig, 1 tab, 2 ref.

Descriptors: *Ice, *Rivers, *Roughness (Hydraulic), *Ice-water interfaces, Wisconsin, Frazil ice, Mannings equation, Darcy-Weisbach equation.
Identifiers: St. Croix River (Wis), Ice configuration (Underside).

Ripplelike and dunelike features have been found during a second winter on the underside of the ice cover on the St. Croix River, Wis. Profiles of the features and measurements of ablation and accretion show that the features began to form when the underside of the ice was accreting, and continued their development during ablation. The Belokon-Sabaneev formula satisfactorily shows the relationship between the roughness coefficients for the ice, the bed, and the total channel. Calculations of the roughness coefficient for the underside of the ice, n sub 1, range from 0.0039 to 0.0142, except for one calculation which indicates no retardation of the flow by the ice cover. This anomaly is believed to be caused by an incorrect estimate of the effective size of the roughness projections of the bed. Caution is therefore given that the computed (published) values of the ice roughness parameters are slightly smaller than actual. (USGS)
W69-04976

WINTER LOSS AND SPRING RECOVERY OF DISSOLVED SOLIDS IN TWO PRAIRIE-POTHOLE PONDS IN NORTH DAKOTA,
Geological Survey, Lincoln, Nebr.
For primary bibliographic entry see Field 02J.
W69-04983

NET, ALLWAVE RADIATION AS AN INDEX OF NATURAL SNOWMELT AND SNOWMELT ACCELERATED WITH ALBEDO REDUCING MATERIALS,
Forest Service (USDA), Boise, Idaho. Intermountain Forest and Range Experiment Station.
Walter F. Meghan, James R. Meiman, and Bertram C. Goodell.
Proc. Internatl. Hydrology Symp. Colorado State U., 1967, pp 149-156.

Descriptors: *Snowmelt, *Albedo, *Solar radiation, *Energy transfer, Evaporation, Lysimeters, Meteorology, Melt water, Snow managment, Snowpacks, Snow removal, Irradiation, Wavelengths.
Identifiers: Air-snow interfaces, Net radiation, All wave radiation.

An evaluation of the utility of net radiation as an index of snowmelt in the open was made as part of a study in the Rocky Mountains of Colorado to evaluate methods of accelerating snowmelt by decreasing the albedo of snow. Snowmelt was measured with the use of clear, false bottom, lucite lysimeters, 41 centimeters (16 inches) in diameter and 41 centimeters (16 inches) deep. Net radiation was recorded from two Funk, net allwave radiometers for daily periods over snow lysimeters either treated with carbon blacks or untreated. Two kinds and two application rates of carbon blacks were used. A bimetal type pyranometer was operated concurrently with the Funk radiometers to measure incoming, short-wave radiation. Five days of records were used to relate radiant energy to snowmelt under extreme ranges of snow albedo. The correlation coefficient was .95 using the net allwave radiation data. Snowmelt was accelerated an average of 2.8 times with the use of albedo reducing materials for a one day period. There was no significant difference in the amount of melt among the various carbon black treatments. Estimates were made of the evaporation loss from snow. There was some indication that carbon black treatments reduce snow evaporation.
W69-05103

SNOW LOADS ON ROOFS IN AREAS OF HEAVY SNOWFALL,
Forest Service (USDA), Logan, Utah. Intermountain Forest and Range Experiment Station.
Robert D. Doty, and Glenn H. Deitschman.
U.S.D.A. Forest Serv. Res. Note INT-43, 1966, 4 pp.

Descriptors: *Snow surveys, Snowfall, *Snowpacks, *Weather data, Moisture content, Aluminum.
Identifiers: *Snow depth measurements.

This study tested the feasibility of estimating snow loads on roofs from measurements of depth and water content of snow on nearby ground. The water content, and therefore the weight, of snow on the ground proved comparable to that of snow on roofs.
W69-05109

CLIMATOLOGY OF SEVERE WINTER STORMS IN ILLINOIS,
For primary bibliographic entry see Field 02B.
W69-05159

2D. Evaporation and Transpiration

EVAPOTRANSPIRATION-REVIEW OF RESEARCH,
Nebraska Univ., Lincoln. Dept. of Horticulture and Forestry.
Norman J. Rosenberg, Hoyt E. Hart, and Kirk W. Brown.
Nebr Univ-Water Resources Res Inst Rep, Nov 1968. 78 p, 240 ref. OWRR Project A-001-NEBR (3).

Descriptors: *Evapotranspiration, *Reviews, *Bibliographies, Advection, Climatology, Energy budget, Hydrologic budget, Evaporation, Lysimeters, Meteorology, Micro-environment, Transpiration.
Identifiers: Evapotranspiration review.

The literature of evapotranspiration is reviewed, selected references are listed, and the drought problems in the Great Plains are discussed. Orginal source materials from the earliest available to 1967 are evaluated. Mass transport, aerodynamics, energy budget, and empirical methods are discussed in detail. Advection, a new field of interest not yet well understood, is emphasized and many references are reviewed and listed. Lysimetry is stressed because it appears to be the most promising technique for new research in evapotranspiration. Older review articles are reviewed to summarize earlier work and to help give a general background to evapotranspiration research. (Knapp-USGS)
W69-04764

EFFECTS OF PHENYLMERCURIC ACETATE ON TRANSPIRATION AND GROWTH OF SMALL PLOTS OF GRASS,
Nottingham Univ. (England). Dept of Horticulture.
D. C. Davenport.
Nature, Vol 212, No 5064, pp 801-802, November 19, 1966. 3 fig.

Descriptors: *Grasses, *Fescues, *Transpiration control, *Plant growth, *Inhibitors, Moisture stress, Carbon dioxide, Soil moisture, Metabolism, Stomata, Wetting, Soil-water-plant relationships, Retardants, Drying.
Identifiers: *Phenylmercuric acetate (PMA), Transpirometers, Plots.

Experiments were conducted to determine whether any concentration of the metabolic inhibitor phenylmercuric acetate (PMA) could be used to achieve a reduction of transpiration without substantially restricting the transfer of carbon dioxide or adversely affecting growth. Small plots of creeping red fescue grass were used as transpirometers, providing a highly reproducible method of assaying both transpiration and growth under a variety of environmental conditions. PMA was more effective under conditions of low soil moisture stress. The effects of the anti-transpirant could be detected within 24 hours and transpiration continued to be reduced, though with diminishing intensity, for as long as 4 weeks after application. No toxic effects were observed even with the highest rate of application of 4.8 gms of solution per plot. (Blecker-Arizona)
W69-05071

CALCULATION MODEL FOR THE ACTUAL EVAPOTRANSPIRATION FROM CROPPED AREAS AND OTHER TERMS OF THE WATER BALANCE EQUATION,
Research and Advisory Inst. for Field Crop and Grassland Husbandry, Wageningen (Netherlands).
G. F. Makkink, and H. D. J. van Heemst.
UNESCO Arid Zone Research, Vol 25, pp 489-494, 1965. 4 fig, 1 tab 20 ref, disc.

Descriptors: *Evapotranspiration, *Water balance, *Moisture content, *Drainage water, *Equations, Model studies, Correlation analysis, Soil moisture, Absorption, Precipitation (Atmospheric), Measurement.
Identifiers: Cropped area, Parameters.

A calculation model is given in which several processes are approximated quantitatively to arrive at the value of actual evapotranspiration of a cropped area and at all other terms of the water balance during the course of the year. The model is based on continuous water book-keeping of the water content in the soil throughout one or more years. Results obtained from the model not only give totals of drainage water, but also those of evapotranspiration, quantities of water absorbed from below and evapotranspiration deficits. A correlation coefficient of 0.91 has been found between the measured monthly quantities of drainage water and figures calculated by means of a schematic model for book-keeping of the water content of a cropped area. (Blecker-Arizona)
W69-05072

THE DETERMINATION OF THE EVAPORATION FROM THE PLANT COVER AND THE SURFACE OF THE SOIL BY RELATING LYSIMETER AND SOIL MOISTURE MEASUREMENTS TO POTENTIAL EVAPORATION,
O. Klausing.
UNESCO Arid Zone Research, Vol 25, pp 461-465, 1965. 1 fig, disc.

Descriptors: *Soil surfaces, *Evaporation, *Evapotranspiration, *Moisture content, *Measurement, Air temperature, Solar radiation, Soil water, Lysimeters, Ecology, Instrumentation, Water balance, Radiation, Soil moisture, Soil-water-plant relationships.
Identifiers: *Potential evaporation, Plant cover.

The theoretical problem of potential evaporation is discussed along with evapotranspiration. Also mentioned is the problem of providing a physical definition of potential evaporation acceptable to all and showing a practical way for its direct measurement. Potential evaporation is defined as evaporation from a plane horizontal water surface at actual air temperature in full daylight under conditions of unrestricted radiation and ventilation. Ecological measurement of evapotranspiration is one of the most complex problems in the field of ecology because soil surface and plant cover are dependent upon atmospheric and soil water conditions. A monolith-lysimeter in an ecologically natural position has apparently no effect on the soil surface. Its plant cover was constructed in order to satisfy all ecological requirements when potential evaporation was measured. (Blecker-Arizona)
W69-05073

PERPETUAL SUCCESSION OF STREAM-CHANNEL VEGETATION IN A SEMIARID REGION,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
C. J. Campbell, and Win Green.
Jour of the Ariz Academy of Sci, Vol 5, No 2, pp 86-98, Oct 1968. 5 fig, 7 tab, 20 ref.

Descriptors: *Succession, *Channels, *Streams, *Vegetation, *Semiarid climates, Ecology, Arizona, Ecosystems, Plant groupings, Riparian plants, Speciation, Elevation, Shrubs, Trees, Desert plants, Soil-water-plant relationships, Floods, Soil moisture, Moisture, Availability, Vegetation regrowth.
Identifiers: *Association index, *Pseudoriparian, Sycamore Creek, Arizona.

Community aspects of channel vegetation with respect to changing elevation on Sycamore Creek, Maricopa County, Arizona, were studied by means of association indices of dominant species. Ninety-five percent of the shrub species samples and approximately fifty percent of the tree species were indigenous to the semiarid mountain slopes and were not dependent upon additional subsurface moisture in the channel for survival. These species were termed 'pseudoriparian'. Pseudoriparian species remained confined to their area of introduction--migrating neither upstream nor downstream. Riparian species existed only where additional subsurface moisture was available in addition to annual precipitation. Riparian species were found along the stream channel in a relatively narrow band that sometimes bisected sharply demarked vegetational zones. It was suggested that channel vegetation probably never reached a climax hierarchy due to periodic flood disturbances such as erosion, inundation and deposition. (Affleck-Arizona)
W69-05080

INFLUENCE OF THE THICKNESS AND FREE POROSITY OF A DRIED LAYER ON EVAPORATION,
Akademiya Nauk SSSR, Moscow. Institut Geografii.
L. K. Tselishcheva.
Soviet Soil Sci, No 3, pp 257-260, March 1965. 2 fig.

Descriptors: *Drying, *Evaporation, *Porosity, *Soil surfaces, *Soil density, Water vapor, Mulching, Equations, Diffusion, Moisture content, Air-earth interfaces, Temperature, Soil moisture, Density.

A dried layer, which performs the role of natural mulch through which moisture can move in a vaporous state, will be formed on the soil surface during evaporation. The purpose of this study was to obtain additional data on a formula which shows the ratio of evaporation from dried soil to the evaporation from the surface of wet soil and secondly, to explain the nature of the relation between a coefficient which determines the water vapor diffusion rate through a dried layer or mulch and free porosity of the soil. Results indicated that the ratio of evaporation from dried soil and wet soil described accurately the influence of the thickness of a dried soil layer or mulch on evaporation. The equations developed could be used to determine the quantity of moisture that is lost to evaporation in arid climates. (Blecker-Arizona)
W69-05083

DETERMINATION OF THE REGIONAL COEFFICIENT 'K' FOR COMPUTING THE CONSUMPTIVE USE OF NATIVE BLACK KIDNEY BEAN IN THE IRRIGATION DISTRICTS OF VERACRUZ STATE,
Irrigation and Drainage Engineering Office, Veracruz (Mexico).
For primary bibliographic entry see Field 02I.
W69-05086

CONSUMPTIVE USE OF WATER FOR SOME MAJOR CROPS IN U.A.R. (EGYPT),
Cairo Univ., Giza (Egypt). Dept. of Irrigation and Hydraulics, Ministry of Agriculture, Cairo (Egypt).
For primary bibliographic entry see Field 02I.
W69-05087

INFLUENCE OF SOIL WATER POTENTIAL AND ATMOSPHERIC EVAPORATIVE DEMAND ON TRANSPIRATION AND THE ENERGY STATUS OF WATER IN PLANTS.
Utah State Univ., Logan.
For primary bibliographic entry see Field 02I.
W69-05088

CONSUMPTIVE USE COMPUTATIONS FROM EVAPORATION PAN DATA,
George H. Hargreaves.
Irrigation and Drainage Conference, Las Vegas, Nevada, Nov 2-4 1966, American Society of Civil Engineers, pp 35-64. 5 tab, 21 ref, disc.

Descriptors: *Evapotranspiration, *Consumptive use, *Evaporation pans, *Crops, *Water requirements, Arid climates, Evaporation, Rainfall, Data collections, Equations, Irrigation efficiency, Climatic data, Analytical techniques, Computers.
Identifiers: *Formulas.

The history of development of evaporation and evapotranspiration (consumptive use) formulas in given and improved evaporation formulas are presented. Ratios of evapotranspiration to Class A pan evaporation are studied for a large number of crops. Crops are grouped according to similar irrigation requirements and similar relationships to evaporation. A comprehensive system of irrigation requirement computations is developed. A formula is presented for converting consumptive use to irrigation requirements by allowing for a suitable irrigation efficiency and for utilizable rainfall. The methods and procedures presented area applicable to arid climates where data are quite complete as well as to those locations or projects for which only temperature and rainfall data are available. (Blecker-Ariz)
W69-05092

ESTIMATING CONSUMPTIVE USE - MUNSON P. E. INDEX METHOD,
Bureau of Reclamation, Washington, D. C.
Wendell C. Munson.
Irrigation and Drainage Speciality Conference, Las Vegas, Nevada, Nov 2-4, 1966, American Society of Civil Engineers, pp 65-107. 8 tab, 4 illus.

Descriptors: *Consumptive use, *Semiarid climates, *Temperature, *Evapotranspiration, *Estimating, Evaporation, Transpiration, Precipitation (Atmospheric), Monthly, Annual, Crop production, Irrigation efficiency, Climatic data, Water requirements, Measurement.
Identifiers: *Munson P.E. Index Method, Formulas.

The purpose of this paper was to update previous work that used the Munson P.E. Index, discuss problems encountered and their possible solutions, and correct some misconceptions of basic factors included in the formula. Procedures are described for adapting the formula to areas other than semiarid sections of the United States. The method described showed that monthly and annual consumptive use estimates may be determined for project formulation utilizing only average monthly temperatures and a set of predetermined P. E. ratios. Results obtained by the method have been compared with those obtained by many other methods over a wide geographical range and a great divergence in cropping procedures as well as different crops have been found. Validity of the method has been shown to be comparable to that of any other method and has the advantage of its extreme simplicity. (Blecker-Ariz)
W69-05094

EVAPORATION RATES IN MOUNTAINOUS TERRAIN,
Forest Service (USDA), Logan, Utah. Intermountain Forest and Range Experiment Station.
Eugene L. Peck, and Dale J. Pfankuch.
I.A.S.H. Committee for Evaporation, Publication No. 62, 1963, pp 267-278.

Descriptors: *Evaporation, *Mountains, *Gaging stations, *Meterological data, *Hydrologic data, Elevation, Atmospheric pressure, Radiation, Dew point, Wing velocity, Watershed management, Anemometers, Thermometers, Evaporation pans.
Identifiers: *Evaporation rates, *Evaporation stations, *Diurnal rates, Drainage winds.

An investigation of evaporation rates in mountainous terrain is being conducted with a specially designed network of 13 Weather Bureau 'Class A' evaporation stations at elevations ranging from 4,400 to 9,000 feet in the Wasatch Mountains near Farmington, Utah. The investigation seeks to determine the effects of elevation, topography, and exposure on evaporation rates. Measurements during the first summer consisted of daily readings at all stations and simultaneous hourly readings from sunrise to sunset for the base station and each other station on an alternating basis. Analyses of the data are presented, including comparison of evaporation rates from the different stations, for pairs of stations near the same elevation with different exposures, as well as comparison of daytime and nighttime evaporation rates. The effect of drainage winds on nighttime evaporation is noted.
W69-05098

INFLUENCE OF SOIL TEMPERATURE ON TRANSPIRATION UNDER VARIOUS ENVIRONMENTAL CONDITIONS,
Forest Service (USDA), Logan, Utah. Intermountain Forest and Range Experiment Station.
R. K. Tew, S. A. Taylor, and G. L. Ashcroft.
Agronomy Journal, 1963, Vol. 55:558-560.

Descriptors: *Transpiration, *Environmental effects, *Air temperature, *Relative humidity, *Soil temperature, Soil physical properties, Soil-water-plant relationship, Evapotranspiration, Root development, Soil water movement, Growth chambers, Wind velocity, Capillary water, Soil stability, Lighting.
Identifiers: *Leaf temperatures, *Stem temperatures, Root membrane permeability.

Soil temperature had a significant influence on transpiration. In growth chambers, variations in air temperature and relative humidity had little influence on transpiration when the soil temperature was low. Under the experimental conditions, low soil temperature was a major factor in controlling transpiration rates.
W69-05099

EVAPOTRANSPIRATION AND SOIL-MOISTURE DEPLETION,
Forest Service (USDA), Moscow, Idaho. Intermountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 02G.
W69-05102

2E. Streamflow and Runoff

HYDROGRAPHICAL INVESTIGATION OF THE BRAHMAPUTRA RIVER IN EAST PAKISTAN,
East Pakistan Water and Power Development Authority, Dacca. Water Investigation.
A. Latif.
For the 8 Volume Proceedings, see Vol 2, No 9, Field 06B, W69-03305. Int Conf on Water for Peace, Wash D C, Vol 4, pp 309-319, 1968. 11 p, 4 fig, 1 tab, 5 ref.

Descriptors: *Hydrograph, *Alluvial channels, *Floods, *Rivers, *River basin development, Data collections, Investigations, Hydrologic data, Social aspects, Agriculture, Regional analysis, Surveys, River forecasting, Channel improvement, Flood protection, Levees.
Identifiers: Brahmaputra River (Pakistan).

Brahmaputra is the largest river in the Indo-Pakistan sub-continent. The river rises in the northernmost ranges of the Himalayas in the Tibet and, flowing through Assam in India, enters East Pakistan. At Goalundo in East Pakistan it meets the Ganges river and after meeting the Meghna river at Chandpur discharges into the Bay of Bengal. The length of the river from the source to Goalundo is 1,600 mi. The average annual precipitation over the whole river basin is 85 in. The flood flows of the river are among the largest in the world. The estimated maximum discharge in the river channel was 2.5 million cusecs and annual sediment-load is about 900 million tons. Three successive damaging floods occurred in East Pakistan in 1954-56. A U.N. Technical Mission, which carried out a study of the problem of water development in East Pakistan, recommended investigation of the feasibility and effects, beneficial and adverse, of a system of flood embankments along the major rivers with sluices, flushing channels and drainage channels. During the last 12 yr East Pakistan has been subjected to 6 severe floods inundating each time about 12,000 to 15,000 sq mi, which represents about half of the cultivated area of the province. The density of population in the flooded areas of the Brahmaputra basin in East Pakistan varies from 1,000 to 16,000 sq mi. With the growth of population the pressure for living space and food is assuming greater importance. Control of floods by storage dams is not possible as the upper reaches of the river lie outside Pakistan. Construction of an embankment on the right bank of the river in East Pakistan is in progress. It is proposed also to construct marginal embankments on the left bank of the Brahmaputra. Results of a preliminary survey of the effects of earthquakes and landslides upstream of Pakistan are discussed. (Knapp-USGS)
W69-04752

BASIC DATA COLLECTION FOR WATER DEVELOPMENT IN EAST PAKISTAN,
East Pakistan Water and Power Development Authority, Dacca. Water Investigation.
For primary bibliographic entry see Field 07A.
W69-04755

A STUDY OF WATER RESOURCES IN THE CANBERRA AREA AND THE QUEANBEYAN RIVER WATERSHED (GOOGONG DAM CATCHMENT),
Northern Illinois Univ., DeKalb. Dept. of Earth Sciences.
Loren T. Caldwell.
Water Resources Bull, Vol 4, No 4, pp 15-27, Dec 1968. 13 p, 6 fig, 3 tab, 7 ref.

Descriptors: *Water resources, *Groundwater, *Surface waters, *Hydrologic budget, Data collections, Hydrologic data, Streamflow, Water levels, Water level fluctuations, Temperature, Rainfall, Evaporation, Hydrographs.
Identifiers: Australia, Queanbeyan River (Australia).

Data provided by the Australian Commonwealth Bureaus of Meteorology and Mineral Resources are used in a water budget study of the Queanbeyan River watershed. Air and soil temperatures show close correlation from month to month during the five-year period. A close parallel also exists for the air temperature values and the seasonal variations in the Nett-Moisture (rainfall minus evaporation) plots. Groundwater levels appear to be influenced by drought periods and by underground water storage conditions. The groundwater levels were unusually high early in the drought year of 1964-65. The annual rainfall totals for 1962, 1963, and 1966 were all exceeded by the evaporation totals. In 1964 and in 1965 (the drought year) the evaporation total exceeded the rainfall total. The minimum annual water discharge values for the Queanbeyan River ranged from 4.9 in. in 1963 to 1.4 in. in 1965. (Knapp-USGS)
W69-04757

ELECTRONIC DATA PROCESSING SYSTEM FOR STREAMFLOW,
Southern Great Plains Watershed Research Center, Chickasha, Okla.
For primary bibliographic entry see Field 07C.
W69-04759

SURFACE AND SUBTERRANEAN HYDROLOGY IN ITS APPLICATION TO THE STUDY OF THE MODAVE KARSTIC AQUIFER IN BELGIUM (FRENCH),
Bordeaux Univ., (France).
Joseph Agie de Selsaten.
Bull Int Assoc Sci Hydrol, Vol 13, No 1, pp 49-57, Feb 1968. 9 p, 4 fig, 10 ref.

Descriptors: *Mathematical studies, *Mathematical models, *Aquifers, *Karst, Hydrologic properties, Runoff, Discharge (Water), Water sources, Topography, Limestones, Carbonate rocks, Hydrograph analysis, Floods, Hydraulic properties, Climatic data, Dry seasons, Darcys law, Basins, Hydrogeology.
Identifiers: Karstic zone, Modave, Belgium.

Surface and groundwater runoffs of the Modave karstic area were analyzed on the basis of mathematical formula developed by Boussinesq and later modified by Maillet and Schoeller (1962). The study shows that the aquifer of this karstic area consists of marine limestones and some dolomite. The Bonne, Hoyoux, and Ry de Pailhe rivers drain the area. A strong parallelism is shown between the surface and subterranean runoffs. The values of decrease in coefficients computed for various runoffs of the zone can be easily compared with those found in other basins. (Gabriel-USGS)
W69-04762

SURFACE WATER DATA, QUEBEC, WATER YEAR 1964.
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.

Inland Waters Br, Dep Energy, Mines and Resources Data Rep, 1969. 294 p.

Descriptors: *Data collections, *Surface waters, *Streamflow, Discharge (Water), Stream gages, Lakes, Reservoirs, Stage-discharge relations.
Identifiers: Canada, Quebec, Surface water records, Water resources data.

The surface-water records for the 1964 water year for gaging stations, partial-record stations, and miscelleneous sites in Quebec are presented. The data generally comprise a description of the station and a table showing the daily discharge and monthly and yearly discharge of the stream. The description of the station gives the location, drainage area, records available, type and history of gages, average discharge, extremes of discharge, and general remarks. Information on the accuracy of the records and conditions which affect the natural flow is given under 'Remarks.' Daily discharges, average discharge, extremes, yearly totals, and peak discharges are listed. (Knapp-USGS)
W69-04768

FLOOD PLAIN INFORMATION, SANTA FE RIVER, SANTA FE, NEW MEXICO.
Corps of Engineers, Albuquerque, N. Mex.
For primary bibliographic entry see Field 04A.
W69-04783

FLOOD PLAIN INFORMATION, CROW RIVER, ROCKFORD, MINNESOTA.
Corps of Engineers, St. Paul, Minn.
For primary bibliographic entry see Field 04A.
W69-04784

FLOOD PLAIN INFORMATION, LOWER LAS VEGAS WASH, CLARK COUNTY, NEVADA.
Corps of Engineers, Los Angeles, Calif.
For primary bibliographic entry see Field 04A.
W69-04785

FLOOD PLAIN INFORMATION, MISSISSIPPI AND YAZOO RIVERS, VICKSBURG, MISSISSIPPI.
Corps of Engineers, Vicksburg, Miss.
For primary bibliographic entry see Field 04A.
W69-04786

FLOOD PLAIN INFORMATION, SOUTH FORK OF THE CROW RIVER, DELANO, MINNESOTA.
Corps of Engineers, St. Paul, Minn.
For primary bibliographic entry see Field 04A.
W69-04787

WATER RESOURCES APPRAISAL OF THOUSAND SPRINGS VALLEY, ELKO COUNTY, NEVADA,
Geological Survey, Carson City, Nev.
Eugene F. Rush.
Nev Dep Conserv and Nat Resources, Water Resources Reconnaissance Ser Rep 47. June 1968. 61 p, 3 fig, 1 plate, 20 tab, 18 ref.

Descriptors: *Water resources, *Groundwater, *Surface waters, *Nevada, Aquifers, Alluvium, Carbonates, Water yield, Water sources, Irrigation water, Water utilization, Stock water, Domestic water.
Identifiers: Thousand Springs Valley (Nev).

The sparsely populated Thousand Springs Valley is in northeastern Nevada and has an area of about 1,440 sq mi. Carbonate rocks and alluvium, which are abundant throughout the report area may transmit substantial parts of the valley's water resources. Agriculture, other than grazing, is limited to the mile-wide flood plain of Thousand Springs Creek, where hay and pasture land are irrigated. Sampled well and surface waters were generally chemically suitable for irrigation in the 3 western segments, but samples collected in Montello Valley were more highly mineralized. A table summarizes most of the estimated hydrologic quantities for the area. The average annual precipitation is 600,000 acre-ft, runoff 35,000 acre-ft, evapotranspiration 5,700 acre-ft, and water yield, 24,000 acre-ft. The quantity of water in transitional storage is about 2 million acre-ft. (Knapp-USGS)
W69-04791

SURFACE WATER DATA, BRITISH COLUMBIA, WATER YEAR 1966.
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.

Inland Waters Br, Dep Energy, Mines and Resources Data Rep, 1969. 579 p, 2 maps.

Descriptors: *Data collections, *Surface waters, *Streamflow, Discharge (water), Stream gages, Lakes, Reservoirs, Stage-discharge relations.
Identifiers: Canada, British Columbia, Surface water records, Water resources data.

The surface-water records for the 1966 water year for gaging stations, partial record stations, and miscellaneous sites in British Columbia are presented. The data generally comprise a description of the station and a table showing the daily discharge and monthly and yearly discharge of the stream. The description of the station gives the location, drainage area, records available, type and history of gages, average discharge, extremes of discharge, and general remarks. Information on the accuracy of the records and conditions which affect the natural flow is given under 'Remarks.' Daily discharges, average discharge, extremes, yearly totals, and peak discharges are listed. (Knapp-USGS)
W69-04792

FLOOD PLAIN INFORMATION, CHARLOTTE AND NORTH LEE COUNTIES, FLORIDA.
Corps of Engineers, Jacksonville, Fla.
For primary bibliographic entry see Field 04A.
W69-04918

FLOOD PLAIN INFORMATION, CAMPBELL CREEK, ANCHORAGE, ALASKA.
Corps of Engineers, Anchorage, Alaska.
For primary bibliographic entry see Field 04A.
W69-04919

FLOOD PLAIN INFORMATION, PUPUKEA, OAHU, HAWAII.
Corps of Engineers, Honolulu, Hawaii.
For primary bibliographic entry see Field 04A.
W69-04920

FLOOD PLAIN INFORMATION, AGUA FRIA RIVER, MARICOPA COUNTY, ARIZONA.
Corps of Engineers, Los Angeles, Calif.
For primary bibliographic entry see Field 04A.
W69-04921

FLOOD PLAIN INFORMATION, CHESTER CREEK, ANCHORAGE, ALASKA.
Corps of Engineers, Anchorage, Alaska.
For primary bibliographic entry see Field 04A.
W69-04922

FLOOD PLAIN INFORMATION, CHAGRIN RIVER, LAKE AND CUYAHOGA COUNTIES, OHIO.
Corps of Engineers, Buffalo, N. Y.
For primary bibliographic entry see Field 04A.
W69-04923

FLOOD PLAIN INFORMATION OF PURPLE CREEK IN VICINITY OF JACKSON, MISSISSIPPI.
Corps of Engineers, Mobile, Ala.
For primary bibliographic entry see Field 04A.
W69-04924

FLOOD PLAIN INFORMATION, CUYAHOGA RIVER, BIG CREEK AND TINKERS CREEK, CUYAHOGA COUNTY, OHIO.
Corps of Engineers, Buffalo, N. Y.
For primary bibliographic entry see Field 04A.
W69-04925

FLOOD PLAIN INFORMATION, BLACK HAWK CREEK, BLACK HAWK COUNTY, IOWA.
Corps of Engineers, Rock Island, Ill.
For primary bibliographic entry see Field 04A.
W69-04926

ANNUAL PEAK DISCHARGES FROM SMALL DRAINAGE AREAS IN MONTANA THROUGH SEPTEMBER 1968,
Geological Survey, Helena, Mont.
M. V. Johnson, and R. J. Omang.
Geol Surv - Mont State Highway Comm Annu Progr Rep, 1969. 139 p, 1 fig.

Descriptors: *Data collections, *Surface waters, *Streamflow, Floods, Montana, Small watersheds, Water year, Stream gages, Gaging stations, Stage-discharge relations.
Identifiers: Surface water records, Annual peak stage, Water resources data, Crest-gage stations.

Annual peak discharge records through the 1968 water year for gaging stations, and crest-gage stations on small watersheds in Montana are presented. The data generally comprise a description of the station and a table showing the peak stage and discharge of the stream. The description of the station gives the location, drainage area, records available, type and history of gages, annual maximum discharge, extremes of discharge, and general remarks. The type of gage currently in use and the datum of the gage above mean sea level, and a condensed history of the types, locations, and datums of previous gages used during the period of records available are listed. Information on the accuracy of the records and conditions which affect the natural flow is given. Peak discharges are tabulated. (Knapp-USGS)
W69-04927

STREAMFLOW SYNTHESIS FOR UNGAGED RIVERS,
Corps of Engineers, Sacramento, Calif. Hydrologic Engineering Center.
Leo R. Beard.
Int Ass Sci Hydrol Pub No 76, Symp on Hydrol Aspects of Util of Water, Bern, Sept 25-Oct 7, 1967, pp 98-109, 1968. 12 p, 6 tab, 4 ref.

Descriptors: *Streamflow forecasting, *Synthesis, Regression analysis, Statistical methods, Model studies, Correlation analysis, Statistical models, Routing, Flood routing, Stream gages, Stochastic processes.
Identifiers: Monthly streamflow forecasts.

The Hydrologic Engineering Center of the Corps of Engineers developed a mathematical model for simulating monthly streamflow. This model was tested extensively to assure that all characteristics of monthly average streamflow pertinent to water resources development are adequately described in the model. Model coefficients consist of frequency and correlation coefficients for each of the 12 calendar months and number 48 for a single location. These are far more numerous where more than one location must be considered simultaneously. For the purpose of deriving a monthly streamflow model for ungaged locations, these coefficients must be combined into a small number of generalized coefficients, which can feasibly be related to drainage basin characteristics. Generalized coefficients for simulating monthly streamflows have been developed with the requirements that important characteristics of flows generated using the generalized coefficients compare reasonably with those characteristics of recorded data at long-record stations throughout the United States. Means of establishing generalized model coefficients and generating hypothetical streamflows for ungaged locations are described. Such streamflows would form the basis for water resources studies in regions of little or no streamflow data.
W69-04932

DETERMINING STREAMFLOW ABSTRACTIONS FROM ANTECEDENT CONDITIONS,
Agricultural Research Service, Chickasha, Okla. Southern Plains Branch.
Russell R. Schoof, Monroe A. Hartman, and Charles G. Hunt.
Int Ass Sci Hydrol Pub No 76, Symp on Hydrol Aspects of Util of Water, Bern, Sept 25-Oct 7, 1967, pp 89-97, 1968. 9 p, 6 fig, 1 tab, 1 ref.

Descriptors: *Routing, *Floods, Oklahoma, Streamflow forecasting, Evapotranspiration, Floods, Overflow, Infiltration, Storage, Hydrographs, Hydrograph analysis, Stream gages, Runoff.
Identifiers: Streamflow abstractions, Washita River (Okla), Antecedent flow.

The abstractions including evapotranspiration, bank storage, and infiltrated overbank flow from 16 runoff events with peak mean-daily inflows varying from 500 to 10,000 cfs were studied in a 22-mile reach of the Washita River in southwestern Oklahoma. The flow abstractions varied from 5 to 77% of the events' peak mean-daily inflows. Net flow abstractions up to 12% and gains up to 6% were computed for 14-day events. Ten events gained and 6 lost volume in this study. High antecedent flow reduced the abstraction from 3 events. Abstractions from runoff were greater in the summer months when evaporation loss was great and the antecedent flow was low. Conversely, maximum gains were associated with the winter and early spring flows.
W69-04933

A NEW METHOD OF MAPPING THE WATER RESOURCES,
Northern Research Inst. of Hydraulic Engineering and Reclamation, Kazan (USSR). Dept. of Hydrology and Water Resources.
R. S. Petrova, E. M. Zinovyeva, and G. N. Petrov.

Int Ass Sci Hydrol Pub No 76, Symp on Hydrol Aspects of Util of Water, Bern, Sept 25-Oct 7, 1967, pp 60-64, 1968. 5 p.

Descriptors: *Streamflow forecasting, *Routing, *Water utilization, Water resources, Runoff, Flood forecasting, Water quality, Surveys, Geomorphology, Soils, Vegetation, Groundwater basins, Water resources development.
Identifiers: USSR, Water resources mapping, Ice surveys, Geobotanical surveys.

Maps of annual runoff isolines are necessary for perspective mapping and geographical descriptions, but they are not suitable for determining the water resources of certain rivers where local zone peculiarities of runoff distribution exist. A new method permits determination of the water resources of ungaged rivers during the most important periods of agriculture, low water and spring flood. Water resources during low water period are determined and mapped by means of hydrometric surveying which (if possible) should be made together with hydrochemical, thermometric, geobotanic and organoleptic surveys. If groundwater levels do not fluctuate, it is possible to calculate average values of base flow taking into account the types and categories of the underground waters feeding the rivers. For determining and mapping the water resources during spring flood, the observations made in a limited discharge zone should be aided by constructed hypothetical discharge flow nets in typical stretches of the river. Water resources of individual basins are measured by comparing conditions necessary to form the runoff. Three categories of accuracy are (a) determined by direct measurements; (b) determined by analyzing the geographical conditions and confirmed by the data of typical basins; and (c) determined by means of one analysis which must be checked for conditions in spring basins.
W69-04934

SEASONAL DISTRIBUTION AND REGULATION FOR FLOW RIVERS OF MOUNTAIN COUNTRIES,
Moscow State Univ. (USSR). Dept. of Land Hydrology.
V. D. Bykov.
Int Ass Sci Hydrol Pub No 76, Symp on Hydrol Aspects of Util of Water, Bern, Sept 25-Oct 7, 1967, pp 65-69, 1968. 5 p, 3 fig, 3 ref.

Descriptors: *Streamflow forecasting, *Synoptic analysis, Water resources, Runoff, Flood forecasting, Water resources development, Hydrograph analysis, Flow characteristics.
Identifiers: USSR.

The seasonal variation of flow of rivers originating in the mountainous areas of the USSR was studied. Runoff regimes were correlated with climatic conditions, altitude of river basins, surface geological structures, topography, and river length. Regions of similar runoff conditions were mapped. The general principles of streamflow regulation are briefly discussed in relation to problems in the USSR. (Knapp-USGS)
W69-04935

A METHOD OF DETERMINING THE AVAILABLE SURFACE WATER RESOURCES,
Institut fuer Wasserwirtschaft, Berlin (East Germany).
J. Hubner.
Int Ass Sci Hydrol Pub No 76, Symp on Hydrol Aspects of Util of Water, Bern, Sept 25-Oct 7, 1967, pp 70-76, 1968. 7 p, 2 fig, 1 ref.

Descriptors: *Water resources development, *Surface waters, *Streamflow forecasting, Surveys, Water resources, Hydrograph analysis, Probability, Statistical methods, Water balance.
Identifiers: Minimum monthly discharges.

Approximate water management balances have to show whether the probability of the available discharges corresponds to the probability required by water usage. The probabilities which must be calculated refer to all discharges, whereas random samples composed of the minimum monthly mean discharges of each year of the observation period - as they generally applied to characterize surface water resources - only relate to the frequency of years with discharges lower than the considered discharges without taking into account the duration of these discharges within the year. An approximative method of separating this part of the duration curve, which may be considered representative of all discharges, is obtained by transforming the frequency distributions of the minimum mean discharges of one, two or more consecutive months of each year. The application of this method also permits the selection of discharges apt to characterize the available surface water resources. (Knapp-USGS)
W69-04950

PLANNED UTILIZATION OF WATER RESOURCES,
TRW Systems, Redondo Beach, Calif.
M. L. Frankel.
Int Ass Sci Hydrol Pub No 76, Symp on Hydrol Aspects of Util of Water, Bern, Sept 25-Oct 7, 1967, pp 77-85, 1968. 9 p, 3 fig, 6 ref.

Descriptors: *Water resources development, *Planning, *California, *Inter-basin transfers, Hydrogeology, Computer programs, Digital computers, Groundwater basins, Water quality, Water demand, Water utilization, Economics, Irrigation.
Identifiers: San Bernardino Valley, California Water Project.

California's semiarid San Bernardino Valley, which relies heavily on groundwater, is experiencing a rapid grwoth in the face of diminishing water resources. To avert critical water shortages in the future, the State of California is engaged in a massive effort, the California Water Project, which includes the redistribution of the state's water resources. However, mass redistribution of Northern California water to Southern California does not solve the problems. The recipent of the water--in this case the San Bernardino Valley--must somehow manage its existing resources and imported water in an economic framework that promotes regional growth. Planned utilization of the Valley's water resources is a comprehensive project involving studies of the region's hydrology, geology, demography, and economy. The entire project is outlined, emphasizing the study of groundwater. The success of the project is keyed to a thorough understanding of available groundwater resources and their economic mix with imported water. A digital computer program was designed to simulate the region's groundwater supply and its interaction with imported water. A detailed description of the computer program and its relation to the overall project is included. (Knapp-USGS)
W69-04952

THE DISCHARGE RECESSION AS CRITERION ON THE RETENTION CAPACITY OF BASINS,
Institut fuer Wasserwirtschaft, Berlin (East Germany).
S. Narbe.
Int Ass Sci Hydrol Pub No 76, Symp on Hydrol Aspects of Util of Water, Bern, Sept 25-Oct 7, 1967, pp 162-167, 1968. 6 p, 4 fig.

Descriptors: *Recession curves, *Hydrograph analysis, River forecasting, Hydrographs, Retention, Storage, Routing, Streamflow forecasting.
Identifiers: Drainage basin retention.

The retention capacity of drainage basins is studied by analysis of the recession behavior of river discharges during dry periods. The retention capacity of the study areas is represented by exponential recession curves, or straight lines on semi-log paper with linear time scale. Geologically similar basins show similar shapes of discharge recession curves. Different areas have curves with different exponents. The base-flow portion of the recession curve used alone is less suited to characterize retention capacity than is the entire recession curve. (Knapp-USGS)
W69-04953

ESTIMATION OF MAXIMUM DISCHARGES AND HYDROGRAPHS OF FLOOD,
Gidrometeorologicheskii Institut, Leningrad (USSR).

L. Sokolovsky, and I. A. Skiklomanov.
t Ass Sci Hydrol Pub No 76, Symp on Hydrol spects of Util of Water, Bern, Sept 25-Oct 7, 967, pp 343-347, 1968. 5 p.

escriptors: *Streamflow forecasting, *Flood recasting, *Computer models, Hydrograph anal-is, Routing, Stage-discharge relations, Unit ydrographs, Rainfall intensity, Rainfall disposi-on.
entifiers: USSR, Travel time.

ome methods of estimation of the maximum scharges and flood hydrographs by use of elec-nic modeling equipment are described. The eory of 'time of travel' is established to account r the transformation of the runoff hydrograph in cordance with the Duhamel integral which is ed in the unitgraph theory. The principal flood rameter is considered to be the value of time lag tween maximum rainfall and runoff, as well as e coefficient of the flood shape defined as the lation between the time of fall and the time of rise the hydrograph. In the estimation process, the ne of travel may be considered either constant ring flood (linear scheme) or changing, depend-g on the discharge variation (nonlinear scheme). the water yield hydrograph, taking into account e runoff coefficient, the maximum discharges of infloods may be defined for gaged and ungaged reams. The flood parameters are defined in ac-ordance with the area, slope and shape of this sin, the extent of the wooded land, and other ysiographic and morphometric characteristics of catchment area. The methods have been tested n many streams under different conditions and oved very economical in time and accuracy of sults, especially in comparison with other ethods. (Knapp-USGS)
/69-04955

ONTRIBUTION CONCERNING THE FLOW ATES OF RIVERS TRANSPORTING DRAIN /ATERS OF OPEN-CAST MINES,
/asserwirtschaftsdirektion, Cottbus (East Ger-any).
or primary bibliographic entry see Field 04C.
/69-04956

NLET HYDROGRAPH ESTIMATION FOR INEAR FLOW MODELS ACCORDING TO UTLET HYDROGRAPH,
ydrometeorological Centre (USSR).
or primary bibliographic entry see Field 02A.
/69-04961

NALYTICAL APPROACHES TO COMPUTA-ION OF DISCHARGE OF AN ICE-COVERED TREAM,
eological Survey, Madison, Wis.
evin L. Carey.
eol Surv Res 1967, Prof Pap 575-C, pp C200-207, 1967. 8 p, 7 fig, 2 tab, 3 ref.

escriptors: *Discharge measurement, *Streams, Ice, Closed conduit flow, Open channel flow, ackwater, Stage-discharge relations, Current me-ers, Stream gages, Mannings equation, Darcy-Veisbach equation.
dentifiers: Pipe-flow equations, Velocity-discharge elations.

wo analytical methods for computing winter ischarge of an ice-covered stream have recently een developed from observations on the St. Croix iver, Wis. One method is based on pipe-flow quations, and the other method on an analogy ith methods used to compute open-water for treams affected by backwater. Accuracy of com-uted discharge in the first method is within 19% of neasured discharge, whereas the second method ives results within 9%. Relationships in both nethods are developed with data either recorded r measured in the field. After the relationships ave been developed for a particular stream-gaging tation, only recorded data (water-surface stage at oth ends of a reach) are needed to compute ischarge. (USGS)

W69-04975

TWO METHODS OF ESTIMATING BASE FLOW AT UNGAGED STREAM SITES IN KANSAS AND ADJACENT STATES,
Geological Survey, Lawrence, Kan.; Geological Survey, Albany, N. Y.
L. W. Furness, and M. W. Busby.
Geol Surv Res 1967, Prof Pap 575-C, pp 208-211, 1967. 3 fig, 4 ref.

Descriptors: *Base flow, *Estimating, Estimating equations, Regression analysis, Current meters, Runoff, Kansas.
Identifiers: Ungaged streams, Base flow estimation.

In investigating a satisfactory technique for estimating base flow (a component of total stream flow) at ungaged stream sites, 2 different methods were studied and the results were compared. By the first method, base flow was estimated from 6 physical and hydrologic basin characteristics. These 6 characteristics were resolved from regression analyses of about 1,000 combinations of 27 basin characteristics in relation with the base-flow data of 84 long-term streamflow stations in Kansas and adjacent States. The second, and more reliable, method was developed by correlating base-flow current-meter measurements made at the ungaged stream site with data from the records of an established gaging station. Base-flow values estimated by the second method had a smaller standard error than values estimated by the first method in 62% of the comparisons made of the results. (USGS)
W69-04978

THE CONSTRUCTION AND USE OF FLOW-VOLUME CURVES,
Geological Survey, Trenton, N.J.
E. G. Miller.
Geol Surv Res 1967, Prof Pap 575-C, pp C216-C218, 1967. 3 p, 1 fig, 2 ref.

Descriptors: *Streamflow, *Hydrographs, Duration curves, Discharge measurement, Hydrograph analysis.
Identifiers: Flow-volume curves.

Flow-volume curves, dealing with the volume of water flowing in a stream, are similar in form to flow-duration curves and are computed from the same arrays of streamflow discharge records used in computing flow-duration curves. They provide an additional tool for preliminary and general studies of the feasibility of using or storing water for various purposes. (USGS)
W69-04979

CHARACTERISTICS OF SUMMER BASE FLOW OF THE POTOMAC RIVER,
Geological Survey, Washington, D. C.
Ronald L. Hanson.
Geol Surv Res 1967, Prof Pap 575-C, pp C212-C215, 1967. 4 p, 5 fig, 1 ref.

Descriptors: *Base flow, Recession curves, Runoff, Storage, Hydrographs, Regression analysis, Precipitation (Atmospheric).
Identifiers: Potomac River.

A relation defining the rate of depletion of summer base flow during periods of negligible precipitation, and a relation expressing the monthly increase in summer base flow due to precipitation have been defined for a virtually unregulated stream. Testing these relations in a combined form using known values of monthly precipitation gives reasonable estimates of summer base flow for subsequent 1-to 4-month periods. A poor correlation was found to exist between monthly precipitation and corresponding increase in base flow. Consideration of variations in monthly evapotranspiration rates and antecedent ground-water conditions should help to explain much of the scatter in this relation; however, additional ground-water data are needed in the basin before a significant improvement in this relation can be expected. (USGS)

W69-04981

MICROSCOPIC DETERMINATION OF BOUNDARY SHEAR AND SUBLAYER TURBULENCE CHARACTERISTICS IN AN OPEN CHANNEL,
Illinois Univ., Urbana.
For primary bibliographic entry see Field 08B.
W69-05150

HYDRAULIC GEOMETRY OF ILLINOIS STREAMS,
Illinois State Water Survey, Urbana; Illinois Univ., Urbana.
For primary bibliographic entry see Field 08B.
W69-05153

FONTENOT V SMITH (CONTRACT AGREEMENTS AND RIGHTS TO NATURAL FLOW).
For primary bibliographic entry see Field 06E.
W69-05170

CONDIFF V KOPSEIKER (EASEMENT - SURFACE DRAINAGE).
For primary bibliographic entry see Field 06E.
W69-05175

2F. Groundwater

DEVELOPING AN IRRIGATION WATER SUPPLY IN THE COASTAL PLAIN,
Auburn Univ, Ala. Dept. of Agricultural Engineering.
James G. Hendrick, and V. Douglas Browning.
J Soil and Water Conserv, Vol 24, No 1, pp 23-24, Jan-Feb 1969. 2 p.

Descriptors: *Observation wells, *Subsurface investigations, Drilling, Shallow wells, Wellpoints, Alluvium, Aquifers, Pipes, Pumping, Water yield, Specific capacity, Transmissivity.
Identifiers: Pumping tests, Aquifer tests, Test wells, Driven wells.

A simple method is given for exploring and determining the potential yield of shallow alluvial aquifers using driven observation and exploration wells. Sections of 2-in pipe, open at the bottom, are driven into the ground and jetted clean with a portable pump. Wells to be used in pumping tests are developed by placing a smaller diameter screen and casing inside the 2-in. pipe, removing the larger pipe, and surging. Pumping tests are run and analyzed by standard methods. (Knapp-USGS)
W69-04749

BASIC DATA COLLECTION FOR WATER DEVELOPMENT IN EAST PAKISTAN,
East Pakistan Water and Power Development Authority, Dacca. Water Investigation.
For primary bibliographic entry see Field 07A.
W69-04755

A STUDY OF WATER RESOURCES IN THE CANBERRA AREA AND THE QUEANBEYAN RIVER WATERSHED (GOOGONG DAM CATCHMENT),
Northern Illinois Univ., DeKalb. Dept. of Earth Sciences.
For primary bibliographic entry see Field 02E.
W69-04757

SURFACE AND SUBTERRANEAN HYDROLOGY IN ITS APPLICATION TO THE STUDY OF THE MODAVE KARSTIC AQUIFER IN BELGIUM (FRENCH),
Bordeaux Univ., (France).
For primary bibliographic entry see Field 02E.
W69-04762

RATIO METHOD FOR DETERMINING CHARACTERISTICS OF IDEAL, LEAKY, AND BOUNDED AQUIFERS,
Hyderguda, Hyderabad (India).
T. N. Narasimhan.
Bull Int Assoc Sci Hydrol, Vol 13, No 1, pp 70-83, Feb 1968. 14 p, 7 fig, 12 tab, 7 ref.

Descriptors: *Aquifers, *Groundwater, *Leakage, *Bound water, *Mathematical models, Mathematical studies, Aquifer characteristics, Depression, Wells, Discharge, Pumping, Thermal conductivity, Water storage, Storage coefficient, Groundwater movement, Transmissivity.
Identifiers: *Ideal aquifer, Bounded aquifer, Ratio method.

A ratio method is presented which eliminates the use of classical curve-matching techniques for computing the characteristics of ideal, leaky and bounded aquifers. The method is based on application of the Theis non-equilibrium equation and several modifications suggested by Jaeger (1959) Bendochea (1963), and Narasimhan (1966). The method consists of selecting any three values of observed drawdown, (t sub 0, s sub 0), (t sub 1, s sub 1) and (t sub 2, s sub 2), such that t sub 1 = 2 t sub 0 and t sub 2 = 100 t sub 0, where t sub 0, t sub 1, t sub 2, are the pumping times and s sub 0, s sub 1, and s sub 2 are the drawdown of groundwater surfaces. By using the s sub 0/s sub 1 and s sub 0/s sub 2 ratios and extrapolating curves, the aquifer characteristics can be evaluated. Some assumed examples for the demonstration of the use of this ratio method are given. (Gabriel-USGS)
W69-04763

THEORETICAL FRAMEWORK FOR ASCERTAINING PORE WATER PRESSURE IN CONFINING LAYERS IN THE VICINITY OF A PUMPING WELL,
Nevada Univ., Reno. Desert Research Inst.
David V. Anderson.
Water Resources Res Center Proj Rep No 9, July 1968. 8 p, 1 fig, 1 ref. OWRR Project A-016-NEV (1).

Descriptors: *Pore pressure, *Aquicludes, *Drawdown, *Mathematical models, Numerical analysis, Computers, Pumping, Aquifers, Boundaries (Surfaces), Hydraulics, Hydrogeology, Water storage.
Identifiers: Confining bed drawdown, Pore pressure changes.

A mathematical method is described for determining pore water pressure changes in a confining layer overlying an aquifer near a pumping well. A numerical analysis method for solution of the equations is discussed. Much of the analysis was developed by Hantush in his work on the theory of leaky aquifers. The model assumes cylindrical symmetry with a well completely penetrating an aquifer and an overlying semipervious or impervious layer, but not penetrating an underlying impermeable layer. (Knapp-USGS)
W69-04767

INFLUENCE OF THE SOUTH SASKATCHEWAN RESERVOIR (CANADA) ON PIEZOMETRIC LEVELS IN UNDERLYING BEDROCK AQUIFERS,
Department of Energy, Mines and Resources, Calgary (Alberta). Inland Waters Branch.
R. O. Van Everdingen.
J Hydrol, Vol 5, No 4, pp 351-359, Oct 1967. 9 p, 3 fig, 3 tab, 2 ref.

Descriptors: *Reservoirs, *Water level fluctuations, *Aquifers, *Surface-groundwater relationships, Water table, Discharge (Water), Reservoir leakage, Water loss, Seepage.
Identifiers: Saskatchewan, Saskatoon, Saskatchewan River.

Effects of filling of the South Saskatchewan Reservoir on piezometric levels in the three upper bedrock aquifers in the surrounding area are a function of hydraulic connection between the reservoir and the aquifers, and of back-up of potential discharge from still deeper aquifers. Some water is probably being lost from the reservoir into the uppermost bedrock aquifer on the west side of the reservoir. No evidence was found for a loading effect, which would have been indicated by subsequent lowering of piezometric levels due to dissipation of the initial effect. (Knapp-USGS)
W69-04774

GEOLOGY OF THE REGOLITH AQUIFERS OF THE NISHNABOTNA BASIN,
Iowa State Univ., Ames.
Lyle V. A. Sendlein, Donald E. Henkel, and Keith M. Hussey.
OWRR Project A-012-IA. Iowa State Water Resources Res Inst Completion Rep, June 30, 1968. 29 p, 6 fig, 42 ref.

Descriptors: *Hydrologic budget, *River basins, Seismic studies, Electrical studies, Resistivity, Groundwater movement, Geophysics, Alluvium, Glacial drift, Aquifers, Sands, Gravels, Iowa.
Identifiers: Buried glacial valleys, Outwash, Drainage basin analysis.

In the analysis of the water budget of basins, the one variable generally assumed to be constant is groundwater inflow and outflow. This study is the first phase of an investigation designed to evaluate the validity of this assumption in a glacial terrain underlain by a bedrock valley system. With the integrated use of geologic and geophysical data a major bedrock valley was mapped. The valley mapped represents the northern extension of a major buried valley system of Missouri. Sand and gravel deposits were not only found in segments of the buried valley but also as a basal drift unit on the bedrock upland surface. The modern West Nishnabotna roughly overlies the major buried valley whereas the East Nishnabotna River only overlies segments of tributaries of the major valley. Bedrock which subcrops in the basin is Pennsylvanian in the southern half both on the upland and in the buried valley. In the northern portion it is Cretaceous on the uplands and Pennsylvanian in the valleys. The application of the seismic refraction electrical resistivity methods proved valuable and economical. (Knapp-USGS)
W69-04781

WATER RESOURCES APPRAISAL OF THOUSAND SPRINGS VALLEY, ELKO COUNTY, NEVADA,
Geological Survey, Carson City, Nev.
For primary bibliographic entry see Field 02E.
W69-04791

NEW THRUSTS IN GROUND WATER,
Geological Survey, Washington, D. C.
C. L. McGuinness.
Water Well J, Vol 23, No 2, pp 22-24, Feb 1969. 3 p.

Descriptors: *Water resources development, *Groundwater, *Planning, Water utilization, Water supply, Water yield, Water storage, Surface waters, Water wells, Water treatment, Desalination, Recharge, Aquifers, Reservoirs, Injection wells, Waste disposal.

The use of groundwater is increasing in the U.S., and it is expected to continue to increase in the future. From 1950 to 1965, groundwater withdrawals doubled from about 30 to about 60 bgd, while surface water use rose from about 150 to about 250 bgd. The use of aquifers should continue to increase as surface water costs, driven upward by increasing reservoir site and treatment costs, become prohibitive. Aquifers are good storage media in place of dams and reservoirs. Saline aquifers will be considered part of the water resource, while very saline aquifers will be used as storage media for industrial and domestic wastes. Both the techniques and economics of groundwater development must be studied on a much larger scale than is being done now. (Knapp-USGS)
W69-04793

GROUND WATER: PERSPECTIVES AND PROSPECTS,
Geological Survey, Washington, DC.
Raymond L. Nace.
Water Well J, Vol 23, No 2, pp 28-29, Feb 1969. 2 p, 1 fig, 1 tab.

Descriptors: *Water resources development, *Groundwater, Planning, Water management (applied), Water utilization, Water supply, Water yield, Water storage, Water wells, Recharge, Injection wells, Reservoirs, Waste disposal, Vadose water, Runoff, Water control.
Identifiers: Isochronous water volume.

Trends in groundwater and aquifer use are reviewed. About 96% of all continental fresh water is in aquifers. Planning for efficient water use must include underground water storage because the construction and maintenance costs of recharge projects are low, there is no reservoir silting, valuable land surface is not used, no surface flooding of any great extent is used, and evaporation loss is small. Some disadvantages are slow response time, need for pumping, invisibility to planners and the public, lack of recreational or esthetic values, and lack of monumental quality for engineers, planners, and politicians. Planning of groundwater development is necessary to prevent reckless depletion and waste disposal practices. Underground disposal of wastes is not well regulated now but it is increasing rapidly. No organized specifications or criteria exist for evaluating or regulating its impact on water supplies. (Knapp-USGS)
W69-04794

FLUID MECHANICS OF DEEP-WELL DISPOSALS,
DeGolyer and MacNaughton, Dallas, Tex.
For primary bibliographic entry see Field 05E.
W69-04928

SUBSURFACE DISPOSAL OF LIQUID INDUSTRIAL WASTES BY DEEP-WELL INJECTION,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio. Cincinnati Water Research Lab.
For primary bibliographic entry see Field 05E.
W69-04941

IMPORTANCE OF DEEP PERMEABLE DISPOSAL FORMATIONS IN LOCATION OF A LARGE NUCLEAR-FUEL REPROCESSING PLANT,
Oak Ridge National Lab., Oak Ridge, Tenn. Health Physics Div.
For primary bibliographic entry see Field 05E.
W69-04942

POSSIBILITIES FOR DISPOSAL OF INDUSTRIAL WASTES IN SUBSURFACE ROCKS OF NORTH FLANK OF APPALACHIAN BASIN IN NEW YORK,
Shell Canadian Exploration Co., Houston, Tex.; Tidewater Oil Co., Pittsburgh, Pa.; Consolidated Gas Supply Corp., Clarksburg, W. Va.
For primary bibliographic entry see Field 05E.
W69-04943

POSSIBILITIES FOR SUBSURFACE WASTE DISPOSAL IN A STRUCTURAL SYNCLINE IN PENNSYLVANIA,
Princeton Univ., N. J. Dept. of Geological Engineering; Atomic Energy Commission, Washington, D. C.
For primary bibliographic entry see Field 05E.
W69-04944

EOLOGY OF SUBSURFACE WASTE SPOSAL IN MICHIGAN BASIN,
ichigan Univ, Ann Arbor.
r primary bibliographic entry see Field 05E.
69-04945

BSURFACE WASTE-DISPOSAL POTENTIAL SALINA BASIN OF KANSAS,
ugustana Coll., Rock Island, Ill.; Kansas State eological Survey, Lawrence.
r primary bibliographic entry see Field 05E.
69-04946

OTENTIAL OF DENVER BASIN FOR SPOSAL OF LIQUID WASTES,
n Oil Co., Denver, Colo.; Wolf Exploration Co., llas, Tex.
r primary bibliographic entry see Field 05E.
69-04947

EDIMENTARY HISTORY AND ECONOMIC EOLOGY OF SAN JUAN BASIN, NEW MEX-O AND COLORADO,
ontana State Univ., Missoula; El Paso Natural as Co., Tex.; Texaco, Inc., Farmington, N. Mex.
r primary bibliographic entry see Field 05E.
69-04948

N INVESTIGATIONS CONCERNING THE IN-LUENCE OF AGRICULTURAL UTILIZATION N THE RUNOFF FORMATION BY MEANS OF ROUNDWATER-LYSIMETERS,
stitut fuer Wasserwirtschaft, Berlin (East Ger-any).
r primary bibliographic entry see Field 02G.
69-04951

ONTRIBUTION CONCERNING THE FLOW ATES OF RIVERS TRANSPORTING DRAIN ATERS OF OPEN-CAST MINES,
asserwirtschaftsdirektion, Cottbus (East Ger-any).
r primary bibliographic entry see Field 04C.
69-04956

MMOBILITY OF CONNATE WATER IN ERMEABLE SANDSTONE,
eological Survey, Washington, D. C.; Bureau of lines, Morgantown, W. VA., Petroleum Research ab.
. Edward Manger, and W. T. Wertman.
eol Surv Res 1967, Prof Pap 575-C, pp C192-194, 1967. 3 p, 1 tab, 3 ref.

escriptors: *Connate water, *Sandstones, Permeability, Texas, Unsaturated flow, Diffusion, aturated flow, Porous media.
lentifiers: Immobile connate water.

ome natural-state cores of moderately permeable ocene sandstone, obtained by drilling with oil-ase mud in Karnes County, Tex., appear to be aturated and other cores appear to be partially un-aturated. The variation of interstitial water hlorinity is related to the depositional environ-ent of the different sandstone strata. These esults suggest that a small fraction of connate ater has remained immobile in the sandstone nce the Eocene. Such immobility agrees with that ound experimentally by Wyckoff and Botset and iscussed theoretically by Irmay for a small fraction f fluid in a saturated permeable porous medium. bsence of significant diffusion over geologic ages eems to be necessary to explain the present esults; reasons for this are not yet evident. (USGS) V69-04977

YDROGEOLOGIC SIGNIFICANCE OF CAL-CIUM-MAGNESIUM RATIOS IN GROUND VATER FROM CARBONATE ROCKS IN THE LANCASTER QUADRANGLE, SOUTHEAST-ERN PENNSYLVANIA,
Geological Survey, Harrisburg, Pa.
Harold Meisler, and Albert E. Becher.
Geol Surv Res 1967, Prof Pap 575-C, pp C232-C235, 1967. 4 p, 3 fig, 1 tab, 3 ref.

Descriptors: *Water chemistry, *Limestones, *Dolomite, *Carbonate rocks, Geologic mapping, Calcium, Magnesium, Hydrogeology.
Identifiers: Calcium-magnesium ratios, Carbonate rock mapping.

The ratios in equivalents of calcium to magnesium in groundwater from the limestones and dolomites of the Lancaster quadrangle in southeastern Pennsylvania correlate well with the composition of the carbonate source rocks. The lowest calcium-magnesium ratios occur in water from dolomite; the ratios are very close to the stoichiometric proportion of calcium to magnesium in the mineral dolomite. The highest calcium-magnesium ratios are in water from limestone. In groundwater from interbedded limestone and dolomite, the calcium-magnesium ratios are between those in water from dolomite. When applied with caution, calcium-magnesium ratios in groundwater can be an aid to geologic mapping of a limestone and dolomite terrane. (USGS)
W69-04985

MEASUREMENT OF THE ABUNDANCE OF FRACTURE TRACES ON AERIAL PHOTOGRAPHS,
Geological Survey, Washington, D. C.
F. W. Trainer.
Geol Surv Res 1967, Prof Pap 575-C, pp C184-C188, 1967. 5 p, 3 fig, 14 ref.

Descriptors: *Fractures (Geology), *Aerial photographs, Remote sensing, Methodology, Carbonate rocks, Porosity, Mapping, Water wells.
Identifiers: *Fracture traces, Discovery-time curve.

An objective method is illustrated of investigating the areal abundance of fracture traces seen on aerial photographs. The report discusses several factors to be considered in a standardized technique based on a study in a 10 sq mi area near Front Royal, Va. A uniform duration of search, in time per unit area, assures consistent results; and rate of discovery of fracture traces decreases logarithmically with time. The probably total number of traces per unit can be estimated from the straightest part of the discovery-time curve. Contour maps based on such index numbers show areal distribution of abundance. Fracture traces can be mapped as indices of fracture porosity. The abundance of traces may be proportional to the total number of open fractures. Extensive surface weathering accompanied by subsurface weathering and fracture-trace intersections may indicate areas of higher specific capacity in water wells on or near the traces. (Lang-USGS)
W69-04987

FACTORS AFFECTING BIOLOGICAL CLOGGING OF SAND ASSOCIATED WITH GROUND WATER RECHARGE,
Weizmann Inst. of Science, Rehovoth (Israel).
For primary bibliographic entry see Field 03C.
W69-05075

FURTHER STUDY OF AQUIFER PERFORMANCE,
Illinois Univ., Urbana.
For primary bibliographic entry see Field 02A.
W69-05149

2G. Water in Soils

A CLIMATOLOGICAL-TECHNOLOGICAL METHOD FOR ESTIMATING IRRIGATION WATER REQUIREMENTS FOR MAXIMUM CROP YIELDS,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 03F.
W69-04750

WATER HOLDING CAPACITY OF PONDEROSA PINE FOREST FLOOR LAYERS,
Forest Service (USDA), Flagstaff, Ariz. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 03B.
W69-04751

THERMAL CONDUCTIVITY OF TWO-PHASE POROUS MATERIALS: DRY SOILS,
Rajasthan Univ., Jaipur (India). Dept. of Physics.
For primary bibliographic entry see Field 07B.
W69-04949

ON INVESTIGATIONS CONCERNING THE INFLUENCE OF AGRICULTURAL UTILIZATION ON THE RUNOFF FORMATION BY MEANS OF GROUNDWATER-LYSIMETERS,
Institut fuer Wasserwirtschaft, Berlin (East Germany).
Dietrich Kramer, and Hermann Taeger.
Int Ass Sci Hydrol Pub No 76, Symp on Hydrol Aspects of Util of Water, Bern, Sept 25-Oct 7, 1967, pp 123-133, 1968. 11 p, 2 fig, 6 tab, 19 ref.

Descriptors: *Lysimeters, *Evaportanspiration, *Rainfall-runoff relationships, Farm management, Catch crops, Crop response, Cultivation, Demonstration farms, Demonstration watersheds, Fallowing.
Identifiers: Germany, Groundwater lysimeters, Crop rotation.

Lysimeter studies of the effect of agricultural practices on the rainfall-runoff relationships were made in Germany. A system of 28 groundwater lysimeters was set up as 14 pairs in fallow, rotation-crop, and pasture lands. The water table fluctuates seasonally between 20 and 150 cm below the land surface. Soil and climatic data are tabulated. Cultivation was found to diminish runoff compared to fallow, with the larger differences in the growth periods of plants. Runoff is increased by intensification of pasture-land fertilization and mowing. Catch crop cultivation caused a diminished runoff of 49 mm for the year 1966. (Knapp-USGS)
W69-04951

PROPERTIES OF SALINE RANGE SOILS OF THE RIO GRANDE PLAIN,
Agricultural Research Service, Weslaco, Tex. Soil and Water Conservation Research Div.; Soil Conservation Service, Harlingen, Tex.; Soil Conservation Service, Alice, Tex.
C. D. Fanning, C. M. Thompson, and Dean Issacs.

J. Range Management, Vol 18, No 4, pp 190-193, July 1965. 3 fig, 2 tab.

Descriptors: *Soil properties, *Ranges, *Saline soils, *Revegetation, *Vegetation regrowth, Texas, Range management, Desert plants, Grazing, Range grasses, Ecology, Rainfall, Soil chemical properties, Soil physical properties, Salts, Soil-water-plant relationships.
Identifiers: Reseeding, Rio Grande Plain, Texas.

This study was an evaluation of properties common to three saline soils in the Rio Grande Plain and provided basic chemical and physical data for consideration in obtaining solutions to problems related to their ecology and management. Range conditions on the saline soils were poor as a result of overgrazing. On saline soils reseeding attempts were discouraging. The successful establishment of grass was primarily dependent on timely rainfall. Soil properties suggested that proper vegetative cover would enhance salt removal. Reseeding efforts would need to take into consideration proper species selections and drought-inducing effects of the excess salts that occur in an arid area of Texas. (Blecker-Arizona)
W69-05084

TILLAGE INFLUENCES WATER INTAKE,
Agricultural Research Service, Morris, Minn. North Central Soil Conservation Research Center;

Southwest Minnesota Agricultural Experiment Station, Lamberton.
R. E. Burwell, L. L. Sloneker and W. W. Nelson.
J. of Soil and Water Conservation, Vol 23, No 5, pp 185-187, September-October 1968. 3 tab, 9 ref.

Descriptors: *Cultivation, *Soil surfaces, *Infiltration, *Runoff, *Weathering, Soil treatment, Loam, Clay loam, Soil texture, Soil erosion, Soil moisture, Mulching, Water storage, Artificial precipitation.
Identifiers: *Roughness (Soil), Sealing.

The studies were conducted to determine the influence of different tillage methods on soil surface condition and subsequent infiltration. Artificial rainfall was applied at the rate of 5 inches per hour to various surface conditions on loam, clay loam and sandy clay loam. Surface conditions were created by moldboard plowing, moldboard plowing-disking-harrowing, rotary tillage and mulch tillage. Infiltration before runoff started on freshly-tilled bare surfaces increased as tillage-induced random roughness increased. Infiltration was not closely related to this roughness after rainfall or fall-to-spring weathering caused surface seal development. Infiltration before runoff began was twice as high on freshly plowed surfaces as on freshly plowed-disked-harrowed surfaces. Fall mulch-tilled surfaces provided eight times greater infiltration capacity before runoff started and four times greater infiltration during runoff the following spring than did fall plowed surfaces which were disked and harrowed in the spring. The tillage-infiltration relationships that were studied could possibly be used to increase infiltration and reduce the runoff from arid soils. (Blecker-Arizona)
W69-05089

CAPILLARY CONDUCTIVITY AND SOIL WATER DIFFUSIVITY VALUES FROM VERTICAL COLUMNS,
California Univ., Davis.
W. J. Flocker, M. Yamaguchi, and D. R. Nielsen.
Agronomy J, Vol 60, No 6, pp 605-10, Nov-Dec 1968. 5 fig, 21 ref, append.

Descriptors: *Evaporation, *Darcys law, *Soil water movement, *Capillary conductivity, *Diffusivity, Air temperature, Loam, Gamma rays, Soil water, Density, Moisture content, Electrical conductance, Saline soils, Depth, Equations, Moisture tension, Water loss, Soil physics.
Identifiers: *Soil columns.

Water evaporated from vertical columns of Yolo loam, 100 cm long, for 200 days at ambient temperatures of 10, 20, and 30 degrees C. plus or minus 1 degree C. Changes in soil water were monitored at 5 cm. depth intervals by gamma-ray attenuation. Water movement within the soil columns was analyzed using Darcy's law. Water contents decreased monotonically at each soil depth. For the three ambient temperatures, soil water characteristics curves were similar except at soil water tensions less than 75 cm where colder samples retained more water. For any measured water content, values of capillary conductivity increased with ambient temperature. Electrical conductivity measurements made on soil extracts taken at the conclusion of the experiment indicated a slight but significant salinity gradient over soil depths for which calculations of capillary conductivity were made. Capillary conductivity and soil water diffusivity values for arid soils could be determined using procedures and methods discussed in the paper. (Blecker-Ariz)
W69-05093

PROPERTIES OF SOIL UNDER ASPEN AND HERB-SHRUB COVER,
Forest Service (USDA), Logan Utah. Intermountain Forest and Range Experiment Station.
Ronald K. Tew
U.S.D.A. Forest Serv. Res. Note INT-78, 1968, 4 pp

Descriptors: *Soil chemical properties, *Soil physical properties, *Soil-water-plant relationship, *Sagebrush, Rabbit-brush, Soil environment, Soil analysis, Correlation analysis, Soil types, Nitrates, Phosphorus, Fertility, Sites.
Identifiers: *Herb-shrub cover, Vegetative density.

Several physical and chemical soil properties were measured and related to site aspect and vegetation type. Soil texture, aggregation, organic matter content, nitrate production, and moisture-holding characteristics varied between aspects. Soils under aspen stands have higher organic matter content, with accompanying higher moisture-holding capacity, than do soils on adjacent herb-shrub sites.
W69-05097

FIELD CORRELATION OF TWO NEUTRON-SCATTERING SOIL MOISTURE METERS,
Forest Service (USDA), Logan, Utah. Intermountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 07B.
W69-05100

THE INFLUENCE OF GROWTH MEDIA, TEMPERATURES, AND LIGHT INTENSITIES ON ASPEN ROOT AND TOP GROWTH,
Forest Service, (USDA), Logan, Utah. Intermountain Forest and Range Experiment Station.
Gerald F. Gifford.
U.S.D.A. Forest Serv. Res. Note INT-67, 1967, 4 pp.

Descriptors: *Root development, *Root systems, *Soil properties, *Soil types, Light intensity, Air temperature, Vegetation regrowth, Environmental effects, Nutrient requirements, Moisture availability, Growth chamber, Potassium, Nitrogen, Phosphorus, Ecological distribution, Clay loam, Elevation, Plant growth regulators, Photosynthesis.
Identifiers: *Growth media, Root inhibition, *Populus species.

Root and top growth of aspen cuttings in three soils (sand, loam, and clay) were studied in a controlled environmental chamber. The cuttings were exposed to two light intensities (2,000 ft.-c. and 600 ft.-c.) for 50 days at each of three temperatures (10 deg., 18 deg., and 27 deg. C.). Root growth in loam soil was favored when plants were grown at 18 deg. C. but at 27 deg. C. the top growth was erratic and root growth was small. At all temperatures and light intensities, the plants growing in sand and clay produced smaller yields of roots and less top growth than did those growing in loam. Light intensity significantly influenced root growth only in loam soil at 18 deg. C. Top growth was not significantly influenced by light intensity at all three temperatures.
W69-05101

EVAPOTRANSPIRATION AND SOIL-MOISTURE DEPLETION,
Forest Service (USDA), Moscow, Idaho. Intermountain Forest and Range Experiment Station.
Edward R. Burroughs, Jr., and John D. Schultz.
Proceedings, Society of American Foresters, Denver, Colorado, 1964, 4 pp.

Descriptors: *Hydrologic cycle, *Evapotranspiration, *Water yield improvement, *Nuclear moisture meters, Water measurement, Soil moisture, Water storage, Seepage, Throughfall, Stemflow, Gravimetric analysis, Lysimeters, Seismic studies, Resistivity, Geophysics, Percolation, Soil physics, Geologic formations.

The methods used to evaluate evapotranspiration by measuring the depletion of soil moisture are discussed, the problems encountered in obtaining reliable data and interpreting results are pointed out, and some suggestions for getting better results are made. Two major problems exist in many field installations; (1) separation of deep seepage loss from evapotranspiration, and (2) edaphic heterogeneity of the study site. A mathematical method of separating seepage from evapotranspiration is discussed, and a possible field test procedure is given. Edaphic and geologic heterogeneity of study sites may be minimized by use of seismic and electrical resistivity equipment. The most common method of measuring soil moisture content, the neutron-scatter method, possesses some inherent problems, too. Hints are given for easier and better installation of access tubes, especially in rocky soils, and suggestions are made for better service from soil moisture probes.
W69-05102

SOIL MOISTURE DEPLETION BY ASPEN IN CENTRAL UTAH,
Forest Service (USDA), Logan, Utah. Intermountain Forest and Range Experiment Station.
Ronald K. Tew.
U.S.D.A. Forest Serv. Res. Note INT-73, 1967, 8 pp.

Descriptors: *Soil moisture, *Vegetation effects, *Evapotranspiration, Vegetation regrowth, Soil-water-plant relationship, Water yield, Sites, Elevation, Soil analysis, Root systems, Soil profiles, Range management, Wildlife management, Soil moisture meters, Nuclear meters.
Identifiers: *Populus species, Seasonal fluctuations.

Aspect and elevation of site and age of vegetation affect the amount of soil moisture depleted by aspen (Populus tremuloides Michx.) during the growing season in central Utah. Clones on west aspects used more soil moisture than those on either north- or south-facing slopes. Differences in elevation had little effect on the amount of soil moisture depleted by mature aspen, but sprout stands used significantly greater amounts of soil moisture on the lower elevation sites. As much as 5 inches of moisture was conserved in the upper 6 feet of soil during the first season after aspen removal, but as sprout stands became reestablished, there was a decrease in these moisture savings.
W69-05106

SOIL MOISTURE DEPLETION BY GAMBEL OAK IN CENTRAL UTAH,
Forest Service (USDA), Logan, Utah. Intermountain Forest and Range Experiment Station.
Ronald K. Tew.
U.S.D.A. Forest Serv. Res. Note INT-74, 1967, 8 pp.

Descriptors: *Soil moisture withdrawal, *Evapotranspiration, *Sites, *Elevation, Vegetation effect, Soil moisture, Vegetation regrowth, Period of growth, Water holding capacity, Soil physical properties, Soil-water-plant relationship, Soil profiles, Root systems, Water yield improvement, Soil moisture meters, Nuclear meters.
Identifiers: *Quercus.

Aspect and elevation of site and age of vegetation affect the amount of soil moisture depleted by Gambel oak (Quercus gambelii Nutt.) during the growing season in central Utah. More soil moisture was lost at the higher elevation (7,900 feet) than at the lower (6,600 feet) on all aspects. A south-facing site at the higher elevation lost the most moisture, whereas one at the lower elevation lost the least. Most available soil moisture was depleted to a depth of 6 feet on all sites during seasons of normal rainfall. Removing oak and allowing regrowth of a vigorous sprout stand reduced soil moisture depletion nearly an inch during the year following cutting, but by the end of the third year, sprout stands were using up to an inch more soil moisture than mature stands.
W69-05107

SOIL MOISTURE DEPLETION BY GAMBEL OAK IN NORTHERN UTAH,
Forest Service, (USDA), Logan, Utah. Intermountain Forest and Range Experiment Station.
Ronald K. Tew.

D.A. Forest Serv. Res. Note INT-54, 1966, 7

criptors: *Soil moisture, *Evapotranspiration, il profile, *Soil-water-plant relationship, Rain- intensity, Soil physical properties, Ground er, Water yield management, Root systems, rland flow, Environmental effect, Soil moisture ers, Nuclear meters.
ntifiers: *Quercus.

ears of normal rainfall, 11 to 13 inches of sture are extracted by Gambel oak from the er 8 feet of soil during the growing season. The l evapotranspirational loss ranges from 15 to 19 es, depleting moisture from the entire profile. y season moisture depletion occurs mainly in upper 4 feet of soil with losses occurring lower e profile later in the season. Winter precipita- usually provides sufficient moisture to fully harge the soil profile after the growing season.
9-05108

ARACTERIZATION OF THE RATE OF TER INFILTRATION INTO SOIL,
due Univ., Lafayette, Ind.
wartzendruber, R. W. Skaggs, and D. Wiersma.

due University Water Resources Research ter, Technical Report No. 5, Dec 1968. 120 pp, ig, 13 tab, 37 ref. OWRR Project A-004-IND.

criptors: *Infiltration, Soil water movement, aturated flow, *Infiltrometers, *Surface seal- Cores, Rainfall simulators, *Overland flow, k density, Porous media, Darcy's law, Soil sics, Agricultural engineering.
ntifiers: Infiltration equations, Stratified porous dia.

e of water infiltration was measured for surface- ded sand-silt columns and field cores in the oratory, for small field plots (1.16 by 1.16 m) by rinkler infiltrometer, and for larger field plots by 35 ft) by a rainfall simulator. Results were ssed by the theoretically based Green-Ampt Philip equations, and the empirical Horton and tan equations. For the sand-silt columns, the roximate theory of the Green-Ampt equation rked well for uniform conditions at different ini- water contents, and for initially air-dry coarse- r-fine stratifications, but not as well for fine- r-coarse stratifications. Some difficulty also was ountered in describing field-core rates, which erally compared more closely with small-plot nkler-determined rates when the soil surface unprotected from sprinkler-drop impact. This gests the possibility of a partial core-surface l, perhaps somehow caused by the core-sam- g process. Large-plot rainfall-simulator infiltra- rates for 13 soils, determined by correcting for face storage rates with an overland flow analy- could be reasonably well described by any of four equations, but the two empirical ones were newhat better than the two theoretically based es.
9-05143

H. Lakes

ND-DRIVEN SUMMER CIRCULATION IN E GREAT LAKES,
aterloo Univ. (Ontario).
T. Csanady.
ant WP-01139-01 (FWPCA), Grant A-1347 RC). J Geophys Res, Vol 73, No 8, pp 2579- 89, Apr 15, 1969. 11 p, 3 fig, 9 ref.

scriptors: *Currents (water), *Water circula- n, *Great Lakes, Winds, Thermocline, Model dies, Mathematical models, Kinetics, Energy.
ntifiers: Frictionless circulation model.

nplified models of wind-forced motions are con- ered in the two-layer circular basin 'model Great ke'. Under summer conditions, when a ther- ocline is present, both a uniform, steady wind and uniform wind varying periodically in time produce a frictionless lake response characterized by strong boundary currents and pronounced thermocline movements in the shore zone. The length scale determining the width of this shore zone is the 'radius of deformation', typically three miles. Observations on Lakes Huron, Michigan, and Ontario show such motions to be present near the shores. (Knapp-USGS)
W69-04789

DISTRIBUTION, ENVIRONMENTAL REQUIREMENTS AND SIGNIFICANCE OF CLADOPHORA IN THE GREAT LAKES,
Ontario Water Resources Commission, Toronto, Biology Branch.
John H. Neil, and Glenn E. Owen.
Publication Number 11, Great Lakes Res Div, Michigan Univ, pp 113-121, 1964. 4 fig, 2 tab, 2 ref.

Descriptors: *Algae, *Algal control, *Essential nutrients, *Eutrophication, *Cladophora, *Nuisance algae, *Sewage, Algicides, Aquatic algae, Aquatic productivity, Bioassay, Cycling nutrients, Environmental effects, Harvesting algae, Inhibition, Light penetration, Limnology, Nitrogen compounds, Nutrient requirements, Nutrients, Phosphorus compounds, Physiological ecology, Pollution identification, Sewage disposal, Water pollution, Water pollution control, Water pollution effects, Water pollution sources.

Excessive growths of Cladophora sp along certain sections of the Great Lakes shoreline create serious nuisance conditions which affect the use of water for recreational, industrial, and municipal purposes. Information on the ecology of this algae was collected as part of a study directed toward the development of control measures. The presence of Cladophora sp is dependent on a suitable substrate for attachment, water movement, adequate light, and nutrients in excess of those normally available in the waters of the upper Great Lakes. Lakes Ontario and Erie have sufficient inherent fertility to support marginal growths, but, where local nutrient sources are available, production increases. Application of phosphorus to a location providing suitable physical conditions but devoid of Cladophora sp resulted in the establishment of a sizeable area of growth. The results of attempts at control are also discussed. (Fitzgerald-Wis)
W69-04798

CALORIFIC VALUES OF SOME INVERTEBRATES IN LAKE MENDOTA, WISCONSIN,
Wisconsin Univ., Madison. Lab. of Limnology.
Thomas E. Wissing, and Arthur D. Hasler.
J Fish Res Board Can, Vol 25, No 11, pp 2515-2518, 1968. 2 tab, 6 ref.

Descriptors: *Invertebrates, *Energy budget, Analytical techniques, Crustaceans, Daphnia, Ecosystems, Energy, Eutrophication, Growth stages, Insects, Lakes, Limnology, Mayflies, Midges, Wisconsin.
Identifiers: *Calorific content, *Energy flow, *Lake Mendota, Wis, Calorimetry, Glyptotendipes, Caenis, Chitin, Leptodora kindii, Hyalella azteca.

Analysis of energy flow through aquatic ecosystems requires calorific equivalents of their biotic components. In this paper, authors contribute data on calorific content of aquatic organisms derived from 53 determinations on 33 collections comprising 8 types of insect and crustacean material from eutrophic Lake Mendota, Wisconsin. Oven-dried materials (60 deg C, 24 hours) were burned in a Phillipson microbomb calorimeter. Results are expressed as calories/gram of ash-free weight (units are almost certainly gram calories although report does not so specify). Ranges of mean values determined for various collections (numbers of determinations, N, indicated in parentheses) are: midge Glyptotendipes sp laryae (9), 4979-5752; midge Glyptotendipes sp pupae (1), 5023; mayfly nymph Caenis sp (2), 6985-7130; Daphnia spp (13), 4132-6071; female Daphnia spp. with eggs (5), 3776-5652; daphnid chitin (2), 5753; Leptodora kindii (16), 4305-5169; Hyalella azteca (5), 3819-4079. Tabulation in report includes data pertaining to percentage ash, numbers, weights of organisms burned, and ranges for individual determinations when N exceeds 2. Authors present no estimates of accuracy and precision of measurements. They state that further studies of seasonal variation in calorific content of species and larval instars are underway. (Eichhorn-Wis)
W69-04799

ON THE MECHANISM OF LANGMUIR CIRCULATIONS AND THEIR ROLE IN EPILIMNION MIXING,
State Univ. of New York, Albany. Atmospheric Sciences Research Center.
Jon T. Scott, Glenn E. Myer, Ronald Stewart, and Eric G. Walther.
Final Rep No 3-The Role of Langmuir Circulation in Mixing of Lake George. Atmos Sci Res Center Pub No 61, pp 1-18, Aug 1968. 18 p, 11 fig, 24 ref. OWRR Project B-008-NY (5).

Descriptors: *Currents (Water), *Lakes, *Vortices, Eddies, Winds, Waves (Water), Water temperature, Water circulation, Turbulence, Mixing, Limnology, New York, Epilimnion, Thermal stratification.
Identifiers: Lake George (NY), Langmuir circulation, Upwelling currents, Ekman drift, Vertical circulation.

Six mechanisms have so far been proposed for explaining vertical or Langmuir circulations and their associated wind streaks. One mechanism involving shearing instability and 2 requiring the action of a surface film are supported by the greatest amount of evidence. Studies at Lake George, N. Y. suggest that more than 1 mechanism may operate at 1 location. A particular mechanism may operate at a specific site because of typical conditions at that site, but a different mechanism may be more important at another site. Plots of thermal structure in the near surface layer of Lake George and measurements of vertical current velocities suggest that Langmuir circulations are the most important mixing process in the epilimnia of lakes.
W69-04929

WAVE INTERACTION AND LANGMUIR CIRCULATIONS,
State Univ. of New York, Albany. Atmospheric Sciences Research Center.
Ronald Stewart, and Richard K. Schmitt.
Final Rep No 3-The Role of Langmuir Circulation in Mixing of Lake George. Atmos Sci Res Center Pub 61, pp 42-47, Aug 1968. 6 p, 2 fig, 14 ref. OWRR Project B-008-NY (5).

Descriptors: *Waves (Water), *Lakes, Numerical analysis, Winds, Water circulation, Turbulence, Mixing, New York.
Identifiers: Water wave interactions, Wind streaks, Langmuir circulation, Lake George (NY).

The interaction of 2 trochoidal wave trains is examined numerically to compare the computed wave shapes and locations to the observation of streaking associated with Langmuir circulations. The wave trains approach each other at an angle of $\theta = 15$ deg, 20 deg, and 25 deg. The resulting areas of maximum amplitude form apparent streaks and move across the field of vision, similar to the motion of streaks associated with Langmuir circulations. Lateral motion of whitecap areas was observed as the normal movement of wind streaks.
W69-04930

THERMAL STRUCTURE AND VERTICAL HEAT TRANSPORT IN LANGMUIR CIRCULATIONS,
State Univ. of New York, Albany. Atmospheric Sciences Research Center.
Glenn E. Myer.

Final Rep No 3-The Role of Langmuir Circulation in Mixing of Lake George. Atmos Sci Res Center Pub No 61, pp 19-41, Aug 1968. 23 p, 19 fig, 4 tab, 12 ref. OWRR Project B-008-NY (5).

Descriptors: *Currents (Water), *Lakes, *Vortices, Instrumentation, Eddies, Winds, Waves (Water), Water temperature, Water circulation, Turbulence, Mixing, Limnology, Regression analysis, New York, Thermal stratification, Thermocline, Epilimnion.
Identifiers: Lake George (NY), Langmuir circulation, Upwelling currents, Ekman drift, Vertical circulation.

The results of a study to determine thermal structure associated with streaks and the role of Langmuir circulations in epilimnion mixing are reported. A floating instrument probe was constructed to obtain data on Lake George from August 1967 through December 1967. The thermal structures of Langmuir circulations under stable and unstable conditions were obtained. Autocorrelations of water temperature were computed and indicated that there was a scale of turbulence associated with streaking conditions much larger than that of ordinary turbulence. Thermal effects in the air implied an organization to the air flow over streaks. From this study it was found that Langmuir circulations are a major cause of epilimnion mixing and thermocline formation and movement in summer and autumn.
W69-04931

WATER POLLUTION BY OUTBOARD MOTORS,
State Univ. of New York, Albany. Atmospheric Sciences Research Center.
Ronald Stewart, and H. H. Howard.
Final Rep No 3-The Role of Langmuir Circulation in Mixing of Lake George. Atmos Sci Res Center Pub No 61, pp 48-52, Aug 1968. 5 p, 13 ref. Grant 14-01-0001-1036. OWRR Project B-008-NY (5).

Descriptors: *Water pollution sources, *Lakes, *Boats, Fuels, Oil wastes, New York, Oily water, Phenols, Cooling water, Taste, Odor.
Identifiers: Lake George (NY), Outboard motor wastes.

Pollution of water by outboard motor oil and fuel discharges is reviewed, and the amount of oil contributed to Lake George, New York, by outboard motors is calculated. Outboard fuel and oil sales average about 400,000 gal per year of which 10% is discharged to the water in the southern end of the lake. It is calculated that 1 part total fuel consumed to 1 million parts lake water is enough to raise the threshold odor level. Fuel sales are tripling about every 8 yr. The problem will become severe if ignored. Oil and fuel wastes increase BOD and turbidity and will seriously degrade the esthetic quality of the lake. (Knapp-USGS)
W69-04936

HYDROLOGIC BASES OF WATER RESOURCES UTILIZATION OF LAKES,
Research Inst. for Water Resources Development, Budapest (Hungary).
K. Szesztay
Int Ass Sci Hydrol Pub No 76, Symp on Hydrol Aspects of Util of Water, Bern, Sept 25-Oct 7, 1967, pp 187-196, 1968. 10 p, 7 fig, 2 tab, 4 ref.

Descriptors: *Lakes, *Storage, *Streamflow, *Water utilization, Streamflow forecasting, Hydrologic budget, Analog models, Digital computers.
Identifiers: Hungary, Finland

Long-term meteorologic and hydrologic forecasts are necessary for regional use of lake water resources. The water in lakes can be regarded as composed of static (stored volume) and dynamic (streamflow) components. Depletion of static resources lowers lake levels, while use of dynamic resources reduces natural outflow. Both must be inventoried before beneficial use is developed. Inventory by study of all individual lakes and ponds is difficult in regional surveys, so regional water budget methods and analysis of regional lake geomorphology to give volume-area relations are used. Studies of the lakes of Finland and Hungary are given as examples. Analog models and digital computer methods aid in evaluation of economic alternatives of water use on a regional scale. (Knapp-USGS)
W69-04957

1967: AN EXCEPTIONAL YEAR IN THE LIFE OF THE DE BERRE POND (FRENCH),
Centre National de la Recherche Scientifique, Marseille (France). General Biology and Ecology Lab.; EDF Hydraulic Group of South-Alps Region.
For primary bibliographic entry see Field 05C.
W69-04958

WATER BALANCE OF LAKE AFFECTED BY SEA (FRENCH),
State Inst. of Hydrology and Meteorology, Warsaw (Poland).
Zdzislaw Mikulski, and Maria Bojanowicz.
Int Ass Sci Hydrol Pub No 76, Symp on Hydrol Aspects of Util of Water, Bern, Sept 25-Oct 7, 1967, pp 197-203, 1968. 7 p, 3 fig, 1 tab, 9 ref.

Descriptors: *Hydrologic budget, *Lakes, *Bays, *Deltas, Inflow, Evaporation, Discharge (Water), Sea water, Precipitation (Atmospheric), Floods, Tides.
Identifiers: Vistula River, Lake Druzno.

The water budget of coastal lakes which are fed by streams and also affected by sea water is estimated, and Lake Druzno in the delta of the Vistula River is used as an illustration. Before computing the water balance of the lake, the exchange of water between the sea and lake was determined. Precipitation, marine water inflow, discharge from the lake, and evaporation were calculated. Stream water inflow to the lake was 2/3 - 3/4 of the lake's total input, and sea water inflow was also significant and rapid enough to be turbulent and affect local flooding conditions. (Knapp-USGS)
W69-04960

EQUILIBRIUM MODELS AND COMPOSITION OF THE GREAT LAKES,
Syracuse Univ., N. Y. Dept. of Geology.
For primary bibliographic entry see Field 02K.
W69-04970

SHORELINE FEATURES AS INDICATORS OF HIGH LAKE LEVELS,
Geological Survey, Ocala, Fla.
Darwin D. Knochenmus.
Geol Surv Res 1967, Prof Pap 575-C, pp C236-C241, 1967. 6 p, 6 fig, 1 tab, 3 ref.

Descriptors: *Lakes, *Lake shores, *Shore-line cover, Trees, Beaches, Water levels, Water level fluctuations, Florida.
Identifiers: Lakeshore tree line, Lake level indicators.

A relation between certain shoreline features (tree line of the slash pine, beach scarp, beach ridge) and high lake levels was found on 8 Florida lakes. For the lakes studied, the features were above the lake level an average of 95% of the time. An estimate of former high levels of ungaged lakes can be made from this relation. Grain-size analyses of the material comprising the various geomorphic features show a consistent relation between median diameter and the type of feature. In order of decreasing median grain size, material of the high beach ridge is followed by that of the low beach ridge, the upland, and the base of the beach scarp. This relation helps separate areas which have been under the influence of wave action from those which have been above the water level. (USGS)
W69-04984

'ANOMALOUS' THERMAL CONDITIONS IN A HYPERSALINE INLAND POND,
Arizona State Univ., Tempe.
Gerald A. Cole, and W. L. Minckley.
Jour of the Ariz Academy of Sci, Vol 5, No 2, pp 105-107, Oct 1968. 1 fig.

Descriptors: *Saline water, *Ponds, *Water temperature, *Thermocline, Density, Arid lands, Mexico, Gravity, Solar radiation, Surface waters, Thermodynamics, Water chemistry, Temperature.

In saline water of arid regions and elsewhere, anomalous temperature profiles are common and result in part by dissolved substances imparting density, and being more important than temperature in this respect. This paper describes some unique temperature gradients in a saline Mexican pool, and presents data on density relations that prevailed. The surface temperature was 24.0 deg C and at 46 cm the temperature was 47.0 deg C. The surface water had a specific gravity of 1.01 at 24.0 deg C and bottom water was at 1.075 at 47 deg C. The high temperature in the deeper water was explained by direct solar radiation penetrating the upper layer. The dense saline bottom water accumulated heat while the dilute upper stratum reduced outgoing radiation and prevented evaporation from it. The contrasting density prohibited mixing of the two layers. (Affleck-Arizona)
W69-05078

OBSERVATIONS ON THE FORMATION AND BREAKDOWN OF THE OXIDIZED MICROZONE AT THE MUD SURFACE IN LAKES,
Freshwater Biological Association, Ambleside (England).
Eville Gorham.
Limnol Oceanogr, Vol 3, pp 291-298, 1958. 2 fig, 9 ref.

Descriptors: *Lakes, *Mud-water interfaces, Turbulence, Lake morphometry, Oxygen, Aerobic conditions, Anaerobic conditions, Aquatic environments, Limnology, Diatoms, Oxidation reduction potential, Algae, Tubificids.
Identifiers: Esthwaite Water, English Lake District, Iron compounds, Melosira italica.

The theory is presented that the oxidized microzone at the mud-water interface is due to turbulent mixing of mud into the oxygen-richer water, followed by resettling. Its thickness varies with time of year and the reducing activity of the underlying mud. In Esthwaite Water and others of the English Lake District the zone is sharply defined by orange-brown caused by ferric compounds, overlying blacker mud caused by ferrous sulfide deposition. Evidence for the turbulence theory: formation after the fall overturn; presence of algal colonies and tubificid worm tracks; lighter density; sharp differences in electrical conductivity and redox potential; and correlation with life cycle of Melosira italica subarctica. This theory is a challenge to Mortimer's previous explanation of the zone as reflecting downward diffusion of oxygen from the water to surface mud meeting a barrier in the reducing power of the underlying mud. (McCoy-Wisconsin)
W69-05139

SEASONAL VARIATION IN CONTENT OF NITROGENOUS COMPOUNDS AND PHOSPHATE IN THE WATER OF TAKASUKA POND, SAITAMA, JAPAN,
Tokyo Imperial Univ. (Japan). Geographical Inst.
S. Yoshimura.
Archiv fur Hydrobiologie, Vol 24, pp 155-176, 1932. 6 fig, 13 tab, 72 ref.

Descriptors: *Nitrogen compounds, *Phosphorus compounds, *Cycling nutrients, Water chemistry, Water analysis, Phosphorus, Ponds, Phytoplankton, Eutrophication, Lakes, Limnology, Aquatic environment, Aquatic productivity, Hypolimnion, Algal control, Seasonal, Annual turnover.
Identifiers: Takasuka Pond (Japan), Lake Mendota (Wis), Phytoplankton crops, Trophic, Tropholytic,

itrogen annual budget, Phosphorus annual idget.

nall, eutrophic Takasuka Pond, Japan, has been alyzed both vertically and seasonally (1928 to 31) for nitrate, free ammonia, albuminoid trogen and soluble phosphate, and the data corre- ted with phytoplankton cycles. Organic nitrogen inversely proportional to inorganic nitrogen. In- ganic nitrogen and soluble phosphate are nerated at the end of stagnation caused by composition of warm-water phytoplankton and me aquatic plants. Seasonal change in soluble osphate in inflowing waters affects the ytoplankton productivity. Data concerning the polimnion in the stagnant period (April to end of ctober) are presented. Calculations are offered r annual budgets for nitrogen and phosphorus in e trophic zone, tropholytic zone, and pond as a ole. Comparisons are made with lakes and ponds the world, including Lake Mendota, Wisconsin. e limiting factor for phytoplankton crop in kasuka is said to be 'phosphate at times and am- onia in others.' (McCoy-Wisconsin)
69-05142

I. Water in Plants

OPULATION, GROWTH RATE, AND MATU- ITY OF VEGETABLE CROPS IN RELATION O SOIL SALINITY AND TEXTURE UNDER PRINKLER AND FURROW IRRIGATION
alifornia Univ., Davis, Dept. of Water Science d Engineering: California Univ.. Riverside. rank E. Robinson, and Orval D. McCoy. gronomy J, Vol 59, No 2, pp 178-181, March- pril 1967, 7 tab, 10 ref.

escriptors: *Vegatable crops, *Saline water, Saline soils, *Sprinkler irrigation, *Furrow irriga- on, Salts, Soil texture, Irrigation efficiency, ant populations, Plant growth, California, oisture uptake, Seeds, Evaporation, Soil- ater-plant relationships, Moisture tension, nds.
dentifiers: Imperial Valley (California).

study was initiated at the University of Califor- a Imperial Valley field station to study uni- rmity of maturity of lettuce, cabbage, carrots, d onions, under 3 different irrigation schedules ith both sprinkler and furrow systems that plied saline water to saline soils of varying xtures. Conventional furrow irrigation required pproximately 2.5 times as much water as was plied by sprinkler irrigation. Movement of ater up into seed beds in furrow irrigation and bsequent evaporation produced an accumula- on of salt in the seed rows. Downward move- ent of water into the soil with sprinkler applica- on removed salts, thus preventing surface salt ccumulations. (Blecker-Arizona)
69-05074

PATIAL PATTERN OF SHRUBS ON A ESERT PLAIN IN ETHIOPIA,
aile Sellassie I Univ., Addis Ababa (Ethiopia).
dward W. Beals.
cology, Vol 49, No 4, pp 744-746, 1968. 1 fig, 3 ab.

escriptors: *Desert plants, *Shrubs, *Ecological istribution, *Distribution patterns, *Spatial dis- ibution, Soil moisture, Competition, Data collec- ons, Dispersion, Statistical methods, Seeds, ands, Sampling, Semiarid climates, Plant popula- ons, Dry seasons, Wet seasons.
dentifiers: *Ethiopia, Plots.

bservers have often suggested that desert shrubs ow a regular spatial pattern, but statistical vidence is meager. The distribution of the shrub, adaba rotundifolia on a sandy plain showed a omplex pattern which apparently included a trend owards aggregation, and within areas of higher ensity a strong trend towards regularity. The latter ay result from competition for water which may ccur both near the soil surface during the brief ainy periods and deep in the substrate during the more extended dry periods. A factor causing regularity was thought to be seed dispersal. Of the various methods of analyzing departure from randomness, the ratio, observed variance to expected variance, and the index of dispersion associated with it, were the most sensitive. (Affleck-Arizona)
W69-05077

GERMINATION OF FOURWING SALTBUSH SEEDS AT DIFFERENT LEVELS OF MOISTURE STRESS,
Forest Service (USDA), Albuquerque, N. Mex. Rocky Mountain Forest and Range Experiment Station.
H. W. Springfield.
Agronomy J, Vol 58, No 2, pp 149-150, March-April 1966. 2 fig, 2 tab.

Descriptors: *Germination, *Seeds, *Moisture stress, *Vegetation establishment, *Southwest U S., Air temperature, Soil temperature, Osmotic pressure, Revegetation, Semiarid climates, Soil-water-plant relationships, Ranges.
Identifiers: *Saltbush.

Studies were conducted to determine the effect of different levels of moisture stress and temperatures on seed germination of fourwing saltbush which is a promising species for seeding of arid Southwestern ranges. Six sources of seeds were germinated at moisture stress of 0.3, 3.0, 7.0, 11.0 and 15.0 atmospheres of osmotic pressure and at temperatures of 85, 63, and 49F. Germination was affected by the level of moisture stress, temperature and seed source. As moisture stress increased, germination generally was reduced regardless of temperature. The Mountainair source germinated better at moisture stresses of 11 and 15 atmospheres than 4 of the other 5 sources. This source may have characteristics that enables it to germinated more readily and thereby improve its chances of becoming established under relatively dry conditions. (Blecker-Arizona)
W69-05081

EXPERIENCE WITH THREE VAPOUR METHODS FOR MEASURING WATER POTENTIAL IN PLANTS,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Land Research and Regional Survey.
H. D. Barrs, and R. O. Slatyer.
UNESCO Arid Zone Research, Vol 25, pp 369-384, 1965. 17 fig, 29 ref, disc.

Descriptors: *Plant physiology, *Leaves, *Vapor pressure, *Hygrometry, *Plant tissues, Water vapor, Instrumentation, Measurement, Equilibrium, Humidity, Calibrations, Temperature.
Identifiers: *Water potential, *Psychrometers, Vapor phase, Thermocouples, Liquid phase.

Three vapor methods were used to measure water potential in plants. The vapor exchange method involves equilibrium of discs or segments of leaf tissue being examined in microdesiccators over solutions of known water potential. The principal requirement of the apparatus is that it should provide and maintain, at the surface of the tissue under examination, a constant and known water potential in the vapor phase. The second method is that of balancing the water potential of the tissue against the water potential of vapor directly against the solution. The psychrometer method measures relative vapor pressure of small chambers using a thermocouple and thermocouple chamber. Tissue water potential of plants should be determined in order to know whether these plants could live in arid climates. (Blecker-Arizona)
W69-05085

DETERMINATION OF THE REGIONAL COEFFICIENT 'K' FOR COMPUTING THE CONSUMPTIVE USE OF NATIVE BLACK KIDNEY BEAN IN THE IRRIGATION DISTRICTS OF VERACRUZ STATE,
Irrigation and Drainage Engineering Office, Veracruz (Mexico).
Carlos Guzman Cortes.
International Commission on Irrigation and Drainage, Annual Bulletin, pp 84-90, 1967. 6 fig, 4 tab.

Descriptors: *Consumptive use, *Crop production, *Beans, *Mexico, *Border irrigation, Regional analysis, Evapotranspiration, Wells, Irrigation districts, Infiltration, Soil analysis, Water requirements, Data collections, Sampling, Irrigation efficiency.
Identifiers: *Regional coefficient, *Kidney beans.

This paper describes a study made in one of the irrigation districts in Mexico to determine the regional coefficient K for the native black kidney bean and to arrive at a basic curve for computing consumptive uses of water at various stages of crop growth. The method of border strip irrigation as adopted was best for the bean crop and yield of the crop was favorable. Data for K were decennial and the highest point for evapotranspiration corresponds to the largest consumption of water. (Blecker-Arizona)
W69-05086

CONSUMPTIVE USE OF WATER FOR SOME MAJOR CROPS IN U.A.R. (EGYPT),
Cairo Univ., Giza (Egypt). Dept. of Irrigation and Hydraulics, Ministry of Agriculture, Cairo (Egypt).
Mamdouh Shahin, and Mohamed I. El-Shal.
International Commission on Irrigation and Drainage, Annual Bulletin, pp 72-83, 1967. 8 fig, 3 tab, 16 ref.

Descriptors: *Consumptive use, *Evaporation, *Crop production, *Soil surfaces, *Soil moisture, Cotton, Wheat, Water requirements, Equations, Data collections, Moisture content, On-site investigations, Seasonal, Irrigation effects, Evapotranspiration.
Identifiers: *United Arab Republic, Maize, Formulae, Berseem.

This paper presented results of an investigation on consumptive use requirements of water for some major crops cultivated in the U. A. R. (Egypt). Maximum rate of moisture removal took place at the surface 10-cm layer of soil. Over 80% of total moisture extraction was confined to the uppermost 50 cm of soil. Consumptive use found experimentally for each of the investigated crops (cotton, wheat, maize, berseem) followed a particular trend that changed slightly from one location to another. Data on consumptive use obtained from field measurements have been substituted in a number of formulas developed for estimating evaporation and evapotranspiration. A new formula for estimating the daily consumptive use of a crop has been developed. (Blecker-Arizona)
W69-05087

INFLUENCE OF SOIL WATER POTENTIAL AND ATMOSPHERIC EVAPORATIVE DEMAND ON TRANSPIRATION AND THE ENERGY STATUS OF WATER IN PLANTS.
Utah State Univ., Logan.
S. A. Gavande, and S. A. Taylor.
Agronomy J, Vol 59, No 1, pp 4-7, Jan-Feb 1967. 8 fig, 15 ref.

Descriptors: *Soil moisture, *Evaporation, *Turgidity, *Transpiration, *Energy, Orchardgrass, Tomatoes, Air temperature, Humidity, Light intensity, Moisture stress, Moisture uptake, Soil-water-plant relationships, Stomata, Plant growth, Water balance, Environmental effects, Leaves, Osmotic pressure.
Identifiers: *Soil water potential, Atmospheric evaporative demand, Osmotic potential, Turgor potential.

Orchardgrass and tomato plants were subjected to varying soil moisture conditions. Constant atmospheric evaporative demand conditions were maintained by controlling temperature, relative humidity, light intensity and hours of daylight while plants were carried through one series of soil moisture conditions. The total plant water poten-

tial, the osmotic potential, turgor potential and transpiration losses from the two plant species were influenced by soil water potential and atmospheric evaporative demand. The influence of the atmospheric demand was more marked in moist than in drier soil. High atmospheric evaporative demand caused by a combination of high temperature and low relative humidity increased steepness of the water potential gradient between the leaf and the air, thus increasing the transpiration rate. (Blecker-Arizona)
W69-05088

PHENOLOGICAL ASPECTS OF A FEW PROMISING EUCALYPTUS IN THE ARID ZONE,
Central Arid Zone Research Inst., Jodhpur (India). Div. of Resource Utilization Studies.
R. N. Kaul.
Science and Culture, Vol 33, No 6, pp 289-291, June 1967. 1 tab.

Descriptors: *Reproduction, *Flowering, *Genetics, *Trees, *Phenology, Seeds, Sexual maturity, Vegetation, Soil moisture, Humidity, Air temperature, Arid climates, Plant growth, Age.
Identifiers: *Eucalyptus, India, Fruiting, Exotic plants.

A good test of a successful exotic is that it should be able to reproduce itself by seed propagation or vegetatively. Species of Eucalyptus were planted at Jodhpur to determine their flowering age which is one of the important factors in determining the degree of genetic improvement. The minimum flowering was 7 months and 17 days. Most of the species fell within the range of four to four and one-half years. Soil moisture, atmospheric humidity, and comparatively low ambient temperatures, were the controlling factors for the initiation of flowering. The species exhibited marked variation in the percentage of the trees that flowered. This variation between the individuals of the species may be due to initial differences in their growth and vigor. (Blecker-Ariz)
W69-05091

MEASUREMENT OF THE WATER POTENTIAL OF INTACT PLANT TISSUES III. THE WATER POTENTIALS OF GERMINATING PEAS (PISUM SATIVUM L.),
Nottingham Univ. (England). Dept. of Horticulture.
Man Singh Manohar.
J Experimental Botany, Vol 17, pp 231-235, 1966. 1 fig.

Descriptors: *Seeds, *Germination, *Hydrometry, *Measurement, *Plant growth, Osmosis, Root development.
Identifiers: *Water potential, *Peas, Thermocouple, Distilled water.

A microthermocouple psychrometer was used to measure the water potential over part of the surface of a pea seed. Pea seeds subjected to an external water potential below 6,000 joules per kg germinate at a lower internal water potential than they exhibit in distilled water. The water potentials of the seeds decreased just after radicle emergence until the radicle establishes contact with its germination medium. No detectable amounts of osmotically active substances are exuded from the seed during germination. In order to obtain information on their germination performance in arid climates, the seed's water potential could be measured by the method outlined above. (Blecker-Ariz)
W69-05095

2J. Erosion and Sedimentation

ENTRY VELOCITY CONTROL LIMITS DRAIN SEDIMENTATION,
Agricultural Research Service, Brawley, Calif.; and Agricultural Research Service, Columbus, Ohio.
For primary bibliographic entry see Field 08B.
W69-04720

ELECTRONIC DATA PROCESSING SYSTEM FOR STREAMFLOW,
Southern Great Plains Watershed Research Center, Chickasha, Okla.
For primary bibliographic entry see Field 07C.
W69-04759

SEDIMENT DATA FOR CANADIAN RIVERS, WATER YEAR 1966.
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.

Inland Waters Br, Dep Energy, Mines and Resources Data Rep, 1969. 155 p, 1 map.

Descriptors: *Sediment load, *Rivers, *Suspended load, *Data collections, Sediment discharge, Sediment yield, Streamflow, Discharge (Water), Sediment transport, Stream gages, Sampling.
Identifiers: *Canada, Sediment sampling.

Data on the quantity and character of stream-transported sediment in Canada for water year 1966 are tabulated for use as a basis for studies of river channel morphology, erosion, deposition, and water resources. The sampling equipment used is described. Each sampling station record includes location of station, drainage area, type of gage, period of record, mean discharge, extremes of discharge and sediment load, history of station, remarks on record quality, monthly mean sediment load, and daily suspended load data. Particle-size analyses are included in some records. (Knapp-USGS)
W69-04766

LOCALIZED SCOUR IN ERODIBLE-BED CHANNELS,
Universidad de la Republica, Montevideo (Uruguay). Facultad de Ingenieria Agrimensura; New York Univ., N. Y. Courant Inst. of Mathematical Sciences.
Mario H. Gradowczyk, Oscar J. Maggiolo, and Hugo C. Folguera.
J Hydraul Res, Vol 6, No 4, pp 289-326, 1968. 38 p, 14 fig, 1 tab, 24 ref.

Descriptors: *Scour, *Alluvial channels, *Flow around objects, *Mathematical models, Reynolds number, Froude number, Turbulence, Digital computers, Hydraulic models, Model studies.
Identifiers: *Erodible-bed channels.

A mathematical model to predict scour around isolated obstacles in erodible-bed channels gives numerical results in good agreement with experimental work in laboratories. Depth of scour is calculated as a function of obstacle width and water depth, using a shear intensity number calculated for the undisturbed flow. Results of experimental studies are shown by tables and graphs. The model is compared with several other models of bed scour and gives better results. (Knapp-USGS)
W69-04788

A SCALE MODEL STUDY OF SILTING IN THE VILAINE RIVER DUE TO THE ARZAL DAM (FRENCH),
French Central Hydraulic Lab, France.
For primary bibliographic entry see Field 02A.
W69-04795

A STUDY OF THE PHYSICAL PROPERTIES OF VARIOUS FORMS OF VERY FINE SEDIMENTS AND THEIR BEHAVIOR UNDER HYDRODYNAMIC ACTION (FRENCH),
French Central Hydraulic Lab.
C. Migniot.
La Houille Blanche (Rev of French Hydrotech Soc), No 7, pp 591-620, 1968. 30 p, 57 fig, 6 tab.

Descriptors: *Silts, *Mud, *Sediments, *Physical properties, Hydrodynamics, Model studies, Flocculation, Sediment load, Runoff, Chemical analysis, Shrinkage, Sands, Turbidity, Rigidity, Erosion.
Identifiers: Laboratory research, France, Samples from abroad.

Some basic physical properties of very fine sediment samples collected from various localities in France and abroad were investigated at the French Central Hydraulic Laboratory for evaluation of the dynamics of the sediments. The study shows that the flocculation of suspensions, the settling time of deposits, and the rheological characteristics of deposits may be considered as the basic properties of very fine sediments. In general, the process of suspension and deposition of these fine sediments in various soil-water complexes behave in a similar way under a hydrodynamic action, if their basic properties are somewhat similar. In particular, the slope of a submerged or emergent mud bank, tan alpha, will be proportional for an assumed 40-cm height of deposit to the initial rigidity r sub y, as follows: tan alpha = Kr sub y, where K is about 25/100 and 7/100 for a submerged and above-the-water deposit, respectively. Similarly, the critical bed friction velocity U can be related to initial velocity as follows: U = 0.5 r sub y to the 1/2 power, where r sub y is dynes/cm squared for deposits of initial rigidity greater than 10 dynes/cm squared. (Gabriel-USGS)
W69-04796

SUMMARY AND ANALYSIS OF SEDIMENT RECORDS IN RELATION TO ST. LOUIS HARBOR SEDIMENTATION PROBLEM,
Geological Survey, Washington, D. C.
P. R. Jordan.
Prepared in cooperation with U S Army Corps of Engineers, St. Louis, Mo. Geol Surv open-file rep, 1968. 30 p, 11 fig, 3 tab, 6 ref.

Descriptors: *Silting, *Sedimentation, *Harbors, *Mississippi River, *Missouri River, Sediment transport, Streamflow, Scour, Particle size, Suspended load, Channel morphology.
Identifiers: St. Louis Harbor (Mo).

Records of sediment discharge in the Mississippi and Missouri Rivers at St. Louis, Missouri, are compiled and analyzed in a study of silting in the St. Louis harbor docking area on the Mississippi River. The combined flows of the lower Missouri and upper Mississippi Rivers commonly transport more suspended sediment, and sand in particular, than does the flow of the Mississippi River at St. Louis, resulting in deposition of sediment between Hermann and St. Louis in many years. Impoundments in the Missouri River basin have reduced the suspended-sediment discharge by at least 25% at Kansas City, but have had little effect on the discharge of sand which constitutes most of the deposition. According to the calculations presented, the depth would be inadequate for docking at the Municipal Dock and some of the other docks about 9% of the time. However, this estimate should be used with caution because of the limitations of the data from which the assumptions and calculations were made. It is probably safe, however, to conclude that, in the absence of major changes in water use, river regulation, and channel geometry, troublesome deposits of sand will continue to be found periodically near the barge terminals. (Knapp-USGS)
W69-04938

BED-MATERIAL MOVEMENT, MIDDLE FORK EEL RIVER, CALIFORNIA,
Geological Survey, Sacramento, Calif.
John R. Ritter.
Geol Surv Res 1967, Prof Pap 575-C, PP C219-C221, 1967. 3 p, 5 fig, 1 tab, 5 ref.

Descriptors: *Bed load, *Gravels, Tractive forces, Velocity, Discharge (Water), Particle size, California.
Identifiers: Eel River (Cal), Cobbles.

The Middle Fork Eel River, at a discharge of about 3,750 cfs and an average velocity of about 6 fps, moved bed material of cobble size. The size of the transported material was determined by actually noting, through the use of photographs, which individual rocks had been removed from painted areas on the riverbed, particle size of these rocks is proportional to average velocity and to tractive force. (USGS)
W69-04980

WINTER LOSS AND SPRING RECOVERY OF DISSOLVED SOLIDS IN TWO PRAIRIE-POTHOLE PONDS IN NORTH DAKOTA,
Geological Survey, Lincoln, Nebr.

es H. Ficken.
l Surv Res 1967, Prof Pap 575-C, pp C228-1, 1967. 4 p, 3 fig, 1 tab, 2 ref.

criptors: *Water chemistry, *Potholes, *Playas, nds, *Sediments, Ice, Diffusion, Freezing, th Dakota.
ntifiers: Prairie potholes.

emporary loss of more than 25% of dissolved-ls tonnage was detected in 2 prairie-pothole ds in each of several winters. Analyses of ice, er beneath the ice, and water in the bed materi-uggest that 'lost' dissolved solids were stored porarily in the bed material. Probably dissolved ls migrate by diffusion into the bed as the ice kens and migrate back after the ice melts. Full very of the loss required at least several weeks. slowness of recovery may be due to a slow rate iffusion from the bed material. (USGS)
9-04983

. Chemical Processes

EMICAL MEASUREMENT OF MEAN TEM-RATURE,
nsylvania State Univ., University Park.
primary bibliographic entry see Field 07A.
9-04765

PLICATION AND LIMITATIONS OF EMICAL THERMODYNAMICS IN NATU-L WATER SYSTEMS,
fornia Inst. of Tech., Pasadena. W. M. Keck . of Environmental Health Engineering.
es J. Morgan.
p on Equilibrium Conc in Natur Water Supt, ance in Chem Ser 67, pp 1-29, 1967. 29 p, 13 38 ref. PHS Grant WP-00941.

criptors: *Thermodynamics, *Aqueous solu-s, *Equilibrium, Solubility, Solutes, Water mistry, Chemical potential, Chemical reactions, minum, Manganese, Iron, Oxygen, Oxidation.
ntifiers: Open-system thermodynamics, Closed-em thermodynamics, Buffered solutions.

dying thermodynamic relationships at constant perature and pressure permits comparison ween actual chemical composition of a natural er system and the equilibrium composition of a del closed system. Comparing the composition he equilibrium model with that of the actual ural water system is an important step in un-standing the real system. In contrast to closed-em models, for which the time-invariant state is ilibrium, the stationary state is the correspond-state of open systems. Three different chemical ems in natural waters illustrate these principles: nogeneous and heterogeneous buffer capacities natural waters, hydrolysis reactions of aqueous minum, and the oxidation of reduced man-ese by oxygen. (Knapp-USGS)
9-04770

E MECHANISM OF PHOTOSYNTHETIC E OF BICARBONATE BY HYDRODICTYPN RICANUM,
nbridge Univ. (England) Botany School.
. Raven.
p Bot, Vol 19, No 58, pp 193-206, Feb 1968. 5 1 tab, 31 ref.

criptors: *Algae, *Carbonates, *Carbon dioxide, *Bicarbonates, *Photosynthesis, Aquatic al-. Aquatic microbiology, Cycling nutrients, Es-tial nutrients, Environmental effects, Light in-sity, Photosynthetic oxygen, Physiological logy.

drodictyon africanum can photosynthesize at n pH under conditions in which bicarbonate ion ner than carbon dioxide is the carbon species en-ng the cell. Since a four-fold variation in the centration of bicarbonate ion does not in-nce the fixation rate under low light at low tem-ature, a passive entry seems unlikely; a metabol-icarbonate ion pump is proposed. It is possible t such a pump is related to a light-dependent ction specific to the use of bicarbonate ion. On a is of moles of carbon fixed, bicarbonate ion use is more sensitive to N- (3,4 dichlorophenyl)-N', N'-dimethylurea than is carbon dioxide use. Carbonyl cyanide meta-chlorophenylhydrazone inhibits both processes by the same absolute amount. Therefore, bicarbonate ion use is dependent on photosystem 2, but is independent of adenosine triphosphate. These characteristics are similar to those of active light-dependent chlorine influx in H africanum and suggest a similar energy source for the two pumps. The bicarbonate ion pump may be electrogenic. (Fitzgerald-Wis)
W69-04803

TRACE INORGANICS IN WATER,
Robert A. Baker.
Symp by Div of Water, Air, and Waste Chem: 153rd Meeting, Amer Chem Soc, Miami Beach, Fla, Apr 1967. Advances in Chem Ser 73, Amer Chem Soc, 1968. 396 p, 21 chapters, index.

Descriptors: *Trace elements, *Inorganic compounds, *Water chemistry, *Water structure, *Water properties, *Chemical analysis, Biological properties, Physicochemical properties, Chemical properties, Flame photometry, Fluorometry, Neutron activation analysis, Polarographic analysis, Radiochemical analysis, Chromatography, Spectrophotometry.
Identifiers: Water chemistry symposium, Trace inorganic determination in water, Natural water systems, Atomic fluorescence analysis.

Recent advances in the determination of trade inorganics in water and in the study of their relationships to water structure and water use by organisms are discussed in a symposium of 21 papers. The topics presented include critical assessments of broad subjects, applied and fundamental research reports, and analytical developments. Inorganic materials are involved in corrosion, eutrophication, and microbiological processes of economic and general concern. Water structure, effects of trace inorganics on the ice/water system, weathering, and biological effects of trace inorganics are discussed. New analytical methods include automatic microanalysis, polarography, atomic absorption, extraction techniques, neutron activation analysis, and atomic fluorescence. (Knapp-USGS)
W69-04962

MASTER VARIABLES AND ACTIVITY SCALES,
Royal Inst. of Tech., Stockholm (Sweden).
Lars Gunnar Sillen.
Symp of Equilibrium Conc in Natur Water Syst, Advance in Chem Ser 67, pp 45-56, 1968. 12 p, 5 fig, 18 ref.

Descriptors: *Aqueous solutions, *Equilibrium, *Ions, Solubility, Electrolytes, Solutes, Water chemistry, Chemical potential, Chemical reactions, Hydrogen ion concentration, Oxidation, Reduction (Chemical), Oxidation-reduction potential.
Identifiers: Ionic activities, Electron activity.

The infinite dilution activity scale is useful for calculating ionic equilibria in fresh waters, but for equilibria in sea water one gains precision by applying an ionic medium activity scale. Measuring pH in sea water gives less information than total alkalinity and total carbonate. Calculations on redox equilibria are simplified by introducing the master variable pE = (-log electron activity). (Knapp-USGS)
W69-04963

GIBBS PHASE RULE AND MARINE SEDIMENTS,
Royal Inst. of Tech., Stockholm (Sweden).
Lars Gunnar Sillen.
Symp on Equilibrium Conc in Natur Water Syst, Advance in Chem Ser 67, pp 57-69, 1968. 13 p, 2 fig, 1 tab, 24 ref.

Descriptors: *Aqueous solutions, *Mineralogy, *Equilibrium, Ions, Sea water, Sediments, Air, Zeolites, Calcite, Clays, Quartz, Silica, Sodium, Potassium, Aluminum, Chlorides.
Identifiers: Gibbs phase rule.

An imaginary equilibrium model of the sea water + sediment + air system is constructed by adding the components successively. The working hypothesis is proposed that in an intermediate model, with the eight components water - HCl - silica - Al hydroxide - NaOH - KOH - MgO - CaO, seven phases would be at equilibrium: (1) an aqueous solution of composition like sea water, (2) quartz, (3) kaolinite, (4) hydromica (illite), (5) chlorite, (6) montmorillonite, (7) phillipsite or some other zeolite. The composition of the solution and of each solid phase will be fixed once p, T, and chloride ion are given. Adding carbon dioxide brings calcite; adding FeO and iron oxide brings glauconite and geothite. Studies of separated clay phases are highly desirable. (Knapp-USGS)
W69-04964

THE STRUCTURE OF WATER AND WATER-SOLUTE INTERACTIONS,
Miami Univ., Fla. Inst. of Marine Science.
W. Drost-Hansen.
Symp on Equilibrium Conc in Natur Water Syst, Advance in Chem Ser 67, pp 70-120, 1968. 51 p, 12 fig, 162 ref.

Descriptors: *Water structure, Solutes, Water chemistry, Molecular structure, water properties, Viscosity, Refractivity, Density, Solubility, Thermodynamics, Water chemistry.
Identifiers: Proton spin, Infrared absorption, Specific heat, Water thermal anomalies.

Thermal anomalies in the properties of water and aqueous solutions appear to be manifestations of higher-order phase transitions in structured elements of water. Some concentration-dependent anomalies are also described and discussed in terms of: (a) the occurrence of discrete structural units of water in the unaffected solvent, (b) the possible separate existence of somewhat similarly structured units in the ionic hydration atmospheres, and (c) overlapping of large (but not necessarily structured) hydration atmospheres. (Knapp-USGS)
W69-04965

AQUEOUS SURFACE CHEMISTRY OF OXIDES AND COMPLEX OXIDE MINERALS,
Stanford Univ., Calif.
George A. Parks.
Symp on Equilibrium Conc in Natur Water Syst, Advance in Chem Ser 67, pp 121-160, 1968. 40 p, 13 fig, 7 tab, 95 ref. AT (04-3)326 C.A. No. 3.

Descriptors: *Water chemistry, *Chemical potential, Adsorption, Ions, Settling velocity, Suspension, Colloids, Aqueous solutions, Water structure, Hydrogen ion concentration, Ion exchange, Ionization.
Identifiers: Isoelectric point, Surface charges, Surface chemistry.

The factors controlling the sign and magnitude of surface charges on particles of oxides and minerals in aqueous suspension are summarized. Surface charges are responsible for such behavior as ion exchange, electrolyte adsorption, formation of colloids, and coagulation. It is useful to define the zero point of charge (ZPC) or isoelectric point of the solid. ZPC designates the pH in any system, however complex, at which there is no net charge on the solid particles of interest. If the charge is formed only by H or OH ions, water, and species interacting with them, then the ZPC is given the special name IEP. ZPC can be estimated by maximum coagulation or sedimentation rates, minimum ion exchange rates, streaming potential, of H and OH ionic adsorption. Models are developed to correlate measured ZPC and IEP with solid composition, calculating values for new species, and predicting behavior of particles. The factors which determine many surface reactions in nature are discussed. (Knapp-USGS)
W69-04966

THE NATURE OF INORGANIC SOLUTE SPECIES IN WATER,
North Carolina Univ., Chapel Hill.
S. Y. Tyree, Jr.

Symp on Equilibrium Conc in Natur Water Syst, Advance in Chem Ser 67, pp 183-195,1968. 13 p, 3 fig, 1 tab, 46 ref.

Descriptors: *Water chemistry, *Ions, *Solutes, *Hydrolysis, Chemical precipitation, Hydrates, Hydration, Solvation, Chemical reactions, Hydrogen ion concentration, Chelation.
Identifiers: Chemical kinetics, Isopolyions.

In the range of pH exhibited by most natural water and in the concentration range greater than millimolar, few metal ions exist as simple hydrated cations, and relatively few oxyanions exist as simple monomeric species. The hydrated cations are good buffers toward bases, the metallate ions toward acids. As pH is raised in solutions of many hydrated cations, isopolycations are produced, and ultimately, hydrous metal oxides precipitate. As pH is lowered in solutions of many metallate ions, isopolyanions are produced, and ultimately, hydrous oxides precipitate. Salts of the intermediate isopolyions precipitate in some cases. Where the results are unambiguous, the nature of the intermediate species can be described. Kinetics are thought to have been neglected in studies of such solutions up to the present time. (Knapp-USGS)
W69-04967

HETEROGENEOUS EQUILIBRIA INVOLVING OXIDES, HYDROXIDES, CARBONATES, AND HYDROXIDE CARBONATES,
National Bureau of Standards, Washington, D. C.
Paul W. Schindler.
Symp on Equilibrium Conc in Natur Water Syst, Advance in Chem Ser 67, pp 196-221, 1968. 26 p, 8 fig, 10 tab, 63 ref, 1 append.

Descriptors: *Water chemistry, *Sea water, *Equilibrium, Chemical precipitation, Aqueous solutions, Carbon dioxide, Solubility, Solutes, Hydrolysis, Chemical potential, Chemical reactions, Thermodynamics.
Identifiers: Heterogeneous equilibria, Steady state chemistry, Sea water chemistry.

The law of mass action in the solid-water-atmospheric gas system is discussed in relation to the mechanism of control of the concentrations of some major and minor constituents of sea water by simple solubility equilibria. Comparison of calculated and observed concentrations suggests that the ocean is a steady-state system in which the degree of oversaturation of a constituent is related to its rate of sedimentation. Recent laboratory work on heterogeneous systems is summarized. The chemical species discussed belong to ternary systems of the type metal ion-water-carbon dioxide. (Knapp-USGS)
W69-04968

ORIGIN OF THE CHEMICAL COMPOSITIONS OF SOME SPRINGS AND LAKES,
Northwestern Univ., Evanston, Ill.; Bermuda Biological Stations, St. George's West.
Robert M. Garrels, and Fred T. MacKenzie.
Symp on Equilibrium Conc in Natur Water Syst, Advance in Chem Ser 67, pp 222-242, 1968. 21 p, 4 fig, 9 tab, 8 ref. Grant GP-4140 NSF.

Descriptors: *Water chemistry, *Springs, *Alkaline water, Weathering, Lakes, Sodium, Calcium, Carbonates, Bicarbonates, Aqueous solutions, Equilibrium, Chemical precipitation, Evaporation, Quartz, Mineralogy, Clays.
Identifiers: Sierra Nevada (Cal), Feldspar weathering.

The spring waters of the Sierra Nevada result from the attack of soil waters on high carbon dioxide concentration on typical igneous rocks and hence can be regarded as nearly ideal samples of a major water type. Their compositions are consistent with a model in which the primary rock-forming silicates are altered in a closed system to soil minerals plus a solution in steady-state equilibrium with these minerals. Isolation of Sierra waters from the solid alteration products followed by isothermal evaporation in equilibrium with the earth's atmosphere should produce a highly alkaline sodium-bicarbonate-carbonate water; a soda lake with calcium carbonate, magnesium hydroxy-silicate, and amorphous silica as precipitates. (Knapp-USGS)
W69-04969

EQUILIBRIUM MODELS AND COMPOSITION OF THE GREAT LAKES,
Syracuse Univ., N. Y. Dept. of Geology.
James R. Kramer.
Symp on Equilibrium Conc in Natur Water Syst, Advance in Chem Ser 67, pp 243-254, 1968. 12 p, 7 fig, 2 tab, 16 ref.

Descriptors: *Water chemistry, *Equilibrium, *Great lakes, Solutes, Solubility, Mineralogy, Calcium, Magnesium, Carbonates, Carbon dioxide, Calcite, Dolomite, Temperature, Chemical reactions, Chemical precipitation.
Identifiers: Apatite, Steady state chemistry.

A model of Great Lakes water composition involves the equilibrium of calcite, dolomite, apatite, kaolinite, gibbsite, and feldspars at 5 deg C with air having a partial pressure of carbon dioxide of 0.00035, and water. With carbon dioxide pressure and temperature variable and other concentrations fixed, cold waters contain excess carbon dioxide and are unsaturated in calcite, dolomite, and apatite, whereas warm waters are nearly at equilibrium with carbon dioxide but are somewhat supersaturated in calcite, dolomite, and apatite. (Knapp-USGS)
W69-04970

COORDINATION CHEMISTRY OF THE OCEANS,
University of South Florida, Tampa.
Dean F. Martin.
Symp on Equilibrium Conc in Natur Water Syst, Advance in Chem Ser 67, pp 255-269, 1968. 15 p, 3 tab, 45 ref.

Descriptors: *Water chemistry, *Sea water, Chelation, Chemical reactions, Solubility, Red tide, Solvation, Hydrolysis, Ions, Ion exchange, Hydrogen ion concentration, Carbonates, Magnesium, Calcium.
Identifiers: *Coordination chemistry, Coordination compounds, Complexes, Complex ions, Lability, Ligands.

The coordination chemistry of sea water represents a new and useful approach to understanding the chemical properties of sea water. The coordination chemistry of sea water differs from contemporary coordination chemistry in the following respects: most complexes involve pretransition metals, most complexes are labile, the ligands are simpler (water, hydroxide, chloride, carbonate, sulfate), and time and space are important parameters. Principles of coordination chemistry are applied to contemporary research in marine science in four areas: analysis of constituents of natural waters, the nature of metallic species in the oceans, the Red Tide problem, and carbonate geochemistry. (Knapp-USGS)
W69-04971

REDOX EQUILIBRIA AND MEASUREMENTS OF POTENTIALS IN THE AQUATIC ENVIRONMENT,
Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
J. Carrel Morris, and Werner Stumm.
Symp on Equilibrium Conc in Natur Water Syst, Advance in Chem Ser 67, pp 270-285, 1968. 16 p, 7 fig, 1 tab, 17 ref.

Descriptors: *Water chemistry, *Equilibrium, *Oxidation, *Reduction (Chemical), Oxidation-reduction potential, Biochemistry, Carbon, Nitrogen, Oxygen, Sulfur, Iron, Manganese, Chemical analysis.
Identifiers: Natural water systems, Redox equilibria.

Equilibrium models are valuable in interpreting the stability relations of pertinent redox components in natural water systems. Unfortunately, concentrations of oxidizable or reducible species may be far from those predicted thermodynamically because many redox reactions are slow. Maintenance of life resulting directly from a steady input of solar energy is also a major cause on nonequilibrium conditions. Nonphotosynthetic organisms, however, tend to restore equilibrium by catalytically decomposing, through energy-yielding redox reactions, the unstable ultimate products of photosynthesis. Measuring redox potentials frequently yields results that are not amenable to unambiguous interpretation. Quantitative interpretation with respect to solution composition is frequently not justified because the required electrochemical reversibility is usually not attained. Moreover, the point of zero applied current is not necessarily the equilibrium potential. Most redox-potential measurements on natural waters represent mixed potentials. (Knapp-USGS)
W69-04972

SOME pH-CONTROLLING REDOX REACTIONS IN NATURAL WATERS,
Scripps Institution of Oceanography, LaJolla, Calif.
K. Bostrom.
Symp on Equilibrium Conc in Natur Water Syst, Advance in Chem Ser 67, pp 286-311, 1968. 26 p, 8 fig, 6 tab, 50 ref. NSF-GP5112.

Descriptors: *Water chemistry, *Oxidation, *Reduction (Chemical), *Hydrogen ion concentration, Equilibrium, Alkalinity, Acidity, Carbon dioxide, Oxygen, Mineralogy, Sulfides, Manganese, Iron, Sediments, Solutes, Solubility, Model studies.
Identifiers: Redox reactions, Buffered systems.

Using stoichiometric model systems, it can be shown that some naturally occurring redox processes have a pronounced pH-controlling action, even in the presence of substances that act as buffers. High pH values can be reached particularly in systems where higher metal oxides act as oxidizers whereas an acid condition often develops when free oxygen is the oxidizer. However, in most natural systems carbonates and silicates have a more pronounced pH controlling effect than redox processes. (Knapp-USGS)
W69-04973

BIOLOGICAL ACTIVITY IN RELATION TO THE CHEMICAL EQUILIBRIUM COMPOSITION OF NATURAL WATERS,
Wisconsin Univ., Madison. Water Chemistry Lab.
Fred G. Lee, and Alfred W. Hoadley.
Symp on Equilibrium Conc in Natur Water Syst, Advance in Chem Ser 67, pp 319-338, 1968. 20 p, 2 fig, 1 tab, 70 ref. Grant 5TI-WP-22-04 FWPCA.

Descriptors: *Water chemistry, *Biochemistry, *Equilibrium, Ions, Solutes, Chemical reactions, Hydrogen ion concentration, Oxidation, Reduction (Chemical), Hydrolysis, Sorption, Chemical precipitation, Respiration, Photosynthesis, Acidity, Alkalinity.
Identifiers: Complex ions, Protolysis.

For many elements, the concentration of a species in a given body of water can be predicted by abiotic chemical reactions such as protolysis, precipitation, complexation, redox, and sorption. Aquatic organisms can influence the concentration of compounds directly by metabolic uptake, transformation, storage, and release. Aquatic organisms may also cause chemical reactions by changing the concentrations of solutes which are important in abiotic equilibria. The two most important reactions of this type are changes in the pH of the water as a result of respiration and photosynthesis and the uptake and release of organic compounds. Both of these reactions can influence acid-base, precipitation, complexation, redox, and sorption reactions in natural waters. (Knapp-USGS)
W69-04974

HEMICAL CHARACTERISTICS OF BULK RECIPITATION IN THE MOJAVE DESERT EGION, CALIFORNIA,
eological Survey, Menlo Park, Calif.
H. Feth.
eol Surv Res 1967, Prof Pap 575-C, pp C222-227, 1967. 6 p, 2 fig, 2 tab, 7 ref.

escriptors: *Precipitation (Atmospheric), Water chemistry, *Water quality, Chemical analys, Dusts, Calcium, Silica, Magnesium, Sodium, tassium, Bicarbonates, Sulfates, Chlorides, trates.
entifiers: Mojave Desert (Calif), Bulk precipitaon.

nalyses of 41 samples of bulk precipitation from places in the Mojave Desert region show wide nges of dissolved-solids concentration and a riety of chemical types, although the calcium carbonate type water dominates. Specific conctance of the solutions analyzed ranged from 8.9 823 micromhos and shows strong inverse corlation with quantities of rain but no discernible rrelation with time of exposure of the gage tween samples. Dust that locally includes saline aterials appears directly to govern the chemical pe and concentration of a few samples. Bulk ecipitation in the Mojave is closely similar to lk precipitation sampled at Menlo Park, Calif., ar the coast, in the San Francisco Bay area. SGS)
69-04982

YDROGEOLOGIC SIGNIFICANCE OF CALIUM-MAGNESIUM RATIOS IN GROUND ATER FROM CARBONATE ROCKS IN THE ANCASTER QUADRANGLE, SOUTHEASTRN PENNSYLVANIA,
eological Survey, Harrisburg, Pa.
or primary bibliographic entry see Field 02F.
69-04985

FFECT OF SEAWEED ON THE LEVELS OF VAILABLE PHOSPHORUS AND NITROGEN A CALCAREOUS SOIL,
hile Univ., Santiago. Faculty of Chemistry and harmacy.
ario Caiozzi, Pedro Peirano, Eduardo Rauch, and ugo Zunino.
gron J, Vol 60, pp 324-326, 1968. 6 fig, 3 tab, 15 f.

escriptors: *Calcareous soils, *Phosphorus, Nitrogen compounds, Nitrogen, Nitrates, osphates, Loam, Eutrophication, Cycling utrients, Aquatic plants.
entifiers: *Seaweed, Macrocystis intergrifolia, lt loam.

samples of a calcareous silt loam (pH 7.7), supemented with potassium nitrate and diacid potasum phosphate and incubated with seaweed Macrocystis intergrifolia at 4 g/400 g soil), there as an increase in available phosphorus and immolization of nitrate-nitrogen. Results also indicated at inorganic phosphorus of seaweed origin was robably in a form other than simple phosphate. Konrad-Wisconsin)
69-05136

HE FATE OF NITRATE NITROGEN IN SOME ROPICAL SOILS FOLLOWING SUBMERENCE,
nternational Rice Research Inst., Los Banos, aguna (Philippines).
C. MacRae, Rosabel R. Ancajas, and S. alandanan.
oil Sci, Vol 105, No 5, pp 327-334, 1968. 8 fig, 1 ab, 8 ref.

Descriptors: *Nitrates, *Nitrogen compounds, Tropical regions, *Soils, Denitrification, Organic matter, Analytical methods.
Identifiers: *Submerged soils, Nitrogen isotopes, Philippines.

In laboratory experiments, labeled potassium nitrate was added to six Philippine soils immediately before flooding. Total nitrogen, nitrate plus nitrite, potassium chloride-extractable ammonium-nitrogen and organic nitrogen, and nitrogen-15 in each of these fractions were determined periodically throughout a six-week period of submergence. Denitrification was rapid after flooding, especially in soils containing the highest levels of organic matter; ammonium-nitrogen increased in all soils after submergence, finally attaining concentrations of 56-346 ppm. Total nitrogen-15 in the soil decreased after submergence and, after two weeks, disappeared completely from the two soils with the highest organic matter contents (8 and 4.8%). The amount of nitrogen-15 detected in the other soils after submergence for six weeks represented 8-41% of the labeled nitrate. From 4.5 to 39% of nitrogen-15 was recovered from the organic fraction of four of the soils after submergence for six weeks. (Konrad-Wisconsin)
W69-05138

2L. Estuaries

ESTUARIES AND SOUNDS OF NORTH CAROLINA,
Geological Survey, Raleigh, N. C.
Hugh B. Wilder.
Water Resources Bull, Vol 4, No 4, pp 28-38, Dec 1968. 11 p, 9 fig.

Descriptors: *Estuaries, *North Carolina, Hydrology, Water quality, Streamflow, Saline water intrusion, Tides, Winds, Currents (Water), Recreation, Scenery.
Identifiers: *North Carolina estuaries.

The estuaries and sounds of North Carolina are described in terms of tides, river flow, saline water intrusion, and use. Water velocities in the estuaries are very low and the wind-induced currents are often faster than streamflow or tidal currents. The tidal range of estuaries opening into the ocean is about 4 ft, and in estuaries opening into sounds it is about 1 ft. The length of salt water intrusion depends on winds, tides, streamflow, and channel shape, and varies from about 20 to 50 miles. At present the North Carolina estuaries are relatively unspoiled esthetically by pollution and shoreline development. Planning is necessary to preserve their esthetic values. (Knapp-USGS)
W69-04758

PREDICTION OF THE EXTENT OF SALT-WATER INTRUSION INTO ESTUARIES AND SEAS,
Rijkswaterstaat-Service for the Delta Works, The Hague (Netherlands).
P. van der Burgh.
J Hydraul Res, Vol 6, No 4, pp 267-288, 1968. 22 p, 17 fig, 2 tab, 2 ref.

Descriptors: *Saline water intrusion, *Estuaries, *Channel improvements, Navigation, Tides, Currents (Water), Streamflow, Canals, Coasts, Sea water, Water levels.
Identifiers: Netherlands.

A method was developed to calculate the effect of channel modifications on saline water intrusion and tidal flows in estuaries. Small changes in channel depth are shown to cause large changes in length of saline water intrusion. The Rotterdam Waterway, the Netherlands, has been studied for the past 60 yr, and the effects of many channel changes are analyzed and presented by graphs. An empirical relationship between channel deepening and intrusion length is given. (Knapp-USGS)
W69-04782

A SCALE MODEL STUDY OF SILTING IN THE VILAINE RIVER DUE TO THE ARZAL DAM (FRENCH),
French Central Hydraulic Lab, France.
For primary bibliographic entry see Field 02A.
W69-04795

WATER BALANCE OF LAKE AFFECTED BY SEA (FRENCH),
State Inst. of Hydrology and Meteorology, Warsaw (Poland).
For primary bibliographic entry see Field 02H.
W69-04960

SPORT FISHING SURVEY OF THE LOWER POTOMAC ESTUARY,
Charles M. Frisbie, and Douglas E. Ritchie, Jr.
Chesapeake Science, Vol 4, No 4, December, 1963, pp 175-191.

Descriptors: *Sport fishing, *Surveys, *Fish harvest, *Bays, Census, Fishing, Recreation, Water sports, Maryland, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Geographical regions, Northeast U. S., Regions, Virginia, Southeast U. S., Statistics, Data collections, Creel census.

A survey of the sport fishery was conducted in a 265-square-mile area of the lower Potomac Estuary during the summer and fall of 1959, 1960, and 1961. Fisherman interviews, postal card questionnaires, and aerial boat counts were used to determine angling pressure, rates of catch, estimated harvest, species importance, and economic value of the sport fishery. The 1961 estimate indicated that 101,000 angler trips produced approximately 1,200,000 fish weighing almost 642,000 pounds. Party size averaged 3.0 anglers who fished approximately 4.5 hours per trip and creeled 2.6 fish per man-hour. During the five-month survey in 1961, an estimated $594,000 was spent by Potomac Estuary anglers. The average angler spent $5.80 on each of his 29 mean yearly trips.
W69-04992

THE FISHERIES--A NEGLECTED ASPECT OF ESTUARINE RESEARCH,
William H. Massmann.
29th North American Wildlife and Natural Resources Conference, Transactions, March 9-10, 1964, pp 337-352.

Descriptors: *Sport fish, *Fish management, *Environmental effects, *Estuarine fisheries, Life history studies, Management, Fisheries, Fish hatcheries, Ecology, Animals, Aquatic animals, Aquatic life, Fish, Wildlife.

The author states that the bulk of marine sport fish of the Atlantic and Gulf coasts are dependent on estuaries for either spawning, nursery, or feeding grounds, but there has been little research on the management of estuarine fishes. Striped bass and Atlantic shad research has uncovered basic information, but most questions regarding management remained unanswered. Further detailed life history, ecological and behavior studies, information on fish population dynamics are needed for important estuarine dependent coastal fishes (flounders, weakfish, spotted seatrout and others). Information is also needed on effects of environmental factors and engineering structures on fish populations. Basic studies on the fishes in estuaries should ultimately result in methods for minimizing or compensating for damage to these waters. The use of artificial reefs by sport fishes needs to be clearly evaluated. Catch regulations, where needed, should be based on the results of biological studies, and their effects should be thoroughly evaluated.
W69-05025

HORIZONTAL DIFFUSION FROM AN INSTANTANEOUS POINT SOURCE DUE TO OCEANIC TURBULENCE,
A. Okubo.
Chesapeake Bay Institute, Johns Hopkins University, Baltimore, Maryland, Report No 32, 1962.

Descriptors: *Diffusion, *Ocean circulation, *Turbulence, Mathematical models, Eddies, Circulation, Movement, Energy, Water circulation, Mathematical studies, Model studies, Currents (Water), Turbulent flow, Flow.

In this paper the author discusses horizontal turbulent diffusion of a patch of a diffusive substance released from an instantaneous point-source in the sea. In Part I, a systematic derivation of some proposed concentration distributions for a patch is developed on the basis of a non-Markov hypothesis combined with knowledge of the rate of mean square dispersion. A new proposal for the concentration distribution is also presented. The solutions of others are critically discussed in comparison with available information about horizontal diffusion in the sea. In Part II, a re-examination is made of the relations between the variance of the distribution and diffusion time and between the coefficient of eddy diffusion and the scale of the phenomenon, using accumulated data. In addition to this, some speculation about the two-dimensional horizontal energy spectrum of oceanic turbulence is presented.
W69-05036

A REVIEW OF THEORETICAL MODELS OF TURBULENT DIFFUSION IN THE SEA,
A. Okubo.
Chesapeake Bay Institute, Johns Hopkins University, Baltimore, Maryland, Report No 30, 1962.

Descriptors: *Mathematical models, *Diffusion, *Turbulence, *Ocean circulation, Mixing, Dye releases, Turbidity currents, Radioactivity, Stratification, Water circulation, Mathematical studies, Model studies, Analytical techniques, Currents (Water), Density currents, Circulation, Movement.

A comprehensive survey of theoretical models for turbulent diffusion in the sea is presented. In the introductory sections, the author describes results of some recent observations of turbulent structure in the sea and points out some fundamental concepts which are necessary for the treatment of turbulent diffusion in the sea. Material presented in later sections falls into two parts: (1) Some of the important statistical properties associated with particle displacement in a turbulent velocity field are discussed without having information about the probability distribution functions. (2) A systematic derivation of some proposed concentration distributions for a patch of diffusive substance is shown on the basis of a non-Markov hypothesis combined with a knowledge of the rate of mean dispersion. Also some theoretical models for the mean concentration of substance released from a continuous fixed source are presented in comparison with available information. In addition to these, the author reviews briefly an empirical approach to the general problem of turbulent diffusion in the sea, where the dependence of the vertical coefficient of diffusion on the stratification of water is emphasized.
W69-05037

INSHORE MARINE CONSERVATION,
Carleton Ray.
First World Conference on National Parks, National Park Service, Department of the Interior, Washington, D. C., June 30-July 7, 1962, pp 77-87.

Descriptors: *Aquatic habitats, *Fish conservation, *Soil conservation, *Water conservation, *Regulation, Parks, Water resources development, Fish management, Conservation, Commercial fishing, Management

The major theme in this paper is a proposal to project the ideas and support of land and fresh water conservation to the marine environment. This would necessitate the establishment of: (1) parks, (2) sanctuaries for research and study, (3) management programs, and (4) regulations and enforcement. To support his contention, the author cites five illustrative points: (1) The sea has productive and desert areas. Inshore areas are most productive. (2) The sea has been utilized with replenishment (by man) for centuries. (3) Commercial fishing can be decimated in productive inshore areas. (4) There is limited knowledge of the marine environment. (5) The sea is a three dimensional environment with three atmospheres to protect
W69-05044

PRECONSTRUCTION STUDY OF THE FISHERIES OF THE ESTUARINE AREAS TRAVERSED BY THE MISSISSIPPI RIVER-GULF OUTLET PROJECT,
G. A. Rounsefell.
Fishery Bulletin, U. S. Fish and Wildlife Service, Vol 63, No 2, 1964, pp 373-393.

Descriptors: *Construction, *Channels, *Mississippi River, *Louisiana, *Commercial shellfish, Saline water systems, Salt marshes, Gulf of Mexico, Estuarine fisheries, Oysters, Commercial fishing, Crabs, Coastal plains, Geographical regions, Gulf coastal plain, Regions, Southeast U. S., Fishing, Industries, Bodies of water, Interstate rivers, Rivers, Running waters, Streams, Surface waters, Marshes, Wetlands, Gulfs, Animals, Aquatic animals, Aquatic life, Invertebrates, Shellfish.

The author speculates that the construction of the deep water navigation channel from New Orleans to the Gulf of Mexico would cause a rise in salinity that could adversely affect the commercial blue crab and oyster populations. Blue crab larvae spend time in low saline marsh areas, while the higher salinities on the oyster beds may permit the intrusion of the oyster drill, a serious predator.
W69-05049

REALISM IN THE MANAGEMENT OF ESTUARIES,
Alabama Marine Resources Lab., Dauphin Island.
G. A. Rounsefell.
Report No. 1, December, 1963.

Descriptors: *Management, *Fish management, *Ecology, Food chains, Fisheries, Statistics, Data collections, Estuarine fisheries, Biological communities.

The author maintains that estuaries are vital because they are nursery areas for many species. He feels that the productivity of estuaries is being endangered by unrealistic recommendations that do not deal with the entire estuarine system. Some interesting statistics derived from other sources are quoted as are the findings of a number of biological studies illustrating the complexities of estuarine systems.
W69-05050

THE SEDIMENTS OF CHESAPEAKE BAY,
J. Donald Ryan.
Maryland Board of Natural Resources, Department of Geology, Mines, and Water Resources, Bulletin No. 12, 1963.

Descriptors: *Sedimentation, *Sediments, *Oysters, *Maryland, Sedimentation rates, Sediment distribution, Rates, Animals, Aquatic animals, Aquatic life, Benthic fauna, Benthos, Commercial shellfish, Invertebrates, Marine animals, Mollusks, Shellfish, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Geographical regions, Regions, Northeast U. S., Bays, Bodies of water.

The results of research to determine the physical characteristics and origins of Chesapeake Bay sediments are reported. Methods of study and descriptions of samples, geologic and physiographic characteristics, hydrographic considerations, erosion rates and sources, oyster distribution, and mineralogy of the sediments are discussed. Maps of sediments are shown. The objective of the study was, 'to determine the mechanism of siltation in Chesapeake Bay', and did not include study of the effects of siltation upon oyster production. However, the report states '...the oyster beds are restricted to the sandy areas of the bay bottom where silt and clay are practically absent. Most of the large areas of sand bottom within the bay include extensive areas where oysters breed....the absence of oyster bars in channel muds is probably due more to the poor environment than to the silt and clay-size particles. Similar toxic conditions are not present in the favored areas of shallow water and sand bottom. It does not seem likely, therefore, that a mere increase in quantity of the fine materi in suspension would have much of an adverse effe on the oyster crop. Rapid encroachment of mu over oyster bars might cause gradual readjustme in the location of the bars, but no such e croachment was observed in this investigation.'
W69-05052

SHORELINE RECREATION RESOURCES O THE UNITED STATES.
George Washington University for the Outdo Recreation Resources Review Commissio (ORRRC), Report No. 4, 1962.

Descriptors: *Recreation facilities, *Water poll tion control, *Erosion control, *Shores, Beache Parks, Control.

The report inventories existing coastal recreatic facilities. Accessibility and availability are chara terized as the two important recreation area ta gets. Shoreline areas are considered highly access ble if they are within 30 miles, or one hour drivin time, of a metropolitan area of 500,000 or mor Recreation shoreline is defined as: (1) having marine climate and environment, (2) having an e panse of view over water of at least five miles, an (3) being located on a water boundary. This defin tion excludes many estuarine shoreline recreatio sites. Inventories of shoreline recreation areas ar designated by coast, state, type (beach, bluff, c marsh), ownership, and degree of developmen Appendix B discusses, by state, general features c shoreline recreation areas, administration, wate pollution control, erosion control, tidelands owner ship and access, and the status of recreatio planning.
W69-05054

MULTIPLE UTILIZATION OF GULF COAST ESTUARIES,
J. E. Sykes.
17th Annual Conference, Southeastern Associa tion of Game and Fish Commissioners, 1963, pp 323-326.

Descriptors: *Estuarine fisheries, *Productivity *Gulf of Mexico, Commercial fishing, Commercia shellfish, Multiple purpose, Fisheries, Animals Aquatic animals, Aquatic life, Invertebrates, Shellf ish, Fishing, Industries, Bodies of water, Gulfs, Sur face waters, Coasts, Beneficial use.

It is estimated that some 7500 square miles o 4,800,000 acres of estuarine area exist on the periphery of the Gulf of Mexico. Gulf commercia catches of fish and shellfish in 1960 consisted o over one billion pounds of estuarine dependen species. The contribution of Gulf estuaries towar these catches amounted to approximately 23(pounds per acre. The evaluation of estuaries i discussed in terms of total production including other forms of organic matter. Beneficial and detri mental uses of shallow-water coastal areas are cited.
W69-05057

WHAT IS HAPPENING TO OUR ESTUARIES,
For primary bibliographic entry see Field 06B.
W69-05060

THE DIFFERENTIATION, ANALYSIS, AND PRESERVATION OF NITROGEN AND PHOSPHORUS FORMS IN NATURAL WATERS,
California Univ., Berkeley. Sanitary Engineering Research Lab.
For primary bibliographic entry see Field 05A.
W69-05137

. WATER SUPPLY AUGMENTATION AND CONSERVATION

.. Saline Water Conversion

GH-CAPACITY DUAL-PURPOSE PLANT R GENERATING ELECTRICITY AND ODUCING FRESH WATER FROM SEA TER,
nmissariat a l'Energie Atomique, Paris ance).
Balligand, J. Huyghe, M. d'Orival, and P. Vignet.

the 8 Volume Proceedings, see Vol 2, No 9, d 06B, W69-03305. Int Conf on Water for ce, Wash, D C, Vol 2, pp 146-157, 1968. 12 p, , 1 tab, 2 ref.

criptors: *Nuclear powerplants, *Desalination nts, *Electric generators, *Cost comparisons, illation, Comparative costs, Sea water, Fresh er.
ntifiers: France, Kestner process, Electric erating plant.

combination of a plant for desalting sea water distillation with a power-generating 500 MW lear reactor of the natural uranium-graphite-on dioxide type, using the French system is ussed for the process of successive expansions S.F.) or of the Kestner process (L.T.V.). If llation facilities are joined to each of the 2 o-alternator units of the reactor, the produc- of fresh water becomes about 500,000 cu m day for a net electric power of 250 to 300 MW lable to the system and the auxiliary units of the er plant; however, the generating plant must rate as the primary unit. If a single turbo-alter- r unit is equipped with a distillation facility, the o of the production of water to the production lectricity is lower, but the operation of the elec- generating plant can be more flexible. The ef- of the main parameters on the cost of the er, ratio of the production of electricity to that ater, conditions pertaining to financial invest- ts, cost of steam, cost of water, depreciation charges are given. Several development studies ch would be necessary to continue this prelimi- project are cited. (Vorhis-USGS)
9-04754

ELOPMENT OF A LOW-COST IRON-BASE LOY TO RESIST CORROSION IN HOT SEA TER,
tinghouse Electric Corp., Pittsburgh, Pa.
essall, F. C. Hull, N. Michael, and C. Liu.
ce Saline Water Res and Develop Progr Rep 394, Jan 1969. 79 p, 30 fig, 7 tab, 27 ref, 1 ap- d. OSW Contract No. 14-01-0001-1447.

criptors: *Corrosion, *Desalination, *Sea r, *Material testing, Evaluation, Economics, trochemistry, Deaeration, Model studies, hodology.
tifiers: *Iron-base alloys, *Potentiostatic niques, High-temperature test loop.

ervations made during the first phase of basic arch aimed primarily at seeking a low-cost base alloy to resist corrosion in hot sea water summarized. Alloys, test conditions, corrosion ht losses, corrosion rates, and other data are d in tables and experimental procedures are ribed and conclusions presented. Dynamic tests at 250 deg F in deaerated sea water, and ies of anodic polarization curves made at room perature in deaerated 0.IN NaCl solution, were to evaluate relative corrosion behavior of al- Minimal effects were indicated of melting tice, processing procedures, and crystallo- hic texture on the corrosion of iron-base alloys ot sea water. Based on the observations of rgietic alloying effects in Fe-Cr and Fe-Al al- loys, future development of corrosion resistant iron-base alloys probably will be centered on multi-component single phase alloys containing chromium and/or aluminum as major alloying components. Beneficial effects as alloying elements were shown by additions of Co, Mo, Ni, Nb, Si, W, Ag, Zr, V, and Ti. The electrochemical method is preferred for evaluation of new iron-base alloy compositions. (Lang-USGS)
W69-04771

PROSPECTS OF DESALINATION FOR SOLVING WATER PROBLEMS ON THE MAKRAN COAST,
Pakistan Atomic Energy Commission, Karachi.
Ismat Kamal.
For the 8 Volume Proceedings, see Vol 2, No 9, Field 06B W69-03305. Int Conf on Water for Peace, Wash, D C, Vol 6, pp 782-790, 1968. 9 p, 2 fig, 1 tab, 4 ref.

Descriptors: *Desalination, *Nuclear powerplants, *Water sources, *Arid lands, Coasts, Water resources development, Reclamation, Land reclamation, Irrigation.
Identifiers: Baluchistan (Pakistan), Makran Coast (Pakistan).

Basic facts on Pakistan are given with particular reference to West Pakistan and the areas of the former Baluchistan province, and the effect of the absence of water supplies in hampering development of the area and in causing soil erosion. There is archaelogical evidence to show that in ancient times Baluchistan was a well irrigated and cultivated area - 'the desert in Baluchistan is largely man-made'. Desalination of sea water can be applied to solve the problems of 2 of the 7 physiographic regions of Baluchistan which lie on the Arabian Sea Coast. These are the southern Coastal Sub-Region, occupied by the lower valleys of the Porali, the Kharari and the Windar, with the fishing port of Sonmiani as a potential site, and the Makran Coastal Sub-Region, with the fishing ports of Gwadar, Jiwani and Pasni as potential sites. The geographical features of these regions are described with reference to their importance in absorbing the overflow of population from the Indus Basin and the Karachi area, and providing sites for 1 or 2 additional ports to relieve the present congestion at Karachi harbour. A nuclear power and desalination plant on the Makran Coast must be applied not only for improving the existing fish and date processing industries (which will provide valuable foreign exchange) but must also be accompanied by an overall industrial and, possibly, agricultural development of the area. The existing natural water resources of the area and the extent to which they can be exploited are described. Most of the rivers of the area under discussion are dry for the greater part of the year and the sea, if properly exploited, can be the only permanent and reliable source of fresh water. A dual-purpose plant on the Makran Coast is discussed with reference to existing and future cost economics and the use to which the incumbent electricity supply can be put. (K-napp-USGS)
W69-04776

COST PROJECTIONS FOR LARGE DESALTING SYSTEMS WITH VARIOUS TYPES OF COUPLING,
I. Spiewak, and R. A. Ebel.
For 8 volume Proceedings see Vol 2, No 9, Field 06B, W69-03305. International Conference on Water for Peace, Vol 2, pp 296-303, 1968. Washington, D C: U S Government Printing Office, 8 p, 4 fig, 1 tab, 13 ref.

Descriptors: *Desalination plants, Electricity, Nuclear reactors, Costs, Nuclear energy, Water costs, Evaporators.
Identifiers: *Cost projection, *Coupling, Dual plants, Nuclear plants, Surplus power, Nuclear power costs.

This paper discusses cost projections for large nuclear steam plants which are suited to the production of electric power or to the production of water in dual-purpose power-and-desalting plants. These types of nuclear power plants are under active development in the United States and Europe. Cost projections for coupled evaporators are derived from studies sponsored by the Office of Saline Water. The dual-purpose power-desalting plant provides desalted water at the lowest cost based on present concepts. The amount of surplus power may be so large that it cannot be marketed in all cases. This paper, therefore, explores methods of coupling nuclear plants and evaporators so as to reduce or eliminate the surplus power. (Loeb-Rutgers)
W69-04814

COST REDUCTION IN DESALTING SEA WATER,
O. B. Waters, Jr., M. C. Uy, A. J. Weinberger, and D. F. De Lapp.
For 8 Volume Proceedings see Vol 2, No 9, Field 06B, W69-03305. International Conference on Water for Peace, Vol 2, pp 305-314, 1968. Washington, D C : U S Government Printing Office.

Descriptors: *Sea water, *Costs, *Desalination, Descaling.
Identifiers: *Cost reduction, Mineral by-products, W R Grace and Co, American Cyanamid Co.

Descaling of raw sea water and recovery of mineral by-products as a part of desalination may offer ways to reduce the overall cost of obtaining fresh water from the seas. This paper discusses work done on both these possibilities by two American Chemical companies under contract with the Office of Saline Water, U S Department of the Interior. As such, a lime-magnesium carbonate pretreatment process developed at W R Grace and Co is discussed as well as a feasibility study by investigators at the American Cyanamid Co. The latter has yielded two processes which could combine recovery of economically valuable chemical by-products with recovery of fresh water from the sea. The value of the by-products may, under certain conditions, be enough to reduce the overall cost of purifying the water. This latter paper outlines mineral values worth recovering and presents two processes proposed for by-product recovery as a part of sea water desalting. The advantages, limitations, and projected economics (under U S conditions) of these processes are discussed. (Loeb-Rutgers)
W69-04826

ANALYSIS OF THE COST OF WATER TRANSMISSION BY PIPELINE,
C. C. Burwell.
For 8 Volume Proceedings see Vol 2, No 9, Field 06B, W69-03305. International Conference on Water for Peace, Vol 3, pp 171-181, 1968. Washington, D C: U S Government Printing Office.

Descriptors: *Pipelines, *Desalination, *Water costs, *Water transfer, Forecasting, Nuclear energy, Costs, Water supply.
Identifiers: *Water transmission costs, *Water transmission, Power cost, Optimum pipeline diameter, Pipeline capacity, Rate of return, Cost projections.

Low cost projections for desalination depend upon low cost nuclear energy. Water transmission costs are also affected by energy costs, in that the cost of pumping power to overcome drag and to elevate water is a function of power cost and in that the optimum pipeline diameter (and therefore its installation cost) for a given water capacity decreases as power costs decrease. A correlation of the installed cost of pipelines as a function of pipeline diameter is used to develop an analytical expression that predicts the optimum pipe diameter as a function of pipeline capacity, power cost, and rate of return on the capital investment. The pipeline diameter cor-

relation is then used to predict the unit cost of water conveyance over a wide range of parameters, to determine the sensitivity of water cost to variations in a given parameter and to illustrate the relationship of conveyance costs to total water cost for particular examples. (Loeb-Rutgers)
W69-04827

GIBBS PHASE RULE AND MARINE SEDIMENTS,
Royal Inst. of Tech., Stockholm (Sweden).
For primary bibliographic entry see Field 02K.
W69-04964

COORDINATION CHEMISTRY OF THE OCEANS,
University of South Florida, Tampa.
For primary bibliographic entry see Field 02K.
W69-04971

DESALINIZATION AND FUTURE WATER SUPPLY IN THE UNITED STATES,
R. J. Faust.
American Water Works Association, Journal, Vol 54, No 5, May, 1962, pp 519-529.

Descriptors: *Desalination, *Water sources, *Reclaimed water, *Water supply, Demineralization, Separation techniques, Water purification, Water treatment, Supply.

Desalinization is discussed as one alternative to providing fresh water supplies in the United States. The article concludes that except for isolated cases, there is plenty of water. A distribution problem exists, but the main concern is to use present resources wisely. The reuse of treated sewage in Baltimore, Maryland, by Bethlehem Steel for industrial purposes is proposed as an example of wise water use.
W69-04988

ECONOMIC ASPECTS OF SALINE-WATER CONVERSION,
James C. Lamb, III.
American Water Works Association, Journal, Vol 54, No 7, July, 1962, pp 781-788.

Descriptors: *Desalination, *Economic feasibility, *Distillation, *Electrodialysis, *Brackish water, Costs, Feasibility, Demineralization, Separation techniques, Water purification, Water treatment, Dialysis, Membrane processes, Saline water, Water types.

The purpose of this paper is to review the basis for costs which have been presented for both conventionally treated and desalted water supplies and to discuss several factors which must be considered in any definite comparison of these costs. Among the points noted by the author are the following: (1) Cost of desalting by distillation is not greatly affected by concentration of salts. On the other hand, electrodialysis and several other processes are affected by concentration. These processes seem particularly suited to desalting brackish waters. (2) The only practical way of comparing desalination costs to the costs of other fresh water sources is on the basis of the cost on an additional increment of fresh water added at a specific location, both estimates to include all times of expense. (3) Desalting may play an important role on a local level, but it is not anticipated that saline-water conversion will supplement national water resources to a significant degree in the foreseeable future.
W69-05017

OUTLOOK FOR ECONOMIC USE OF FRESH WATER FROM THE SEA,
S B Morris
Journal of the Irrigation and Drainage Division, June, 1961, pp 15-26.

Descriptors: *Economic feasibility, *Desalination, *Texas, Central U. S., Coastal plains, Geographical regions, Gulf coastal plain, Regions, Southwest U. S., Feasibility, Demineralization, Separation techniques, Water purification, Water treatment.

The prospects for desalination systems in the United States are analyzed. The author is pessimistic except in special instances and along the Texas Gulf Coast.
W69-05032

DEVELOPMENT OF TRANSPORT DEPLETION PROCESSES,
Southern Research Inst., Birmingham, Ala.
Everett L. Huffman.
Office of Saline Water R and D Report No 439, 1969. 104 p. OSW 14-01-0001-698.

Descriptors: *Desalination, *Transport depletion, *Electrodialysis, *Membrane processes, Energy, Brackish water, Scaling, Calcium sulfate, Bicarbonates, Costs, Efficiencies.
Identifiers: *Neutral membranes, Current density, Solution velocity.

The transport depletion variant of electrodialysis in which a near-neutral membrane replaces the anion-selective membrane was investigated for demineralizing both natural and synthetic brackish waters. When waters containing pH sensitive salts were demineralized, current densities up to and well above the economic optimum current density could be used without encountering the polarization-induced precipitation problems normally associated with conventional electrodialysis. With a high-sulfate water, on the other hand, the problems of calcium sulfate precipitation at high waste stream concentrations were similar for both transport depletion and conventional electrodialysis. Due to the fact that the near-neutral membranes used in the transport depletion experiments became cation-selective in dilute solutions, the current efficiencies ranged from 60 to 95% of that theoretically attainable. The properties of the near-neutral membrane also controlled the relative energy requirements of transport depletion, making them range from 63 to 110% of those for conventional electrodialysis with the same product flow rate per diluting compartment. Even with these membranes, however, overall demineralization costs with transport depletion with some waters will be lower than those for conventional electrodialysis. (Mintz-OSW)
W69-05156

SYNTHESIS AND EVALUATION OF NEW MEMBRANE CANDIDATES FOR APPLICATION IN REVERSE OSMOSIS,
Peninsular Chem Research, Gainesville, Fla.
Thomas W. Brooks, and Carl L. Daffin.
Office of Saline Water Research and Development Progress Report No. 385, Jan 1969, 40 p. OSW 14-01-0001-1260.

Descriptors: *Reverse osmosis, *Semipermeable membranes, Desalination, Desalination processes, Demineralization, Membranes, Permselective membranes, Osmosis, Films, Membrane processes, Plastics, Thin films.
Identifiers: Block copolymers, Graft copolymers.

Block copolymers were synthesized from peroxycarbamate-terminated poly (ethylene oxide) and the vinyl monomers styrene, methyl methacrylate, and acrylonitrile. Transport coefficients were determined for membranes fabricated from these block copolymers and it appears that they are relatively insensitive to the structure of the hydrophobic cosegments. The morphology of the poly (ethylene oxide) phase in these block copolymers was found to be an important factor insofar as water permeability is concerned. A substantial increase in the crystallinity of the poly (ethylene oxide) phase, which can be detected calorimetrically, is accompanied by a substantial decrease in water permeability. Compaction of a PEO/styrene block copolymer membrane during testing under reve osmosis conditions resulted in a significant increa in selectivity with only a slight decrease in wa permeability. These membranes, even after co paction, are one to two orders of magnitude fas than dense cellulose acetate membranes. Prelim nary studies on styrene grafted syndiotactic po (vinyl alcohol) films indicate that membranes this type are at least as water permeable as cel lose acetate, although much less selective. T Kedem-Katchalsky system for evaluating per selective membranes, which is based on the the ries of non-equilibrium thermodynamics, has be found to be most useful as a guide in evaluation st dies. (Kindley-OSW)
W69-05157

3B. Water Yield Improvement

WEATHER MODIFICATION, PRESENT AN FUTURE,
Travelers Insurance Co, Hartford, Conn.
Thomas F. Malone.
J Amer Water Works Ass, Vol 60, No 10, pp 114 1148, Oct 1968. 6 p.

Descriptors: *Weather modification, *Weath Atmosphere, Winds, Atmospheric precipitatio Temperature, *Energy conversion, *Effects, En gy, Storms, Storm structure, Mathematical mode Meteorology, Simulation analysis, Social impa Forecasting, Cloud seeding, Legal aspects, Arti cial precipitation.
Identifiers: Weather effect, Atmospheric researc

The atmosphere is a complex physical syste where movement of air, change in temperatu and transformation of water among liquid, sol and gaseous phases are taking place in response certain forces and through particular processe The quantities of energy involved in weath systems and processes occurring naturally in the a mosphere substantially exceed the quantities energy under the control of man. Two chara teristics of the atmosphere keep the outlook weather modification from being pessimistic: (an intrinsic tendency toward certain instabiliti and (2) the key role of the processes at the int face between the atmosphere and the underlyi surface in determining energy inputs into the a mosphere. Four scientific and technologic develo ments suggesting new horizons of research a given. The present state of the art is summarize Related problems that may arise because weather modification are discussed. (USBR)
W69-04717

WATER HOLDING CAPACITY OF PO DEROSA PINE FOREST FLOOR LAYERS,
Forest Service (USDA), Flagstaff, Ariz. Roc Mountain Forest and Range Experiment Station.
Warren P. Clary, and Peter F. Ffolliott.
J Soil and Water Conserv, Vol 24, No 1, pp 22-2 Jan-Feb 1969. 2 p, 1 fig, 1 tab, 11 ref.

Descriptors: *Forest soils, *Infiltration, *Storag Runoff, Humus, Soil water movement, Rainfall-r noff relationships, Forest management, S management, Excess water (Soils), Water conse vation, Water yield.
Identifiers: *Water retention.

The retention of water by 3 undisturbed forest flo layers was studied in an Arizona ponderosa pi forest. The 3 layers are the L layer of unaltered o ganic matter, the F layer of partly decomposed o ganic matter, and the H layer of well decompos organic matter. In the Beaver Creek watersh study area, north-central Arizona, the annu precipitation is 24 inches. Soils are developed fro basaltic volcanic materials and surface materia are clay loams. At each test location a 1 ft sq sa ple was isolated by pushing a metal frame throu the surface. About 4 gal of water was added, t surface was sealed to prevent evaporation, and t frame was left in place 24 hr for drainage. The i dividual layers were then weighed immediatel

after 24 hr drying at 105 deg c. Average water ined in the L layer was 0.003 in., in the F layer, in., and in the H layer, .075 in. It is estimated 1 in. of forest floor will hold 0.05 in. water, and additional in. of floor material will hold 0.07 f water. To reduce the ability of forest floors to water in a runoff-increasing program, the H must be removed or modified; the feasibility is is not presently known. (Knapp-USGS)
-04751

AL SPREAD OF THE EFFECT OF CLOUD DING AT THE WHITETOP EXPERIMENT,
fornia Univ., Berkeley. Dept. of Statistics.
y Neyman, Elizabeth Scott, and Jerome A.
h.
nce, Vol 163, No 3874, pp 1445-1448, Mar
. 4 p, 3 fig, 2 tab, 19 ref.

criptors: *Cloud seeding, *Statistics, Halides, densation, Evaporation, Weather modification, leation, Rain, Rainfall, Silver iodide, Artificial ipitation, Missouri, Arkansas, Synoptic analy-

tifiers: Whitetop Cloud-Seeding Experiment.

reference to arguments that weather modifi- n technology is sufficiently advanced for the ral government to finance cloud-seeding ations as a means of alleviating water tages, an analysis of the Whitetop rain stimula- experiment was performed. The average 24- precipitation in 6 concentric regions up to mi from the center of the target on 102 days of d seeding was less than that on the 96 experi- tal days without seeding. For distances less 30 mi, the apparent loss of rain due to seeding 32%. With the increase in distance, this ap- nt loss decreased to a minimum of 9% for s between 120 and 150 mi from the center. ever, the 48 gages at distances between 150 180 mi showed a 22% apparent loss of rain due eeding. The estimated average loss of rain in the whole region of about 100,000 sq mi was of what would have fallen without seeding. n a 5-yr experiment, expected to produce a 5 0% increase, shows a 20% decrease in rainfall, relevant technology does not appear reliable gh for practical use. (Knapp-USGS)
-04775

NOMICS AND THE CONSERVATION STION,
eton Univ., Ottawa (Ontario).
lon Scott.
nal of Law and Economics, Vol 1, pp 110-121, 1958. 12 p.

riptors: *Natural resources, *Conservation, opoly.
tifiers: *Capital investment, *Time distribu- Depletion, Fixed resources, Social costs, So- benefits, Ocean fisheries.

most distinct conclusion for policy that seems merge from an analysis of the conservation lem is that very little governmental inter- ice of an explicitly conservationist nature is d for. Better results would appear to follow activities designed to correct the institutional cts, so that the private decisions of resource are more likely to approximate the social . Such institutional developments are not easy ing about, but they are more fundamental, and promise of more enduring and satisfactory ions. Insofar as considerable misuse of natural urces stems from scientific and technical rance, the only remedial policy would seem to n efforts to increase our knowledge of both retical and applied science. The problem of tsightedness' of small producers due to inabili- borrow on or liquidate resource assets at factory prices is one which can be solved by ter development of the markets for capital s and for certain commodities. It is the com- property problem and the divergence between te and social costs and benefits that seem to be most worthy of the application of administrative and legal ingenuity. And it seems we are destined to attempt to devise such solutions first in the case which is probably the most difficult-ocean fisheries. Water developments at times conflict with conservation issues and this article is relevant to clarifying the economic problems involving both interests. (Sokoloff-Rutgers)
W69-04841

NET, ALLWAVE RADIATION AS AN INDEX OF NATURAL SNOWMELT AND SNOWMELT ACCELERATED WITH ALBEDO REDUCING MATERIALS,
Forest Service (USDA), Boise, Idaho. Intermountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 02C.
W69-05103

3C. Use of Water of Impaired Quality

COOLING WITH SEAWATER,
G. Heinemann.
Chemical Engineering, Vol 70, No 12, June 10, 1963, pp 188-189.

Descriptors: *Cooling, *Sea water, *Chlorination, Cooling water, Saline water, Water types, Chemical reactions, Tidal waters.

It is expected that the use of sea water for cooling should increase as the supply of fresh water becomes more and more limited. This article discusses materials for use in systems using sea water and water from tidal basins. The use of chlorine to prevent the growth of organisms in these systems is also discussed.
W69-04999

FACTORS AFFECTING BIOLOGICAL CLOGGING OF SAND ASSOCIATED WITH GROUND WATER RECHARGE,
Weizmann Inst. of Science, Rehovoth (Israel).
Z. Nevo, and R. Mitchell.
Water Research, Vol 1, No 3, pp 231-236, March 1967. 3 fig, 9 ref.

Descriptors: *Groundwater recharge, *Sands, *Degradation (Decomposition), *Soil microorganisms, *Rice, Microorganisms, Aerobic bacteria, Reclaimed water, Infiltration, Ponds, Waste water treatment, Environmental sanitation, Flooding, Hydrogen ion concentration, Microbiology, Water temperature, Percolation, Oxidation-reduction potential.
Identifiers: *Clogging, *Polysaccharides, Israel, Potential.

A major problem associated with ground water recharge is biological clogging of sand. Studies were conducted in Israel to obtain precise information concerning effects of environmental conditions on processes underlying clogging and reopening of sand beds. During flooding of waste water, clogging of sand beds by microbial polysaccharides appeared to be correlated with a decline in measured potential in the sand, which inhibited degradation of the polysaccharides. Periodic resting of infiltration ponds was found to be effective in unclogging sand beds, presumably by stimulating aerobic polysaccharide decomposition. Growth of paddy rice, which exudes oxygen from its roots, was found to be an effective means of keeping sand beds oxidized. It was suggested that pH adjustment could also be used to prevent polysaccharide accumulation. A correlation between water temperature and clogging was observed. (Affleck-Arizona)
W69-05075

3D. Conservation in Domestic and Municipal Use

PUBLIC PARKS - PLAYGROUNDS.
For primary bibliographic entry see Field 06E.
W69-04878

3E. Conservation in Industry

REPORT ON THE 1961 TRANSPORTATION RESEARCH AND SERVICE ACTIVITIES OF THE BUREAU OF COMMERCIAL FISHERIES,
Carl P. Hoffman, Jr., and Donald S. Fitzgibbon.
Branch of Economics, Bureau of Commercial Fisheries, Washington, D. C., Report No. 544, June, 1962.

Descriptors: *Transportation, *Commercial fishing, *Federal government, Fishing, Industries, Data collections, Statistics, Financial analysis, Analytical techniques, Commercial fish, Animals, Aquatic animals, Aquatic life, Fish, Wildlife, Commercial shellfish, Invertebrates, Shellfish, Costs, Regulation, Negotiations, Storage.

The activities reported upon include (1) participation in regulatory proceedings and (2) negotiations with carriers to obtain improvements in transportation rates, services, and facilities for the fishing industry. The research activities of the Transportation Section involve collection and analysis of financial and traffic data and study of the methods used in moving, terminal handling, packing, and storing of fish and shellfish. The work is carried on by the Transportation Section staff, by other Government agencies, and by private firms working under contract.
W69-05001

COMMERCIAL AND SPORT FISHERIES,
Interstate Commission on the Potomac River Basin, Washington, D. C.
Edgar H. Hollis.
In PROBLEMS OF THE POTOMAC ESTUARY, January, 1964, pp 23-27.

Descriptors: *Maryland, *Virginia, *Sport fishing, *Commercial fishing, *Productivity, Personnel, Market value, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Geographical regions, Northeast U. S., Regions, Commercial shellfish, Crustaceans, Invertebrates, Fish, Shellfish, Wildlife, Southeast U. S., Statistics, Data collections, Crabs, Finfish, Fishing, Industries, Recreation, Water sports, Animals, Aquatic animals, Aquatic life.

A general discussion of the fisheries of the Potomac Estuary is presented. The report contains estimates of the production capability of commercial fisheries, their value to the Potomac River and its tributaries during recent years, and estimates of the number of people participating in the commercial fishery. Estimates of sport fishing usage and catch based on surveys conducted in 1960 and 1961 by the Natural Resources Institute are given. It concludes that the commercial production of crabs and finfish in the Potomac Estuary is of a sizeable magnitude and in all probability can be maintained at the existing or at a slightly increased level for a long period of time. However, because of the economic conditions and trends generally prevailing in the inshore fishing industry, prospects for increasing the production and values for commercial species in the Potomac Estuary do not appear as great as for the other resources.
W69-05002

3F. Conservation in Agriculture

A CLIMATOLOGICAL-TECHNOLOGICAL METHOD FOR ESTIMATING IRRIGATION

WATER REQUIREMENTS FOR MAXIMUM CROP YIELDS,
Illinois State Water Survey, Urbana.
Stanley A. Changnon, Jr.
J Soil and Water Conserv, Vol 24, No 1, pp 12-15, Jan-Feb 1969. 4 p, 1 photo, 4 tab, 13 ref.

Descriptors: *Irrigation efficiency, *Irrigation water, *Crop production, Crop response, Regression analysis, Forecasting, Irrigation practices, Supplemental irrigation, Illinois, Consumptive use, Evapotranspiration, Climates, Weather, Rainfall, Temperature.
Identifiers: Irrigation water requirements.

A method is given for estimating irrigation water requirements, using regression analysis of weather and crop production data including preseason precipitation, monthly mean temperatures, and monthly precipitation. The data used are from Illinois for the period 1930-1963. The results of analysis are tabulated for the 12 regional subdivisions of Illinois in terms of % increase of yield, weather types, July-August conditions, and frequency of yield increase for given amounts of irrigation water. The frequency information is accurate enough to use in planning irrigation water supplies anywhere historical climate and yield data are available. (Knapp-USGS)
W69-04750

POPULATION, GROWTH RATE, AND MATURITY OF VEGETABLE CROPS IN RELATION TO SOIL SALINITY AND TEXTURE UNDER SPRINKLER AND FURROW IRRIGATION,
California Univ., Davis. Dept. of Water Science and Engineering; California Univ., Riverside.
For primary bibliographic entry see Field 021.
W69-05074

HYDROLOGIC MINI-CYCLE FOR SOIL MOISTURE AND SALT CONTROL IN IRRIGATED AGRICULTURE,
California Univ., Davis. Dept. of Water Science and Engineering.
Robert J. Miller.
Calif Agr, Vol 23, No 1, pp 8-11, Jan 1969. 3 fig.

Descriptors: *Soil moisture, *Salts, *Hydrologic cycle, *Solar distillation, *Plastics, Irrigation efficiency, Furrow irrigation, Moisture content, Evapotranspiration control, Evaporation control, Soil surfaces, Soil temperature, Cycles, Germination, Arid lands, Seeds.
Identifiers: *Salt control, Irrigation agriculture, Recycling.

A method which utilizes solar energy and clear plastic to recycle water from irrigated furrows to adjacent seed or plant beds was proposed for soil moisture and salt control in irrigation. Clear plastic canopies over the irrigated furrows prevented evaporation and maintained a moist seed bed for long periods of time. Harmful concentrations of soluble salts can also be redistributed within the bed by recycling water from the wetted furrow. Installation of the hydrologic minicycle system can be useful in areas of insufficient rainfall and high temperatures, especially where water is costly or of poor quality. Warmer soil temperatures found in the plant beds beneath the edge of plastic canopies could facilitate early spring seed germination when solar energy is available but outside air temperatures are still too low for a normal seeding date. (Affleck-Arizona)
W69-05076

OPERATING POLICIES FOR IRRIGATION SYSTEMS UNDER STOCHASTIC REGIMES,
Harvard Univ., Cambridge, Mass.
For primary bibliographic entry see Field 06A.
W69-05131

OPERATING POLICIES FOR IRRIGATION SYSTEMS UNDER STOCHASTIC REGIMES: DYNAMIC PROGRAMMING MODEL,
Harvard Univ., Cambridge, Mass.
For primary bibliographic entry see Field 06A.
W69-05132

OPERATING POLICIES FOR IRRIGATION SYSTEMS UNDER STOCHASTIC REGIMES: SEQUENTIAL LINEAR PROGRAMMING MODEL,
Harvard Univ., Cambridge, Mass.
For primary bibliographic entry see Field 06A.
W69-05133

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

CONTROL OF SUBMERSED AQUATIC WEEDS IN IRRIGATION CANALS BY DAILY APPLICATIONS OF LOW CONCENTRATIONS OF COPPER SULFATE,
Bureau of Reclamation, Denver, Colo.
Thomas R. Bartley.
Pap, Amer Soc Civ Eng Nat Meet Water Resour Eng, New Orleans, La, Feb 1969. 16 p, 3 tab, 5 ref, append.

Descriptors: *Copper sulfate, Sago pondweed, Water quality, Algicides, *Pondweeds, Algae, *Aquatic weed control, Operation and maintenance, Water temperature, Toxicity, Dosage, Aquatic weeds, *Herbicides, Canals, Irrigation canals, Weed control, Phytotoxicity, Irrigation operation and maintenance.
Identifiers: *Submersed weeds, *Filamentous algae.

A field experiment was started in 1966 to determine the effectiveness of daily applications of copper sulfate in low concentrations in controlling submersed aquatic weeds, and to study related factors in developing this technique for aquatic weed control. Factors other than herbicidal effectiveness considered include: (1) performance and maintenance of a copper sulfate feeding device, (2) appropriate size of copper sulfate crystals for the feeder, (3) schedule of copper sulfate feeding rates, (4) effects of copper sulfate on nontarget organisms, and (5) water quality and temperature. Results of the 3-yr field study show effective control of sago, leafy and horned pondweed, elodea, and filamentous green algae. Recommendations are given on materials and techniques for using copper sulfate control in canals. Copper sulfate appears to be the safest aquatic weed herbicide available in regard to toxicity to nontarget organisms. (USBR)
W69-04729

THE GENERAL POLICY OF THE IRANIAN MINISTRY OF WATER AND POWER IN DEVELOPMENT OF WATER RESOURCES,
Ministry of Water and Power, Tehran (Iran).
A. G. Bayani.
For the 8 Volume Proceedings, see Vol 2, No 9, Field 06B, W69-03305. Int Conf on Water for Peace, Wash, D C, Vol 6, pp 59-67 1968. 9 p.

Descriptors: *Water resources development, *Optimum development plans, *Water conservation, *Water allocation (Policy), Water policy, Water utilization, Inter-basin transfers, Multiple-purpose projects, Evaporation, Seepage, Water loss, Governments, Project planning, Regulation, Water demand.
Identifiers: *Iran, National water policy.

The general policy of the Iranian Ministry of Wa and Power is summarized. Surface waters retained in surface and underground reservo The possibility of artificial recharge by inspread basins and by building of small dams and drilling of recharge wells is being studied. The isting irrigation networks are being modified reduce water losses. River flow is transferred fr northern and southern slopes of Iran's plateau the central part. Some structures of this type h already been constructed, for example, Koohrang Tunnel which brings water to the cen plateau from some of the tributaries of the Kar River, flowing to the Persian Gulf. Because of extensive area covered by evaporitic formati many of the rivers which are fresh at their ori become saline due to dissolution of soluble sa Investigations in the Rezaien Lake Catchm Basin are concerned with this type of salin problem. These investigations are being expan to various regions of the country. Since 1962 se detailed groundwater surveys have been carr out in 14 regions. Detailed studies covering the tire country will take many years so a reconna sance program has been established. Many spri emerge from limestone formations in the Zag range. These indicate that in certain are limestone formations are capable of produc large quantities of water; it is necessary to vestigate them as sources of underground wa The central and southern regions of Iran covered by great salt marshes-the water table these regions ranges from 0 to 7 ft and, natura contains great amounts of salt (averaging fr 4000 to 17,000 mg/1). The quality and quantity waters existing below the surface of the Kavir largely unknown, but no doubt large amounts water enter these marshy lands. These flows m be controlled and limited. This loss and waste water by uncontrolled ganats must be prevent (Knapp-USGS)
W69-04753

FLOOD PLAIN INFORMATION, SANTA RIVER, SANTA FE, NEW MEXICO.
Corps of Engineers, Albuquerque, N. Mex.

Prepared for the city of Santa Fe. Corps Eng Flo Plain Rep, May 1968. 31 p, 11 fig, 11 plate, 9 tab

Descriptors: *Floods, *Flood damage, Flo plains, Flood control, Non-structural alternativ New Mexico, Maximum probable flood, Histo flood.
Identifiers: Santa Fe (N. Mex), Santa Fe Riv Standard project flood, Intermediate regio flood.

Flooding of the Santa Fe River, Santa Fe, N Mexico is described in a report of flood pl problems based on records of rainfall, runoff, a historical and present flood heights. Maps, pho graphs, profiles, and cross sections indicate the tent of flooding that has occurred and which m be expected to occur in the future. The informati is for use in study and planning ways to minim vulnerability to flood damages by control of flo plain use by zoning and subdivision regulations, t construction of flood protection works, or by co binations of these approaches. (Knapp-USGS)
W69-04783

FLOOD PLAIN INFORMATION, CROW RIVE ROCKFORD, MINNESOTA.
Corps of Engineers, St. Paul, Minn.

Prepared for village of Rockford. Corps Eng Flo Plain Rep, Feb 1968. 46 p, 10 fig, 8 plate, 7 tab.

Descriptors: *Floods, *Flood damage, Flo plains, Flood control, Non-structural alternativ Minnesota, Maximum probable flood, Histo flood.
Identifiers: Rockford (Minn), Crow River (Min Standard project flood, Intermediate regio flood.

looding of the Crow River, Rockford, Minnesota s described in a report of flood plain problems ased on records of rainfall, runoff, and historical nd present flood heights. Maps, photographs, rofiles, and cross sections indicate the extent of ooding that has occurred and which may be ex-ected to occur in the future. The information is or use in study and planning ways to minimize vul-erability to flood damages by control of flood lain use by zoning and subdivision regulations, the onstruction of flood protection works, or by com-inations of these approaches. (Knapp-USGS)
/69-04784

LOOD PLAIN INFORMATION, LOWER LAS EGAS WASH, CLARK COUNTY, NEVADA.
orps of Engineers, Los Angeles, Calif.

repared for Clark County. Corps Eng Flood Plain ep, Dec 1967. 23 p, 4 fig, 18 plate, 5 tab.

escriptors: *Floods, *Flood damage, Flood lains, Flood control, Non-structural alternatives, evada, Maximum probable flood.
lentifiers: Clark County (Nev), Las Vegas Wash, as Vegas (Nev), Standard project flood, Inter-ediate regional flood.

looding of Lower Las Vegas Wash, Clark County, evada is described in a report of flood plain roblems based on records of rainfall, runoff, and storical and present flood heights. Maps, photo-raphs, profiles, and cross sections indicate the ex-nt of flooding that has occurred and which may e expected to occur in the future. The information for use in study and planning ways to minimize ulnerability to flood damages by control of flood ain use by zoning and subdivision regulations, the onstruction of flood protection works, or by com-nations of these approaches. (Knapp-USGS)
/69-04785

LOOD PLAIN INFORMATION, MISSISSIPPI ND YAZOO RIVERS, VICKSBURG, MISSIS-IPPI.
orps of Engineers, Vicksburg, Miss.

repared for the city of Vicksburg and Warren ounty. Corps Eng Flood Plain Rep, June 1968. 37 9 fig, 22 plate, 7 tab.

escriptors: *Floods, *Mississippi River, *Flood mage, Flood plains, Flood control, Non-struc-ral alternatives, Mississippi, Maximum probable ood, Historic flood.
entifiers: Vicksburg (Miss), Yazoo River (Miss), andard project flood, Intermediate regional ood.

ooding of the Mississippi and Yazoo Rivers, icksburg, Mississippi is described in a report of ood plain problems based on records on rainfall, noff, and historical and present flood heights. aps, photographs, profiles, and cross sections in-cate the extent of flooding that has occurred and hich may be expected to occur in the future. The formation is for use in study and planning ways to inimize vulnerability to flood damages by control flood plain use by zoning and subdivision regula-ons, the construction of flood protection works, by combinations of these approaches. (Knapp-SGS)
/69-04786

LOOD PLAIN INFORMATION, SOUTH FORK F THE CROW RIVER, DELANO, MIN-ESOTA.
orps of Engineers, St. Paul, Minn.

epared for the village of Delano. Corps Eng ood Plain Rep, June 1968. 54 p, 21 fig, 6 plate, 7 b.

escriptors: *Floods, *Flood damage, Flood ains, Flood control, Non-structural alternatives, innesota, Maximum probable flood, Historic ood.
Identifiers: Delano (Minn), Crow River (Minn), Standard project flood, Intermediate regional flood.

Flooding of the South Fork of the Crow River, Delano, Minnesota is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-04787

CAN WE CONTROL THE ARCTIC CLIMATE,
P. M. Borisov.
Bull At Sci, Vol 25, No 3, pp 43-48, Mar 1969. 6 p, 1 fig, 1 tab.

Descriptors: *Climatology, *Climatic zones, *Arctic Ocean, *Arid lands, Arid climates, Atlantic Ocean, Water level, Sea level, Sea water, Basins, Water balance, Temperature, Temperature control, Population, Dams, Dam sites, Dam construction, Glaciation, Glaciers, Snowmelt, Ice breakup, Ice loads, Pacific Ocean.
Identifiers: Bering Strait Dam.

An examination is made by a Soviet climatologist of a means of warming the climate of Siberia and other northern regions for development by an expanding population. The construction of a dam across the Bering Strait is proposed, which would control the flow of warmer Atlantic water into the Arctic basin and drive the colder Arctic water into the Pacific Ocean through the Strait. Calculations made by the author indicate that 10-14 deg C increase in the surface water temperature as a result of water transfer, in the Arctic Basin and on the shores of Siberia and Alaska will not create any imbalance of the Antarctic ice-sheet, and the melting of the Greenland ice cap might cause the sea level to rise at a rate of 1.5 to 2.0 mm/year. Construction of the dam across the Bering Strait is considered technically feasible. (Gabriel-USGS)
W69-04790

THE DYNAMIC CHARACTER OF MULTIPURPOSE RIVER DEVELOPMENT: THE TVA EXPERIENCE,
Aubrey J. Wagner.
For 8 volume Proceedings see Vol 2, No 9, Field 06B, W69-03305. International Conference on Water for Peace, Vol 8, pp 611-618, 1968. Washington: U S Gov't Printing Office, 8 p, 1 map.

Descriptors: *Tennessee Valley Authority Project, Federal project policy, Water management (Applied), Multipurpose projects, Recreation, *Water resource development, Watershed management, *Resource development, Flood control, Transportation, Electric power, Nuclear energy, Water quality, Environmental effects.
Identifiers: Underdeveloped countries.

This paper discusses water resource development in the Tennessee Valley since the creation of TVA. Since the Tennessee Valley was an underdeveloped area in the early period of TVA, the paper emphasizes those features of the TVA experience which will be of assistance to the developing nations of the world. The water resource in its developed state becomes a basic tool of area development. The paper describes how multipurpose river development helps to break bottlenecks to economic progress. The paper shows that dam and reservoir construction creates new situations, physical and economic, which require attention. The paper points out that as economic and social growth take place within the watershed, accommodations are required both in regulating structures and in their operation. The paper stresses the desirability of unified management of the river control system and the shorelines of the reservoirs in order to achieve the highest public benefit. (Winn-Rutgers)
W69-04818

BARBER PURE MILK CO V YOUNG (OBSTRUCTION OF SURFACE WATER FLOW).
For primary bibliographic entry see Field 06E.
W69-04863

MCHENRY V FORD MOTOR CO (EROSION BY WATERS OF RESERVOIR).
For primary bibliographic entry see Field 06E.
W69-04864

STATE V ANDERSON (ACTION TO ESTABLISH FLOWAGE EASEMENT).
For primary bibliographic entry see Field 06E.
W69-04865

LIPPMAN V HUHN (RIGHT TO ESTABLISH PUBLIC DRAINAGE DITCHES).
For primary bibliographic entry see Field 06E.
W69-04866

RUBIN V STATE (DRAINAGE WATER DIVERSION).
For primary bibliographic entry see Field 06E.
W69-04868

LIBBY, MCNEIL AND LIBBY V ROBERTS (INTERFERENCE WITH NATURAL DRAINAGE COURSE).
For primary bibliographic entry see Field 06E.
W69-04872

LIABILITY, AS REGARDS SURFACE WATERS, FOR RAISING SURFACE LEVEL OF LAND,
For primary bibliographic entry see Field 06E.
W69-04873

FISCHER V TOWN OF ALBIN (TOWN MAY NOT ALTER DRAINAGE DISTRICT WITHOUT CONSIDERING RIGHTS OF DISTRICT LANDOWNERS).
For primary bibliographic entry see Field 06E.
W69-04874

LYTLE V PENNSYLVANIA RR (BRIDGE CONSTRUCTION AND OBSTRUCTION TO FLOW).
For primary bibliographic entry see Field 06E.
W69-04880

COUNTY CONTROL OF DAM CONSTRUCTION.
For primary bibliographic entry see Field 06E.
W69-04881

SEWERS AND DRAINS.
For primary bibliographic entry see Field 06E.
W69-04885

SAWYER V SHADER (OBSTRUCTION TO FLOW).
For primary bibliographic entry see Field 06E.
W69-04888

CRAWFORD V SPRINGVIEW CORP (SURFACE DRAINAGE OVER LOWER ADJACENT TRACT).
For primary bibliographic entry see Field 06E.
W69-04889

BISHOP V RICHARD (OBSTRUCTION OF DRAINAGE BY LOWER LANDOWNER).
For primary bibliographic entry see Field 06E.

W69-04890

GIBSON V SHARP (DRAINAGE DITCH RIGHT OF WAY)
For primary bibliographic entry see Field 06E.
W69-04891

GOTT V FRANKLIN (BARRICADE TO NATURAL SURFACE WATER FLOW).
For primary bibliographic entry see Field 06E.
W69-04892

DAVIS V ATLANTIC COAST LINE RR (DRAINAGE FLOW EASEMENTS).
For primary bibliographic entry see Field 06E.
W69-04893

MASON V LAMB (ACTION TO RECOVER DAMAGES FROM SURFACE WATER RUNOFF ONTO PLAINTIFFS' PROPERTY).
For primary bibliographic entry see Field 06E.
W69-04894

SCHMITT V KIRKPATRICK (DRAINAGE EASEMENT).
For primary bibliographic entry see Field 06E.
W69-04897

BENNETT V COUNTY OF EATON (CONCENTRATED DRAINAGE ONTO LOWER LANDS).
For primary bibliographic entry see Field 06E.
W69-04898

YOUNG V MOORE (LANDOWNERS RIGHT TO DRAIN EXCESS SURFACE WATER).
For primary bibliographic entry see Field 06E.
W69-04899

CLARK V CITY OF SPRINGFIELD (NUISANCE ABATEMENT SEWAGE AND SURFACE WATER).
For primary bibliographic entry see Field 06E.
W69-04900

SCAMP V STATE (ACTION FOR NEGLIGENT HIGHWAY CONSTRUCTION OBSTRUCTING NATURAL SURFACE WATER FLOW).
For primary bibliographic entry see Field 06E.
W69-04901

DE VORE FARMS V BUTLER HUNTING CLUB (DAMS AND OBSTRUCTION TO FLOW).
For primary bibliographic entry see Field 06E.
W69-04916

FLOOD PLAIN INFORMATION, CHARLOTTE AND NORTH LEE COUNTIES, FLORIDA.
Corps of Engineers, Jacksonville, Fla.

Prepared for Boards of County Commissioners of Charlotte and Lee Counties. Corps Eng Flood Plain Rep, May 1968. 42 p, 14 fig, 7 plate, 4 tab.

Descriptors: *Floods, *Flood damage, *Flood plains, Flood control, Non-structural alternatives, Florida, Maximum probable flood, Hurricanes, Coasts, Tides, Historic flood.
Identifiers: Standard project flood, Intermediate regional flood, Charlotte County (Fla), Lee County (Fla).

Flooding in Charlotte and northern Lee Counties, Florida is described in a report of flood problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-04918

FLOOD PLAIN INFORMATION, CAMPBELL CREEK, ANCHORAGE, ALASKA.
Corps of Engineers, Anchorage, Alaska.

Prepared for the Greater Anchorage Borough. Corps Eng Flood Plain Rep, June 1968. 55 p, 13 fig, 12 plate, 16 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, Alaska, Maximum probable flood.
Identifiers: Campbell Creek (Alaska), Anchorage (Alaska), Standard project flood, Intermediate regional flood.

Flooding of Campbell Creek, Anchorage, Alaska is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-04919

FLOOD PLAIN INFORMATION, PUPUKEA, OAHU, HAWAII.
Corps of Engineers, Honolulu, Hawaii.

Prepared for State of Hawaii and City and County of Hawaii. Corps Eng Flood Plain Rep, Oct 1968. 24 p, 3 fig, 20 plate, 3 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, Hawaii, Maximum probable flood, Historic flood.
Identifiers: Pupukea (Hawaii), Oahu (Hawaii), Standard project flood, Intermediate regional flood.

Flooding of Pupukea, Oahu, Hawaii is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-04920

FLOOD PLAIN INFORMATION, AGUA FRIA RIVER, MARICOPA COUNTY, ARIZONA.
Corps of Engineers, Los Angeles, Calif.

Prepared for County of Maricopa. Corps Eng Flood Plain Rep, Mar 1968. 31 p, 12 fig, 32 plate, 4 tab.

Descriptors: *Floods, *Flood damage, *Flood plains, Flood control, Non-structural alternatives, Arizona, Maximum probable flood, Historic flood.
Identifiers: Maricopa County (Ariz), Agua Fria River (Ariz), Standard project flood, Intermediate regional flood.

Flooding of the Agua Fria River, Maricopa County, Arizona, is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimiz vulnerability to flood damages by control of floo plain use by zoning and subdivision regulations, th construction of flood protection works, or by com binations of these approaches. (Knapp-USGS)
W69-04921

FLOOD PLAIN INFORMATION, CHESTE CREEK, ANCHORAGE, ALASKA.
Corps of Engineers, Anchorage, Alaska.

Prepared for Greater Anchorage Borough. Corp Eng Flood Plain Rep, June 1968. 56 p, 16 fig, 1 plate, 18 tab.

Descriptors: *Floods, *Flood damage, *Floo plains, Flood control, Non-structural alternative Alaska, Maximum probable flood.
Identifiers: Chester Creek (Alaska), Anchorag (Alaska), Standard project flood, Intermediate re gional flood.

Flooding of Chester Creek, Anchorage, Alaska described in a report of flood plain problems base on records of rainfall, runoff, and historical an present flood heights. Maps, photographs, profile and cross sections indicate the extent of floodin that has occurred and which may be expected t occur in the future. The information is for use i study and planning ways to minimize vulnerabilit to flood damages by control of flood plain use b zoning and subdivision regulations, the construc tion of flood protection works, or by combinatio of these approaches. (Knapp-USGS)
W69-04922

FLOOD PLAIN INFORMATION, CHAGRI RIVER, LAKE AND CUYAHOGA COUNTIE OHIO.
Corps of Engineers, Buffalo, N. Y.

Prepared for Ohio Dept of Nat Resources, Div o Water. Corps Eng Flood Plain Rep, July 1968. 5 p, 35 fig, 12 plate, 15 tab.

Descriptors: *Floods, *Flood damage, *Floo plains, Flood control, Non-structural alternative Ohio, Maximum probable flood, Historic flood.
Identifiers: Cleveland (Ohio), Lake Count (Ohio), Cuyahoga County (Ohio), Chagrin Rive (Ohio), Standard project flood, Intermediate re gional flood.

Flooding of the Chagrin River, Lake and Cuyahog Counties, Ohio is described in a report of floo plain problems based on records of rainfall, runof and historical and present flood heights. Maps photographs, profiles, and cross sections indicat the extent of flooding that has occurred and whic may be expected to occur in the future. The infor mation is for use in study and planning ways t minimize vulnerability to flood damages by contro of flood plain use by zoning and subdivision regula tions, the construction of flood protection works or by combinations of these approaches. (Knapp USGS)
W69-04923

FLOOD PLAIN INFORMATION OF PURPL CREEK IN VICINITY OF JACKSON, MISSIS SIPPI.
Corps of Engineers, Mobile, Ala.

Prepared for Jackson City Planning Board. Corp Eng Flood Plain Rep, June 1968. 34 p, 6 fig, 1 plate, 11 tab.

Descriptors: *Floods, *Flood damage, *Floo plains, Flood control, Non-structural alternatives Mississippi, Maximum probable flood.
Identifiers: Jackson (Miss), Purple Creek (Miss) Standard project flood, Intermediate regiona flood.

Flooding of Purple Creek, Jackson, Mississippi i described in a report of flood plain problems base

n records of rainfall, runoff, and historical and resent flood heights. Maps, photographs, profiles, nd cross sections indicate the extent of flooding at has occurred and which may be expected to ccur in the future. The information is for use in udy and planning ways to minimize vulnerability flood damages by control of flood plain use by ning and subdivision regulations, the construc- on of flood protection works, or by combinations these approaches. (Knapp-USGS)
69-04924

LOOD PLAIN INFORMATION, CUYAHOGA IVER, BIG CREEK AND TINKERS CREEK, UYAHOGA COUNTY, OHIO.
orps of Engineers, Buffalo, N. Y.

epared for Ohio Dept of Nat Resources, Div of ater. Corps Eng Flood Plain Rep, July 1968. 61 61 fig, 16 plate, 13 tab.

escriptors: *Floods, *Flood damage, *Flood ains, Flood control, Non-structural alternatives, hio, Maximum probable flood, Historic flood.
entifiers: Cleveland, Cuyahoga River, Big Creek, nkers Creek, Cuyahoga County, Standard pro- ct flood, Intermediate regional flood.

ooding of the Cuyahoga River, Big Creek, and nkers Creek, Cuyahoga County, Ohio is scribed in a report of flood plain problems based records of rainfall, runoff, and historical and esent flood heights. Maps, photographs, profiles, d cross sections indicate the extent of flooding at has occurred and which may be expected to cur in the future. The information is for use in udy and planning ways to minimize vulnerability flood damages by control of flood plain use by ning and subdivision regulations, the construc- on of flood protection works, or by combinations these approaches. (Knapp-USGS)
69-04925

LOOD PLAIN INFORMATION, BLACK AWK CREEK, BLACK HAWK COUNTY, WA.
orps of Engineers, Rock Island, Ill.

orps Eng Flood Plain Rep, Dec 1968. 55 p, 36 fig, plate, 11 tab.

escriptors: *Floods, *Flood damage, *Flood ains, Flood control, Maximum probable flood, ood forecasting, River forecasting, Flood protec- n, Hydrograph analysis, Flood plain zoning, wa.
entifiers: Black Hawk Creek (Iowa), Standard oject flood, Intermediate regional flood.

ooding of the Black Hawk Creek, Iowa, is scribed in a report by the U. S. Corps of En- neers based on the systematic collection of runoff d rainfall data beginning with March 1929. aps, photographs, profiles, cross sections, and ates indicate the extent of flooding that has oc- rred and which may be expected to occur in the ture. In general, the report should be of value in e study and planning of ways to minimize the in- nsity of flood damage by control of the flood ain using zoning and subdivision regulations. abriel-USGS)
69-04926

QUATIC PLANT NUISANCES,
terstate Commission on the Potomac River sin, Washington, D. C.
harles K. Rawls.
PROBLEMS OF THE POTOMAC ESTUARY, nuary, 1964, pp 51-56.

escriptors: *Maryland, *Virginia, *Aquatic eds, *Vegetation effects, *Aquatic weed con- l, Aquatic plants, Appalachian Mountain region, lantic coastal plain, Coastal plains, Geographical gions, Northeast U. S., Regions, Southeast U. S., quatic life, Plants, Weeds.

The author presents a brief discussion of the two introduced water-plant nuisances in the Potomac Estuary, the water chestnut (Trapa natans L.) and the Eurasian water nilfoil (Myriophyllum spicatum L.). He discusses the problems posed by their occurrence, the extent of infestation, and current control methods and their effectiveness.
W69-05043

REVIEW REPORT ON JAMES RIVER, VIRGINIA.
U. S. Army Engineer District, Norfolk, Corps of Engineers, Norfolk, Virginia, 2 Volumes, January, 1962.

Descriptors: *Rivers, *Channel improvement, *Virginia, *Cost-benefit analysis, Aquatic life, Aquatic animals, Waste disposal, Transportation, Harbors, Benefits, Fish, Wildlife, Animals, Costs, Surveys, Bodies of water, Running waters, Streams, Surface waters, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Geographical regions, Regions, Southeast U. S.

The purpose of this survey report is to determine the need and justification for the further improvement of James River from its mouth at Hampton Roads to the deep water terminal at Richmond, Virginia, a nautical distance of 86.4 miles. The study has included hydrographic surveys of those sections of the river where natural depths are less than 37 feet; topographic surveys of lands to be cut away in widening the existing channel; outlines of prospective shore areas for disposal of dredged material; planning of channel improvements and estimates of quantities, and costs therefore; and complete economic data to determine savings and benefits to accrue to existing and potential shipping. Two plans for further improvement of the channel are presented. The detailed design and cost estimates for channel improvements and a report on the considered navigation channel improvements in relation to fish and wildlife resources of James River are given in Volume 2.
W69-05045

A GUIDE TO THE CONSERVATION OF SHORELINES, SUBMERGED BOTTOMS AND SALTWATERS WITH SPECIAL REFERENCE TO BULKHEAD LINES, DREDGING AND FILLING,
Florida State Board of Conservation, St. Petersburg. Marine Lab.
Kenneth D. Woodburn.
Educational Bulletin No. 14, September, 1963.

Descriptors: *Conservation, *Shores, *Beds, *Saline water, Landfills, Land development, Dredging, Bulkhead line, Water types, Standards, On-site investigations, Maps, Publications, Florida, Atlantic coastal plain, Coastal plains, Geographical regions, Gulf coast plain, Regions, Southeast U. S.

A guide is presented for evaluating marine productivity and adopting standards for waterfront development. Some of the factors considered include: the use of field inspection, interviews and consultation, and publications and maps. Guidelines that were developed for Manatee County by the Florida Board of Conservation for establishment of bulkhead lines are listed. The approach suggested appears to be based primarily upon the making of qualitative judgments rather than evaluation of economic 'trade-offs'.
W69-05068

INTERRELATIONSHIP BETWEEN PHYSIOGRAPHY, HYDROLOGY, SEDIMENTATION, AND SALINIZATION OF THE LODDEN RIVER PLAINS, AUSTRALIA,
Geological Survey of Australia, Melbourne.
For primary bibliographic entry see Field 02A.
W69-05079

EFFECTS OF SEEDBED TREATMENT ON GRASS ESTABLISHMENT ON LOGGING ROADBEDS IN CENTRAL IDAHO,
Forest Service (USDA), Boise, Idaho. Intermountain Forest and Range Experiment Station.
Walter J. Kidd, Jr., and Harold F. Haupt.
U.S.D.A. Forest Serv. Res. Pap. INT-53, 1968, 9 pp, illus.

Descriptors: *Erosion control, *Soil stabilization, *Vegetation establishment, *Roads, *Planting management, Fertilization, Seeds, Grasses, Mulching, Watershed management, Conservation.
Identifiers: *Scarification, Slope aspect, Logging (Forest).

Deep and shallow scarification treatments, before and after broadcasting seed, were studied to determine if they would be conducive to establishment of a heavier stand of grass than could be obtained by merely broadcasting seed. Mulching with wood chips and fertilizing were also tried. Results show a slight advantage for deep scarification before seeding. Three of five perennial species became well established; the other two did poorly. Crested and intermediate wheatgrass and smooth brome produced good cover; timothy and bulbous bluegrass produced sparse cover. Establishment of seedlings was significantly affected by site aspect and mulch.
W69-05096

CONTROLLING SOIL MOVEMENT FROM STEEP ROAD FILLS,
Forest Service (USDA), Boise, Idaho. Intermountain Forest and Range Experiment Station.
Nedavia Bethlahmy, and Walter J. Kidd, Jr.
U.S.D.A. Forest Service Res. Note INT-45, 1966, 4 pp.

Descriptors: *Roads, *Bank protection, *Vegetation establishment, *Erosion control, *Planting management, *Soil stabilization, Seeds, Fertilizers, Mulching, Grasses, Sediments, Erosion.
Identifiers: *Netting (Soil cover).

Eight test plots were established on the fill slope of a newly constructed road. One plot was retained as a control, while different soil-stabilizing treatments were used on each of the other plots. These consisted of various combinations of seeding, fertilizing, mulching, and surface netting. Treatments that included both straw mulch and netting effectively controlled erosion.
W69-05105

PROBABLE MAXIMUM PRECIPITATION OVER SOUTH PLATTE RIVER, COLORADO AND MINNESOTA RIVER, MINNESOTA,
Weather Bureau, Silver Spring, Md.
John T. Reidel, Francis K. Schwarz, and Robert L. Weaver.
Hydrometeorological Report No. 44, January 1969. 114 p, 10 tab, 18 fig, 7 ref.

Descriptors: *Probable maximum precipitation, *Design criteria, *Weather patterns, Snowmelt, Water control.
Identifiers: South Platte River (Colorado), Minnesota River (Minnesota).

In this report meteorological criteria are given for planning and design of spillways and other water control structures within two drainages: (a) South Platte River above Chatfield Dam site, Colorado; (b) Minnesota River, Minnesota. The report is one of 44 similar major reports that have been mostly prepared for and financed by the Corps of Engineers. Estimates of probably maximum precipitation (PMP) are given for each river basin and selected subbasins. Durations of rainfall are up to 3 days. Seasonal variation of PMP is given in order that the combined snowmelt and rain flood can be evaluated. Critical sequences of snowmelt winds and temperatures are given for the springtime PMP storm and for several prior days. Areal distribution of rainfall during the PMP storm is given by

average depths over subbasins in the case of the South Platte River Basin and by isohyetal maps for each subbasin of interest in the Minnesota River Basin. (Strahl-ESSA)
W69-05158

REDDMANN V REDDMANN (OBSTRUCTION TO SURFACE WATER FLOW).
For primary bibliographic entry see Field 06E.
W69-05174

ROBINSON V BELANGER (SURFACE WATER DRAINAGE RIGHTS).

332 Mich 657, 52 NW 2d 538-542 (1952).

Descriptors: *Michigan, *Runoff, *Earth dams, *Obstruction to flow, Riparian rights, Riparian lands, Lakes, Surface runoff, Precipitation excess, Surface drainage, Rainwater, Storm runoff, Drainage water, Easements, Boundaries (Property), Judicial decisions, Legal aspects, Ownership of beds, Abatement, Relative rights, Remedies.

Plaintiff brought action to enjoin construction of an embankment which prevented the waters of a lake from flowing upon the premises of the plaintiff and, at the same time, prevented surface water drainage from the plaintiff's premises into the lake. The lower court ordered removal of the entire embankment, noting that it impounded the lake waters and would tend to cause stagnation. The reviewing court found that the plaintiff had no riparian rights, and thus had no standing to seek relief on the grounds used by the lower court. However, plaintiff could assert interference with a servitude, existing in favor of the upper estate, permitting the natural flowage of surface water over and upon the lower tract. The court remanded the case for a determination of the size of the opening which would be required to permit surface waters to flow into the lake. (Katz-Fla)
W69-05177

WATTERS V NATIONAL DRIVE-IN (SURFACE WATER DRAINAGE DAMAGE).
For primary bibliographic entry see Field 06E.
W69-05178

CAPES V BARGER (DAMAGES CAUSED BY DAM TO REPEL SURFACE WATERS).
For primary bibliographic entry see Field 06E.
W69-05181

H B CARTER V CHUQUATONCHEE CONSOLIDATED DRAINAGE DISTRICT (DRAINAGE DISTRICT DISSOLUTION).
218 So 2d 30-33 (Miss 1969).

Descriptors: *Mississippi, *Judicial decisions, *Drainage districts, *Consolidation, Governments, Legal aspects, Local governments, Leglislation, Canals, State governments, Drainage systems.
Identifiers: District consolidation.

Petitioners, property owners, sought to dissolve a consolidated drainage district which maintained and operated a drainage canal constructed by its three constituent drainage districts. Section 4733 Mississippi Code 1942 Annotated (1956) provides that any drainage district having no unmatured bonded indebtedness or assets may be dissolved after 3 years from the date of its creation. A prior constructed drainage canal in each constituent district is necessary for consolidation. The court denied petitioner's action for dissolution. The fact that the original drainage districts made improvements prior to their consolidation prevents the dissolution. Upon consolidation these improvements become an asset of the consolidated district. (Molica-Fla)
W69-05183

RIDDLE V BALTIMORE AND OHIO (FLOOD DAMAGE CAUSED BY INADEQUATE CULVERT).

73 SE 2d 793-809 (W Va 1952).

Descriptors: *Obstruction to flow, *West Virginia, *Flood damage, *Precipitation excess, Rainfall intensity, Judicial decisions, Damages, Rainfall, Railroads, Culverts, Rainfall disposition, Excessive precipitation, Rain gages, Runoff, Drainage, Impact (Rainfall), Surface runoff, Floods, Cloudbursts, Hydrographs, Storms, Climatology, Thunderstorms, Storm runoff, Remedies, Legal aspects.
Identifiers: *Act of God, Proximate cause.

Plaintiff brought suit for damages against defendant railroad for flooding of plaintiff's residential property allegedly due to the inadequacy of a culvert constructed by defendant through the fill in a roadbed. The culvert was insufficient to handle the drainage during an excessive rainfall. Defendant contended that the rainstorm constituted an independent intervening cause, breaking the chain of proximate causation between the negilgent act and the damage incurred. The court affirmed the lower court's holding that such rainfall should have been anticipated from the climatological history of the area. One who obstructs a natural watercourse will not be excused from liability for damages resulting therefrom on the theory of act of God, unless the act of God was the sole and proximate cause of the injury. That which reasonable human foresight, pains, and care should have prevented cannot be called an act of God. (Heckerling-Fla)
W69-05191

NASS V TOWN OF DUXBURY (DIVERSION OF FLOW BY CHANNEL OBSTRUCTION).

99 NE 2d 54-57 (Mass 1951).

Descriptors: *Massachusetts, *Riparian rights, *Alteration of flow, *Remedies, Channel flow, Judicial decisions, Beaches, Sands, Erosion, Water pollution, Land tenure, Deflection damages, Legal aspects.
Identifiers: *Burden of proof, *Expert testimony.

Plaintiff and defendant occupied opposite sides of a river which formed the boundary between their respective lots. The defendant created a sandy beach by dumping white sand into the watercourse. The sand blocked off one channel, causing a deflection of the flow into the other channel. Plaintiff claimed such deflection caused a scouring out and removal of a portion of his land. On appeal from a denial of defendant's motion for a directed verdict, the Supreme Judicial Court held that, in order to recover damages, the evidence had to establish a greater likelihood that injury was caused by the alleged nuisance than by some other force. A definite causal connection had not been established, and the lower court erred in refusing to direct a verdict for defendant absent such proof. (Harris-Fla)
W69-05197

DRUMMOND V FRANK (OBSTRUCTION OF SURFACE FLOW).

41 So 2d 268-273 (Ala 1949).

Descriptors: *Alabama, *Surface runoff, *Obstruction to flow, *Prescriptive rights, Surface waters, Water law, Relative rights, Judicial decisions, Surface drainage, Backwater, Storm drains, Ditches, Natural flow, Rain water, Storm runoff, Legal aspects.
Identifiers: Injunctions (Prohibitory), Standing, Injunctions (Mandatory).

Respondent owned property at the higher end of an alley which property was bordered by land owned by complainants. Only defendant and one complaint had a property interest in the alley. Complainants sued to enjoin respondent from further filling in the alley and to compel removal of materials a ready placed upon the alley; damages resulti from the obstruction of the natural flow of surfa water from complainants' lands were also soug The court below granted the relief prayed for a awarded damages to all complaints. The appella court reversed in part, holding that only the par with a property interest in the alley had a right action for injunctive relief and damages; eviden was insufficient to establish a prescriptive right the order complainants. The decree was affirmed so far as it adjudicated rights of those parties po sessing proprietary interests in the alley, and t case was remanded for proper assessment damages. (Wheeler-Fla)
W69-05200

4B. Groundwater Management

CONCEPTS IN GROUND WATER MANAGEMENT,
John F. Mann, Jr.
J Amer Water Works Ass, Vol 60, No 12, pp 133 1344, Dec 1968. 9 p, 22 ref.

Descriptors: *Groundwater, Groundwater minin Water quality, Thermal pollution, Aquife Groundwater flow, Groundwater movemer Groundwater basins, Groundwater recharg Salinity, Water reuse, Filtration, Quality contr Waste water treatment, Turbidity, Temperatu control, Waste water disposal, Water tabl Bibliographies, Safe yield.
Identifiers: *Groundwater management, Artifici replenishment, Groundwater hydrology.

The goals of ground-water management are part a general objective of serving present and futu demands for water at minimum cost and acceptab quality. The goals should be coldly practical, reco nizing that almost every use of water results some biological, chemical, or thermal deterior tion. In most basins the goal is continued usabilit The trend is toward better control of the amoun and patterns of extractions, augmenting recharg to ground storage, decreasing evapotranspirati waste or outflows that go to waste, controllin mineral and thermal pollution, intensifying use ground-water storage, and avoiding damage caus by high water tables or land-surface subsidenc Management objectives are aided by powerf computer techniques (developed mainly within t last 10 yr) that predict and test the effects of ma assumptions on the ground-water body. (USBR)
W69-04704

OPERATION OF A RECHARGE BOREHOLE,
Willcox, Raikes and Marshall, Consulting E gineers (Gt. Brit.).
J. K. Marshall, A. Saravanapavan, and Z. Spiegel. Inst Civ Eng Proc, Vol 41, pp 447-473, Nov 196 27 p, 9 fig, 8 ref, 5 append.

Descriptors: Boreholes, Conductivity, Recharg *Recharge wells, Theis equation, Aquifer Groundwater, *Groundwater recharge, Iron ba teria, Groundwater mining, Irrigation water, Wat supply, *Water wells, Wells, Irrigation well Suspended solids, Suspended sediments, Well f ters, Groundwater geology, Salt velocity method.
Identifiers: Foreign testing, Great Britain, We failures, Pumping tests.

A deep borehole was used as a source of irrigatio water for the Birmingham Racecourse, Wa wickshire, Great Britain, in the summer an recharged during the winter. Recharging the rel tively small amount of water abstracted for irrig tion, about 3.6 million gal/yr, was difficult. Exper ments were made to find the cause of the recharg failure. Measures to improve recharge pe formance were found, but before these could b fully implemented, the racecourse was sold for housing development and the borehole becam redundant. Borehole operations over a 2-1/2-y period are discussed and experiments describe Factors investigated include: (1) suspended matte

the borehole, (2) characteristics of recharge ter, and (3) presence of iron bacteria in the rehole. Experiments included salt injection and asurement of flow with a suspended conductivi- cell. Pumping records were analyzed, using Theis l Hantush equations, to interpret aquifer navior. The main conclusion is that the initial harge failure was caused primarily by solids posited on the face of the borehole or in pores mediately around the borehole. (USBR)
9-04723

ASTE WATER CONSERVATION AND NOVATION RESEARCH,
nsylvania State Univ., University Park.
primary bibliographic entry see Field 05D.
9-04748

E GENERAL POLICY OF THE IRANIAN NISTRY OF WATER AND POWER IN VELOPMENT OF WATER RESOURCES,
nistry of Water and Power, Tehran (Iran).
primary bibliographic entry see Field 04A.
9-04753

CH V WICK (PRIVATE OWNER MAY EN- IN COUNTY'S ATTEMPT TO USE GROUND- ATER ON OTHER THAN OVERLYING ND).
primary bibliographic entry see Field 06E.
9-04870

BRUZZO V ATLANTIC DREDGING AND NST CO (ACTION TO RECOVER DAMAGES R DISRUPTION OF UNDERGROUND REAM).
primary bibliographic entry see Field 06E.
9-04909

BRUZZO V ATLANTIC DREDGING CON- RUCTION CO (EXCAVATION DIVERTING DERGROUND WATERS).
primary bibliographic entry see Field 06E.
9-04910

C. Effects on Water of Man's Non-Water Activities

NTRIBUTION CONCERNING THE FLOW TES OF RIVERS TRANSPORTING DRAIN ATERS OF OPEN-CAST MINES,
sserwirtschaftsdirektion, Cottbus (East Ger- ny).
lter Golf.
Ass Sci Hydrol Pub No 76, Symp on Hydrol ects of Util of Water, Bern, Sept 25-Oct 7, 7, pp 306-316, 1968. 11 p, 6 fig, 3 tab.

scriptors: *Streamflow, *Flow characteristics, rip mines, *Mine drainage, Groundwater move- nt, Surface-groundwater relationships, Base w, Hydrographs, Hydrograph analysis, Dewater- , Stream gages, Discharge (Water).
ntifiers: Germany, DDR, Spree River (DDR).

e draining of the coal srip-mines of lower satia, Germany, and the effect on the hydrology the Spree River and its tributaries is discussed. e quantitative effects on the surface-discharge sed by lowering the groundwater table and ining the waters of the open-cast mines may be ided into a long-term increase or decrease of the al discharge rate which is related to depletion or lling the groundwater reservoir and into the alization of flow-rates which is related to an in- ase of retention and an improvement of the ab- bing conditions in the mining area. The in- ences may be quantified by a comparison of logous drainage areas with and without mining by an analysis of long-term observations of charge rates relating to the period before mining began. The results are only of local validity. However, based on these studies, it is possible to establish general principles for calculating the flow rates of rivers transporting open-cast mine drain waters. (Knapp-USGS)
W69-04956

SEDIMENT,
Interstate Commission on the Potomac River Basin, Washington, D. C.
For primary bibliographic entry see Field 04D.
W69-05029

4D. Watershed Protection

PREDICTION OF WATERSHED DEVELOPMENT SUCCESS OF LOCAL COMMUNITIES,
P. Thomas Cox.
For 8 Volume Proceedings see Vol 2, No 9, Field 06B, W69-03305. International Conference on Water for Peace, Vol 8, pp 772-779, 1968. Washington, D C: U S Government Printing Office, 8 p, 3 tab, 5 ref.

Descriptors: Environment, Watershed management, Forecasting.
Identifiers: *Watershed development, Discriminant analysis, Socio-economic variables, Local communities, Chance of success.

This paper reports the results of an intensive analysis of the performance of more than 180 upstream watershed development projects which were started by local citizens. Through the use of discriminant analysis, the watersheds were classified into four groups representing slow to fast rates of development. These groups were then separately analyzed to discover the basis for the observed difference. There was found to be a wide divergence in the ability of communities to inaugurate and carry to completion water development projects. Since planning funds are always scarce, the available funds should be allocated to those communities showing the ability to carry out water development projects. The ability to select the more adept areas could save a governmental water planning agency significant funds. Through the utilization of classification function coefficients developed by the discriminant program, 66 future communities needing water development projects were classified into groups predicted to achieve development with fast to slow rates. (Loeb-Rutgers)
W69-04822

SEDIMENTATION FROM A HYDRAULIC DREDGE IN A BAY,
Thomas R. Hellier, Jr., and Louis S. Kornicker.
Institute of Marine Science, Vol 7, 1962, pp 212-215.

Descriptors: *Dredging, *Silts, *Spoil banks, *Sediment transport, *Gulf coastal plains, Channel improvement, Fine textured soils, Pervious soils, Soil types, Texas, Central U. S., Coastal plains, Geographical regions, Regions, Southwest U. S., Inland waterways, Channels.

Red gravel was used to mark the movement of sediment after the dredging of a section of an intercoastal waterway near Arkansas Pass, Texas. The spoil was placed in 'spoil banks'. Eighteen months later a negligible amount of silt had by-passed the spoil island or was eroded from the island.
W69-05000

SEDIMENT,
Interstate Commission on the Potomac River Basin, Washington, D. C.
Paul W. McKee.
In Problems of the Potomac Estuary, January, 1964, pp 40-46.

Descriptors: *Soil erosion, *Surface runoff, *Construction, *Urbanization, *Maryland, Erosion, Sediment discharge, Sediment control, Runoff, Surface drainage, Drainage, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Geographical regions, Northeast U. S., Regions.

The control of erosion resulting from urban development has been largely ignored. This report presents some data to show the sediment yields of various areas in Maryland. Sediment yields from construction sites are from three to 100 times the average yield from rural areas.
W69-05029

EFFECTS OF SEEDBED TREATMENT ON GRASS ESTABLISHMENT ON LOGGING ROADBEDS IN CENTRAL IDAHO,
Forest Service (USDA), Boise, Idaho. Intermountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 04A.
W69-05096

EFFECT OF EXPOSURE AND LOGGING ON RUNOFF AND EROSION,
Forest Service (USDA), Boise, Idaho. Intermountain Forest and Range Experiment Station.
Nedavia Bethlahmy.
U.S.D.A. Forest Serv. Res. Note INT-61, 1967, 7 pp.

Descriptors: *Overland flow, *Erosion control, *Infiltration, *Infiltrometers, Rainfall intensity, Watershed managment, Accelerated erosion, Simulated rainfall, Sediments, Forest soils, Forest management.
Identifiers: *Logging (Forest), *Slope aspect.

High-intensity rainfall was applied artificially to plots on eight steep, forested areas in the Payette National Forest in central Idaho. Logged and unlogged sites on northeast and southwest exposures were represented equally. Results show that runoff and erosion are greater on southwest than on northeast exposures, and that even after careful logging, erosion increases on southwest but not significantly on northeast exposures.
W69-05104

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

SCIENTIFIC PARAMETERS OF MARINE WASTE DISCHARGE,
Harvey F. Ludwig, and Ben Onedera.
International Journal of Air and Water Pollution, Vol 7, No 2/3, May, 1963, pp 159-172.

Descriptors: *Water pollution, *Ecology, *Data collections, *Treatment facilities, Monitoring, Aquatic productivity, Plant growth, Nutrients, Productivity, Water treatment.

The article presents a discussion of a study undertaken by Engineering-Science, Inc., on behalf of the California State Water Pollution Control Board, for the 'assembly, collation, and critical review of the sizeable mass of marine monitoring data accumulated over the past decade, both for 'open' coastal waters and for 'restricted' waters such as estuaries and bays'. It presents conclusions on the meaningfulness and usefulness of specific types of measurements employed, the effects of monitoring program findings on design of treatment facilities, and the significance of information voids.
W69-05018

THE DIFFERENTIATION, ANALYSIS, AND PRESERVATION OF NITROGEN AND PHOSPHORUS FORMS IN NATURAL WATERS,
California Univ., Berkeley. Sanitary Engineering Research Lab.
David Jenkins.

Trace Inorganics in Water, Advances in Chemistry Series, Number 73, pp 265-280, Amer Chem Soc, Washington, DC, 1968. 2 fig, 6 tab, 20 ref.

Descriptors: *Water chemistry, *Nitrogen compounds, *Phosphorus compounds, Chemical analysis, Water analysis, Water chemistry, Eutrophication, Nitrogen, Ammonia, Nitrites, Nitrates, Organic phosphorus, Phosphates, Estuaries, Estuarine environment, Saline water, Water quality.
Identifiers: San Francisco Bay.

For waters of varying salinity, such as San Francisco Bay, techniques were developed for differential analyses of suspended and soluble organic nitrogen, ammonium-nitrogen, nitrite-nitrogen, nitrate-nitrogen; total and soluble phosphorus; soluble orthophosphate; and condensed phosphate. Certain modifications of standard methods were required. Samples preserved by storage (1) at 4 deg C, (2) at -10 deg C, (3) at 4 deg C with added 2 ml/liter of 5% sulfuric acid, and (4) at 4 deg C with mercuric chloride at 40 mg mercuric ions per liter were compared for periods of a few days to one month. For all forms of nitrogen, storage at 4 deg C with 40 mg mercury per liter was best but did not hold initial levels of organic nitrogen or nitrite-nitrogen as long as 30 days. Most satisfactory for phosphorus was storage at -10 deg C with mercury for 30 days or 4 deg C with mercury for a few days. Chloroform preservation for phosphorus caused marked reduction in soluble orthophosphate and accompanying increase in total soluble phosphorus. (McCoy-Wisconsin)
W69-05137

5B. Sources of Pollution

EFFECTS OF MULTIPLE USES OF WATERSHEDS ON WATER QUALITY,
Federal Water Pollution Control Administration, Washington, D. C.
John M. Rademacher.
J Amer Water Works Ass, Vol 60, No 11, pp 1247-1254, Nov 1968. 8 p.

Descriptors: *Multiple use, Effects, *Watersheds (Basins), Recreation, *Water quality, *Drainage basins, *Watershed management, Potable water, Operation and maintenance, Pollution abatement, Spilling, Contamination, *Water pollution, Sewage, Waste disposal, Waste treatment, Standards, Boats.
Identifiers: Federal Water Pollution Control Act, Pollution control, Federal-State cooperation, Contaminants.

Any definitive study of the effects of multiple uses of watersheds on water quality would consider all of the generally recognized uses--water supply, agriculture, navigation, and recreation. Controlling wastes from these activities is an over-present problem. The primary concern is the efficient design, operation, and maintenance of waste treatment plants. Federal and state control pressures for design and operation, development of training opportunities for waste treatment plant operations, technical experts for solving the many anomalies, and monetary incentives are key elements needed to close designing and operating gaps. Spill pollution is an ever-present threat to watersheds from a variety of potential sources. Legislative relief measures to accelerate developing a workable prevention program, further refinement of surveillance and notification for spill situations, and blending of a Federal-state government reaction capability, drawing heavily on industry, are program approaches applicable to all areas. Waste control from watercraft requires developing uniform regulations, effective onboard treatment or control systems, and shore-based support facilities. Solving pollution problems will be an important step toward the clean water goal. (USBR)
W69-04702

DETERMINATION, EVALUATION AND ABATEMENT OF COLOR IN TEXTILE PLANT EFFLUENTS,
Georgia Inst. of Tech., Atlanta. French Textile School.
R. K. Flege.
Supported in part by Textile Educ Found, Inc, and Ga Textile Mfg Ass, Inc. Water Resources Res Center Completion Rep WRC-0868, Georgia Inst Technol, Dec 1968. 59 p, 3 fig, 4 tab, 18 ref, 3 append. OWRR Project B-012-GA.

Descriptors: *Water pollution, *Dye releases, *Pollutants, *Textiles, Georgia, Color, Surfactants, Degradation (Stream), Biodegradation, Waste water disposal.
Identifiers: Coosa River, Conasauga River, Oostantaula River.

Data on quantities of dyestuffs and chemicals used by representative dyers and finishers of textile products in the Coosa River basin in Georgia were analyzed by graduate students. Processing chemicals yield an effluent of about 2,000 ppm, but maximum dyestuff content is only about 7 ppm in the effluent. Dyehouse effluent was colored only where the effluent was discharged periodically into a stream, or receiving lagoon, or a treatment plant; but color was reduced significantly by conventional waste treatment or aeration in sunlight. Many dyes are not responsive to treatment and conventional spectrophotometric methods were unsatisfactory for color evaluation of streams. Under severe drought conditions total flow in the Conasauga River may be composed entirely of textile mill effluent plus outfall from a modern waste treatment facility. Growth of the textile industry in the Coosa, Conasauga and Oostanaula River valleys may aggravate further the pollution problem. Treatment of textile wastes with surfactants may be an economically feasible means for abatement of pollution in streams where surfactants of the LAS type were a primary cause of foam and turbidity. The molecular structure of dyestuff significantly affects the rate of biological degradation with the azo linkage in some disperse dyes being degradable in conventional waste treatment systems. Anaerobic conditions were required for the reduction of the more hydrophobic dyes. Chemical methods for degrading dyes and chemicals in dyehouse effluents are suggested. Partial biological degradation of dye yielded colorless toxic aromatic amine metabolite with degradation of sludge. Tables show some possible degradation products from dyestuffs. (Vorhis-USGS)
W69-04756

UNUSUAL PHOSPHORUS SOURCE FOR PLANKTON ALGAE,
Texas A and M Univ., College Station. Dept. of Biology.
Walter Abbott.
Ecology, Vol 38, No 1, p 152, 1957.

Descriptors: *Phosphorus compounds, *Phytoplankton, *Water pollution sources, *Cycling nutrients, Algae, Analytical techniques, Clay loam, Clays, Colloids, Eutrophication, Impoundments, Lakes, Loams, Reservoirs, Texas.
Identifiers: Harris County, Tex, Polyphosphates, Organic phosphates.

Although Lake Houston, a newly impounding lake in eastern Harris County, Texas, supports phytoplankton populations fluctuating twenty-fold, phosphate-phosphorus in centrifugate from samples of water from ten stations was not demonstrable by a technique sensitive to 1 gamma/liter. In a series of 18 samplings, water containing colloidal matter, after oxidation with perchloric acid, contained a mean of 85 gamma/liter (range, 32-285), highest values occurring immediately after heavy rains. Filtrate from passage through Seitz no. 14 filter, similarly treated, showed only barely detectable traces of phosphate-phosphorus. Author offers these data as evidence that planktonic algae may derive nutritive phosphorus from complex polyphosphates or in the suspended colloidal clay, originating from soils of surrounding watershed without benefit of intermediate stage of dissolv phosphate. (Eichhorn-Wis)
W69-04800

CAIRO PICKLE CO V MUGGRIDGE (BRIN DISPOSAL POLLUTION BY UPPER RIPARIA OWNER).
For primary bibliographic entry see Field 06E.
W69-04857

COMMONWEALTH EX REL SHUMAKER NEW YORK AND PENNSYLVANIA CO, IN (JURISDICTION OF SANITARY WATE BOARD OVER STREAM POLLUTION).
For primary bibliographic entry see Field 06E.
W69-04887

MONTGOMERY LIMESTONE CO V BEARDE (ACTION TO ENJOIN POLLUTION OF STREAM BY QUARRY OPERATION).
For primary bibliographic entry see Field 06E.
W69-04911

SPARTAN DRILLING CO V BULL (INJUN TION TO CURE SALT WATER POLLUTIO AND INSECT BREEDING).
For primary bibliographic entry see Field 06E.
W69-04914

WATER POLLUTION BY OUTBOARD M TORS,
State Univ. of New York, Albany. Atmosphe Sciences Research Center.
For primary bibliographic entry see Field 02H.
W69-04936

THERMAL DISCHARGE BIBLIOGRAPHY,
State Univ. of New York, Albany. Atmosphe Sciences Research Center.
Mark W. Fenlon, Ronald Stewart, and Anne Hutchinson.
Final Rep No 3-The Role of Langmuir Circulati in Mixing of Lake George. Atmos Sci Res Cent Pub No 61, pp 53-68, Aug 1968. 16 p, 106 r Grant 14-01-0001-1036. OWRR B-008-NY (5).

Descriptors: *Bibliographies, *Thermal pollutio *Pollution abatement, Heated water, Therm powerplants, Temperature, Publications.
Identifiers: Thermal pollution bibliography (196 68).

A bibliography of articles, lectures and oth references to thermal discharges published in 19 and early 1968 is presented. Control of dischar of heat into the atmosphere and water, and the po sibilities of using waste heat for beneficial purpos are stressed. (Knapp-USGS)
W69-04937

ORGANIC POLLUTION OF NEW YORK HA BOR APPLICATION,
J. S. McCabe.
Water Pollution Control Federation, Journal, V 34, No 10, 1962, pp 987-998.

Descriptors: *Water pollution, *Dissolved oxyge *Harbors, *New York, *Sampling, *Analytic techniques, Mathematical models, Mathematic studies, Model studies, Appalachian Mountain gion, Geographical regions, Great Lakes regio Northeast U. S., Forecasting, Regions, Huds River, Bodies of water, Rivers, Running wate Streams, Surface waters, On-site investigations.

The relation between pollution and dissolved ygen in the New York Harbor is reviewed. Fi sampling programs and analytical studies are cluded in the review. Reference is made to a stu conducted in 1960 which developed a mathema cal model for predicting the dissolved oxyg

profile from the city line on the Hudson River to the Narrows.
W69-05026

ORGANIC POLLUTION OF NEW YORK HARBOR - THEORETICAL CONSIDERATIONS,
D. J. O'Connor.
Water Pollution Control Federation, Journal, Vol 34, No 9, September, 1962, p 905.

Descriptors: *Mathematical studies, *Biochemical oxygen demand, *Dissolved oxygen, *New York, *Hudson River, Treatment facilities, Oxygen demand, Appalachian Mountain region, Great Lakes region, Streams, Bodies of water, Rivers, Surface waters, Running waters, Northeast U. S., Regions, Geographical regions, Harbors.

The author presents a mathematical treatment of dissolved oxygen in the Hudson River and Upper Bay with respect to BOD loading from the various waste treatment plants. There is a good agreement between the observed values of dissolved oxygen and BOD to those obtained by using the mathematical model. Minimum dissolved oxygen occurred at the battery.
W69-05034

OXYGEN BALANCE OF AN ESTUARY,
D. J. O'Connor.
Journal of the Sanitary Engineering Division, Vol 86, No SA3, May, 1960, pp 35-55.

Descriptors: *Biochemical oxygen demand, *Dissolved oxygen, *Mathematical models, *Delaware River, Surface waters, Streams, Running waters, Rivers, Reaeration, Bodies of water, Interstate rivers, Mathematical studies, Model studies, Organic matters, Aeration, Aquatic plants, Aquatic life, Plants, Oxygen demand.

The dissolved-oxygen profile of rivers depends on the concentration of the organic material, its rate of oxidation, and the resulting rate of reaeration. The inter-relationship among geophysical and biochemical factors is described by a differential equation under a steady state condition. The proposed formulas defining the biochemical oxygen demand (BOD) decay and oxygen balance in an estuary agree reasonably with the observed data from the Delaware and James Rivers. The dissolved-oxygen profiles are more consistent and in better agreement than the BOD decay for these examples.
W69-05035

THE CALCULATION OF POLLUTION OF THE THAMES ESTUARY AS A THEORY OF QUANTIZED MIXING,
W. S. Preddy, and B. Webber.
International Journal of Air and Water Pollution, Vol 7, No 8, 1963, pp 829-843.

Descriptors: *Water quality, *Mathematical models, *Water pollution, *Mixing, *Foreign countries, Dissolved oxygen, Waste assimilative capacity, Mathematical studies, Model studies, Effluents, Discharge (Water), Organic wastes, Wastes, Thermal pollution, Reaeration, Nitrogen, Gases, Geographical regions, Regions.

This paper describes the mathematical methods which have been used to relate water quality in the Thames Estuary to the amount and nature of organic and thermal pollution discharges, the positions of discharge, rates of waste oxidation, reaeration rates, and the flow of water from tributaries and effluents. Water quality parameters employed are dissolved oxygen, ammoniacal nitrogen, and oxidized nitrogen.
W69-05041

PREDICTION OF TEMPERATURE IN RIVERS AND RESERVOIRS,
Jerome M. Raphael.
Journal of the Power Division, Vol 88, No P02, July, 1962, p 157.

Descriptors: *Thermal pollution, *Mathematical models, *Water temperature, *Weather data, *Inflow, *Discharge (Water), Water pollution, Water types, Heated water, Model studies, Thermocline, Heat transfer, Conduction, Radiation, Temperature, Water properties, Mathematical studies, Transfer, Standing waters, Impoundments, Rivers, Bodies of water, Running waters, Streams, Surface waters, Reservoirs, Lakes.

A procedure is presented for predicting the temperature of various water bodies from weather records, inflow and outflow characteristics, and the surface area and volume of the body of water. The method can be applied to shallow lakes, flowing streams, and detention reservoirs in which the thermocline is absent and water is stirred by wind or current. A numerical method is outlined which combines the atmospheric conditions such as air temperature, relative humidity, cloud cover, wind speed, and barometric pressure on short wave insolation and reflectance, long-wave radiation from atmosphere and water, evaporation, conduction, and advection. An example is given of the use of the method, which is easily adaptable to machine computation. The method should find application in the comparison of temperatures of streams with and without detention reservoirs and in the dissipation of heat from industrial sources in streams and lakes.
W69-05042

MATHEMATICAL MODEL FOR DISSOLVED OXYGEN,
R. V. Thomann.
Journal of the Sanitary Engineering Division, Vol 89, No SA5, October, 1963, pp 1-30.

Descriptors: *Dissolved oxygen, *Mathematical models, *Water quality, Sewage effluents, Mathematical studies, Model studies, Effluents.

A mathematical model for describing the time variation of dissolved oxygen in a finite number of sections in a body of water is presented. Systems analysis techniques are used, and the dissolved oxygen response equations resulting from the imposition of general input forcing functions are derived. Although the model as presented in its general form embodies all types of inputs and is capable of assessing the effects of any one time varying input in one section of the water body on the dissolved oxygen in any other section, the analytical model is presented for the case of DO variations in an estuary.
W69-05058

ESTUARINE WATER QUALITY MANAGEMENT AND FORECASTING,
Robert V. Thomann, and Matthew J. Sobel.
Journal of the Sanitary Engineering Division, Vol 90, No SA5, October, 1964, pp 9-36.

Descriptors: *Systems analysis, *Forecasting, *Water quality control, *Water pollution, Optimization, Linear programming, Water quality, Mathematical studies, Control, Quality control, Dissolved oxygen, Delaware River, Bodies of water, Interstate rivers, Rivers, Running waters, Streams, Surface waters, Water pollution control, Costs.

The basic techniques of systems analysis are applied to describing time and space variations of dissolved oxygen in an estuary. The results of the analysis are applied to the annual variation of dissolved oxygen in the Delaware estuary. The analysis is further extended to include the formulation for optimum (least cost) solutions when specific dissolved oxygen goals are given. This latter approach uses linear programming techniques.
W69-05059

FORECASTING HEAT LOSS IN PONDS AND STREAMS,
C. J. Velz, and J. J. Gannon.
Water Pollution Control Federation, Journal, Vol 32, No 4, April, 1960, p 392.

Descriptors: *Forecasting, *Heat balance, *Thermal pollution, *Water temperature, Thermal properties, Pressure, Physical properties, Vapor pressure, Radiation, Wind pressure, Heated water, Cooling, Water types, Streams, Bodies of water, Water pollution, Circulation, Convection, Evaporation, Industries, Water properties, Running waters, Ponds, Lakes, Standing waters, Hydrologic data, Meteorological data, Temperature.

The authors present a rational method for forecasting expected water temperature conditions in streams and ponds based on probability of occurrence of the controlling meteorologic and hydrologic variables. It is possible to evaluate temperature effects before constructing industries and steam power plants. Basic equations involve effect of evaporation, convection, radiation, atmospheric vapor pressure, wind velocity, and air temperature.
W69-05062

THE OCCURRENCE, EFFECTS, AND FATE OF OIL POLLUTING THE SEA,
For primary bibliographic entry see Field 05C.
W69-05070

MICROBIOLOGIC AND ESCHERICHIA COLI SEROLOGIC TRACING OF MICROBIAL POLLUTION,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
Paul J. Glantz.
Institute for Research on Land and Water Resources, Research Publication No. 56, University Park, Pa., Dec. 1968. 32 pp, 4 fig, 9 tab, 18 ref. 14-01-0001-983. OWRR Project A-010-PA.

Descriptors: *E. coli, *Waste water pollution, *Coliforms, *Aquatic microbiology, Sewage bacteria, Analytical techniques, Sewage effluent.
Identifiers: *Serogroups, *Tracing microbial pollution, Fecal coliform counts, Total coliform counts.

Total and fecal coliform counts of 15 miles of a creek and its tributaries indicated a higher summer and a lower winter level of microbial pollution. Bacteria counts per 100 ml at a number of sampling sites were fairly constant, but had extreme variations at 5-minute intervals on the same day as well as on different days. Serologic identification of the E. coli strains isolated at different sites in the creeks produced a variety of E. coli serogroups. Isolation of a specific E. coli serogroup along the course of the creek was considered evidence of a constant source of pollution. In a forestry plot, percolation of sewage effluent through the soil effectively reduced the number of total and fecal coliforms and led to the disappearance of E. coli serogroups. (Sink-Penn State)
W69-05155

FAIRES V DUPREE (WATER POLLUTION FROM ANIMAL WASTES).

197 SW 2d 735-738 (Ark 1946).

Descriptors: *Arkansas, *Hogs, *Animal wastes, *Water pollution, Cold springs, Farm wastes, Impaired water quality, Public health, Seepage, Damages, Legal aspects.
Identifiers: *Damages (Legal aspects).

Plaintiff brought action for damages resulting from the operation of a hog ranch in an unsanitary manner on land situated adjacent to plaintiff's property. The court found there was insufficient evidence to show an ascertainable monetary loss to plaintiff's spring from defendant's operation of a hog farm near plaintiff's land in such a manner that seepage from garbage washed down filling plain-

tiff's spring, polluting the water, and infecting it with maggots. However, evidence that plaintiff had periods of vomiting, nausea, and general debility presented a question for the jury as to whether plaintiff's illness was caused by the imposition of stench, flies, and filth or whether plaintiff was overstating the corrupting causes. Therefore, case was reversed and remanded for new trial. (Reed-Fla)
W69-05182

SOUTHLAND CO V MCDONALD (POLLUTION OF WATERCOURSE BY ESCAPED CRUDE OIL).

82 So 2d 448-450 (Miss 1955).

Descriptors: *Mississippi, *Water pollution, *Oil wastes, *Effluents, Flooding, Flood damages, Oily water, Natural streams, Organic wastes, Industrial waste, Oil reservoirs, Overflow, Pastures, Legal aspects, Judicial decisions.
Identifiers: *Game and Fish Comm'n Certificate, Refineries.

Plaintiff brought action for damages for pollution of watercourse caused by crude oil, which had escaped from defendant's refinery. Following the escape of large quantities of oil, plaintiff's land was overflowed and was covered in spots with this substance, and was ruined as pasture land for which it had been previously utilized. The court found that evidence that pollution had continued after notice by plaintiff and others to defendant supported an award of punitive damages. Further, a State Game and Fish Commission Certificate that, as of a date prior to the period sued for, defendant had been complying with rules and regulations on industrial waste effluent had no evidentiary value and was properly excluded. (Reed-Fla)
W69-05186

UNITED FUEL GAS CO V SAWYERS (WELL POLLUTION THROUGH PERCOLATING WATERS).

259 SW 2d 466-468 (Ky 1953).

Descriptors: *Kentucky, *Water wells, *Percolating waters, *Reasonable use, Precipitable water, Water pollution, Subsurface waters, Water law, Judicial decisions, Legal aspects, Water rights.
Identifiers: *American rule, Gas wells.

Plaintiff, landowner brought suit against gas company for contamination of a water well alleged to have been caused by a nearby gas well. This court, in reversing a lower court's judgment for the plaintiff, confined its decision to pollution of percolating waters. Percolating waters are those which ooze, seep, or filter through the soil beneath the surface, without a defined channel, or in a course that is unknown and not discoverable from surface indications without excavation for that purpose. Percolating waters are part of the earth itself with the same right of use and appropriation by the owner of the land. Kentucky law is in accord with the 'American Rule' that in the absence of negligence there is no liability if there was a 'reasonable use' of the property. Thus, where a defendant, in a legitimate manner, drilled a gas well on his property, and there was no proof that he should have anticipated injury to a well on plaintiff's adjoining land, nor any question of malice or waste on defendant's part, contamination of plaintiff's well fed by percolating waters was damnum absque injuria. (Reed-Fla)
W69-05187

ROUGHTON V THIELE KAOLIN CO (CHEMICAL POLLUTION BY UPPER RIPARIAN OWNER).

209 Ga 577, 74 S E 2d 844-848 (1953).

Descriptors: *Water pollution, *Georgia, *Riparian rights, *Relative rights, Water rights, Diversion, Industrial wastes, Chemical wastes, Pollution abatement, Prescriptive rights, Reasonable use, Remedies, Damages, Appropriation, Overflow, Legal aspects, Usufructuary right, Judicial decisions, Water law, Soil contamination effects, Non-navigable waters, Obstruction to flow.
Identifiers: Debris.

In 1947, defendant purchased a kaolin plant. Following the custom of the previous owner, he continued to divert the water from an unnamed, non-navigable stream for use in his plant. After such use, the water, polluted with chalk, chemicals and other debris, was returned to its natural channel. In 1950, plaintiff purchased a tract of land downstream from defendant's plant. Defendant's refuse gradually filled up the channel causing the polluted stream to overflow and to damage plaintiff's land. After unsuccessfully requesting abatement of this condition, plaintiff sued for damages. The court sustained defendant's demurrer and dismissed the petition. Plaintiff excepted and prosecuted this appeal. This court reversed the lower court and held plaintiff's allegations sufficient to state a cause of action. Riparian proprietors are entitled to have water come to their land in its natural and usual flow; pollution thereof constitutes trespass. The court held that a grantee, as well as the original owner has standing to seek abatement of the polluting activity and to recover damages. Such action will lie against the person initiating the pollution causing activity or his immediate or remote grantee. An action may be brought if a request to desist is ignored. (Gabrielson-Fla)
W69-05190

5C. Effects of Pollution

THE EFFECT OF PHOTOSYNTHESIS ON THE OXYGEN BALANCE IN A MIDWESTERN STREAM,
Iowa Univ, Iowa City. Dept. of Civil Engineering.
D. B. McDonald, W. L. Paulson, and C. A. Merritt.

OWRR Project A-016-IA. Iowa State Water Resources Res Inst Completion Rep, June 30, 1968. 27 p, 9 fig, 5 tab, 9 ref.

Descriptors: *Dissolved oxygen, *Photosynthesis, *Streams, *Iowa, Aquatic plants, Transpiration, Photosynthetic bacteria, Plankton, Phytoplankton, Oxygen demand, Chemical oxygen demand, Biochemical oxygen demand, Biochemistry, Light, Turbulence, Streamflow.
Identifiers: Iowa River.

The relation of photosynthesis to oxygen concentration in the Iowa River was studied by comparing dissolved oxygen with plankton counts, by plotting diurnal oxygen curves, and by studying photosynthesis in light and dark bottles. Photosynthetic oxygen production exceeds total respiration by a factor of 2. In the Iowa River, plankton counts were less than 500 organisms per ml 23% of the time above a dam in the study reach, and 13% of the time below the reservoir. Although the organic activity and total organic load of the stream are low, the results of study are comparable to studies of other rivers. (Knapp-USGS)
W69-04780

DISTRIBUTION, ENVIRONMENTAL REQUIREMENTS AND SIGNIFICANCE OF CLADOPHORA IN THE GREAT LAKES,
Ontario Water Resources Commission, Toronto, Biology Branch.
For primary bibliographic entry see Field 02H.
W69-04798

CALORIFIC VALUES OF SOME INVERTEBRATES IN LAKE MENDOTA, WISCONSIN,
Wisconsin Univ., Madison. Lab. of Limnology.
For primary bibliographic entry see Field 02H.
W69-04799

ALGAL GROWTH AQUEOUS FACTOR OTHER THAN NITROGEN AN PHOSPHORUS,
Robert A. Taft Sanitary Engineering Center, Cin cinnati, Ohio.
Kenneth M. Mackenthun, and William Marcus Ingram.
Publication No WP-24, Federal Water Pollutio Control Admin, Dept of Interior, Washington, DC 1966.

Descriptors: *Algae, *Bibliographies, *Eutrophica tion, *Plant growth, Analytical techniques, An tibiotics, Bioassay, Noron, Calcium, Chlorine Cobalt, Copper, Ecology, Environmental effect Grazing, Iron, Manganese, Molybdenum, Plan growth regulators, Predation, Productivity, Trac elements, Sodium, Viruses, Vitamins, Wate chemistry, Water pollution control, Water pollu tion sources, Water quality.
Identifiers: Autoinhibitors, Extracellular product Hormones, Auxins, Metabolites, Inhibition, Si icon, Vanadium, Zinc, Gallium.

Although researchers have emphasized the role i eutrophication of the major plant nutrients nitrogen and phosphorus, there is little doubt tha other chemical and biotic influences on productio of macrophytes and phytophankton are importan though poorly understood. This selected bibliog raphy of 399 entries, compiled for engineers an scientists confronted with applied control in vestigations related to pollutants, focuses attentio on such factors and their effects on algae. The re port is organized into sections, as follows, wit numbers of citations indicated: general reference 15; antibiotics, 31; autoinhibitors, 11; environmen tal factors, 25; extracellular products, 31; hor mones and auxins, 13; inhibiting metabolites, 24 predation and grazing, 24; general references o trace metals and compounds, 29; boron, 14; calci um, 2; chlorine, 5; cobalt, 7; copper, 5; gallium, 1 iron, 2; manganese, 5; molybdenum, 12; silicon, 7 sodium, 8; vanadium, 3; zinc, 17; mixed element 15; viruses and parasites, 11; vitamin assa methods, 22; vitamin occurrence, 22; organismi requirements for vitamins, 27; syntheses o vitamins, 11. Citations are dated from 1903 t 1966, of which 69 citations are from 1960-1966 (Eichhorn-Wis)
W69-04801

MINERAL REQUIREMENTS FOR TH GROWTH OF ANABAENA SPIROIDES I VITRO,
Oregon State Univ., Corvallis. Dept. of Botany.
Sherry L. Volk, and Harry K. Phinney.
Can J Bot, Vol 46, pp 619-630, May 1968. 4 fig, tab, 67 ref.

Descriptors: *Algae, *Analytical techniques *Bioassay, *Essential nutrients, *Nutrient require ments, *Phytoplankton, Aquatic algae, Aquati microbiology, Aquatic productivity, Cyanophyta Environmental effects, Eutrophication, Limnology Nitrogen compounds, Nitrogen fixation, Nuisanc algae, Nutrients, Phosphorus compounds Physiological ecology, Plankton, Oregon.
Identifiers: Klamath Lake.

Anabaena spiroides Klebahn isolated from Uppe Klamath Lake, Oregon, was cultured in Gerloff modification of Chu's No 10 medium. Variations o the concentrations of nutrients were studied t determine minimal requirements for maximum growth. Maximum growth in the nutrition test varied between 30 and 80 mg/litter dry weight. Iro provided in the alkaline-stable chelate ethylenediamine di-ortho-hydroxyphenylacetat was required in lower concentration (0.3 ppm than in Gerloff's medium (iron citrate, 1.2 ppm) The minimum concentration of nutrients providing for maximum growth: magnesium, 0.125 ppm phosphorus, 0.52 ppm; calcium, 10 ppm; sulfur, ppm; potassium, 2.5 ppm. Nitrogen was fixed by this organism. Urea inhibited growth (at 16 ppm nitrogen) while glycine might have stimulated growth. Carbonate did not affect growth. No requirement of minor elements was found for the amount of growth attained. (Fitzgerald-Wis)

/69-04802

ITROGEN AND PHOSPHORUS IN WATER; N ANNOTATED BIBLIOGRAPHY OF THEIR IOLOGICAL EFFECTS.
ublic Health Service, Washington, D. C.

ublic Health Service Publication No 1305, /ashington, D. C., 1965. 111 pp.

escriptors: *Bibliographies, *Eutrophication, Nitrogen compounds, *Nutrients, *Phosphorus ompounds, *Water pollution effects, Algae, nimals, Aquatic plants, Biomass, Fertilization, akes, Limnology, Midges, Nitrates, Nitrogen, itrogen cycle, Nitrogen fixation, Phosphates, hosphorus, Productivity, Standing crop, Streams, /ater Chemistry, Water pollution control, Water llution sources, Water quality.
entifiers: Ducks, Nitrate poisoning.

his selected and annotated bibliography of 171 itries was intended by its author for engineers and ientists who are faced with predicting limnologi- l changes resulting from plant nutrient loadings standing bodies of water, emphasizing critical ncentration values for algal development and ef- cts of fertilication upon aquatic life. It is indexed r major categories with numbers of citations in- cated as follows: algae, 86; animals, 4; chemistry, 2; eutrophication, 5; artificial fertilization, 32; fer- ization by ducks, 4; lakes, 18; midges, 1; nitrate oisoning, 8; nitrogen fixation by algae, 7; nitrogen d phosphorus, 194; organism standing crops, 11; gher aquatic plants, 6; production, 12. Dates ted range from 1918 to 1965 with 70 references om 1960-1965. Publication includes a general in- oduction, subject index, author index, and lists of finitions and equivalents at both beginning and d of the bibliography. (Eichhorn-Wis)
/69-04805

HE NEW POLLUTION,
ilbert V. Levin.
or 8 Volume Proceedings see Vol 2, No 9, Field 6B, W69-03305. International Conference on /ater for Peace, Vol 3, pp 934-41, 1968. Washing- n, D C: U S Government Printing Office.

escriptors: *Eutrophication, *Water pollution, Phosphates, *Nitrogen, Thermal pollution, ewage effluents, Sludge treatment, Sewage treat- en(.
entifiers: *New pollution, *Nutrient pollution, nlight, Agricultural runoff.

ike the water it afflicts, the shape of the pollution roblem constantly shifts and changes. The rela- vely recent and unanticipated emergence of trient pollution, or eutrophication, as a major roblem in lakes and estuaries around the world is prime example of this characteristic. Ironically, wage treatment, itself, produces this new form of llution. Furthermore, the more advanced the egree of sewage treatment, the greater the result- g load of nutritutional pollutants. This is because e organic material present in the sewage is more oroughly degraded with the result that the sub- quent affending nutrients are released as soluble inerals. Of principal concern are phosphate and trogen. A number of different approaches have een made toward removing eutrophying minerals om sewage effluent. The principal attempts nter upon dissolved nitrate and phosphate. The trophication problem has become so acute, and s persistence is so feared, that regulatory action quiring removal of phosphate from sewage ef- uent has been instituted at several cities in the nited States. Any rational approach to solving the trophication problem must include control of gricultural runoff. Furthermore, careful ecologi- l studies are needed to determine if the limitation f nutrients will produce or unmask other 'new pol- tants.' (Loeb-Rutgers)
/69-04828

SOUTHLAND V AARON (RIPARIAN OWNER'S ACTION FOR DAMAGES FROM OIL WASTE POLLUTION OF STREAM).
For primary bibliographic entry see Field 06E.
W69-04884

DIVELBISS V PHILLIPS PETROL CO (ACTION FOR DAMAGES TO DAIRY HERD BY STREAM POLLUTION).
For primary bibliographic entry see Field 06E.
W69-04902

W G DUNCAN COAL CO V JONES (PRESCRIPTIVE RIGHTS TO MINEWATER POLLUTION).
For primary bibliographic entry see Field 06E.
W69-04915

THERMAL DISCHARGE BIBLIOGRAPHY,
State Univ. of New York, Albany. Atmospheric Sciences Research Center.
For primary bibliographic entry see Field 05B.
W69-04937

1967: AN EXCEPTIONAL YEAR IN THE LIFE OF THE DE BERRE POND (FRENCH),
Centre National de la Recherche Scientifique, Marseille (France). General Biology and Ecology Lab.; EDF Hydraulic Group of South-Alps Region.
A. Kiener, and R. Longuemare.
La Houille Blanche (Rev of French Hydrotech Soc), No 8, pp 725-734, 1968. 10 p, 14 fig, 3 tab, 6 ref.

Descriptors: *Ponds, *Hydrologic properties, *Hydraulic properties, Model studies, Salinity, Temperature, Precipitation (Atmospheric), Water balance, Meteorological data, Winds, Evaporation, Industrial production, Water yield, Water supply, Tidal waters, Springs, Sea water.
Identifiers: France, Durance River, De Berre pond.

Hydrologic, chemical, and biological environments of De Berre pond, located near the city of Martigues, Southeastern France, were analyzed after the introduction of some industrial plants in the lower reaches of the Durance River. A model simulating the general environment of the De Berre pond was also constructed and its operation analyzed. The study shows the considerable effect of climatic, sea-water incursion, and other factors such as the Durance industrial plants, on the hydrologic, chemical, and biological characteristics of the De Berre pond. (Gabriel-USGS)
W69-04958

RISING ACTIVE WATER FLOW IN THE OSIRIS REACTOR POOL (FRENCH),
Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires' Societe Grenobloise d'Etude et d'Applications Hydrauliques (France).
B. Lerouge, J. P. Huffenus, and P. Lambert.
La Houille Blanche, (Rev of French Hydrotech Soc), No 8, pp 711-724, 1968. 14 p, 12 fig, 2 tab.

Descriptors: *Nuclear reactors, *Industrial water, *Hydraulic design, *Ponds, Industrial production, Radioactivity, Energy losses, Model studies, Design criteria, Water storage, Water temperature, Water treatment, Water properties, Water pollution, Irradiation.
Identifiers: *Scale model, France, Grenoble, Nuclear Research Center.

The authors describe the general problems encountered in designing the circulation pattern of the Osiris swimming pool type reactor of 50 MW output, in operation since 1966, and discuss the hydraulic research carried out on a 1:3 scale model at Sogreah, Grenoble. The model tests consisted of the following two phases: (1) a constant-temperature geometrical study using various Reynolds numbers, and (2) a study of the effect of temperature gradients on water density leading to an upward flow of active water in the system. The study shows that pool pollution rates under conditions present in the pool remain at an acceptable level. The tests confirm the reliability of the scale model approach to certain mixed convection problems in reactor operation. (Gabriel-USGS)
W69-04959

POLLUTION OF LONDON'S RIVER,
A. L. H. Gameson.
New Scientist (London), Vol 22, No 389, April, 1964, pp 295-298.

Descriptors: *Foreign countries, *Water pollution, *History, Water pollution sources, Water pollution effects.

The author presents a brief history and description of pollution conditions in the Thames estuary in the vicinity of London, including principal findings of 'a 15 year study of the causes and effects of variations in pollution conditions between Teddington and the sea'. The findings discussed are from a major study report entitled 'Effects of Polluting Discharges on the Thames Estuary', by the Thames Survey Commission and Water Pollution Research Laboratory.
W69-04993

EFFECTS OF HEATED DISCHARGES IN THE TEMPERATURE OF THE THAMES ESTUARY II,
A. L. H. Gameson, L. Hall, and W. S. Preddy.
Combustion, Vol 32, No 7, January, 1961, p 37.

Descriptors: *Mathematical models, *Heated water, *Thermal pollution, Heat transfer, Mixing, Mathematical studies, Model studies, Regions, Water pollution, Water types, Transfer, Tidal effects, Fresh water, Dispersion, Foreign countries, Geographical regions.

The paper presents a mathematical model for Thames Estuary to evaluate the effect of heated discharges on the excess temperature of the estuary. Effects of tidal movement, fresh water movement, process of longitudinal mixing, and dispersion have been used in the model. Three families of curves are prepared to evaluate the temperature distribution at various sections of the estuary due to heat discharging sources at different points of the estuary. Good correlation was achieved between calculated and observed results.
W69-04994

ON OYSTERS AND SULFITE WASTE LIQUOR,
Gordon Gunter, and Jack McKee.
Pollution Control Commission of the State of Washington, February, 1960.

Descriptors: *Oysters, *Water pollution, *Industrial wastes, *Sulfite liquors, *Pulp wastes, *Washington, Pollution abatement, Ecology, Water pollution control, Wastes, Sulfur compounds, Geographical regions, Pacific coast region, Pacific northwest U. S., Animals, Aquatic animals, Aquatic life, Benthic fauna, Benthos, Commercial shellfish, Shellfish, Invertebrates, Marine animals, Mollusks, Regions, Water quality, Standards.

Information dealing with the effects of sulfite wastes from pulp mills on the oyster industry of Washington is reviewed. Recommendations are made to the Pollution Control Commission pertinent to the adaption of water quality standards for water on or near oyster beds.
W69-04997

THE BIOLOGY OF POLLUTED WATERS,
H. B. N. Hynes.
Liverpool, England: Liverpool University Press, 1960.

Descriptors: *Water pollution effects, *Biological communities, *Ecology, Water pollution, Aquatic

environment, Aquatic microbiology, Impaired water quality, Pollutants, Water quality, Environment, Microbiology, Aquatic plants, Aquatic life, Plants, Aquatic animals, Animals, Aquatic habitats, Habitats.

This comprehensive treatment of the biology of polluted waters 'has summarized and codified the information that is available'. The book is largely limited to fresh water, and gives very little consideration to the biology of polluted estuarine waters. With regard to estuarine waters the author concludes that, 'Apart from the effect on migratory fishes there is little detailed information on the biological consequences of estuarine pollution'. The book was evidently written for ready comprehension of the basic principles by the lay reader, and would provide an admirable basic text for the subject of water pollution.
W69-05004

CULTIVATING FISH FOR FOOD AND SPORT IN POWER-STATION WATER,
R. B. Iles.
New Scientist, No 324, January, 1963.

Descriptors: *Thermal pollution, *Beneficial use, *Heated water, *Waste water (Pollution), *Fish stocking, Thermal power, Fish farming, Water sports, Sport fishing, Water pollution, Foreign countries, Geographical regions, Regions, Water types, Effluents, Liquids, Liquid wastes, Wastes, Agriculture, Stocking, Fish establishment, Recreation, Fishing.

The beneficial uses of thermal pollution for fish culture and recreational use are discussed. The possibility of raising of a number of non-indigenous species and ornamental fish in heated effluent is discussed. The author argues that British waters are generally too cold during the winter season to closely approach optimum productivity of fish growth.
W69-05006

ENVIRONMENTAL CHARACTERISTICS OF RARITAN BAY, A POLLUTED ESTUARY,
H. P. Jeffries.
Limnology and Oceanography, Vol 7, 1962, pp 21-31.

Descriptors: *Salinity, *Dissolved oxygen, *Nutrients, *New Jersey, *Water circulation, Temperature, Atlantic coastal plain, Coastal plains, Geographical regions, Northeast U. S., Circulation, Eutrophication.

Temperature, salinity, dissolved O2, PO4-P, and NO3-N in Raritan Bay, New Jersey, were determined over a 16-month period. Each reflects the circulation pattern in which sea water floods along the northern shore, enters a region of mixing with river discharge in the head of the bay, and then ebbs out along the southern shore. A combination of rich nutrient supplies arising from natural and domestic sources, plus a sluggish circulation, efficient nutrient regeneration mechanism, and scarcity of macroscopic algae combine to form an estuarine environment capable of supporting extremely dense plankton populations.
W69-05008

THE EFFECTS OF TEMPERATURE AND SALINITY ON MARINE AND BRACKISH WATER ANIMALS--I. TEMPERATURE,
O Kinne.
Oceanographers and Marine Biologists Annual Review, Vol 1, No I, 1963, pp 301-340.

Descriptors: *Salinity, *Temperature, *Bibliographies, *Brackish-water fish, *Marine fish, Ecology, Environmental effects, Chemical properties, Water properties, Water pollution, Marine animals, Animals, Aquatic animals, Aquatic life, Fish, Saline water fish, Wildlife.

The current literature is reviewed with regard to the effects of temperature and salinity on marine and brackish water animals. It is an ecological approach that includes relevant physiological data but excludes purely biochemical or biophysical aspects. It is noted that a complex correlation exists between salinity and temperature, since various antagonistic and synergistic effects have been identified. An extensive bibliography is provided.
W69-05011

STUDIES ON OYSTER MORTALITY IN RELATION TO NATURAL ENVIRONMENTS AND TO OIL FIELDS IN LOUISIANA,
J. G. Mackin, and S. H. Hopkins.
Institute of Marine Science, Publications, Vol 7, July, 1962, pp 1-131.

Descriptors: *Oysters, *Oil wastes, *Mortality, Southeast U. S., Regions, Gulf coastal plain, Animals, Benthos, Aquatic animals, Aquatic life, Benthic fauna, Commercial shellfish, Invertebrates, Marine animals, Mollusks, Shellfish, Geographical regions, Coastal plains, Louisiana, Organic matter, Wastes, Oil industry, Industries, Water pollution, Salinity, Chemical properties, Water properties, Water temperature, Temperature.

Field studies showed that oysters had a consistently high mortality rate throughout the warmer half of the year in the study area, and that mortality rate increased with salinity increase within this area. Within oil fields, the amounts of unsaponifiable carbon tetrachloride extractives were highest (up to 5.8 percent) in mud samples taken near bleedwater outlets and other known centers of pollution, and were correlated wtih high (up to 0.00578 percent) 'pentane and heavier hydrocarbons' as measured independently by a commercial laboratory. 'Hydrocarbon' content of mud and water was no higher in areas of high oyster mortality than in areas of low mortality. Bacteriological studies showed that crude oil and its fractions were rapidly destroyed by bacteria living in Louisiana bay muds. It was concluded that oil production factors of the kinds tested could not be responsible for the oyster mortalities spread throughout the large area where damage was claimed.
W69-05020

EFFECTS OF CIVILIZATION ON STRIPED BASS AND OTHER ESTUARINE BIOTA IN CHESAPEAKE BAY AND TRIBUTARIES,
R. J. Mansueti.
Gulf and Caribbean Fisheries Institute, Proceedings, Vol 14, 1962.

Descriptors: *Striped bass, *Aquatic productivity, *Fertilizer, *Maryland, Marine fish, Estuarine environment, Environmental effects, Productivity, Sport fisheries, Nutrient requirements, Fisheries, Atlantic coastal plain, Appalachian Mountain region, Animals, Aquatic animals, Aquatic life, Fish, Marine animals, Saline water fish, Sea basses, Wildlife, Agricultural chemicals, Bay, Regions, Northeast U. S., Geographical regions, Coastal regions.

The author states that the effects of civilization, some harmful, some wasteful, have not materially reduced the potential productivity of the Chesapeake estuary. The hypothesis is advanced that civilization and striped bass are compatible in that increasing fertilization by man may be directly responsible for the unusual increase in number and magnitude of dominant year classes. The problem of excessive and uncontrolled mineral fertilization in estuaries is discussed in relation to striped bass and other biota.
W69-05021

OBSERVATIONS ON THE RESPONSE OF SOME BENTHONIC ORGANISM TO POWER STATION COOLING,
S. Markowski.
Journal of Animal Ecology, Vol 29, No 2, 1960, pp 349-357.

Descriptors: *Powerplants, *Thermal pollutio *Temperature, *Cooling water, Chemical prope ties, Ecology, Salinity, Benthos, Aquatic life, A gae, Plants, Water properties, Water temperatur Outlets, Hydroelectric plants, Electric powe plants, Engineering structures, Industrial plant Structures, Afterbays, Water types, Intakes.

The author reports observations made on the se tling of benthonic organisms on experimental slat placed in the intake and in the outfall water of th power station located at the Cavendish Dock. Dat indicate that outfall area is more conducive t growth as the benthonic forms appear earlier tha in the intake. No algae growth was found in the i take, but there was very prolific growth in the ou fall. Specific composition of benthonic inve tebrates were similar in both intake and outfa slabs. In addition, denser animal populations wer found in the intake than in the outfall. Gener characteristics of the environments and the facto introduced by the power station into the aquat medium are discussed.
W69-05023

ECOLOGICAL EFFECTS OF SEWAGE POLLU TION IN BISCAYNE BAY, FLORIDA: SED MENTS AND THE DISTRIBUTION O BENTHIC AND FOULING MACRO-ORGAN ISMS,
J. K. McNulty.
Bulletin of Marine Science, Vol 11, No 3, 1961, p 394-447.

Descriptors: *Benthos, *Water pollution, *Florid Invertebrates, Amphipoda, Fouling, Stream biol gy, Ecology, Atlantic coastal plain, Coastal plain Geographical regions, Gulf coastal plain, Animal Crustaceans, Sewage disposal, Plants, Bacteri Sewage disposal, Plants, Bacteria, Sewage bacteri Regions, Southeast U. S., Marine microorganism Aquatic life, Aquatic microorganisms, Microorgan isms, Seston, Outlets, Aquatic animals.

Harmful and fertilizing effects of sewage i Northern Biscayne Bay, Florida, were establishe by the quantitative distribution of benthic and fou ing macro-organisms. Harmful effects, as indicate by absence of benthic life, were limited to withi 200 yards of sewage outfalls, in greater tha average depths. Fertilizing effects, as measured b abundance of benthic life, were most pronounce in a narrow band roughly 200 to 600 yards fro sewage sources in shallow water with good tidal ci culation and where the bottom consisted of fir sandy mud. The fouling organisms in highly po luted waters (greater than 10,000 MPN) wer mainly tubiculous amphipods.
W69-05030

SOME EFFECTS OF SEWER EFFLUENT O MARINE LIFE,
P. H. Young.
California Fish and Game, Vol 50, No 1, 1964, p 33-41.

Descriptors: *Marine fish, *Shellfish, *Sewer e fluents, *California, *Water pollution effect Water pollution, Animal pathology, Animal Aquatic animals, Aquatic life, Fish, Marin animals, Saline water fish, Wildlife, Patholog Geographical regions, Pacific coast region, R gions, Southwest U. S., Outlets.

The author presents data on the detrimental effe of pollution from sewer-outfalls on certain marin fish and shellfish at a site on the California coas Trauma in the form of lesions and tumors was ver common.
W69-05069

THE OCCURRENCE, EFFECTS, AND FATE O OIL POLLUTING THE SEA,
Claude E. Zobell.
International Journal of Air and Water Pollutio Vol 7, No 2/3, May, 1963, pp 173-198.

Descriptors: *Water pollution, *Water pollution effects, *Sea water, *Water pollution sources, *Oily wastes, Ships, Oil wells, Saline water, Water types, Oily water, Wells, Wastes, Organic matter, Oxygen sag, Oxygen requirements, Aquatic animals, Aquatic life, Animals, Fish, Wildlife, Aquatic plants, Bibliographies.

A general summary article on occurrence, sources, effects, and fate of oil polluting the marine environment, both naturally occurring and resulting from man's activities. Considers submarine seeps, land drainage, wrecked oil tankers, oil discharges from ships, and 'natural' oily materials as sources. Principal geographic areas of occurrence are identified. The effects of oily wastes related to fire hazard, pollution of recreational beaches, sea birds, oysters and other shellfish, finfish and other fauna, plantlife, bacterial population, oxygen regimen, and in fouling of boats and marine structures are presented. The roles of water movements, suspended solids, bottom and beaches, autoxidation, and bacteria in determining the 'fate' of polluting oil are considered. This article also contains an extensive bibliography on physical, chemical, and biological effects of oil as a pollutant in the marine environment.
W69-05070

A BIBLIOGRAPHY ON PERIPHYTON,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Div. of Pollution Surveillance.
For primary bibliographic entry see Field 10.
W69-05140

FACTORS INFLUENCING RADIOSTRONTIUM ACCUMULATION IN DAPHNIA,
California Univ., Berkeley. Sanitary Engineering Research Lab.; California Univ., Berkeley. School of Public Health.
Donald B. Porcella, Charles E. Rixford, and John V. Slater.
Health Physics, Vol 13, pp 391-399, 1967. 8 fig, 2 tab, 7 ref.

Descriptors: *Daphnia, *Radioecology, *Strontium radioisotopes, Analytical techniques, Calcium, Chlorella, Ecosystems, Food chains, Kinetics, Magnesium, Phytoplankton, Radiochemical analysis, Radioisotopes, Scenedesmus, Water chemistry, Water pollution effects, Zooplankton.
Identifiers: *Radioactive accumulation, *Radioactive uptake, Daphnia magna, Chlorella pyrenoidosa, Scenedesmus quadricauda, Discrimination factor.

Authors studied factors affecting strontium accumulation in daphnid populations (fed algae and bacteria) by analysis for calcium ion and radiochemical determination of radiostrontium (strontium-85). Percentage calcium and strontium in Daphnia relates to organism's size and calcium concentration in water. Equilibrium concentrations (Ec) are expressed as discrimination factor, K, a ratio of concentration factors (strontium:calcium). Despite dependance of daphnid size and growth on feeding, Ec of two elements are little affected by food chain, evidenced by K = 0.64, 0.51, 0.49, 0.51, 0.53 for five Ec (range, 3.2-86.9 milligrams calcium/liter). These values approximate K = 0.58, determined by others for Chlorella, next lower step in food chain. Strontium-85 uptake and release follow first order kinetics. Small Daphnia apparently equilibrate before large ones, probably because these ions accumulate primarily in daphnid carapaces, whereupon uptake depends upon population molting rate. The following model, treating K as constant, approximates observed data: D/W = K (O/C) (1-Exp (-kt)), where D = strontium-85 in counts per minute (cpm) /Daphnia at time, t; W = strontium-85 (cpm/milliliter) in water; 0 = calcium (micrograms/Daphnia); C = calcium (micrograms/milliliter) in water; k = reaction rate (dependent upon daphnid size). Authors suggest that rate of strontium-85 uptake estimates daphnid population's growth rate. (Eichhorn-Wisconsin)
W69-05141

SEASONAL VARIATION IN CONTENT OF NITROGENOUS COMPOUNDS AND PHOSPHATE IN THE WATER OF TAKASUKA POND, SAITAMA, JAPAN,
Tokyo Imperial Univ. (Japan). Geographical Inst.
For primary bibliographic entry see Field 02H.
W69-05142

5D. Waste Treatment Processes

WASTE WATER CONSERVATION AND RENOVATION RESEARCH,
Pennsylvania State Univ., University Park.
Earl A. Myers.
Pap, Amer Soc Agr Eng Winter Meet, Chicago, Ill, Dec 1966. 9 p, 1 fig, 2 tab, 4 ref.

Descriptors: *Waste water, *Waste water treatment, Industrial wastes, *Water conservation, Distribution systems, Groundwater recharge, *Water reuse, Return flow, Effluents, Sanitary engineering, *Reclaimed water, Artificial recharge, Sewage effluents, Chemical analysis, Water quality, Aquifers, Sprinkler irrigation, Irrigation systems.
Identifiers: *Waste water reclamation, *Waste water use, *Renovating, Artificial replenishment.

Conservation of waste water involves return, renovation, recharge, and reuse. An interdisciplinary project at Penn State University involving this 4-R cycle is described. The system involves distributing 500,000 gal/day of chlorinated effluent on a 60-acre disposal area. The return section of the cycle involves all factors in transporting and distributing the waste water. Renovation includes the biological and chemical environment receiving waste water plus methods of monitoring quantity and quality. The section on recharge covers the actual amount and condition of the water returned to the ground-water reservoir. Possible uses and potential problems are mentioned in the section on reuse. The complete 4-R cycle must be considered when treating waste water for ground-water recharge. The return effluent must be uniformly distributed and applied slowly to ensure infiltration and renovation. Adequate biological and chemical treatment must take place year-round in the renovation zone; this zone must not be allowed to deteriorate with use. Recharge quantity is governed by the maximum rate that the soil-plant renovation environment can provide treatment. Continual reuse to make room for recharge water must occur in the more humid areas to permit continuous renovation. (USBR)
W69-04748

DETERMINATION, EVALUATION AND ABATEMENT OF COLOR IN TEXTILE PLANT EFFLUENTS,
Georgia Inst. of Tech., Atlanta. French Textile School.
For primary bibliographic entry see Field 05B.
W69-04756

A COMPARISON OF THE INACTIVATION OF ESCHERICHIA COLI AND POLIOVIRUS IN POLLUTED AND UNPOLLUTED WATERS BY CHLORINATION,
Council for Scientific and Industrial Research, Pretoria, (South Africa).
G. J. Stander, A. F. Marais, E. M. Nupen, and J. R. Hoffman.
For the 8 Volume Proceedings, see Vol 2, No 9, Field 06B, W69-03305. Int Conf on Water for Peace, Wash, D C, Vol 3, pp 670-689, 1968. 20 p, 7 fig, 9 tab, 16 ref.

Descriptors: *Water reuse, *Disinfection, *Chlorination, *Viruses, Water purification, Tertiary treatment, Sewage treatment, E. coli, Public health, Viricides.
Identifiers: South Africa, Poliovirus.

The effects of chlorination on E.coli and Poliovirus were studied experimentally to determine the utility of E.coli as in indicator of disinfection effectiveness. In the first series of the experiments, the effects of various levels of free available chlorine on E.coli and Poliovirus in distilled water at pH 7.4 and room temperature were determined. In the second and subsequent series of experiments, polluted waters such as secondary sewage effluents, humus tank effluent after maturation, sand filtered humus tank effluents and a surface water supply serving a large city, were used. These waters, both before and after conventional flocculation, flocculation-floatation, sand filtration and activated carbon filtration, were chlorinated by varying concentrations of chlorine below as well as above breakpoint levels. The investigations show that attenuated type II poliovirus is more resistant to free available chlorine than is Escherichia Coli I under the conditions described. Chlorination of effluents and polluted waters, both before and after conventional purification to breakpoint levels, is a prerequisite for the destruction of both virus and E.coli in less than five minutes; for secondary effluents, the chlorine dosage required to reach breakpoint level can be 10 ppm and more. Where humus tank effluents, even after sand filtration, are considered as sources of raw water for purification for domestic use, it is essential that conditions of chlorination necessary for the total inactivation of the virus are observed, since a negative E.coli test cannot be said to indicate a virologically pure water. Because of risks involved in placing too much reliance on the viri-and bactericidal properties of chlorine, some form of advanced purification of these effluents such as storage in maturation ponds, denitrification, chemical softening or flocculation-floatation, followed by sand and activated carbon filtration, appears to be essential before chlorination. (Knapp-USGS)
W69-04778

FINANCIAL ASPECTS OF POTABLE WATER AND SEWERAGE SYSTEMS,
Domingo A. Ruiz-Delgado, and J. A. Sanchez-Mora.
For 8 Volume Proceedings see Vol 2, No 9, Field 06B, W69-03305. International Conference on Water for Peace, Vol 8, pp 692-697, 1968. Washington, D C: U S Government Printing Office, 6 p.

Descriptors: Financing, Potable water, *Rates, Population.
Identifiers: Sewerage systems, Goals, External financing, Domestic private financing, Earnings of the system, Meterless system.

The paper calls attention to the magnitude of the problem, at the national level, of allocating funds for the construction of necessary projects in order to meet the present need for services and the disheartening prospect of having to apply part of these scarce resources toward subsidizing the operation and maintenance of many of the systems. The authors then consider the rates, which are means of obtaining income to guarantee the maintenance and survival of the systems, as well as their expansion in accordance with the rate of population growth. The rates constitute a simple method, are simple to apply, and are designed to achieve a goal. This goal is defined by the various decisions made in accordance with the laws and regulations controlling these matters and with executive orders. It is for these reasons that the authors believe that these rates must be set in accordance with studies that take into account not only the characteristics peculiar to the system under consideration but also the situation on a national scale and the long-range programs drawn up to reach the foreseen goals. They feel a knowledge of the bases and methods that bring about a determined rate is useful, in order to defend and justify the rate to the public. (Loeb-Rutgers)
W69-04821

MODERN SEWAGE TREATMENT PLANTS--HOW MUCH DO THEY COST.

U. S. Public Health Service, Washington, D. C., 1964.

Descriptors: *Sewage treatment, *Costs, *Treatment facilities, *Sludge treatment, *Filters, Operation and maintenance, Design, Equipment.

This study is based on a tabulation of design and cost information for 1504 sewage treatment projects constructed under the PL-660 program. Treatment processes covered include: (1) Imhoff-tank plants, (2) Imhoff-type plants, (3) primary treatment--separate sludge digestion plants, (4) stabilization ponds, (5) activated sludge plants, (6) trickling filters--separate sludge digestion plants, and (7) trickling filters--Imhoff-type plants.
W69-05031

ESTIMATING SEWAGE TREATMENT PLANT OPERATION AND MAINTENANCE COSTS,
P. P. Rowan, K. C. Jenkins, and D. H. Howells.
Water Pollution Control Federation, Journal, Vol 33, No 2, February, 1961, pp 111-121.

Descriptors: *Sewage treatment, *Operation and maintenance, *Operating costs, *Treatment facilities, *Estimating, Costs, Waste treatment.

Cost data presented in this report represent total annual cost experience for the operation and maintenance of over 300 treatment plants in the contiguous 48 states plus the District of Columbia.
W69-05051

AUTHORITY TO LEVY TAXES FOR STREET IMPROVEMENTS.
For primary bibliographic entry see Field 06E.
W69-05194

5E. Ultimate Disposal of Wastes

FLUID MECHANICS OF DEEP-WELL DISPOSALS,
DeGolyer and MacNaughton, Dallas, Tex.
A. F. Van Everdingen.
Amer Ass Petrol Geol Mem No 10, pp 32-42, Aug 1968. 11 p, 3 fig, 3 tab, 7 ref, 1 append.

Descriptors: *Fluid mechanics, *Groundwater movement, *Injection wells, Porous media, Waste disposal, Groundwater basins, Geologic formations, Aquifers, Pressure head, Hydrostatic pressure, Porosity, Permeability, Fractures (Geology).
Identifiers: Industrial waste injection wells, Well stimulation, Hydraulic fracturing, Acidizing, Well shooting, Reservoir pressure.

The fundamental law which governs the flow of slightly compressible fluids in permeable formations was used to compute three unit functions useful in well or reservoir analysis. These unit functions give quantitative information on (1) the change of pressure in the well or formation as a result of unit rate of injection during a period of time, (2) the amount of fluid which can be disposed of per unit pressure increase in a given time, and (3) the effect of an enlarged borehole on the injection pressure. Accurate prediction of pressures and pressure changes is now possible provided sufficient information is available on the physical characteristics of the formation, the formation fluids, and the injected fluids. The numerical values of these characteristics can vary considerably. To simplify computations, conversion factors are used so that the solutions given here can be used to solve most of the problems irrespective of the numerical values of the characteristics encountered. (Knapp-USGS)
W69-04928

SUBSURFACE DISPOSAL OF LIQUID INDUSTRIAL WASTES BY DEEP-WELL INJECTION,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio. Cincinnati Water Research Lab.
Don L. Warner.
Amer Ass Petrol Geol Mem No. 10, pp 11-20, Aug 1968. 10 p, 2 fig, 58 ref.

Descriptors: *Waste disposal, *Injection wells, *Liquid wastes, Geologic formations, Sandstones, Limestones, Dolomite, Groundwater basins.
Identifiers: Industrial waste injection wells.

Deep-well injection of concentrated, relatively untreatable liquid wastes is discussed. The feasibility of deep-well injection is determined by study of site suitability, waste characteristics, economics, and legal factors. Careful geologic evaluation is necessary to determine site suitability, economics, and suitability of the waste for injection. At least 110 deep industrial injection wells are presently in use, injecting various wastes at widely different rates and pressures into subsurface reservoirs, ranging in age from Pleistocene to Precambrian. Most of the reservoir rocks used are sandstones, limestones, and dolomites. (Knapp-USGS)
W69-04941

IMPORTANCE OF DEEP PERMEABLE DISPOSAL FORMATIONS IN LOCATION OF A LARGE NUCLEAR-FUEL REPROCESSING PLANT,
Oak Ridge National Lab., Oak Ridge, Tenn. Health Physics Div.
Wallace De Laguna.
Amer Ass Petrol Geol Mem No 10, pp 21-31, Aug 1968. 11 p, 3 tab, 11 ref.

Descriptors: *Radioactive waste disposal, *Injection wells, Geologic formations, Aquifers, Mining, Radioactive wastes, Shales, Fractures (Geology), Hydraulic properties, Nuclear wastes.
Identifiers: *Hydraulic fracturing, Salt beds, Krypton-85, High-level wastes, Low-level wastes.

The most important disposal problem in location of a large nuclear-fuel reprocessing plant is that of low-level waste. Disposal into large bodies of surface water was once common, but underground disposal into deep permeable formations seems to offer the best possibilities for disposal of low-level waste. The best method for disposal of medium-level waste is into hydraulically fractured shale, which is generally found in basin areas. A favored method for disposal of high-level waste is storage in solid form in mined cavities in salt. Thus the selection of a site that also has salt beds is advantageous, but not required, because alternate means for disposal of high-level waste can be found. Maximum permissible concentrations of radioactive nuclides in air and water have been determined. As more information is gained, the values may be increased or decreased, and thus may alter the requirements for a plant site. Disposal of radioactive wastes into deep permeable formations is now practicable only for low-level waste, but it holds potential for disposal of certain medium- and high-level wastes, and also of such gaseous wastes as krypton-85. (Knapp-USGS)
W69-04942

POSSIBILITIES FOR DISPOSAL OF INDUSTRIAL WASTES IN SUBSURFACE ROCKS OF NORTH FLANK OF APPALACHIAN BASIN IN NEW YORK,
Shell Canadian Exploration Co., Houston, Tex.; Tidewater Oil Co., Pittsburgh, Pa.; Consolidated Gas Supply Corp., Clarksburg, W. Va.
Thomas P. McCann, Norman C. Privrasky, Frederick L. Stead, and James E. Wilson.
Amer Ass Petrol Geol Mem No 10, pp 43-92, Aug 1968. 49 p, 29 fig, 2 tab, 148 ref.

Descriptors: *Injection wells, *Waste disposal, *New York, Geologic formations, Groundwater basins, Sandstones, Shales, Fractures (Geology), Aquifers, Porosity, Permeability.
Identifiers: Industrial waste injection wells, Appalachian Basin9ny0, hydraulic fracturing, Potsdam Sandstone, Theresa Sandstone, Salt beds.

The north flank of the Appalachian basin in New York was studied to determine the suitability of the region for subsurface disposal of industrial wastes, particularly liquid wastes. Permeable sandstone, salt beds that can provide leak-proof man mad caverns, and shale that can contain fluids in artif cially produced fractures are especially significan Subsurface strate dip southward at rates betwee 50 and 160 ft/mi. Local deformations such as low relief anticlines and small displacement faults ar few. Potential reservoirs for injection of liquids ar the Cambrian Potsdam Sandstone, with 100 ft an the Cambrian Theresa Sandstone with a thickne range from 0 to 1,500 ft. Drilling depths to the Po sdam Sandstone, the lowest potential reservoi range from 1,000 to 12,600 ft. Other possible sand stone reservoirs are present in the Silurian an Devonian Systems, but have less potential becaus of vagaries in porosity and permeability an because of the possibility of leakage from nu merous unrecorded borings in the shallower strat Salt beds in Silurian rocks at depths between 50 and 4,000 ft offer sites for construction of storag cavities. Shale sections that appear to be suitabl for storage of grouted wastes in hydraulicall produced fractures are present in Upper Devonia and Upper Ordovician strata. There are thinne sections of possible interest for the same use i Silurian and Middle Ordovician rocks. (Knapp USGS)
W69-04943

POSSIBILITIES FOR SUBSURFACE WAST DISPOSAL IN A STRUCTURAL SYNCLINE I PENNSYLVANIA,
Princeton Univ., N. J. Dept. of Geological En gineering; Atomic Energy Commission, Washing ton, D. C.
John E. Hardaway.
Amer Ass Petrol Geol Mem No 10, pp 93-127, Au 1968. 35 p, 14 fig, 4 tab, 99 ref.

Descriptors: *Injection wells, *Waste disposa *Pennsylvania, Geologic formations, Groundwate basins, Sandstones, Shales, Fractures (Geology) Aquifers, Porosity, Permeability.
Identifiers: Industrial waste injection wells, Bedfor (Pa), Synclines, Hydraulic fracturing.

Results of a study of a small structural syncline o the western perimeter of the central Appalachia Mountains of Pennsylvania suggest that the are may be suitable for the injection of liquid waste into deep subsurface reservoirs. The bowl-shape syncline forms a basin just north of Bedford Bedford County, and occupies about 45 sq m (116.5 sq km) of the county. The total thickness o Paleozoic strata is more than 7,000 ft (2,134 m) The reservoir aquifer considered suitable fo disposal is the Lower Silurian Tuscarora Sand stone, a clean quartzose sandstone. The investiga tion showed that the syncline has sufficient struc tural closure to warrant consideration as a reser voir. The selected sandstone aquifer crops ou along two-thirds of the syncline's perimeter and i approximately 3,700 ft (1,128 m) beneath th center of the basin. It apparently is not faulted, an it may be treated as a confined aquifer because it i bounded by shale and shaly, silty sandstone whic probably have much lower permeability. Porosity measurements of Tuscarora and Juniata sandstone gave values of 15 and 10 percent, respectively. The probability of the presence of connate brine in the Tuscarora is enhanced by the fact that it is presen in a deep well near Bedford. The Tuscarora strat are described as a 'salaquifer' which will no promote harmful chemical interactions. The shal beds of the area were studied similarly and are re garded as favorable for the injection, into artifi cially created fractures, of wastes that have been incorporated in cement slurries. However, grouting in shale appears less promising for large-scale injec tion than disposal in permeable sandstone. (Knapp USGS)
W69-04944

GEOLOGY OF SUBSURFACE WASTE DISPOSAL IN MICHIGAN BASIN,
Michigan Univ, Ann Arbor.
Louis L. Briggs, Jr.
Amer Ass Petrol Geol Mem No 10, pp 128-153, Aug 1968. 26 p, 18 fig, 3 tab, 12 ref.

Descriptors: *Injection wells, *Waste disposal, *Michigan, Groundwater basins, Geologic formations, Aquifers, Sandstones, Limestones, Shales, Porosity, Permeability, Fractures (Geology).
Identifiers: Michigan basin, Industrial waste injection wells, Synclines, Salt beds.

A study was made of the suitability of rocks in the Michigan basin for disposal of waste by injection wells. The almost circular and symmetrical structural basin contains in the deepest part approximately 14,000 ft of Paleozoic sedimentary rocks. The autogeosyncline developed as a tectonic element in Late Silurian time, during which the middle third of the sedimentary section was deposited. The strato dip generally less than 1 deg toward the center of the basin, although locally there are gentle open folds and a few high-angle fults. The sedimentary formations can be classified into 4 generalized sequences (1) the sandstone sequence of the Cambrian, (2) the carbonate-evaporite sequence of the Ordovician to Middle Devonian, (3) the shale-sandstone sequence of the Late Devonain to Mississippian, and (4) the coal-bearing sequence of the Pennsylvanian. The Cambrian sanstones (Mount Simon) have the most favorable properties for high-volume liquid-waste disposal. They are sutiable thick and reasonable shallow principally in southeastern Michigan near Detroit. The Mount Simon is a typical blanket feldspathic, quartzose sandstone; it is characterized by quartz and feldspar cement, present as grain overgrowths, and detrital and matrix carbonate minerals. Where measured, the porosity averages about 10% and the permeability about 30 md. The Cambrian sandstone beds are overlain by a thick, extensive shale layer (Utica) and salt beds (Salina), which are of secondary importance to liquid- and solid-waste disposal. (Knapp-USGS)
W69-04945

SUBSURFACE WASTE-DISPOSAL POTENTIAL IN SALINA BASIN OF KANSAS,
Augustana Coll., Rock Island, Ill.; Kansas State Geological Survey, Lawrence.
R. W. Edmund, and Edwin D. Goebel.
Amer Ass Petrol Geol Mem No 10, pp 154-164, Aug 1968. 11 p, 7 fig, 11 ref.

Descriptors: *Injection wells, *Waste disposal, *Kansas, Groundwater basins, Geologic formations, Aquifers, Sandstones, Dolomite, Limestones, Shales, Porosity, Permeability.
Identifiers: Salina Basin (Kan), Industrial waste injection wells, Synclines, Salt beds.

The Salina basin, Kansas, was studied to determine its suitability for waste disposal by injection wells. Cambrian sandstones, Pennsylvanian shales, and Permian salt beds are good potential storage reservoirs. The direction of natural fluid flow in the basin appears to be southward. The basin is a simple asymmetric syncline with a uniform gentle southward axial tilt, and is deepest on the SW flank. In most of the basin, Pennsylvanian and Permian rocks crop out. Basin rocks range in age from water is found in all deep porous rocks penetrated by exploratory drilling. (Knapp-USGS)
W69-04946

POTENTIAL OF DENVER BASIN FOR DISPOSAL OF LIQUID WASTES,
Sun Oil Co., Denver, Colo.; Wolf Exploration Co., Dallas, Tex.
George S. Garbarini, and Harry K. Veal.
Amer Ass Petrol Geol Mem No 10, pp 165-185, Aug 1968. 21 p, 12 fig, 1 tab, 47 ref.

Descriptors: *Injection wells, *Waste disposal, *Colorado, Wyoming, Groundwater basins, Geologic formations, Aqufiers, Sandstones, Shales, Porosity, Permeability, Fractures (Geology), Earthquakes.
Identifiers: *Denver Basin, Industrial waste injection wells, Hydraulic fracturing, Synclines, Injection-induced earthquakes.

A reconnaissance subsurface geologic study shows that 3 types of reservoirs are available for liquid-waste disposal in the Denver basin-fractured Precambrian rocks, porous sandstone reservoirs, and thick shale suitable for disposal by the hydraulic-fracturing technique. From early 1962 through early 1966, fractured Precambrian rocks at a depth of 12,000 ft were used as a disposal reservoir for toxic effluent produced at the Rocky Mountain Arsenal near Denver. The disposal well is now shut in, pending investigation of the possible relationship of waste injection to Denver-area earthquakes which increased in frequency and magnitude during the injection period. Sandstone reservoirs most favorable for waste disposal are the Permian Lyons Sandstone, the Triassic Dockum, the Triassic-Jurassic Jelm-Entrada, and sandstones in the Cretaceous Dakota Group and the 'Hygiene zone' of the Pierre Shale. The Lyons, Dockum, and Dakota are best suited for waste disposal in the southern part of the basin. The Dockum sandstone, potentially the best disposal reservoir volumetrically, is limited to the southeast part of the basin. The Jelm-Entrada and Hygiene-zone sandstones are potential disposal reservoirs along the heavily populated strip between Denver and Cheyenne. Cretaceous marine black shale suitable for disposal by the hydraulic-fracturing technique is present everywhere in the basin. The shale crops out over large areas. Beneath the populous strip along the Front Range, the shale is covered locally by as much as 2,000 ft of Upper Cretaceous and Tertiary transitional to continental strata. The basin has good potential for disposal of liquid wastes through wells. (Lang-USGS)
W69-04947

SEDIMENTARY HISTORY AND ECONOMIC GEOLOGY OF SAN JUAN BASIN, NEW MEXICO AND COLORADO,
Montana State Univ., Missoula; El Paso Natural Gas Co., Tex.; Texaco, Inc., Farmington, N. Mex.
James A. Peterson, Allan J. Loleit, Charles W. Spencer, and Richard A. Ullrich.
Amer Ass Petrol Geol Mem No 10, pp 186-231, Aug 1968. 45 p, 24 fig, 61 ref.

Descriptors: *Stratigraphy, *Basins, *Colorado, *New Mexico, *Injection wells, Waste disposal, Groundwater basins, Geologic formations, Aquifers, Sandstones, Shales, Limestones, Porosity, Permeability, Fractures (Geology), Mining, Oil fields, Oil reservoirs.
Identifiers: *San Juan Basin, Industrial waste injection wells, Synclines.

The stratigraphy of the San Juan Basin of Colorado and New Mexico is discussed in detail and the properties of the rocks are reviewed for suitability as waste injection reservoirs. The basin contains up to 15,000 ft of sedimentary rocks from Cambrian to Recent. Development of the area as a sedimentary basin apparently took place in Pennsylvanian time; the basin was maintained with changing rates of subsidence and filling through the remainder of geologic time. Dominantly cyclic marine carbonate deposition during the early phases preceded the infilling of the trough with coarse clastics. The early Mesozoic is characterized by fluvial and eolian environments, interrupted periodically by thin marine transgressive deposits of nearshore redbeds, with a final widespread Late Cretaceous marine thick cyclic sequence of gray shale and sandstone, interbedded with coal. Major reserves of petroleum are in Cretaceous and Pennsylvanian rocks, coal in Cretaceous, and uranium in Jurassic and Cretaceous. Much of the San Juan basin is considered potentially suitable for waste disposal, contingent upon such factors as depth, volume of waste, petroleum and mining activities, present and future groundwater needs, and other industrial and cultural considerations. The Chaco slope probably is the most favorable area for waste disposal. (Lang-USGS)
W69-04948

DISCHARGE OF WASTES INTO THE SEA IN EUROPEAN COASTAL AREAS,
Pierre Koch.
In PROCEEDINGS OF THE FIRST INTERNATIONAL CONFERENCE ON WASTE DISPOSAL IN THE MARINE ENVIRONMENT, University of California at Berkeley, 1959, New York: Pergamon Press, 1960.

Descriptors: *Waste disposal, *Foreign countries, *Coasts, *Water pollution effects, *Oceans, Sanitary engineering, Engineering, Environmental engineering, Geographical regions, Regions, Bodies of water, Surface waters.

The author summarizes information on discharge methods and pollution problems in the marine disposal of effluents. Most European countries are covered in this article. The information is based on reports from experts in these countries.
W69-05015

PROCEEDINGS OF THE FIRST INTERNATIONAL CONFERENCE ON WASTE DISPOSAL IN THE MARINE ENVIRONMENT,
E. A. Pearson.
University of California at Berkeley, 1959, New York: Pergamon Press, 1960.

Descriptors: *Waste disposal, *Hydrography, *Water pollution effects, Environmental sanitation, Water analysis, Foreign countries, Public health, Design, Oceanography, Aquatic life, Engineering, Environmental engineering, Hydrologic aspects, Analysis, Geographical regions, Regions.

Papers were presented in the following subject areas: (1) public health, (2) effects on marine biota, (3) design consideration, (4) nearshore oceanography, (5) receiving water analyses, and (6) estuarine hydrography.
W69-05038

5F. Water Treatment and Quality Alteration

WATER FOR FLUORIDES,
Pan American Health Organization, Washington, D. C.; World Health Organization, Geneva (Switzerland).
Franz J. Maier.
For the 8 Volume Proceedings, see Vol 2, No 9, Field 06B W69-03305. Int Conf on Water for Peace, Wash, D C, Vol 3, pp 748-751, 1968. 4 p.

Descriptors: *Public Health, *Water treatment, *Fluoridation, *Fluorides, Organizations, Investigations, Water supply, Urban sociology.
Identifiers: *Public water supplies.

Despite the fact that controlled fluoride addition to public water supplies has been practiced for over 20 yr, that every study made to evaluate the measure has shown it to be the most effective for reducing dental caries, that no harmful effects whatsoever have ever been observed in over 3000 communities where fluorides are used, and that it is one of the most economical public health measures, progress in adopting it has been remarkable slow. Every dental survey made throughout the world during the past 10 yr has shown that the dental decay prevalence among children is almost 100% in most countries. The number of dentists available to cope with the problem is already most inadequate. The situation is at present becoming progressively worse inasmuch as the population is increasing at a rate faster than the number of dentists. To hasten the extension of fluoridation in urban areas, efforts are being made to reduce the cost of the process by improving the techniques of utilizing fluorspar as a source of fluoride. This mineral is the cheapest source, and is widely distributed throughout the world. In rural areas where many children live in homes with private water supplies which cannot presently be economically fluoridated, studies are being made to fluoridate

school water supplies at levels several times that used in community water supplies. Of all the beneficial public health measures presently used, the fluoridation of public water supplies has been subjected to as thorough investigation of its effectiveness and safety as any other. All of this evidence shows that, if you have a public water supply, it should be fluoridated. (Vorhis-USGS)
W69-04769

FINAL REPORT ON BALITMORE HARBOR STUDY,
Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
E. D. Stroup, D. W. Pritchard, and J. H. Carpenter.

Technical Report No. XXVI, December, 1961.

Descriptors: *Waste assimilative capacity, *Water quality, *Harbors, *Maryland, Diffusion, Circulation, Acidic water, Water types, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Geographical regions, Northeast U. S., Regions, Water pollution effects, Water properties.

This final report describes an investigation which 'concerned itself primarily with the physical description of the waters of Baltimore Harbor and the adjacent portion of Chesapeake Bay, the principal objective being the determination of the mechanisms which bring about flushing of the Harbor and the rate at which this flushing occurs'. The report contains a large collection of descriptive data. The authors conclude that '...the major result of the work can be simply stated: as a result of mechanisms which were not previously recognized, and which have not yet been reported for any other estuarine location, the flushing rate of Baltimore Harbor is substantially more rapid than had previously been estimated. The mean life of the Harbor water, i.e., the average time which any particle of water within the Harbor at any instant may be expected to remain within the Harbor, has been found to be of the order of 10 days; previous estimates placed the mean life at from several times 10 to over 100 days.'
W69-05056

TOWARD THE OPTIMIZATION OF INVESTMENT-PRICING DECISIONS: A MODEL FOR URBAN WATER SUPPLY TREATMENT FACILITIES,
Cornell Univ., Ithaca, N. Y.
Courtney Riordan.
Ph D Thesis, Cornell University, Feb 1969. 304 p, 28 fig, 38 tab, 140 ref, 5 append.

Descriptors: *Dynamic programming, *Decision making, Mathematical models, Annual benefits, Water supply, Water treatment, Project planning, *Water demand, Temporal distribution, Investment, *Pricing, Optimization, Economic efficiency municipal water.
Identifiers: Grid-sampling, Multi-stage expansion, Single-stage expansion.

Two mathematical models were structured to find the optimal time and capacity expansion path of treatment facilities for a hypothetical municipal water supply utility. Both models assumed a linear community demand curve for water which was a function of population, which in turn was a function of time. The objective of both models was to maximize the present value of net community benefits subject to system capacity constraints. A single stage (SS) model was solved by an iterative grid-sampling technique, and then the optimum solution found by calculus techniques once the concavity of the benefit function was verified. A multi-stage (MS) model was solved by a dynamic programming algorithm. A parametric sensitivity analysis was performed on both models. The MS model yielded increased net benefit solutions over the SS model. (Gysi-Cornell)
W69-05128

TOWARD THE OPTIMIZATION OF INVESTMENT-PRICING DECISIONS: A MODEL FOR URBAN WATER SUPPLY TREATMENT FACILITIES,
Cornell Univ., Ithaca, N. Y.
Courtney Riordan.
Ph D Thesis, Chap 4, Cornell University, Feb 1969. 304 p, 28 fig, 38 tab, 140 ref, 5 append.

Descriptors: *Decision making, Mathematical models, Analytical techniques, Annual benefits, Annual costs, *Water supply, Water treatment, Water demand, Temporal distribution, *Pricing, *Project planning, Marginal costs, *Optimization, *Investment, Marginal utility, Water management (Applied).
Identifiers: Grid-sampling, Single-stage expansion.

A single stage capacity expansion model was structured for a hypothetical municipal water supply utility. The objective was to determine the optimal time and size of treatment plant expansion in order to maximize total community net benefits over the planning horizon. Two models were solved, assuming arithmetic and exponential population growth rates respectively, up to an arbitarary population stabilization time. Assumptions included identical linear individual demand curves for water, constant marginal cost of production up to system capacity where it became infinite, and variable pricing which kept aggregate demand equal to system capacity at all times. Grid sampling techniques were used to locate the region of the optimal solution and to establish the concavity of the response surface, and the exact solution found by calculus maximization. A sensitivity analysis was performed on the parameters, and the results discussed. Chapter 4 of a thesis. (Gysi-Cornell)
W69-05129

TOWARD THE OPTIMIZATION OF INVESTMENT-PRICING DECISIONS: A MODEL FOR URBAN WATER SUPPLY TREATMENT FACILITIES,
Cornell Univ., Ithaca, N. Y.
Courtney Riordan.
Ph D Thesis, Chap 5, Cornell University, Feb 1969. 304 p, 28 fig, 38 tab, 140 ref, 5 append.

Descriptors: *Dynamic programming, *Decision making, Mathematical models, Annual benefits, Marginal costs, *Water supply, Water demand, *Pricing, Investment, Timing, Water management (Applied), *Project planning, Marginal utility, Optimization, Municipal water.
Identifiers: Multi-stage expansion.

A multi-stage capacity expansion model was structured for a hypothetical municipal water supply utility. The objective was to find the optimum timing and sizing of treatment plant expansions in order to maximize total community benefits for the planning horizon. The model was solved on a digital computer using a discrete dynamic programming algorithm. Basic assumptions for the model were identical to those used in the single stage expansion model (given in a previous abstract). Exponential and arithmetic population growths problems were solved. Sensitivity analyses on stage time intervals, interest rates, population growth rates and planning horizon lengths were performed. Comparisons of the model results with 'average price costing-even design period' planning methods were made. It was concluded that the multi-stage model (marginal cost pricing) resulted in net benefit increases over the average cost pricing method. Chapter 5 of a thesis. (Gysi-Cornell)
W69-05130

5G. Water Quality Control

EFFECTS OF MULTIPLE USES OF WATERSHEDS ON WATER QUALITY,
Federal Water Pollution Control Administration, Washington, D. C.
For primary bibliographic entry see Field 05B.
W69-04702

DETERMINATION, EVALUATION AND ABATEMENT OF COLOR IN TEXTILE PLANT EFFLUENTS,
Georgia Inst. of Tech., Atlanta. French Textile School.
For primary bibliographic entry see Field 05B.
W69-04756

DEVELOPMENT AND STATUS OF POND FERTILIZATION IN CENTRAL EUROPE,
Wisconsin Univ., Madison. Dept. of Zoology.
John C. Neess.
Trans Amer Fish Soc, Vol 76, pp 335-358, 1949. 24 p, 1 fig, 73 ref.

Descriptors: *Cycling nutrients, *Environmental effects, *Essential nutrients, *Fish, *Fisheries, Algae, Aquatic algae, Aquatic microbiology, Aquatic weeds, Balance of nature, Eutrophication, Fish farming, Fish rood organisms, Fish genetics, Fish handling facilities, Fish management, Limnology, Nitrogen compounds, Nitrogen cycle, Nutrient requirements, Lime, Phosphorus compounds, Physiological ecology, Plankton, Sewage, Sewage lagoons.
Identifiers: Europe.

A review of recent European literature on pond fertilization is offered as a foundation for certain phases of American pond-culture technique. The fertilizing substances, lime, potassium, phosphorus, nitrogen, and carbon, are discussed individually in the light of their usefulness in increasing fish yields and with regard to the important mechanisms through which they are able to effect these increases. European techniques in the employment of fertilizer are described where these are different from corresponding American procedures. In addition, an attempt has been made to integrate divergent aspects of the subject through a consideration of certain fundamentals of trophic metabolism in ponds, the function of pond soils as conservators of nutrients, and microbiological processes relating to the theory of fertilization. A synopsis of the history of pond fertilization in central Europe and a general criticism of research methods are included. (Fitzgerald-Wis)
W69-04804

ECONOMICS OF WATER QUALITY MANAGEMENT,
John F. Timmons, and Merwin D. Dougal.
For 8 Volume Proceedings see Vol 2, No 9, Field 06B, W69-03305. International Conference on Water for Peace, Vol 6, pp 667-678, 1968. Washington, D C: U S Government Printing Office, 12 p, 7 fig, 2 tab, 1 append.

Descriptors: Water quality, Water quality control, Natural resources, Water pollution, Costs, Benefits, Control, Water utilization.
Identifiers: Water quality management, Input-output diagram, Competitive relationship, Complementary relationship.

The major purpose of this paper is to identify the articulate water quality problems within an economic framework for (1) maximizing the satisfaction of human wants from the use of water and (2) minimizing the costs of producing these satisfactions, considering both the direct and derived demands for water, including the goods and services water helps produce. A second purpose is to elaborate an economic framework within which water quality problems facing our States and Nation may be analyzed. In pursuing these objectives, the paper journeys into the nature of and the growing demand for water, the economic dimension of water quality problems in relation to physical and structural dimensions, supply and demand characteristics, use interrelationships, and costs and benefits associated with particular uses and use methods. The terms water quality, control, and pollution are defined. (Loeb-Rutgers)
W69-04823

CLARK V LINDSAY LIGHT AND CHEMICAL CO (RIPARIAN RIGHTS IN WATERS OF STREAM).
For primary bibliographic entry see Field 06E.
W69-04858

BENEFIT-COST ANALYSIS AND WATER POLLUTION CONTROL,
R. J. Hammond.
Food Research Institute, Stanford University, Stanford, California, Miscellaneous Publication 13, 1960.

Descriptors: *Cost-benefit analysis, *Water pollution control, *Bibliographies, Direct benefits, Indirect benefits, Economics, Tangible benefits, Intangible benefits, Waste treatment, Pollution abatement, Benefits, Control, Abatement, Water quality control, Quality control.

This report presents the author's opinions regarding benefit-cost analysis as applied to water pollution control. The report delves into the history of benefit-cost analysis and presents a general discussion on its use for the analysis of water resource investment. The author is, in general, pessimistic about the value of benefit-cost techniques in relation to water quality control. An excellent bibliography is included in the report.
W69-04998

OXYGENATION OF BALTIMORE HARBOR BY PLANKTONIC ALGAE,
C. H. J. Hull.
Water Pollution Control Federation, Journal, Vol 35, No 5, 1963, pp 587-606.

Descriptors: *Photosynthesis, *Reaeration, *Waste assimilative capacity, *Oxygen requirements, *Maryland, Self-purification, Water purification, Water treatment, Oxygenation, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Geographical regions, Northeast U. S., Regions, Harbors.

This paper discusses the contribution of photosynthesis to the oxygen balance and, hence, the waste assimilative capacity of an estuary. A literature review is included. A detailed report is given of the effect of photosynthesis upon the waste assimilative capacity of Baltimore Harbor. Data were collected and analyzed indicating quantities of oxygen produced, but the results were not interpreted directly to provide a measure of overall waste assimilation capacity. It was concluded, however, that the contribution of photosynthesis is greater than is that of reaeration.
W69-05003

BOAT AND MARINA WASTES,
Interstate Commission on the Potomac River Basin, Washington, D. C.
Thomas F. Kelleher.
In PROBLEMS OF THE POTOMAC ESTUARY, January, 1964, pp 60-63.

Descriptors: *Maryland, *Virginia, *Water pollution control, *Marinas, *Recreation wastes, *Legislation, *Water quality control, Water pollution sources, Recreation facilities, Boating, Appalachian Mountian region, Atlantic coastal plain, Coastal plains, Geographical regions, Northeast U. S., Regions, Southeast U. S., Recreation, Wastes, Water sports, Control, Quality control, Income.

Estimates are given for the number of marinas presently in operation in the U. S., their business volume, and the number of people participating in recreational boating. Efforts of the 'boating fraternity' to obtain better pollution control through legislation, research and development, and education are described. A list of conclusions regarding desirable water-quality control programs involving pleasure boats and marinas is included. One significant conclusion is that state and local laws must be sufficiently uniform to permit boat owners and operators to travel from state to state without being challenged on waste treatment equipment aboard.
W69-05009

SOCIO-ECONOMIC ASPECTS OF WATER QUALITY MANAGEMENT,
Allen V. Kneese.
Water Pollution Control Federation, Journal, Vol 36, No 2, February, 1964, pp 254-262.

Descriptors: *Water quality control, *Social aspects, *Values, *Social values, Water policy, Water pollution, Water pollution effects, Recreation, Public health, Benefits, Cost-benefit analysis, Evaluation, Control, Quality control.

The author lists the following concepts as useful in defining the nature of water quality management: (1) A region approach is involved. (2) Multipurpose use is an essential element. (3) Comprehensiveness is essential. (4) A systematic search for alternatives should be involved. (5) Flexible adaptation to existing conditions is necessary. An important element in analysis of water quality alternatives is imputing values to water quality levels for various uses since many of the benefits derived from enhancement of water quality are not measured in the open market. Difficult problems in imputing values occur with recreation, public health, and the general amenities. Techniques with promise in terms of evaluating recreation are under study. Public health is a more difficult problem.
W69-05013

WATER QUALITY IN THE POTOMAC ESTUARY,
Interstate Commission on the Potomac River Basin, Washington, D. C.
Gordon E. McCallum.
Problems of the Potomac Estuary, January, 1964, pp 5-10.

Descriptors: *Water pollution control, *Forecasting, *Biochemical oxygen demand, *Human population, *District of Columbia, *Growth rates, Virginia, Maryland, Population, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Geographical regions, Northeast U. S., Regions, Southeast U. S., Oxygen demand, cities, Water quality, Rates.

This is a short general discussion of past uses and goals of pollution control in the Potomac Estuary. Implications of population growth for future investment requirements for pollution control in the Washington, D. C., area are discussed. Population projections for 1985 and 2010 are given. The implied biochemical oxygen demand loading resulting after 90 percent BOD reduction in 1985 by treatment plants is estimated.
W69-05027

WATER QUALITY CRITERIA, 2nd EDITION,
Jack Edward, McKee, and Harold W. Wolf.
California State Water Quality Control Board, Sacramento, California, Publication No 3-A, 1963.

Descriptors: *Water quality, *Bibliographies, Water analysis, Water properties, Analysis.

The technical and scientific literature pertaining to water quality is evaluated. An extensive bibliography of 3,827 references is included.
W69-05028

PHILLIPS PETROLEUM CO V HARDEE (LIABILITY FOR DAMAGE BY POLLUTION).
189 F 2d 205-212 (5th Cir 1951).

Descriptors: *Water pollution, *Louisiana, *Damages, *Legal aspects, Irrigation systems, Irrigation ditches, Oil fields, Oil wastes, Brines, Oil industry, Saline water, Judicial decisions.
Identifiers: *Damages (Legal aspects), *Joint and several liability.

Plaintiffs, rice farmers, brought suit seeking to recover for damages to crops and land resulting from salt pollution of a creek used for irrigation purposes. Four oil companies and one pipe line company were named as contributing defendants. The trial judge submitted the case to the jury stating that the suit was against each of the five companies separately and apart. The reviewing court found that the evidence presented was insufficient to establish that the negligence of each company by itself was sufficient to cause damage to the entire rice crop. However, the court ordered a new trial on the basis of error in the trial court's instruction. Plaintiffs would be entitled upon remand to recover for their whole damage against one or all of the companies contributing to the damage if they could produce evidence sufficient to establish that the companies, or any one of them, were negligent and, though acting separately, their negligence combined to produce pollution damage. (Katz-Fla)
W69-05199

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

NOTE ON THE STANDARD ERROR OF THE COEFFICIENT OF SKEWNESS,
Geological Survey, Washington, D. C.
Nicholas C. Matalas, and Manual A. Benson.
Water Resources Research, Vol 4, No 1, pp 204-205, February 1968. 2 p, 1 tab, 2 ref.

Descriptors: Distribution patterns.
Identifiers: Standard error, Coefficient of skewness.

Based on Slade's work in 1936, it has long been considered that a skew coefficient is not reliable if it is computed from a sample of less than 140 items. This limitation is erroneous and has acted as a deterrent to the use of computed frequency distributions. A table of the standard error of the skew coefficient is presented to assess the value of a skew coefficient from any sized sample. This article has relevance to empirical economic and technical engineering work being done in water research areas. (Loeb-Rutgers)
W69-04807

BAYESIAN ANALYSIS OF HAAVELMO'S MODELS,
Columbia Univ., New York.
V. K. Chetty.
Econometrica, Vol 36, No 3-4, pp 582-602, July-October 1968. 21 p, 13 fig, 1 tab, 18 ref, 1 append.

Descriptors: *Distribution patterns, *Probability, *Investment, Markov processes, Regression analysis.
Identifiers: *Bayesian analysis, *Haavelmo's models, *Posterior distribution, Probability density, Conditional distribution, Joint density function.

In this paper, the exact posterior distributions of the parameters of Haavelmo's model I is derived for locally uniform prior distributions. Marginal distributions of the parameters have been obtained for Haavelmo's data. Then the predictive probability density of the model is derived for given values of the exogenous variable, investment. In order to check some of the specifying assumptions, the model is expanded and analyzed under the assumption that the error terms are generated by a first order autoregressive scheme. Exact finite sample results are obtained and the posterior distributions are computed for Haavelmo's data. Conditional distributions of the parameters of the model are computed for given values of the autocorrelation parameter, rho, in order to assess the effects of departures from our specifying assumptions. Another specifying assumption that is examined concerns the exogenous nature of investment. For this, Haavelmo's model II, in which investment is assumed to be endogenous, is used. Posterior dis-

tributions of the parameters of the model are computed for this model. Finally, two different prior distributions reflecting two different views about investment are introduced. The posterior distributions of the same parameter are then used to determine how one's prior belief is modified by the sample information. This article has relevance to simultaneous models of water resources and investigations of the properties of the estimated parameters of the model. (Loeb-Rutgers)
W69-04842

A NOTE ON THE VARIANCE OF A MATRIX,
Rice Univ., Houston, Tex.
David H. Nissen.
Econometrica, Vol 36, No 3-4, pp 603-604, July-October 1968. 2 p, 2 ref.

Descriptors:
Identifiers: *Matrix, *Variance, Covariance, Stacking operator, Kronecker product.

To express the covariance of the elements of a matrix, it is convenient first to rearrange the elements of the matrix into a vector. This note proves a theorem which facilitates computations with such rearrangements. An example of the use of the theorem is provided. This article has relevance to the substantial number of water research projects (e.g. input-output methods) that employ matrix algebra and manipulation in their studies. (Loeb-Rutgers)
W69-04844

NOTE ON THE UNBIASEDNESS OF A MIXED REGRESSION ESTIMATOR,
New South Wales Univ., Kensington (Australia).
N. C. Kakwani.
Econometrica, Vol 36, No 3-4, pp 610-611, July-October 1968. 2 p, 3 ref.

Descriptors: *Regression analysis.
Identifiers: *F class, *Bias, Regression disturbance, Symmetrical distribution.

The present note is a sequel to earlier articles by Suzuki and Nagar and Kakwani which, among other things, deal with the bias of a member of the f class of mixed regression estimates proposed by Theil. Suzuki proved that if the regression disturbances are normally distributed the bias of the member of the f class (for which f = 1/s squared, s squared being the unbiased estimator of sigma squared, the residual variance) is of smaller order than 1/T, where T is the number of observations. Nagar and Kakwani derived the bias of this member of the f class without the assumption of the normality of disturbances and showed that under the normality (or even symmetry) assumption, the bias to order 1/T is zero. In this note the author proves that this member of the f class is, in fact, unbiased provided the disturbances are assumed to be symmetrically distributed. This article is relevant to a large part of water research that employs least squares regression analysis in order to quantify water relations. Since data in the water area (e.g. demand studies) will contain similar error disturbance properties as conventional economic data, this article provides meaningful theoretical implications for the problems of the behavior of the error term. (Loeb-Rutgers)
W69-04845

THE INTERPRETATION AND ESTIMATION OF COBB-DOUGLAS FUNCTIONS,
Wisconsin Univ., Madison.
Arthur S. Goldberger.
Econometrica, Vol 36, No 3-4, pp 464-472, July-October 1968. 9 p, 1 tab, 8 ref

Descriptors: *Regression analysis.
Identifiers: *Cobb-Douglas function, Linear regression, Conditional median, Conditional mean, Conditional distribution, Logarithmic variable, Disturbance.

For empirical implementation of the Cobb-Douglas function, it is customary to append a multiplicative lognormal disturbance and fit a linear regression in the logarithmic variables. When this is done, attention is shifted (apparently unwittingly) to the conditional median from the conditional mean which is ordinarily the prime target of study. The customary procedure may be modified to provide minimum variance unbiased estimation of the conditional median or conditional mean. The familiar Cobb-Douglas log-log function is often used in empirical production and demand analysis. This article is relevant to econometric analyses of water demand and supply conditions that employ this log-log functional form. (Loeb-Rutgers)
W69-04853

HORIZONTAL DIFFUSION FROM AN INSTANTANEOUS POINT SOURCE DUE TO OCEANIC TURBULENCE,
For primary bibliographic entry see Field 02L.
W69-05036

A REVIEW OF THEORETICAL MODELS OF TURBULENT DIFFUSION IN THE SEA,
For primary bibliographic entry see Field 02L.
W69-05037

MATHEMATICAL MODEL FOR DISSOLVED OXYGEN,
For primary bibliographic entry see Field 05B.
W69-05058

ESTUARINE WATER QUALITY MANAGEMENT AND FORECASTING,
For primary bibliographic entry see Field 05B.
W69-05059

OPTIMUM OPERATIONS FOR PLANNING OF A COMPLEX WATER RESOURCES SYSTEM,
California Univ., Los Angeles. Water Resources Center.
W. A. Hall, R. W. Shepherd, W. S. Butcher, A. M. Esogbue, and S. C. Parikh.
UCLA Engineering Report No 67-54, (University of California, Water Resources Center, Contribution No 122), October 1967. 75 p, 9 figs, 5 tab, 14 ref, 11 flow-charts, 6 photo.

Descriptors: *Computer programs, *Mathematical studies, *Optimizing, *Planning, Water values, Bodies of water.
Identifiers: *Sacramento Basin, *Flow-chart.

The methods used in this report were derived in context with the physical, legal, social, and economic realities of the combined major resource projects in the Sacramento Basin in Northern California. Four major streams, ten reservoirs, and the associated pumping plants, aqueducts, and power generation facilities are included in the analysis. The financial feasibility for planning based on deliveries of firm energy, firm water, off-peak energy, and off-season water is the objective to be maximized. The analysis provides for the specification of the values, within complexly constrained limits, of the firm energy, firm water, dump energy, and dump water to be produced in each of 120 time periods in dry periods (critical periods) at each of the ten reservoirs comprising the five major subsystems. The individual reservoir operators use dynamic programming to optimize their returns. The manager maximizes the actual returns he could obtain from water and power contracts using linear programming. Included in the report are water resource system schematics and programming flow-charts. (Grossman-Rutgers)
W69-05123

TOWARD THE OPTIMIZATION OF INVESTMENT-PRICING DECISIONS: A MODEL FOR URBAN WATER SUPPLY TREATMENT FACILITIES,
Cornell Univ., Ithaca, N. Y.
For primary bibliographic entry see Field 05F.
W69-05128

TOWARD THE OPTIMIZATION OF INVESTMENT-PRICING DECISIONS: A MODEL FOR URBAN WATER SUPPLY TREATMENT FACILITIES,
Cornell Univ., Ithaca, N. Y.
For primary bibliographic entry see Field 05F.
W69-05129

TOWARD THE OPTIMIZATION OF INVESTMENT-PRICING DECISIONS: A MODEL FOR URBAN WATER SUPPLY TREATMENT FACILITIES,
Cornell Univ., Ithaca, N. Y.
For primary bibliographic entry see Field 05F.
W69-05130

OPERATING POLICIES FOR IRRIGATION SYSTEMS UNDER STOCHASTIC REGIMES,
Harvard Univ., Cambridge, Mass.
Russell J. deLucia.
Ph D Thesis, Harvard University, Div Eng Appl Phys, Jan 1969. 173 p, 15 fig, 8 tab, 39 ref, 3 append.

Descriptors: *Linearing programming, *Dynamic programming, *Irrigation systems, *Irrigation efficiency, Water policy, Water management (Applied), Synthetic hydrology, Stochastic processes, Mathematical models.
Identifiers: *Sequential linear programming, Stochastic regimes, Operating policies.

Two distinct mathematical modelling approaches, used to determine optimal operating policies for irrigation systems subject to stochastic regimes, were presented. A dynamic programming model determined the optimal policy for a one-crop system, while a sequential linear programming model determined policy for a multi-crop problem. The algorithms developed could be applied to existing systems for operational decision making, or be used as a planning tool for preproject decision making. The objective of both models was to maximize expected crop revenues as a function of the forecast hydrology subject to technical crop water requirements. (Gysi-Cornell)
W69-05131

OPERATING POLICIES FOR IRRIGATION SYSTEMS UNDER STOCHASTIC REGIMES: DYNAMIC PROGRAMMING MODEL,
Harvard Univ., Cambridge, Mass.
Russell J. deLucia.
PhD Thesis, Harvard Univ, Chap 2, Jan 1969. 37 p, 4 fig, 6 tab, 13 ref.

Descriptors: *Dynamic programming, *Irrigation systems, *Irrigation efficiency, Water policy, Water management (Applied), Synthetic hydrology, Stochastic processes, Storage, Streamflow, Water allocation (Policy).
Identifiers: *Stochastic regimes.

A dynamic programming model was used to determine the optimal operating policy for a one-crop irrigation system under stochastic regime. The objective was to maximize revenue expectation as a function of the forecast hydrology. The model was solved as a non-stationary stochastic, finite stage process problem. State variables were surface storage, previous period streamflow, and water content of root zone. Random variables were streamflow and rainfall during the period. Decision variables were withdrawals from surface and ground storage. Results of the solution compared with a traditional operating policy reported in the literature, indicated an increase in expected value. (Gysi-Cornell)
W69-05132

OPERATING POLICIES FOR IRRIGATION SYSTEMS UNDER STOCHASTIC REGIMES:

SEQUENTIAL LINEAR PROGRAMMING MODEL,
Harvard Univ., Cambridge, Mass.
Russell J. deLucia.
Ph D Thesis, Harvard Univ, Chap 3, Jan 1969. 46 p, 5 fig, 2 tab, 8 ref.

Descriptors: *Linear programming, *Irrigation systems, *Irrigation efficiency, Water policy, Water management (Applied), Synthetic hydrology, Stochastic processes, Water allocation (Policy), Storage, Streamflow.
Identifiers: *Sequential linear programming, *Stochastic regimes, Multi-crop, Multi-season.

A sequential linear programming model was developed to determine optimal irrigation operating policies for the general multi-crop, multi-soil type, with overlapping growing seasons and variable acreage irrigation systems under stochastic regimes. The objective was to maximize revenue expection as a function of forecast hydrology, subject to minimal crop allotment restrictions. Decision variables were the quantity and timing of irrigation water allocation. A particular two-crop system was examined and solved and the results discussed. The model structure approximated on open-loop optimal feedback scheme. A series of coupled linear programs employed a unique activity definition technique for continual consideration of relevant management possibilities. (Gysi-Cornell)
W69-05133

INTRODUCTION TO 'THE CONJUNCTIVE USE OF SURFACE AND GROUNDWATERS',
R. E. Dearlove.
Proc Reservoir Yield Symp, Water Res Ass, Part II, Pap No 10, pp D10-1 to D10-4, Oxford, England, Sept 1965. 4 p, 3 fig.

Descriptors: *Dynamic programming, *Conjunctive use, Surface-groundwater relationships, Benefits, Analytical techniques, Simulation analysis, Water allocation (Policy), Decision making, Optimization.

A paper titled 'The Conjunctive Use of Surface and Ground Waters' (W69-05135) by N. Buras is introduced. Some fundamentals of stochastic inflows, benefit functions for irrigation, and optimization techniques for adoption of decision policies (including simulation) were outlined. State and decision variables for the dynamic programming model by Buras were listed. The recursive methodology of dynamic programming for determining optimal policy by taking optimal sequential decisions was discussed. Figures illustrated the concepts of transition of state variables, and of net benefit functions. (Gysi-Cornell)
W69-05134

THE CONJUNCTIVE USE OF SURFACE AND GROUND WATERS,
Technion - Israel Inst. of Tech., Haifa; California Univ., Berkeley.
N. Buras.
Proc Reservoir Yield Symp, Water Res Ass, Part I, Pap No 10, pp 10-1 to 10-10, Oxford, England, Sept 1965. 10 p, 2 fig, 14 ref.

Descriptors: *Dynamic programming, *Conjunctive use, Aquifers, Computer models, Groundwater recharge, Reservoir operation, Surface-groundwater relationships, Water demand, *Economic efficiency, Water supply, *Water allocation (Policy), Hydrologic budget.

A dynamic programming model was presented which could be used to determine the optimum conjunctive use from surface and groundwater sources. The hypothetical example investigated involved one groundwater source, one reservoir, and one demand area. The decision variables were the source releases, and the recharge from the reservoir to the groundwater. The state variables were the reservoir and aquifer levels. Stochastic inflows from a known probability distribution were assumed. The model assumed independence of inflows. It was concluded that refinements of the model into larger multipurpose systems should be considered. The model could be useful in a sensitivity analysis of a systems design parameter. (Gysi-Cornell)
W69-05135

6B. Evaluation Process

ECONOMIC AND SOCIAL ASPECTS OF PLANNING OF WATER RESOURCES IN DEVELOPING COUNTRIES.
Water Resour J, pp 76-104, Sept 1968. 29 p, 2 ref.

Descriptors: Water resources, *Water resources development, Benefits, Water supply, Planning, *Project planning, *Economic feasibility, Social impact, Economic justification, Cost-benefit analysis, Foreign projects, *Social aspects, Social values, River basin development, Cost repayment, *Irrigation programs, *Financial analysis, Hydroelectric power.
Identifiers: *Developing countries, *Underdeveloped countries, Asia, Development loans, Benefit-cost analysis, Far East.

Economic and social aspects of water resources development planning suited to the countries of Asia and the Far East are reviewed. Many of the planning criteria and standards currently in use originated in the highly developed industrial countries, and are not fully responsive to the needs of the developing countries. A meeting of a Working Group of Experts on Water Resources Planning was organized by the Economic Commission for Asia and the Far East in Sept 1968, and attended by 19 member countries. Topics discussed include: (1) procedures and standards for economic and financial analyses of water resources planning; (2) social and noneconomic considerations in water resources development programs; (3) coordinating activities of all agencies concerned with water resources development and related fields; and (4) other considerations relative to water resources development and related fields. A summary is given of the conference discussions, conclusions reached by the Working Group of Experts on Water Resources Planning, and recommendations for future conferences and seminars. (USBR)
W69-04741

IMPROVEMENT OF WATER RESOURCES UTILIZATION FOR PUBLIC WATER SUPPLY IN TAIWAN,
Taiwan Provincial Government. Public Works Bureau.
Tsu-san Chang.
For the 8 Volume Proceedings, see Vol 2, No 9, Field 06B W69-03305. Int Conf on Water for Peace, Wash, D C Vol 6, pp 758-765, 1968. 8 p, 1 fig.

Descriptors: *Water supply, *Public utilities, *Water allocation (Policy), *Water resources development, Administration, Conjunctive use, Water distribution (Applied), Conservation, Governments, Optimum development plans, Political aspects, Legal aspects, Social aspects, Water utilization.
Identifiers: Taiwan, Public water supply.

The history of public water supply systems in Taiwan is summarized. Only 17% of the population were served with public water supply systems at the end of the Second World War. As of the end of 1965, the total output of the water supply systems in Taiwan has increased to 1,081,600 cu m of water per day to serve 4.84 million people, or 38.3% of its total population. A 10-year plan formulated by the government has a target to raise the population served to 48.5% of the total by the end of 1974. To reach this target, the potable water production shall be increased by additional 607,900 cu m per day. Regional consolidation of water supply systems is being used to achieve effective and coordinated utilization of water resources, enabling the economic and balanced development of water supplies in big cities as well as in small communities. At the same time, the existing water rights have to be honored. Groundwater is abundant in some areas of Taiwan and is preferable to surface water as the source of water supply for nearby communities, industries, and irrigation. Simplicity in treatment and avoidance of long transmission are obvious advantages. In 2 projects, wells were developed to irrigate nearby farms, in exchange for the surface water coming through a long distance canal owned by the local irrigation associations for many years. An appropriate amount of the surface water is then diverted from the canal for the use of public water supplies in communities and industrial districts close to the surface water source. Such schemes require skillful planning; their implementation involves the successful solution of legal, political, and social complications, because the water sources are located in different administrative areas and are owned by different organizations. (Knapp-USGS)
W69-04760

QUALITATIVE ECONOMICS AND THE SCOPE OF THE CORRESPONDENCE PRINCIPLE,
Washington Univ., Seattle; Colorado Univ., Boulder; Kansas Univ., Lawrence.
Lowell Bassett, John Maybee, and James Quirt.
Econometrica, Vol 36, No 3-4, pp 544-563, July-October 1968. 20 p, 21 ref.

Descriptors: Cycles, Stability.
Identifiers: *Qualitative economics, *Correspondence principle, Comparative statics, Morishima matrix, Chains, Sign stability.

The comparative statics properties of qualitatively specified systems are investigated in two cases: the 'purely qualitative' case studied by Lancaster and Gorman, and the case in which the coefficient matrix of the system is assumed to be stable. Samuelson's 'correspondence principle' is shown to be of particular importance in the Morishima case, but of less importance when the Morishima conditions are violated. This article has relevance to multi-equation water resource models that involve qualitative specifications of the system. (Loeb-Rutgers)
W69-04806

DEEP SEA MANGANESE NODULES: FROM SCIENTIFIC PHENOMENON TO WORLD RESOURCE,
Berea Coll., Ky.
David B. Brooks.
Natural Resources Journal, Vol 8, No 3, pp 401-423, July 1968. 33 p.

Descriptors: *Manganese, Resources, Natural resources, Water resources, Mining, Mineral industry, economic efficiency, International waters, Economic feasibility.
Identifiers: *Manganese nodules.

There are manganese-bearing nodules on the floor of the deep ocean basins. While it may not be economic to mine these nodules at present, analysis of alternative manganese resources indicates that they are close enough to the margin to place a ceiling on the long run prices of manganese, nickel and cobalt. Competition for the best deposits of manganese nodules is almost certain to develop once deep sea mining proves feasible so that rights to mine these deposits will acquire value. In this article attention is focused on ways in which institutional forces could be designed so as to promote economic efficiency in deep sea mining. The usefulness of a market to establish the value of exclusive mining rights was emphasized. (Winn-Rutgers)
W69-04810

IMPORTANCE OF THE ECONOMIC FEASIBILITY OF THE WATER SUPPLY AND SEWER SYSTEM PROJECTS,
Jorge C. Wedel.

For 8 volume Proceedings see Vol 2, No 9, Field 06B, W69-03305. International Conference on Water for Peace, Vol 6, pp 630-636, 1968, Washington: U S Gov't Printing Office, 7 p.

Descriptors: Economics, Economic feasibility, *Feasibility studies, *Project planning, Feasibility, Sewage disposal, Planning, Standards, Evaluation, Costs, Benefits, *Foreign countries, Financial feasibility.
Identifiers: Latin America, Punta del Este Charter.

When resources are scarce and the needs are great, careful planning is indispensable. When evaluating a proposed project, consideration must be given to the standards and specifications to be used and to the preparation of feasibility studies. Most developing countries do not have complete and adequate standards and specifications and for this reason they often turn for assistance to the more developed countries. However, it must be remembered that standards and specifications are set through experience and observation. Consequently, the environment has a great influence on their establishment. Economic feasibility studies must include a complete study of the proposed project from three viewpoints: (1) proof must be given that the proposed technical solution is most economical; (2) the relative priority of the solution must be justified with respect to other existing problems; (3) the financial feasibility must be established. (Winn-Rutgers)
W69-04811

THE BENEFIT-COST RATIO: CONCEPTIONS AND MISCONCEPTIONS,
William S. Butcher.
For 8 volume Proceedings see Vol 2, No 9, Field 06B, W69-03305. International Conference on Water for Peace, Vol 6, pp 681-694, 1968. Washington, D C: U S Government Printing Office, 14 p, 2 fig, 3 tab, 19 ref.

Descriptors: *Cost-benefit ratio, Costs, Benefits, Decision making, Economic efficiency, Direct benefits, Dynamic programming, Linear programming, Computers, Risks, Interest rate.
Identifiers: Secondary benefits, Public investment, Incremental benefit-cost analyses, Economic merit, Computer evaluation.

The benefit-cost ratio, properly used, is the ratio of the change in benefits versus the change in costs which results from pursuing one course of action rather than another. When a benefit-cost ratio is assigned to a single project the comparison is between that project and failure to take any action. The numerical value that is derived when a benefit-cost ratio is calculated, is quite sensitive to what is regarded as a cost or a benefit. For instance, in comparing two projects, if the second is cheaper than the first, this could be regarded as a reduction in comparative cost, or an increase in comparative benefits. Valid comparison between projects is given only by noting if the benefit-cost ratio is greater or less than one. It is an error to assign a meaning to how much greater than one. Usually in comparing project expenditures, the increments of cost under consideration are positive. In these cases the benefit-cost ratio being greater than one indicates an economically efficient additional expenditure. However, when the changes of costs and benefits between projects can be either positive or negative, the normally used criterion must be generalized to take this into consideration. This generalization is useful when making computer evaluations. (Loeb-Rutgers)
W69-04812

THE DEVELOPMENT OF NEW WATER RESOURCES IN THE ECONOMICS OF A TOTAL WATER SYSTEM,
J. M. English, and Nabil El-Rambly
For 8 volume Proceedings see Vol 2, No 9, Field 06B, W69-03305. International Conference on Water for Peace, Vol 6, pp 655-664, 1968. Washington, D C: U S Government Printing Office, 10 p, 3 fig, 9 ref.

Descriptors: *Water resources, Investment, Boundaries, Capital, Planning, Pricing, Demand, Economies of scale.
Identifiers: Development, Total water system, System choices, Optimum decision, Optimum mix, Water-need, Surroundings.

The decision whether to invest in new water supplies and, if so, when, how much, or how long, must be made as to maximize some profitability index of an aggregate system. The development of new water resources for commercial uses has been largely confined to situations which are distinguished by the following common characteristics: (1) the demand greatly exceeds the supply, (2) availability of well-defined high value uses for water, (3) new supplies are the only alternative available or have a distinct advantage in an economic comparison and (4) the demand for water is for small quantities. Under these circumstances it is not difficult to justify the investment. This paper discusses the problem of system choices definition of boundaries, surroundings and their interactions. A methodology for the choice of an optimum decision is presented and the alternative of a mix between the conventional surface supplies and the development of a new resource is introduced. The usual two alternative case is shown to be a special case of the mix alternative. The optimum mix is determined on the basis of maximizing some profitability index, such as an internal rate of return on investment. (Loeb-Rutgers)
W69-04813

REGIONAL WATER RESOURCE DEVELOPMENT IN THE FEDERAL SYSTEM,
Walter Kiechel, Jr.
For 8 volume Proceedings see Vol 2, No 9, Field 06B, W69-03305. International Conference on Water for Peace, Vol 5, pp 628-633, 1968. Washington: U S Gov't Printing Office, 6 p, 22 ref.

Descriptors: *Water resource development, Resource development, Federal government, Governments, Water law, Water Resources Planning Act, Water resources, *Water rights, State governments, United States, Federal government, Legal aspects, Interstate compacts, Court decisions, Federal jurisdiction, State jurisdiction.

Water law and the legal institutions involved are for the most part circumscribed by the geographic limits of the political entity on whose authority the particular laws or institutions are dependent. The growing realization that water resources need to be handled on a drainage basin or river system basis requires a reexamination of the ability to accommodate such an approach within the framework of existing laws and legal institutions. An effective national program must be responsive to regional, state, and local needs. The existing legal institutions on all levels must accommodate a comprehensive national program with federal leadership and financing accompanied by meaningful state and local participation. Progress has been made in fashioning mechanisms which will serve the purposes of regional water resource planning through the Water Resource Planning Act of 1965. The challenge today is whether similar progress can be accomplished in the realm of regulation and administration of water resources. (Winn-Rutgers)
W69-04815

THE SOCIAL-ECONOMIC EVALUATION OF WATER RESOURCE PROJECTS,
Philip Sporn, and Abraham Gerber.
For 8 volume Proceedings see Vol 2, No 9, Field 06B, W69-03305. International Conference on Water for Peace, Vol 6, pp 731-736, 1968. Washington, D C: U S Government Printing Office, 6 p.

Descriptors: Water resources development, Evaluation, Capital costs, Costs, Interest rate, Loans, Obsolescence, Taxes.
Identifiers: Water resource projects, Subsidies, Opportunity cost, Errors, Water power projects, Technological change.

In this paper the authors discuss the principles that enter into a proper economic analysis of the costs of water power projects. Errors in the economic evaluation of water projects most frequently stem from the use of incorrect capital costs. Economic analyses frequently are made on the basis of capital costs associated with the interest rates on government loans or, in the case of international loans, the interest rates on such loans rather than on the real cost of capital or, in technical terms, the opportunity cost of capital in the particular economy. Frequently such distortions in the economic analyses are inadvertently encouraged in the case of international development loans when such loans are tied to a specific project. The availability of such loans predetermines the type of plant to be built without permitting a choice on the basis of sound economic analysis. Errors in evaluation often are also made because the life of the project is evaluated on the basis of its expected physical durability rather than on its economic life and the value of the output is projected without regard to the outlook for technological change that could affect this value. The basic principles for the evaluation of water projects are independent of the form of the particular economy. (Loeb-Rutgers)
W69-04816

IMPROVED EVALUATION PROCEDURES IN APPALACHIAN WATER RESOURCE PLANNING,
James D. Evans, and Robert W. Harrison.
For 8 volume Proceedings see Vol 2, No 9, Field 06B, W69-03305. International Conference on Water for Peace, Vol 6, pp 640-651, 1968. Washington: U S Gov't Printing Office, 12p, 4 ref.

Descriptors: *Appalachian Mountain Region, Geographical regions, Regions, *Planning, *Benefits, Input-output analysis, Governments, Area redevelopment, Economics.
Identifiers: Regional development, *Appalachian Regional Development Act of 1965, Expansion benefits, User benefits, Multiplier.

For the first time in United States directives for water resource planning, the Appalachian Regional Development Act of 1965 directs preparation of a comprehensive plan for water and related resource development specifically to stimulate a lagging economy. If water and other public works are to serve as positive instruments for promoting regional development and growth, they must be planned from the outset to accomplish a new range of goals. The authors discuss this thesis under three headings: the over-all framework; the steps toward project selection; and methods of measuring program and project effects. Under the law the emphasis in public investments shall be in areas with significant potential for future growth and with high expected returns. This requires analysis of the subregional economy, but it also recognizes the role of the region in national development and growth. (Winn-Rutgers)
W69-04817

THE DYNAMIC CHARACTER OF MULTIPURPOSE RIVER DEVELOPMENT: THE TVA EXPERIENCE,
For primary bibliographic entry see Field 04A.
W69-04818

ECONOMICS OF WATER QUALITY MANAGEMENT,
For primary bibliographic entry see Field 05G.
W69-04823

WATER AND ECONOMIC DEVELOPMENT.
World Bank, Washington, D. C.

For 8 Volume Proceedings see Vol 2, No 9, Field 06B, W69-03305. Internationsl Conference on Water for Peace, Vol 8, pp 801-809, Washington, D C, U S Government Printing Office, 1968. 9p.

Descriptors: *Financial analysis, *Irrigation, *Flood control, *Water supply, *Inland waterways, *Hydroelectric power, Feasibility studies, Benefits.
Identifiers: *World Bank, *Capital development projects, Managua.

About half of all Bank Group financing has been for hydroelectric power, railways, ports and waterways, telecommunications and urban water supply--clearly revenue-producing public utilities. Experience in less developed countries clearly indicates that such public utilities will almost invariably fail to meet the needs of economic development unless they are made to pay their own way. Consequently the Bank Group requires especially that rates be established which will cover all operating and maintenance costs, including debt requirements, and produce a surplus which will help finance future extensions; this applies whether the utility is publicly or privately owned. An example of the efficacy of such policies is a small project in Managua, Nicaragua, where the water supply system has been reorganized, modernized and extended with the aid of $3 million credit. As a development institution the World Bank Group must look far beyond the engineering and financial aspects of an irrigation project it considers for financing. There are potential direct benefits to farmers due to realizable cropping patterns, farming methods and the indirect benefits of an irrigation project to the immediate community, the region and the country as a whole may be much greater than those derived by the farmers using the water. A successful project adds to the food supply, reduces need for imports or increases exports, relieves upward pressure on prices, expands the tax base. (Sokoloff-Rutgers)
W69-04825

WATER AND ECONOMIC DEVELOPMENT.
World Bank, Washington, D. C.

For 8 Volume Proceedings see Vol 2, No 9, Field 06B, W69-03305. International Conference on Water for Peace, Vol 6, pp 617-25, Washington, U S Gov't Printing Office, 1968, 9 p.

Descriptors: *Financing, *Public utilities, Fresh water, Water supply, Utilities.
Identifiers: Economic development, World Bank, International Development Association.

While fresh water is necessary for economic development, some of the problems in financing its supply and use are insufficiently understood. From the experience of the World Bank certain guidelines of general application for financing public utilities can be derived. First, sound development requires that each project financed by justified in terms of its priority in relation to competing demands for scarce financial and natural resources. The second major guideline concerns financial policies. The Bank has found that revenue producing public utilities will almost invariably fail to meet the needs of development unless they are made to pay their own way. A third requirement is the availability of a competent engineering organization, subject to effective policy supervision. Another prerequisite to the successful financing of public utilities is the existence or establishment of appropriate institutional arrangements for their administration. (Winn-Rutgers)
W69-04829

THE ROLE OF INVESTOR-OWNED WATER UTILITIES IN NATIONAL DEVELOPMENT,
William F. Hyland.
For 8 Volume Proceedings see Vol 2, No 9, Field 06B, W69-03305. International Conference on Water for Peace, Vol 8, pp 781-85, Washington: U S Gov't Printing Office, 1968.

Descriptors: *Public utilities, Water resource development, Utilities, Return (Monetary).
Identifiers: *Investor-owned water utilities.

There are a number of reasons for encouraging private capital into the area of water resource development. The basic advantage is that it stimulates development. Investor-owned water systems became the pioneers in public utilities in the U S through the default of local governments. None of the governing bodies wanted the responsibility of levying the heavy taxes to raise the necessary capital for construction. Public utility commissions regulate the water service industry. This regulation is considered appropriate in areas of service which are indispensable to the public and where the traditional forces of competition might deny to the public their essential needs. The rate of return established by the utility commission is influenced by the 'comparable earnings' standard and the 'attraction of capital' standard. (Winn-Rutgers)
W69-04830

BASIC DATA FOR WATER PROGRAMMES SOCIAL AND ECONOMIC CHARACTERISTICS FOR WATER PROGRAMMES.
World Health Organization, Geneva (Switzerland).

For 8 Volume Proceedings see Vol. 2, No 9, Field 06B, W69-03305. International Conference on Water for Peace, Vol 4, pp 833-835, Washington, D C: U S Government Printing Office, 1968. 3 p.

Descriptors: *Data collections, *Water supply, *Water resources development, Social aspects, Construction, Financial feasibility.
Identifiers: *Background information, Urban population.

The planner of a community water supply system will need a large number of basic data in the process of developing a construction programme for water supply which will meet all technical and economic criteria. Some of this information may be called 'background information,' data relating to water quantity and water quality, the physical, geological and ecological characteristics of water systems. The two most important single factors to be considered under this category are the trend of future water requirements, and all those economic criteria which may determine the potential of the prospective water consumer to pay for the water service required. Among the socioeconomic data required by the water supply planner are those relating to population, population growth and distribution of population, present and future industrial activity, income and income distribution, etc. Noteworthy examples for the utilization of social and economic information are two preinvestment surveys carried out under contract with the World Health Organization for the Calcutta Metropolitan District and for the Accra-Tema Metropolitan area in Ghana. (Sokoloff-Rutgers)
W69-04832

CONSIDERATIONS INVOLVED IN THE PLANNING, ORGANIZATION, MANAGEMENT, AND DESIGN OF PUBLIC WATER SUPPLIES,
Harold R. Shipman.
For 8 Volume Proceedings see Vol 2, No 9, Field 06B, W69-03305. International Conference on Water for Peace, Vol 8, pp 713-716, Washington, D C, U S Government Printing Office, 1968. 4 p.

Descriptors: *Feasibility studies, Investment, Benefits, Municipal water, Personnel.
Identifiers: *Public water supply program, Revenues, Local conditions, Medium range plan.

In the relatively short time during which the World Bank and its affiliate, the International Development Association, have been engaged in the financing of water systems, the impression has been gained that rather few countries have analyzed their domestic and industrial water supply requirements with other than a short-range goal in mind. It is rare to find a country which has made a comprehensive study of the water supply requirements, consolidated the plans of individual cities and communities, and established the requirements for funds. It is equally rare to find engineering designs and preliminary studies completed to a point where a financing institution can make an appraisal. One of the major reasons why more loans are not being made today is the failure of water supply officials to have projects prepared which could be considered for financing, with preliminary engineering and feasibility studies completed, priorities established, and financing plans reasonably well devloped. (Sokoloff-Rutgers)
W69-04834

THE ROLE OF ECONOMICS IN PLAN FORMULATION,
Daniel V. McCarthy.
For 8 Volume Proceedings see Vol 2, No 9, Field 06B, W69-03305. International Conference on Water for Peace, Vol 6, pp 697-702, Washington: U S Gov't Printing Office, 1968, 6 p.

Descriptors: *Economics, *Planning, *Benefits, Cost allocation, Economic justification, Water resource development, Institutional constraints, Annual costs, Annual benefits, Intangible benefits, Data processing.

In deciding the nature and extent of water resource development in any given area or country there are three principal considerations. Common to all project proposals should be the economic justification. The second major consideration involves institutional restraints which may override or otherwise alter plan formulation goals dictated by considerations of economic efficiency. The third consideration includes those intangibles which do not lend themselves to economic evaluation. In general, considerations of economic efficiency will be paramount in underdeveloped countries. As a country develops, the institutional and intangible considerations become more important. The key factor in analyzing the economic efficiency of projects is the measurement of annual costs and benefits. Measuring cost is fairly easy but better procedures are necessary for measuring benefits. (Winn-Rutgers)
W69-04835

FINANCING WATER PROJECTS IN LATIN AMERICA,
W. A. Carter, H. Schulthess, E. Salazar, and Guzman R. Suarez.
For 8 Volume Proceedings see Vol 2, No 9, Field 06B, W69-03305. International Conference on Water for Peace, Vol 8, pp 788-796, Washington, D C: U S Government Printing Office, 1968. 9 p, 5 tab.

Descriptors: *Irrigation programs, *Hydroelectric power, *Sewerage, *Water supply, *Loans, Feasibility studies, Electric power.
Identifiers: *Interamerican Development Bank, Technical assistance, Social Progress Trust Fund.

This paper discusses the Interamerican Development Bank, its resources, and its financial operations in the fields of irrigation, sanitation, and hydroelectric power. In the irrigation field, the Bank has financed irrigation projects in Mexico, in Peru, in Chile, in Argentina and in Colombia. These projects have permitted irrigation and improvements on 663,000 hectares of land; the loan total of approximately $175 million is financing projects totalling $482 million and approximately 450,000 people have benefited by this program. In the water supply and sewerage field, the Bank has become the foremost external financial agent for its countries. Its operations are aimed at reaching the goals established by the meeting at Punta del Este in 1961 to provide at least 70% of the urban population and 50% of the rural population with potable water and sewerage by 1971. In the hydropower field, the Bank is involved in 10 hydroelectric projects which will represent an additional 2.35 million KW of generating capacity in 6 countries. The Bank's operations in the Water for Peace Program of the Western Hemisphere are assuming greater and greater importance. In the irrigation and

hydropower fields, these operations supplement national operations. However, in the sanitary field, the Bank has become the primary force in financing water supply and sewerage projects in the member countries. (Sokoloff-Rutgers)
W69-04836

WATER LAW AND PRIVATE DECISION MAKING: A CRITIQUE,
Indiana Univ., Bloomington.
J. W. Milliman.
Jour of Law and Economics, Vol 11, pp 41-63, Oct 1959. 23p.

Descriptors: *Resource allocation, *Reparian rights, *Percolating water, *State jurisdiction.
Identifiers: *Public ownership, *Appropriative rights, *Transferability, Market process, Central planning, Social costs, California, Texas, Colorado, Iowa.

This paper presents a survey and evaluation of state water law as it affects individual decision making processes in the use and development of water resources. The basic thesis is that rights to use water resources should be treated as real property. Insofar as possible, water rights should be defined and given legal certainty so that allocation of water between competing uses and users can take place through the market mechanism. Although the doctrine of appropriation, as presently interpreted, is subject to a number of serious criticisms, it can be modified to provide the foundation for an improved system of water law. The riparian doctrine is ill suited to the development of transferable private property rights in water resources. It places major reliance upon judicial judgment for the allocation of water supplies. Many eastern states are beginning to realize the inadequacies of riparian law and are in the process of moving closer to the doctrine of appropriation, but they are doing so for the 'wrong' reasons. Proposed changes in eastern water law do not stress the opportunities which the appropriation doctrine offers for the development of a price system and individual decision making but rather for the opportunity to institute centralized and non-market decision making processes. The new Iowa law of water rights is an example of this type of thinking. Throughout state water law there seems to be a pervasive distrust of the use of the market mechanism for the allocation of water resources. (Sokoloff-Rutgers)
W69-04839

QUADRATIC TEAMS, INFORMATION ECONOMICS, AND AGGREGATE PLANNING DECISIONS,
Carnegie-Mellon Univ., Pittsburgh, Pa.
Charles H. Kriebel.
Econometrica, Vol 36, No 3-4, pp 530-543, July-October 1968. 14 p, 2 tab, 10 ref.

Descriptors: *Planning, *Decision making.
Identifiers: *Quadratic teams, *Information economics, *Aggregate planning decision, Team decision theory, Objective criterion, Quadratic function.

The construct of team decision theory developed by J Marschak and R Radner provides a useful framework for the conceptualization and evaluation of information within organizations. Quadratic teams concern team decision problems where the organizational objective criterion is represented by a quadratic function of the action and state variables. The purpose of this paper is to explicitly relate the analysis of quadratic team decision problems to recent research in optimal decision rules for aggregate planning--for example, as reported by Holt et al, Theil, van de Panne, and others. A numerical example is presented based on the well known microeconomic model of production and employment scheduling in a paint factory. Water investment decisions, it can be argued, are made in an organizational-team framework and this article can be relevant in relating recent microeconomic theoretical developments to situations in the water investment area. (Loeb-Rutgers)
W69-04843

HOMOGENEOUS, ESPECIALLY LINEAR HOMOGENEOUS, PRODUCTION FUNCTIONS AND THE LAW OF YIELD (GERMAN),
Wuerzburg Univ. (West Germany).
Wolfgang Eichhorn, and Udo Muller.
Weltwirtschaft Archiv, Vol 100, No 2, pp 290-305, June 1968. 16 p, 1 fig.

Descriptors: *Homogeneity, Returns to scale.
Identifiers: *Total yield curves, *Production function, *Linear homogeneous, Factor of production, Euler's Theorem, Monotonic.

The paper is concerned with the question whether the assumption of a homogeneity of production functions agrees with the law of yield, i.e., the law of diminishing returns, or, in other words, whether a theory based both on the law of diminishing returns and on the assumption of production functions being homogeneous to the degree of alpha is free of contradiction. As a result of the research undertaken it may be said that the question may be answered in the affirmative for certain types of returns which are in agreement with the law of diminishing returns (total yield curves); whereas the question must be answered in the negative for a different and important type of returns, also in agreement with the law of diminishing returns where it is a case of alpha greater or equal to one, whether or not the homogeneity is linear. The general questions discussed in this article are relevant to empirical models of water production and cost analyses containing underlying (explicit or implied) linear production functions. (Sokoloff-Rutgers)
W69-04846

CAPITAL ACCUMULATION AND TECHNICAL PROGRESS (GERMAN),
Regensburg Univ. (West Germany).
Winfried Vogt.
Weltwirtschaft Archiv, Vol 100, No 2, pp 185-96, June 1968. 12 p, 2 fig.

Descriptors: *Technology, Investment, Stability, Equilibrium.
Identifiers: *Capital accumulation, *Saving quota, *Technical progress, Production function, Transformation curve, Social product, Growth theory.

The paper offers a contribution to the question of the relationship, within growth theory, between capital accumulation and technical progress. It is assumed that the resources not used for the production of consumption goods may be used either for the production of capital goods or, for the creation of (Harrod-neutral) technical progress in such a manner that an existing transformation curve of accumulation rate and technical progress (conventionally a concave curve) moves to the right with an increasing mathematical product of capital productivity and savings quota. Assuming that entrepreneurs want to maximize the growth rate of profits, one arrives at an optimum-combination of accumulation rate and technical progress for each position of the transformation curve. These assumptions are introduced into a neoclassical growth model, with the aid of which the stability and characteristics of growth equilibrium are examined. It is shown, among other things, that, in contradiction to traditional growth theory, equilibrium rates depend upon the savings quota. Theoretical investment problems in water resources as they concern the rate of capital accumulation, technical progress and the savings behavior of the economy can be fitted into the broad issues treated by this paper. (Sokoloff-Rutgers)
W69-04847

AN ECONOMIC EVALUATION OF ALTERNATIVE METHODS OF FISHERY REGULATION,
Washington Univ., Seattle.
James A. Crutchfield.
Journal of Law and Economics, Vol IV, pp 131-143, Oct 1961. 13 p.

Descriptors: *Fisheries, Welfare, Profit, Taxes, Efficiencies, Pacific Coast Region, Salmon.
Identifiers: *Optimal utilization, *Government regulation, Fishing mortality, Gear restriction, Closed areas, Size limits, Halibut, Closed seasons, Quotas.

In previous papers in the economics of the fisheries, three points have been stressed: the motives which make overfishing a serious problem are essentially economic; if the resource must be exploited under common-property conditions, overfishing is not self-correcting, and government regulation will be required; one of the vital objectives of any regulation must be promotion of economic efficiency. Because this third requirement is foreign to the terms of reference of most regulatory agencies, the economic aspects of regulation have usually been neglected where possible, and ignored where too obvious to be neglected. This paper takes a look at the techniques of fishery management from the standpoint of their economic effects. Assuming that rational utilization of the major Pacific Coast fish populations requires limitation of fishing mortality, the two significant questions studied are: how can this limitation of catch be made effective, and which of the alternative methods will minimize the long-run cost of any given level of output selected. This analysis of this article can be extended to the fishery benefits evaluation of specific water development projects. (Sokoloff-Rutgers)
W69-04849

POSITIVE ECONOMICS, WELFARE ECONOMICS, AND POLITICAL ECONOMY,
Virginia Univ., Charlottesville.
James M. Buchanan.
Jour of Law and Economics, Vol II, pp 124-138, Oct 1959. 15 p.

Descriptors: *Welfare.
Identifiers: *Pareto efficiency, *Social welfare function, Presumptive efficiency, Compensation principle, Mutual gains, Ethical valuations, Subsidization, Utility.

The task of the political economist is that of locating possible flaws in the existing social structure and in presenting possible 'improvements.' The specific hypothesis that mutual gains do exist as a result of possible trades, is tested by the behavior of private people in response to the suggested alternatives. Since 'social' values do not exist apart from individual values in a free society, consensus or unanimity is the only test which can insure that a change is beneficial. In utilizing the traditional 'efficiency' tools it is necessary to beware of slipping into the easy assumption of omniscience. The individual preference patterns and the changes which are based on these must always be considered tentative hypotheses to be subjected to testing in the polling places. The economist can never say one social situation is more 'efficient' than another. In all this he is an ethically neutral observer, and his own evaluations of the alternatives considered do not influence his behavior in any way other than that necessarily arising out of his membership in the group. The above would apply to economists' analysis of investment in public water projects. (Sokoloff-Rutgers)
W69-04852

ACHIEVING PUBLIC ACCEPTANCE OF A RIVER BASIN PLAN,
John T. Starr.
International Conference on Water for Peace, Vol 5, pp 948-954 (1968). 7 p. For 8 volume Proceedings see Vol 2, No 9, Field 06B, W69-03305.

Descriptors: *River basin development, *Interstate commissions, *Project planning, *Adoption of practices, Planning, Coordination, Social function, Political aspects, Social aspects, Area redevelopment, Education, Social participation, Water resources development.

Political and social aspects of river basin improvement plans, which are generally more difficult to deal with than economic or technical problems, are covered. A 'coordinating committee approach' is suggested to anticipate and solve non-technical problems before they thwart or diminish the plans effectiveness. This coordinating committee should represent all the major groups involved in the study of a river basin. Every effort should be made to inform the public what the plan will do for them and what it will cost. General guidelines as to activities which such a committee should include are set forth, and establishment of sub-committees to deal with more specific problems which may be pertinent to a particular river basin plan is recommended. The experience of the coordinating committee of the Susquehanna River Basin Study is outlined as a guide for other plans. (Blunt-Fla)
W69-04861

STATE V PUBLIC SERVICE COMM'N (RECREATION FACILITIES).
275 Wisc 112, 81 N W 2d 71-75 (1957).

Descriptors: *Navigation, *Multiple purpose projects, *Recreation, *Wisconsin, Navigable waters, Parks, Ownership of beds, Lakes, Lake beds, Lagoons, Lake shores, Land use, Landfills, Public benefits, Public lands, Public rights, Water law, Watercourses (Legal aspects), Judicial decisions, Legal aspects.
Identifiers: *Public trust doctrine, Constitutional law.

Wisconsin Laws, ch 282 (1953) authorized the city of Madison to develop a park by filling part of the bed of Lake Wingra, subject to the approval of the Public Service Commission. The city's plans for a park were approved by the Commission, which found that, while the landfill would hinder navigation in the filled areas, overall navigation as well as other public benefits would be improved. At the request of the Conservation Commission, the state instituted a proceeding to review the approval order contending that Wisconsin Laws ch 282 (1953) was unconstitutional as an unlawful delegation of legislative authority without adequate standards and that the public trust under which the state owns and controls lake beds had been violated. The Wisconsin Supreme Court upheld the constitutionality of the statute on the ground that it constituted a proper delegation of legislative authority and also held, after reviewing the Wisconsin Public Trust Doctrine, that the Trust had not been violated by the proposed park. (Carruthers-Fla)
W69-04867

HYDROLOGIC BASES OF WATER RESOURCES UTILIZATION OF LAKES,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 02H.
W69-04957

MASSACHUSETTS MARINE SPORT FISHERIES INVENTORY,
W.-A. Fitzpatrick, and S. Russell.
Massachusetts Division of Fisheries and Game, December, 1961.

Descriptors: *Marine fisheries, *Sport fishing, *Massachusetts, Marine fish, Creel census, Geographical regions, New England, Northeast U. S., Regions, Fisheries, Animals, Aquatic life, Aquatic animals, Fish, Marine animals, Saline water fish, Wildlife, Census, Fishing, Recreation, Water sports, Statistics, Data collections.

Figures are provided for the numbers and kinds of sport-fishing facilities along the Massachusetts coast, the catch-per-unit effort, and the total sport-fishing pressure.
W69-04991

THE GENERAL DEVELOPMENT PLAN FOR THE ALBEMARLE REGION.
Division of Community Planning of the Department of Conservation and Development, North Carolina, November, 1964.

Descriptors: *North Carolina, *Agriculture, *Recreation, *Fisheries, *Forestry, Community development, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Geographical regions, Regions, Southeast U. S., Income, Human resources, Wildlife, Animals, Land use, Crop production, Transportation.

The Albemarle Area is a block of ten counties bordering Albemarle Sound in northeastern North Carolina. In this report the major economic activities of the area are analyzed (agriculture, forestry, fisheries, recreation). Land use and land potential are studied, including an analysis of major crop productivity in the area. Recreation and wildlife areas are pictured and characterized. Water and overland transportation are also described with development possibilities presented.
W69-04995

THE GULF OF MEXICO MENHADEN FISHERY IN RELATION TO THE SPORTS FISHERY,
Gordon Gunter.
Gulf and Caribbean Fisheries Institute, Proceedings, Vol 16, 1964.

Descriptors: *Sport fishing, *Fishing gear, *Gulf of Mexico, *Commercial fishing, *Competing uses, Commercial fish, Bodies of water, Surface waters, Gulfs, Fishing, Recreation, Water sports, Equipment.

The author argues that the menhaden fisheries do not conflict with estuarine sport fisheries or other commercial fisheries because the fishing gear does not select for the other species of fish, nor does it destroy the estuarine habitat, as alleged.
W69-04996

BENEFIT-COST ANALYSIS AND WATER POLLUTION CONTROL,
For primary bibliographic entry see Field 05G.
W69-04998

PASSAMAQUODDY-ST. JOHN.
HEARING BEFORE A SUBCOMMITTEE OF THE COMMITTEE ON PUBLIC WORKS, U. S. SENATE, 1964. U. S. Government Printing Office, Washington, D. C.

Descriptors: *Tidal energy, *Cost-benefit ratio, *Tidal powerplants, *Cost-benefit analysis, Electric power, Electric powerplants, Engineering structures, Industrial plants, Powerplants, Energy.

This report presents statements made and reports read into the record relating to a Senate hearing on August 12, 1964, concerning the Passamaquoddy-St. John project. A supplemental report on the project from the Department of the Interior is reproduced in whole. The report states that: 'The recommended benefit-cost ratio of the Passamaquoddy Dickey project is 1.47 to 1, of which the Dickey and Lincoln School benefit-cost ratio is 2.25 to 1 and the Passamaquoddy tidal power projects benefit-cost ratio is 1.04 to 1...These benefit-cost ratios were determined for a 100-year period of analysis with interest at three percent.
W69-05005

INVESTIGATION OF THE INTERNATIONAL PASSAMAQUODDY TIDAL PROJECT.
International Joint Commission of the Passamaquoddy Tidal Project, Docket No 72, April, 1961.

Descriptors: *Electric power, *Cost-benefit analysis, *Tidal powerplants, *Economic feasibility, Tidal energy, Energy, Electric powerplants, Engineering structures, Industrial plants, Powerplants, Structures, Feasibility, Indirect benefits, Benefits.

This report presents the detailed results of an investigation by the International Joint Commission if the Passamaquoddy Tidal Power Project. In finding that the Passamaquoddy tidal power project is not economically feasible, the Commission recommended that development of the project be viewed as a long-range possibility having better prospects of realization when other energy resources available are exhausted. The Commission points out that the economic feasibility of the project may be affected by future changes in the costs and benefits considered in the present evaluation of the project. Consideration of the desirability of crediting the tidal project with certain public benefits that have not been included in the economic feasibility determination presented in this report was identified as a possibility. The Commission also recommends that this report be made available to interested parties as a valuable source of relevant engineering and economic data for use in any future study of the possibilities for development of the international tidal power potential of Passamaquoddy Bay.
W69-05007

SOCIO-ECONOMIC ASPECTS OF WATER QUALITY MANAGEMENT,
For primary bibliographic entry see Field 05G.
W69-05013

SEQUENCE AND TIMING IN RIVER BASIN DEVELOPMENT,
John V. Krutilla.
Washington: Resources for the Future, Inc., February, 1960.

Descriptors: *River basins, *Timing, *Sequence, *Water resources development, Cost-benefit analysis, Economic feasibility, Regions, Resource development, Feasibility, Project benefits, Benefits.

This publication discusses the importance of treating the sequence of project development within a river basin as an element to aid in the maximizing of systems benefits. It emphasizes treatment of the river basin system as a whole, rather than a series of independent projects.
W69-05016

ESTIMATED USE OF WATER IN THE UNITED STATES, 1960,
K. A. Mac Kichon, and J. C. Kammerer.
Geological Survey Circular 456, Washington, D. C., 1961.

Descriptors: *Water utilization, *Electric power industry, *Saline water, *Statistics, Geographical regions, Efficiencies, Regions, Industries, Water types, Data collections.

This document provides analysis of water use data originating from several sources. Tables provide estimates of saline water used by the electric power industry. Another provides data by water resources region, e.g., Chesapeake, Ohio, etc. The report states that the use of saline water was doubled between 1955 and 1960.
W69-05019

STRIPED BASS IN MARYLAND TIDEWATER,
R. J. Mansueti, and E. H. Hollis.
National Resources Institute, University of Maryland, Solomons, Maryland, Educational Series No 61, February, 1963.

Descriptors: *Maryland, *Striped bass, *Costs, *Fish conservation, Sport fishing, Commercial fishing, Fishing, Atlantic coastal plain, Appalachian Mountain region, Coastal plains, Geographical regions, Northeast U. S., Regions, Animals, Aquatic animals, Aquatic life, Fish, Marine animals, Marine fish, Saline water fish, Sea basses, Wildlife, Animal

physiology, Competition, Conservation, Surveys, Statistics, Data collections.

A summary of research conducted on the striped bass in Maryland over a ten-year period from 1953 to 1963 is presented. While most of the material concerns the biology of the fish, the most important and valuable fish in Maryland, information on commercial landings from 1887 through 1962 is provided. Beginning in 1959, annual commercial catches of striped bass became very high, averaging about 4,000,000 pounds per year. The retail values were as high as $900,000 annually at the peak of production. Economic surveys of the sport fishery in Maryland indicate variable expenditures and investments. The Potomac survey showed the daily cost per fisherman to range from $1.50 per day to $35.00 per day in the large cruiser-type fishing boats. A discussion of present-day conservation and management methods as well as suggestions for future management and improvement of the fishery are given.
W69-05022

THE CONFLICT BETWEEN FISH AND POWER RESOURCES IN THE PACIFIC NORTHWEST,
M. E. Marts, and W. R. D. Sewell.
Association of American Geographers, Annals, Vol 50, No 1, March, 1960, pp 42-50.

Descriptors: *Electric power, *Commercial fishing, *Pacific northwest U. S., *Competing uses, *Value, Appraisals, Hydroelectric plants, Regulation, Employment opportunities, Geographical regions, Regions, Fisheries, Costs, Efficiencies, Water utilization, Fish conservation, Conservation, Wildlife conservation, Fishing, Industries, Electric powerplants, Engineering structures, Industrial plants, Powerplants, Structures, Afterbays.

This article discusses the relative economic values of fishing and electric power industries and the difficulties inherent in attempting to resolve the conflict. Foremost among the factors which tend to perpetuate the problem are (1) the historic importance of the fishing industry in the Pacific Northwest, (2) inappropriate comparisons of values of fish and power, (3) increasing costs of preserving the fisheries, and (4) the time required to study the biological aspects of the problem. Compromise alternatives to the mutual use of the water resource are given. These include (1) fishing regulation, (2) sanctuary stream programs, (3) the development of runs on non-power streams, and (4) the development of alternative fisheries and the provision of alternative occupations for fishermen.
W69-05024

EMERGING NATIONAL POLICIES GOVERNING OUTDOOR RECREATION IN FEDERAL WATER DEVELOPMENT PROJECTS,
Kenneth C. Nobe.
Journal of Soil and Water, Vol 19, No 2, March-April, 1964, pp 61-66.

Descriptors: *Recreation, *Federal government, *Multiple-purpose projects, *Water resources development, Land management, Projects, Resource development, Management.

The author states that a wide divergence among the policies of federal agencies affecting outdoor recreation components of multiple-purpose water development projects existed until quite recently. Now emerging is a more uniform national policy that recognizes outdoor recreation as a full partner in these projects. But a major job remains: translation of existing and emerging policy into procedures that will result in sound project formulation. The evolution of new recreation policies and their practical implications are discussed in this article.
W69-05033

POLICIES, STANDARDS, AND PROCEDURES IN THE FORMULATION, EVALUATION, AND REVIEW OF PLANS FOR USE AND DEVELOPMENT OF WATER AND RELATED LAND RESOURCES.
Senate Document No 97, 87th Congress, Second Session, U. S. Government Printing Office, May 29, 1962.

Descriptors: *Federal government, *Standards, *Water utilization, *Water resources development, *Land resources, *Costs, Administration, Benefits, Cost analysis, Governments, Analysis, Mathematical studies, Efficiencies, Resources development, Natural resources, Resources, Planning.

The purpose of this document was to establish official Executive policies, standards, and procedures for uniform application in the formulation, evaluation, and review of comprehensive river-basin plans and individual project plans for use and development of water and related land resources. The document describes, in very broad terms, the nature and scope of plans acceptable to the Federal establishment. Definitions are provided for the various benefits arising from water resource investments. Definitions of costs and means for measuring costs are provided. The document provides a very broad framework within which there is much opportunity for wide variations in the applications of the principles set forth.
W69-05039

A SURVEY OF SALT-WATER SPORT FISHING IN VIRGINIA 1955-1960,
C. E. Richards.
Chesapeake Science, Vol 3, No 4, December, 1962, pp 223-235.

Descriptors: *Sport fishing, *Marine fish, *Creel census, *Virginia, *Statistics, Commercial fish, Striped bass, Surveys, Fishing, Recreation, Water sports, Census, Animals, Aquatic animals, Aquatic life, Fish, Wildlife, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Geographical regions, Regions, Southeast U. S., Marine animals, Saline water fish, Data collections.

A survey of sport fishing in a 1500 square mile area within the Virginia portion of Chesapeake Bay and its tributaries was made from mid-April through October to gain general knowledge of the fishery and its relation to commercial landings. Effort estimates were based on daily boat-counts from a bridge overlooking the York River check area and aerial boat-counts from flights over the entire survey area. Voluntary catch records and interviews were the sources of catch-rate information. Logbook records were generally different from interview records and set catch-rates at a significantly higher level in the areas where both methods were used. Reported sport catches of the four most important commercial food fishes amounted to a low of approximately 8.1 percent in 1955 to a high of 27.2 percent in 1951, of the total catch. The decline of croaker in the catch was severe: 2.2 fish per man-hour in 1955 to 0.2 per man-hour in 1960. A decrease in catch rates of croaker as the number of fishermen aboard party boats increased was noted. Spot catches increased and became the most abundant fish in the fisherman's creel during 1959 and 1960: 1.5 and 2.6 fish per man-hour of fishing. They were also the most abundant fish for 1958, but at a catch rate of 0.8 fish per man-hour. Weakfish or gray sea trout declined from 0.7 fish per man-hour in 1955 to 0.2 fish per man-hour of fishing during 1960. The observed increases in availability of striped bass, puffer, and flounder compared to the declining availability of other fishes is interesting although there may be no connection between these stocks.
W69-05046

THE FUTURE OF ALASKA,
George W. Rogers.
Baltimore, Maryland: Johns Hopkins Press, 1962.

Descriptors: *Commercial fishing, *Economic life, *Alaska, *Industries, Transportation, Navigation, Community development, Geographical regions, Pacific coast region, Regions, Fishing, Oil industry, Erosion, Beach erosion.

Alaska is divided into three major areas, the north-central being the area of interest to the estuary study. The economy of this area has been for some years in a transitory state, due to seasonal labor, rugged weather conditions, and remoteness from markets. Once the principal occupation of the Cook Inlet and Prince William Sound was salmon fishing, but in recent years salmon fishing has declined drastically. More recent emphasis has been on the natural gas and petroleum industries and on defense. The discovery of major oil and gas deposits in the Cook Inlet region has touched off a boom in private oil exploration and development. Knowledge of the physical characteristics of Alaska's tidelands is meager, and coastal and beach erosion are causing serious losses of land and property in some areas. In general, resources in Cook Inlet and Prince William Sound have been sporadically and exhaustively exploited and abandoned. There have been little 'colonization and conservation' efforts, and this remains a problem today. Shipping is limited, since the markets are far away, and there has seemed to be a general trend towards air transport.
W69-05047

ECONOMIC IMPACT OF NARRAGANSETT BAY,
Niels Rorholm.
University of Rhode Island, Agricultural Experiment Station, Kingston, Rhode Island, Bulletin No. 374, December, 1963.

Descriptors: *Economic impact, *Bays, *Rhode Island, *Competing uses, *Cost-benefit analysis, Commercial fishing, Military aspects, Navigation, Transportation, Recreation, Boats, Marinas, Taxes, Government finance, Fishing, Industries, Recreation facilities, Bodies of water, Geographical regions, Regions, New England, Northeast U. S., Value, Management, Efficiencies, Water utilization.

This study presents estimates of the annual 'monetary impact' of the following activities associated with Narragansett Bay: naval installations, general summer sales, ship and boat building, fish landings (commercial), boatyards and marinas, transportation (bridge and ferry only), real estate taxes (on seasonal dwellings), research, and municipal expenditures. It is estimated that these impacts total not less than $145 million per year, of which $132 million is accounted for by naval installation payrolls. The value of the bay in the function of waste disposal is noted. The development of the estimates is explained, as well as their limitations and the importance of conflicts. Management policy recommendations are made for each level of government. Conflicts in use are classified in three types: I--physical space conflicts over a long period, II--physical space conflicts over a short period, and III--conflicts where one use creates a nuisance in relation to another use. It is argued that the best management policy is to increase all uses until conflicts occur, and then make subsequent use decision on the basis of cost-benefit analysis.
W69-05048

SHORELINE RECREATION RESOURCES OF THE UNITED STATES.
For primary bibliographic entry see Field 02L.
W69-05054

INDUSTRIAL FISHERY TECHNOLOGY,
Maurice E. Stansby.
New York: Reinhold Publishing Corporation, 1963.

Descriptors: *Fisheries, *Commercial fishing, *Fish conservation, *Fish harvest, *Fish, Commercial shellfish, Fish handling facilities, Fishing gear, Atlantic menhaden, Salmon, Oysters, Clams, Her-

rings, Marketing, Mollusks, Salmonids, Statistics, Preservation, Equipment, Fish types, Fishing, Industries, Animals, Aquatic animals, Aquatic life, Invertebrates, Shellfish, Facilities, Marine animals, Marine fish, Saline water fish, Wildlife, Benthic fauna, Benthos.

Part I of this book concerns fish characteristics, conservation, statistical data on U. S. and world fisheries from about 1929 through 1959, and fisheries' harvesting methods. Part II is a description of the major fisheries in the U. S. and specific descriptions of the fish species. The 16 most valuable commercial species are discussed in this section. Part III deals with fisheries' by-products, specifically the production of oil and fish meal. Part IV is a discussion of preservation methods employed by U. S. commercial fisheries. Part V discusses the role of modern science as it relates to fisheries technology.
W69-05055

WHAT IS HAPPENING TO OUR ESTUARIES,
Seton H. Thompson.
Twenty-Sixth North American Wildlife and Natural Resources Conference, Transactions, March, 1961, pp 318-322.

Descriptors: *Land reclamation, *Estuarine fisheries, *Economic impact, *Fish harvest, Commercial fishing, Market value, Employment, Fishing, Industries, Fisheries, Value, Beds, Ownership of beds, Coasts, State jurisdiction, Jurisdiction, Federal jurisdiction.

This paper contains a short general discussion of the effects of land reclamation on estuarine fisheries. The author estimates that the estuarine zone of the Gulf and South Atlantic Coasts yields annually about 1.25 billion pounds of fish and shellfish, worth 'upwards of $100 million'. The author suggests the states concerned with the effects of land reclamation in estuaries 'could take three important steps in this direction: (1) Declare a moratorium on the sale of submerged lands. Our troubles begin when these lands fall into private hands. (2) Take inventory to ascertain ownership of all the submerged coastal areas. (3) Establish a Board, similar to a city's zoning commission, to determine the best uses to be made of our coastal waters. The function of this proposed Board would be to develop an overall plan for each segment of our coast and avoid the piece-by-piece type of development we have been experiencing.'
W69-05060

RECREATION--A PURPOSE OF WATER RESOURCES DEVELOPMENT,
Eugene W. Weber.
Civil Engineering, Vol 32, No 9, September, 1962 pp 57-59.

Descriptors: *Recreation facilities, *Recreation demand, *Planning, *Reservoirs, Recreation, Multiple-purpose reservoirs, Demand, Bodies of water, Impoundments, Lakes, Standing waters, Surface waters, Efficiencies, Water utilization, Federal project policy.

Federal reservoirs, which once were constructed for flood control, power development, and water supply, now include recreation as a prime purpose for construction. This was partly due to the demand for recreation at the Corps of Engineers reservoirs which has been increasing at a rate of about three times the annual rate of increase in the nation's GNP and about six times the rate of its population growth. It is now incumbent on planners to insure that: (1) Projections of future needs include estimates of the probable demand for recreation, (2) Projects are designed to minimize loss of existing and inherent recreational values, (3) Projects are designed to permit realization of their recreational potential to the full extent justified by the prospective demand, and (4) Recreation is evaluated on a basis comparable to that used for other project purposes to insure that net benefits, tangible and intangible, for all purposes are maximized.
W69-05067

THE WATER CRISIS,
Frank E. Moss.
New York, Frederick A. Praeger, 1967, 285 pp, 21 map, 2 illus, 1 chart, 78 ref, 1 append.

Descriptors: *Water allocation (Policy), *Water quality, *Water shortage, *Variability, *Planning, *Water resources development, *Political aspects, *Federal government, Estuaries, Water pollution effects, Droughts, Flood damage, Recreation, Wildlife, Water reuse, Research and development, Desalination, Weather modification, Pumping, Institutions.
Identifiers: Depletion.

The first half of this book describes water problems throughout the United States. Without a national water policy, water is allocated and abused according to the strengths of lobbyists. Specific examples are given of the decreasing quality of America's water. Decay of the estuaries and federal contributions to pollution are emphasized. A second problem is water shortage. Moss documents cases of drought from the Atlantic States to the Great Lakes and throughout the West. A third problem is 'variability,' or fluctuation in streamflow. Depletion, or man-made variability, intensifies the destructiveness of alternating drought and flood. Moss discusses the implications of national abuse for recreation and for wildlife. The second half of the book suggests the cure for the nation's ills. Moss gives examples of good regional planning. He recommends a national Conservation Job Corps. California, West Germany, and Orsanco provide examples of water reuse. Moss documents advances in research, particularly regarding desalination, weather modification, and water pumping. In his conclusion, Moss discusses capabilities of present governmental agencies, their histories, and recommendations of other reports. He recommends the establishment of river-basin authorities and creation of a Department of Natural Resources. He outlines a minimum water resources program. (Gossen-Chicago)
W69-05113

THE HYDROGEOLOGIST'S RESPONSIBILITY -- METROPOLITAN WATER RESOURCE PLANNING,
Department of Housing and Urban Development, Washington, D. C.
Arthur J. Zeizel.
Transactions American Geophysical Union, Vol 49, No 3, pp 543-547, September 1968. 5 p, 2 ref.

Descriptors: *Municipal water, *Hydrogeology, Water pollution sources, Waste disposal, Flood damage, Groundwater, Recreation facilities, Water utilization, Land reclamation Pollution abatement, Groundwater recharge, Flood control, Drainage, Engineering.
Identifiers: *Comprehensive planning, Chicago.

Using metropolitan Chicago as an example, this paper described emerging metropolitan water problems, discusses the procedures of comprehensive water resource planning, and examines the traditional and changing role of the hydrogeologist in water planning. Inadequate waste disposal practices in Chicago pollute streams, recreational lakes, parts of Lake Michigan, and the ground-water source of supply to metropolitan residents. Other intense metropolitan water problems include increasing flood losses, haphazard evaluation and development of ground-water sources, lack of adequate water-oriented recreational facilities, and inefficient water use. The comprehensive water resource planning approach evaluates the full range of available alternative water management measures. Its basic consideration is how changes made in one component of a water system will affect other components. A role of the hydrogeologist in water planning is to define the total water system before planning for management. Immediate demands on the hydrogeologist come from waste disposal, land reclamation, stream pollution reduction, ground-water recharge, flood loss reduction, drainage, engineering problems, and enhancement of the urban environment. Study teams of closely-working members who represent varied professional disciplines, including hydrogeology, can best determine legal, administrative, and technical feasibility of alternatives. (Gossen-Chicago)
W69-05114

WATER RESEARCH,
Resources for the Future, Inc., Washington, D. C.
Allen V. Kneese, and Stephen C. Smith.
Baltimore: Johns Hopkins Press, 1966. 526 p.

Descriptors: *Water management, *Theoretical analysis, *Engineering, *Political aspects, *Administration, Discount rate, Investment, Alternative costs, Water resources development, Water management, Recreation, Industrial water, Water quality, Flood control, Legislation, Water transfer, Flood damage, Efficiencies, Cost-benefit analysis, Synthetic hydrology, Rainfall, Runoff, Snow management, Management, Reservoirs, Analog models.
Identifiers: *Water Resources Act of 1964, *Evaluation problems, *Water reallocation, *Research programs, Potomac Estuary, Water recreational facilities, Delaware Estuary.

The pressure on supplies of usable fresh water in many parts of the country has led to an increasing amount of research on the problems of planning and managing our water resources. The Sixth Western Resources Conference at which the papers in this volume were initially presented was organized by Resources for the Future Inc, the University of Colorado, Colorado State University, and the Colorado School of Mines to give leading experts in the field the opportunity to report on and discuss their current research. In the Introduction, Dr. Kneese analyzes the major developments in water research in the past decade. The most recent of these developments if the Water Resources Act of 1964. The volume provides both a survey of past efforts and recommendations for future work. The twenty-six contributions are divided into seven parts: Issues in Theoretical Analysis, Case Studies of Water Management, Research on Evaluation Problems, Studies of Water Reallocation, Political and Administrative Studies, Research on Hydrology and Engineering and Major Research Programs and Needs. (Loeb-Rutgers)
W69-05115

PLANNING A WATER QUALITY MANAGEMENT SYSTEM: THE CASE OF THE POTOMAC ESTUARY,
Resources for the Future, Inc, Washington, D. C.
Robert K. Davis.
Water Research, pp 99-121, Johns Hopkins Press, Baltimore, 1966. 23 p, 4 fig, 4 tab, 13 ref.

Descriptors: *Water quality, *Planning, Cost analysis, Dissolved oxygen, Estuaries, Water pollution, River basin development, Cost-benefit analysis, Optimization, Input-output analysis, Biochemical demand, Low-flow augmentation, Efficiencies.
Identifiers: *Potomac River estuary, Dissolved oxygen management, Cost function, Multipurpose system, Alternative system, Least cost.

This is a study of the cost of alternative systems for dissolved oxygen management in the Potomac River estuary. The technological functions developed in this study are believed comparable in reliability to the cost functions used by the Corps of Engineers. Nevertheless, because of the experimental nature of some of the processes analyzed, the results reported can't be viewed as a technical revision of the Engineer's proposal for the Potomac, but rather as a consequence of some strategic modifications in the water resource planning process. The paper demonstrates the nature of the gains to be realized from expanding the analysis of alternatives in the water resources planning process. Some productive dimensions of an expanded analysis are: (1) to extend the analysis to more than one kind of objective and to more than one set of objectives so that we can begin to

ask some questions about willingness to pay for results, (2) to extend the analysis to payoffs from possible changes in technology and (3) to extend the analysis to possibilities which may be precluded by current institutional arrangements, in order to know something of the gains derived from rearranging institutions bearing on the design and operation of water quality management systems. (Loeb-Rutgers)
W69-05116

WATER TRANSFER PROBLEMS: LAW,
New Mexico Univ., Albuquerque.
Willis H. Ellis.
Water Research, pp 233-248, Johns Hopkins Press, Baltimore, 1966. 16 p, 6 fig, 9 ref, 1 append.

Descriptors: *Water transfer, *Water rights, *Legislation, Income, Population, Industrial use, Water allocation.
Identifiers: Growth potential, Standard of living, Agricultural use, Abandonment, Forfeitures, Downstream transfers, Upstream transfers.

In the western United States, water may be a limiting factor of production and thus limit the growth potential of the region as to the number of people within the region and their standard of living. Two things a community can do when its growth is threatened by a limited supply of water are: (1) find new sources of supply or (2) utilize its limited supply more efficiently. This paper considers the possibilities inherent in the second alternative and concludes that at the present time the water-right market is inefficient because those who would enter it must expend considerable amounts of money just to do so. The paper attempts to show that a state could pay these costs in advance so that potential buyers could enter the water-right market and pay (in the vast majority of cases) only the agreed price for the right purchased. The benefit to the state in greater economic return from its available supply of water should be great. (Loeb-Rutgers)
W69-05117

OPTIMAL FLOOD DAMAGE MANAGEMENT: RETROSPECT AND PROSPECT,
Resources for the Future, Inc., Washington, D. C.; Chicago Univ., Ill.
Gilbert F. White.
Water Research, pp 251-269, Johns Hopkins Press, Baltimore, 1966. 19 p, 1 tab, 29 ref.

Descriptors: *Management, Flood control, Flood damage, Water resources, Flood protection, Flood plains, Technology, Flood plain insurance.
Identifiers: Optimal method, Optimal management, Public policy, Denver flood, Resources management, Choice.

The author reviews the experience with management of flood losses in several steps. In beginning, a confession is made for the confusion concerning optimal management. Next, the state of knowledge about the human use of flood plains is summarized. Those findings that seem sufficiently valid to warrant recommendation for public policy are pointed out. Major research needs are outlined by pointing to those areas where there is a lack of knowledge. Both knowledge and ignorance are stated more concretely in reference to the Denver flood of June 1965. Finally, the concluding section states that what we have learned may be of value in other sectors of resources management. (Loeb-Rutgers)
W69-05118

POLICY PROBLEMS IN THE FIELD OF WATER RESOURCES,
Resources for the Future, Inc., Washington, D. C.
Irving K. Fox
Water Research, pp 271-289, Johns Hopkins Press, Baltimore, 1966. 19 p, 7 ref

Descriptors: *Water resources, *Water policy, Decision making, Water utilization, Attitudes, Water resources development, Benefits, Water quality.
Identifiers: Opportunities, Social optimum, Public decision making, Water abundance, Water disposal, Public policy, Public policy change.

Water resources policy issues have been studied intensively and reported on frequently since the end of World War II. In this paper, it is proposed to examine several overriding problems which promise to be of major, if not dominant, significance in the conduct of water resources activities in the next few decades. The over-all environment within which policies evolve and programs are undertaken will have much to do with the future course of events in the water field. In our concentration on the technical aspects of water uses, we may fail to see the restraints of what is feasible that are imposed by our cultural and institutional environment. The three problems to be considered are: (1) how to achieve a rational public understanding of water resource use problems and opportunities; (2) how to achieve a reasonable approximation of a social optimum through public decision-making process, and (3) how to change policy to accord with the changing environment within which water resources activities are undertaken. (Loeb-Rutgers)
W69-05119

THE IMPACTS OF WATER INVESTMENTS IN DEPRESSED AREAS,
Resources for the Future, Inc., Washington, D. C.; North Carolina State Univ., Raleigh.
G. S. Tolley.
Water Research, pp 457-470, Johns Hopkins Press, Baltimore, 1966. 14 p, 1 fig, 2 tab, 2 ref.

Descriptors: Labor supply, Migration, Employment, Aggregates, Water resources development, Recreation, Low-flow augmentation, Income, Cost-benefit analysis.
Identifiers: *Water investment, *Depressed areas, Appalachian Act, Public investment, Secondary benefits, Multiplier.

This paper has concentrated on some needs for evaluating water resource development proposals for depressed areas. It has not exhausted the list of needs for greater understanding to which the research at North Carolina is directed. Recreation is an increasingly important purpose of projects, particularly in depressed areas. While much progress has been made in recent years in estimating recreation benefits, methods are still lacking to estimate adequately the value of recreation quality and competition between sites. V. S. Hastings and S. Sydneysmith are conducting studies on these subjects. Provision of water for low-flow augmentation affects water available to industry as an intake and as a medium of waste disposal. The recognition of regional development as a project aim, in addition to national income aims, increases the need to understand effects of water availability on industry location. (Loeb-Rutgers)
W69-05120

ECONOMICS AND FINANCE OF WATER DEVELOPMENT IN ALBERTA, CANADA,
G. R. Purnell.
Int. Conf. on Water for Peace, Wash., U. S. Gov't. Printing Office, Vol 8, pp 747-754, 1968. 8 p, 1 map, 6 ref. For 8 volume Proceedings see Vol 2, No 9, Field 06B, W69-03305.

Descriptors: *Administration, *Cost-benefit analysis, *Feasibility, Design, Operation and maintenance, Water resources development.
Identifiers: *Province of Alberta.

Basic to the development and operation of water projects is financing and administration. The administration of the project must be closely related to its financing. Those who benefit the most from the project and those who contribute funds to the development and operation of the project will have the greatest interest in its administration. In 1965 an historical analysis of the financing and administration of water development projects in the Province of Alberta was begun. Historically, financing had been provided by heterogeneous sources and the administration was also varied. Under the auspices of a policy advisory committee, a series of engineering and economic studies were undertaken. These studies were made within a benefit-cost framework. The policy recommendations based on the studies include: consolidation of all legislation into one statute and code; and the establishment of uniform locally based administrations related to water system boundaries. (Grossman-Rutgers)
W69-05122

ECONOMICS IN REGIONAL WATER RESEARCH AND POLICY,
Oregon State Univ., Corvallis. Dept. of Agricultural Economics.
Emery N. Castle, and Russell C. Youmans.
American Journal of Agricultural Economics, Vol 50, pp 1655-1666, Dec 1968. 12 p, 1 fig, 19 ref.

Descriptors: *Federal Government, *Investment, Cost-benefit analysis.
Identifiers: *Hirschman Development Theory, Regional economics.

This paper is in two parts. Part I pertains to water resources and regional economic growth. Part II discusses choice indicators in public decision making with respect to investment in natural resource investment. Recent federal action and statements are discussed, then research results on water availability and economic growth are examined. Using the Hirschman development theory, the author analyzes some growth hypotheses. In the section on choice indicaters in public decision making, the following are mentioned: benefit-cost analysis, economic efficiency, ultimate goals of any society, and individual fulfillment. A reference list is included in the report. (Grossman-Rutgers)
W69-05124

THE NATIONAL WATER RESOURCE ASSESSMENT AND REGIONAL FRAMEWORK PLANS,
Water Resources Council, Washington, D. C.
Harry A. Steele.
American Journal of Agricultural Economics, Vol 50, No 5, pp 1647-1654, Dec 1968. 8 p, 6 ref.

Descriptors: *Water Resources Planning Act, *Legislation, Governments.
Identifiers: *Water Resources Council, National Water Commission.

The paper reviews progress of water resource plans under the Water Resources Planning Act (PI 89-80) and outlines some of the problems encountered. First, there is an explanation of the Water Resources Council, a cabinet-level group interested in water and related land resources. The paper then discusses the Council's national assessment of the adequacy of the nation's water resources to meet requirements. The Council also set up a framework for future development and management of water and related land resources of a region. The framework includes: projections of economic growth, translations of projections into requirements for water and related land resource uses, projections of the availability of water resources, projections of land resource availability, analysis of alternative solutions, and recommendations of needed detailed planning, program authorizations, and other actions. Under the Act, river basin commissions, in addition to their other functions, are to recommend long-range schedules of priorities for the collection and analysis of data. Also discussed in this paper is the impact of urban growth, planning policies and standards, and the establishment of the National Water Commission. (Grossman-Rutgers)
W69-05125

AN EFFICIENT PROGRAM OF WATER RESOURCE DEVELOPMENT IN A FRAMEWORK OF GROWTH AND TRADE,
Hebrew Univ., Jerusalem (Israel); Resources for the Future, Inc., Washington, D. C.
Pinhas Zusman, and Irving Hoch.
American Journal of Agricultural Economics, Vol 50, No 5, pp 1635-1646, Dec 1968. 12 p, 1 fig, 1 tab, 15 ref.

Descriptors: *Leontief models, *Cost-benefit analysis, *Water resources development, Investment.
Identifiers: *General equilibrium model, California.

Decisions concerning investment programs in water systems must be taken with reference to the general capital formation process, anticipated technological charges, population growth, demand behavior, present and future trade opportunities, interregional resource movements, and expected changes in the industrial composition of output and income. The problem of water resources development is approached via a general equilibrium analysis which considers all sectors of the economy simultaneously. The state's economy is represented by a Leontief-type model. The model is developed and discussed. The results are presented and evaluated. A reference list is included. (Grossman-Rutgers)
W69-05127

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

COST PROJECTIONS FOR LARGE DESALTING SYSTEMS WITH VARIOUS TYPES OF COUPLING,
For primary bibliographic entry see Field 03A.
W69-04814

RURAL COMMUNITY WATER SUPPLIES, A DISCUSSION IN FINANCING,
Mark D. Hollis.
For 8 Volume Proceedings see Vol 2, No 9, Field 06B, W69-03305. International Conference on Water for Peace, Vol 8, pp 729-36, 1968. Washington, D C: U S Government Printing Office, 8 p, 1 tab.

Descriptors: Financing, Water supply.
Identifiers: Latin America, Rural Water Program, Revolving fund, International loan, Funding mechanism, Alliance-for-Progress Decade.

The shape of the future rural habitat in Latin America can no more be left to chance then can the urban habitat. This document discusses the background and progress toward the rural water supply goals established in the Charter of Punta del Este. It points out the need for a more concerted effort in the Rural Water Program, and it proposes a funding mechanism to support a system of national revolving funds. These funds will be used, first, for loans to qualifying communities to construct water systems and, subsequently (after becoming self-sustaining) for related community improvements. The rural water proposal has three key objectives: first, to provide impetus to the program and accelerate construction over the second half of the Alliance Decade; second, to strengthen community organization and to develop more fully the self-help potential; and, third, to establish, in each country, a self-sustaining funding mechanism. (Loeb-Rutgers)
W69-04820

FINANCIAL ASPECTS OF POTABLE WATER AND SEWERAGE SYSTEMS,
For primary bibliographic entry see Field 05D.
W69-04821

WATER SYSTEMS FINANCING--FOUR BASIC APPROACHES,
Floyd B. Taylor, and Paul W. Hughes.
For 8 Volume Proceedings see Vol 2, No 9, Field 06B, W69-03305. International Conference on Water for Peace, Vol 8, pp 758-762, 1968. Washington, D C: U S Government Printing Office, 5 p.

Descriptors: Water supply, *Financing, Payment, Training.
Identifiers: *Water systems financing, Paternal financing, Self-help financing, Revolving fund financing, Bond issues, Paja de agua.

Experience, on a world-wide basis, indicates four basic methods in the financing of urban water supply systems. The type of financing in any given country is generally indicative of the degree of economic and political development. The four basic approaches to community water supply financing are (a) paternal, (b) self-help, (c) revolving fund, and (d) bond issue. The authors discuss in detail the four basic approaches to the financing of water supply systems and review the relative merits of each. (Loeb-Rutgers)
W69-04824

ANALYSIS OF THE COST OF WATER TRANSMISSION BY PIPELINE,
For primary bibliographic entry see Field 03A.
W69-04827

ROAD PRICING, SOME TECHNICAL ASPECTS,
Birmingham Univ. (England)
A. A. Waters.
Economist, Vol 116, No 6, pp 716-728, Nov/Dec 1968. 13 p, 2 fig, 4 ref.

Descriptors: *Pricing, Dynamics, Demand, Fluid mechanics, Velocity, Marginal costs.
Identifiers: *Road user charges, *Balanced road budget, *Social costs, Traffic flow, Congestion.

Under conditions of congestion, the social costs of motoring will exceed the private costs. The formula is: Social Cost = Private Cost (1 + the elasticity of cost with respect to traffic flow). Thus the optimumtax under these conditions is equal to this elasticity coefficient multiplied by 100 percent of the private cost. A fluid-dynamic model, borrowed from physics, is used to develop a simple formula for the elasticity of velocity with respect to traffic flow. By postulating a relationship between cost and speed, this elasticity is converted into an estimate of the elasticity coefficient. And so one can obtain, for any specified speed, a value of this coefficient and cost; the product of these two gives an estimate of the difference between social and private cost. In practice one cannot determine the speed independently; it emerges from the demand-supply interactions and so one must also postulate a demand function, but data problems are severe on the demand side. Lastly, some developments are considered--including network models and dynamic demand models. This analysis is also applicable to the use of prices to avoid congestion on waterway facilities, and to water supply problems involving the use of pipe transmission methods. (Sokoloff-Rutgers)
W69-04837

CONGESTION, TOLLS, AND THE ECONOMIC CAPACITY OF A WATERWAY,
Carnegie-Mellon Univ, Pittsburgh, Pa., Rand Corp., Santa Monica, Calif.
Lester B. Lave, and Joseph S. De Salvo.
Jour Pol Econ, Vol 76, No 3, pp 375-391, May 1 June 1968. 17 p, 3 fig, 3 tab, 7 ref.

Descriptors: *Locks, *Taxes, Efficiencies, Cost-benefit analysis.
Identifiers: *Illinois Waterway, *Externality, *Queuing time, *Social cost, *Congestion, Tolls, Tows, Subsidies, Economic capacity.

The analysis of congestion becomes complicated when the arrival of customers is random or the service rate is random. In this stochastic case, optimal economic capacity will be far less than physical capacity. When a facility is used by a number of independent customers, there is an externally associated with the decision to use the facility. Social cost is far greater than private cost in the absence of a tax system or regulatory scheme. Three questions arise whenever congestion occurs: (1) the optimal use of a facility-which might be answered by a system of optimal tolls or subsidies which equate private to social cost. The second question concerns the decision to expand physical capacity. This might be answered by a benefit-cost analysis of the expansion decision, if the dollar benefit exceeds the cost of expansion, physical capacity should be increased. The third question concerns the effect of a toll on the character of the service demanded (the amount of service demanded) (the amount of service time demanded). Since there is an ability to change tow size (and thereby service time), the optimal toll on a waterway should be calculated on the basis of actual service time. This article treats some thorny economic problems involved in water resources, capacity, pricing, and investment timing, and the issues raised are readily extended to problems in water projects other than those of waterways. (Sokoloff-Rutgers)
W69-04838

THE ECONOMIES OF SCALE,
Chicago Univ., Ill.
George J. Stigler.
Journal of Law and Economics, Vol 1, pp 54-71, Oct 1958, 18 p, 1 fig, 8 tab.

Descriptors: *Economies of scale, Regression analysis, Technology, Marginal costs, Average costs.
Identifiers: *Survivor technique, *Optimum size, *Empirical studies, Industry capacity, Actual costs, Rates of return, Steel industry, Auto industry, Petroleum industry.

The survivor technique for determining the range of optimum sizes of a firm seems well adapted to left the theory of economies of scale to a high level of substantive content. Although it is based on inadequate information, the determination of optimum sizes avoids the enormously difficult problem of valuing resources, which occurs with alternative methods. The most striking finding is customarily a fairly wide range of optimum sizes--the long run marginal and average cost curves of the firm are customarily horizontal over a long range of sizes. The survivor method can be used to test the numerous hypotheses on the factors determining the size of firm. The study suggests that advertising expenditures have no general tendency to lead large firms. Size of plant proves to be an important variable and the survivor method should be employed to determine the factors governing plant size. An index of chemistry and engineers as a ratio to all employees was used as a measure of technological characteristics and research and proved to be fairly important. Optimum plant scale is also an important issue in water development and this article can be used in applying the economic issues of optimum plant size of private firms to water producing plants and utilities. (Sokoloff-Rutgers)
W69-04840

DIRECT VERSUS INDIRECT TAXATION,
Trinity Coll., Oxford (England).
I. M. D. Little.
Econ Jour, Vol 61, No 3, pp 577-584, Sept 1951. 8 p, 3 fig.

Descriptors: *Labor supply, Prices.
Identifiers: *Income tax, *Indirect tax, *Transformation curve, *Leisure, Pareto optimum, Incentives, Revenue, Marginal conditions.

The first part of the article is designed to show that the usual theoretical treatment of the problem of direct and indirect taxation is based on extraordinary assumptions, and liable to be misleading. An alternative mode of analysis is suggested, which in-

cludes marginal rates of transformation as well as marginal rates of substitution. It is shown that no case against indirect taxation can be proved from the ordinary, general, purely competitive assumptions of economic theory (pareto efficiency); and that the special assumption necessary to prove such a case, a constant supply of labor involves an unplausible conclusion concerning incentives. The general conclusion is that the best taxes (subsidies) are those on goods for which the demand is least elastic. Income tax, which is a subsidy or leisure is no exception; only so far as the demand for leisure is highly inelastic is it a good tax. This would apply to the pricing and/or taxation policy for water resources. (Sokoloff-Rutgers)
W69-04848

THE PROBLEM OF SOCIAL COST,
Virginia Univ., Charlottesville.
R. H. Coase.
Journal of Law and Economics, Vol III, pp 1-44, Oct, 1960. 44 p.

Descriptors: *Welfare, *Resource allocation, Alternative costs, Administrative costs, Taxes.
Identifiers: *Social product, *Private product, Pigou, Price system, Liability damages, Case studies, Harmful effects.

Analysis in terms of divergencies between private and social products concentrates attention on particular deficiencies in the system and tends to nourish the belief that any measure which removes the deficiency is necessarily desirable. Attention is diverted from those other changes in the system which are inevitably associated with the corrective measure, changes which may well produce more harm than the original deficiency. It would seem more desirable to compare total product yielded by alternative social arrangements, and to take into account the total effect of these arrangements in all spheres of life. Also instead of a comparison between a state of laissez-faire and some kind of ideal world, a better approach would be to start with a situation approximating what actually exists, and then examine the effects of a proposed policy change and decide whether the new situation would be, in total better or worse than the original one. It is also pointed out that if factors of production are thought of as rights, it becomes easier to understand that the right to do something which has a harmful effect is also a factor of production. This type of approach could be used in an analysis of the effects of water pollution. (Sokoloff-Rutgers)
W69-04850

INFLATION AND INCOME DISTRIBUTION (GERMAN),
Hamburg Univ. (West Germany).
Harald Scherf.
Weltwirtschaft Archiv, Vol 100, No 2, pp 258-271, June 1968. 13 p.

Descriptors: *Inflation, Monopoly, Profit.
Identifiers: Demand pull, *Income distribution, Entrepreneurs, Oligopoly, Price fixing, Monetary interpretation, Regressive, Real wealth.

Since Mitchell's study 'History of the Greenbacks' and Bresciani--Turronis's analysis of the German Inflation after World War I, it is the generally accepted view that inflation redistributes income and wealth regressively. Recent investigations of the problem do not support this doctrine. In a critical analysis of these investigations the author concludes that there is no proof of a redistribution of income and wealth in favor of entrepreneurs against the working population by slow inflation. Social difficulties arise only in the adaption of income of retired people to rising prices. The problems of inflation and income distribution indirectly effect the water resource area through their influence on investment incentives, savings effects, and government anti-cyclical policies, all of which in turn may effect water investment and development programs. (Sokoloff-Rutgers)
W69-04851

SOME NEIGHBORHOOD EFFECTS OF OIL-SHALE DEVELOPMENT,
Utah State Univ., Logan.
B. Delworth Gardner, and Allen D. Lebaron.
Natural Resources Journal, Vol 8, No 4, pp 569-586, Oct 1968. 18 p.

Descriptors: *Oil shale, *Water requirements, *Water pollution, *Colorado River Basin, Agriculture, Mexican Water Treaty, Technology, Wyoming, Utah, Radioactivity.
Identifiers: *Neighborhood effects, Refining operations, Transferability, White River.

Few of the issues connected with oil-shale development have been as controversial as those surrounding water requirements. Opinions run the gamut from belief that water supplies are quite adequate to the notion that water shortages will constrain the size of the industry. Water could be allocated like any other marketed commodity and would be price-rationed to the highest bidder. The economic impact on the local economy, especially the agricultural sector, will be determined largely by transfer flexibility and whether new water supplies become available. If farmers are free to sell water or continue to hold and use it, then sale of water should provide ample compensation and minimize neighborhood effects. If it is assumed that technology and water prices are such that the industry will demand approximately 250,000 acre-feet of water per year, what are the prospects for obtaining this quantity of water. These possibilities are either to file for rights on newly-developed water or purchase rights from present users of already appropriated water. The difficulty with the first alternative is that interstate compacts and an international treaty with Mexico greatly limit the amount of water available. Therefore, additional irrigation rights will have to be purchased from agricultural users, but these are marginal producers in the oil-shale region. (Sokoloff-Rutgers)
W69-04854

THE ANATOMY OF MARKET FAILURE,
Massachusetts Inst. of Tech., Cambridge.
Francis M. Bator.
Quart Jour Econ, Vol LXXII, No 3, pp 351-379, August 1958. 29 p.

Descriptors: *Welfare.
Identifiers: *External economies, *Pareto efficiency, Public goods, Social welfare function, Income distribution, Convexity, Competitive markets.

The Paretian maximization-of-welfare problem has embedded within it a set of constants, 'duals' or shadow prices, which have all the analytical characteristics of prices, wages, rents, and interest rates. Implied in this analysis is the notion that decentralized market calculations correctly account for all 'economic' costs and benefits. Duality can fail in 5 ways: by existence--no set of relative market prices will accurately reflect the maximization of a welfare function by being equated to a set of marginal rates of substitution; by signal--the price system guides profit-maximizing entrepreneurs into a position of profit minimum or local profit maximums rather than the maximum maximorum; by incentive--the price system allows negative profits in some desired industries; by structure--if self-policing perfect competition is not present, then prices do not lead to Pareto optimality; and by enforcement--if there is some arbitrary legal or organizational imperfection in the market which prevents introduction of proper accounting prices for inputs or outputs into maximization decisions. These five modes are due to three possible causes of market failure: ownership externalities, technical externalities, and public goods externalities. Economic discussions of water often invoke the technical, ownership and public goods externalities in the analysis of pricing and valuing of water uses. This article presents a comprehensive classification scheme for markets, that like the water market, require public intervention in their functioning. (Sokoloff-Rutgers)
W69-04855

PRODUCERS' MARGINS FOR FOOD FISH AN SHELLFISH,
David K. Saback.
Bureau of Commercial Fisheries, Circular 15 November, 1962.

Descriptors: *Commercial fishing, *Commercia shellfish, *Marketing, *Gross profit, *Indirec costs, Fish harvest, Profit, Net profit, Appreciation Market value, Economics, Competitive prices Fishing, Industries, Fisheries, Animals, Aquati animals, Aquatic life, Invertebrates, Shellfish Value, Costs, Prices.

This article discusses the principal factors affectin producers' (fishermen) margins, defined as th portion he receives of the retail price paid by th consumer and expressed in this report as a percent age of the retail price. The author discusses trend in these margins from around 1947 through 1960 Although the percentages vary, the trends are quit significant. The total amount of fisheries product and the various steps undergone by the product e.g. costs of packaging plants and equipment storage facilities, and transportation are discussed as factors affecting producers' margins. Also discussed are factors affecting the producers' margins for specific fisheries products. Tables and graphs are included which show trends in margins for particular species.
W69-05053

THE VALUE OF A TON OF GENERAL CARGO TO THE AREA'S ECONOMY--DELAWARE RIVER PORT.
Report, Division of Port Development, Delaware River Port Authority, Camden, New Jersey, 1962.

Descriptors: *Harbors, *Delaware River, *Economic impact, *Inflation (Economic), Income, Value, Bodies of water, Interstate rivers, Rivers, Running waters, Streams, Surface waters.

This is a revision of the original study of the same title which was issued in 1953. The revision has been limited to updating the value of a ton of general cargo over the period between 1950 and 1962 from $11.33 to $16.22.
W69-05061

GROUNDWATER UTILIZATION AND TAX POLICY,
Texas Technological Coll., Lubbock. Dept. of Agricultural Economics.
Herbert W. Grubb.
American Journal of Agricultural Economics, Vol 50, No 5, pp 1621-1630, December 1968, 10 p, 1 fig, 6 ref.

Descriptors: *Groundwater, *Taxes, *Prices, *Costs, Aquifers, Irrigation.
Identifiers: *Tax policies, Stock resource, Flow resource.

The purpose of this paper is to discuss major issues regarding effects of taxation upon the use and ultimate value of groundwater as a capital resource. The discussion will be centered around property taxes. Some sources of groundwater could be considered as stock resources and other sources could be considered flow resources. These different types of water deposits present different questions with regard to groundwater resource use and tax policy. The flow resource should be used to the extent that marginal cost equals marginal revenue, measured annually. The stock resource, such as water in a nonrecharging aquifer, is available for use at a later production period and presents conservation questions about intertemporal allocation, given irrigation production and costs. Tax policies should be governed by the major goals and objectives of the groundwater resource utilization. The present approach to taxing groundwater is discussed, as are the needed policy measures. References are included in the report. (Grossman-Rutgers)
W69-05126

N ECONOMIC ANALYSIS OF WATER TILIZATION IN PENNSYLVANIA,
ennsylvania State Univ., University Park. Inst. for esearch on Land and Water Resources.
or primary bibliographic entry see Field 06D.
/69-05154

D. Water Demand

/ATER SUPPLY SCHEME OF GREATER EHRAN CITY,
ehran Regional Water Authority, (Iran).
. Dilmaghani.
or the 8 Volume Proceedings, see Vol 2, No 9, ield 06B W69-03305. Int Conf on Water for eace, Wash D C, Vol 6, pp 826-836, 1968. 11 p.

escriptors: *Municipal water, *Water sources, ivers, Groundwater, Water treatment, Water esources development, Urbanization, Water consmption (Excludes consumptive use).
lentifiers: *Tehran (Iran).

ehran City lies approximately on latitude 36 deg . at an average altitude of 1200 m above sea level. he total area of the city is about 250 sq km, of hich roughly 150 sq km is constructed at the resent time. Population of the greater city is estiated to be 2.5 million. The ultimate population in 5 years is assumed to be 4 million. The first stage esign of the water-supply scheme started in 1946. t that time the system was designed for 1,400,000 habitants of the central city but a preliminary age for 900,000 population was built. However, ie expansion of the city and increase of population ook place much earlier than it was expected. The ap between 900,000 and 1,400,000 inhabitants as filled in 5 yr instead of 30 yr. In 1959 it became uite necessary to draw up a long term program to upply water for greater Tehran, with a population f 4,000,000 and water consumption of 400 million u m per yr. The new program was forseen to cope ith water requirements of the city for the next 20 r. In designing the scheme, 250 litres per capita er day was considered the average. Tehran's water ources are the Karaj River (40 km west of city), ie Jajirud River (30 km east), the Lar River (70 m NE), and groundwater. (Knapp-USGS)
/69-04761

CONOMICS AND FINANCE OF WATER PROGRAMMES: ECONOMIC ANALYSIS, FINANIAL ANALYSIS, FINANCING.
/orld Health Organization, Geneva (Switzerland).

or 8 Volume Proceedings see Vol 2, No 9, Field 6B, W69-03305. International Conference on Vater for Peace, Vol 8, pp 708-710, Washington,) C, U S Government Printing Office, 1968. 3 p.

Descriptors: *Water supply, *Financing, Pricing, nvestment, Capital supply, Benefits, Loans, Grants, Public utilities.
Identifiers: *Construction funds, Shortages, Revenue, Secondary benefits, Government support.

t has been shown that capital can be invested rofitably in water supply if provision for adequate anagement and safeguarding the asset has been ade. But for the purpose of project formulation it sometimes difficult to demonstrate indirect enefits which may accrue from water supply ystems whereas direct benefits can easily be calcuated when looking at water as a commodity which s sold to the water users at a certain price. A still ore quantitative evaluation of the direct benefits f community water supplies will be possible on the asis of current research into the nature of the deand curve of public water supplies, which would llow estimation of the consumer surplus. The inancing of water supply is a problem located omewhere between a rigid business approach and he subsidizing of a social welfare project. WHO-ssisted projects for the planning of community ater supply systems in developing countries inlude the economic and financial analysis as a routine procedure and two noteworthy examples (water supply systems of Seoul, Korea and Accra-Tema, Ghana) are described in some detail in the paper. (Sokoloff-Rutgers)
W69-04833

OUTDOOR RECREATION DEMANDS AND BENEFITS,
Jack L. Knetsch.
Land Economics, Vol 39, No 4, 1963, pp 387-396.

Descriptors: *Recreation demand, *Mathematical analysis, *Investment, *Public benefits, *Value, Recreation, Economic impact, Benefits, Demand, Analysis, Land, Property values, Shores.

The author uses a hypothetical example to demonstrate the construction of demand curves for recreation sites. The analysis is extended to include the effects of time of travel and the availability of close substitutes. Total recreation value is broken into two sources. The first source represents user benefits which people receive from visits to the area. The second source is the capital investment in land near the recreation site. (Land value benefits could be substantial in the case of private recreation facilities along estuarine shorelines). Effects of fee collection are also incorporated into the analysis.
W69-05014

WATER RESOURCES ACTIVITIES IN THE UNITED STATES: WATER SUPPLY AND DEMAND.
Report, Select Committee on National Water Resources, United States Senate, 86th Congress, Committee Print No. 32, August, 1960.

Descriptors: *Water supply, *Water demand, *United States, *Regional analysis, *Forecasting, Water resources development, Geographical regions, Regions, Demand, Supply.

This is a report on the nation's prospective supply of and demand for water in 1980 and 2000. The overall results are summarized and tabulated for the entire country by water resources regions.
W69-05065

WATER USE IN MANUFACTURING, 1963 CENSUS OF MANUFACTURES.
Report, Bureau of the Census, Department of Commerce, 1963.

Descriptors: *Water utilization, *Geographical regions, *Industrial plants, Efficiencies, Buildings, Engineering structures, Structures, Regions, Industrial water, Water types.

This is a report of the 1963 Census of Manufactures data. Water-use data are cited for 2-, 3-, and 4-digit SIC industries by geographical regions and by specific use category.
W69-05066

DEMAND FOR WATER RECREATION,
Virginia Polytechnic Inst., Blacksburg.
Norman L. Brown, and Donald C. Darnton.
Project Completion report, 4 fig, 16 p, August 1968, OWRR Project A-016-Va, 14-01-001-1415.

Descriptors: *Recreation demand, Recreation, Demand, Water sports, Recreation facilities, Methodology.
Identifiers: Roanoke.

The project was designed as a pilot project aimed at developing a method for estimating the value placed on certain types of water recreation activities. The pilot project had four objectives: (1) to develop the questionnaire for collecting information, (2) to determine the best way to distribute and collect the questionnaire, (3) to determine specific recreation sites to be included in the major study, (4) to obtain the cooperation of the owners of the selected study sites. The objectives were later revised to include the analysis of the information obtained as the questionnaire was being tested. The first goal was only partially achieved and the researchers encountered the conceptual problem of determining exactly what is being measured when a user engages in two or more water activities on a single outing. Until this problem is solved, the final form of the questionnaire cannot be prepared. The other project goals were more fully obtained. (Winn-Rutgers)
W69-05121

AN ECONOMIC ANALYSIS OF WATER UTILIZATION IN PENNSYLVANIA,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
J. Dean Jansma, and Waldon R. Kerns.
Institute for Research on Land and Water Resources, Research Publication No. 54, University Park, Pa., June 1968. 75 pp, 6 fig, 21 tab, 1 append. 14-01-0001-983. OWRR Project A-007-PA.

Descriptors: *Water demand, *Regressional analysis, *Water values, *Water users, *Water rates, Economies of scale, Industrial water, Pricing, Pennsylvania, Water requirements, Water utilization.
Identifiers: Economic analysis.

This study outlines the current pattern of water use at the county level for the industrial, residential, commercial, and public sectors, and analyzes price-quantity relationships for water used in Pennsylvania. The utilization patterns were based on a 'per employee requirement' allocation technique. The basic relationships developed were water intake, average price per thousand gallons, and total water expenditures. The data indicated wide variations in the average price paid per thousand gallons of water. The range was from $1.73 per thousand gallons to less than $.06 per thousand gallons. Linear, quadratic and logarithmic regression equations were estimated and tested for significance to determine price-quantity relationships. The regression equations indicated that the logarithmic form produced the 'best fit' between price of water and quantities purchased. The utilities owned by municipalities had the lowest average cost per gallon; privately owned utilities were generally the highest in terms of water prices. (Sink-Penn State)
W69-05154

6E. Water Law and Institutions

WATER POWER LINKS RIPARIANS - AUSTRIA CONTRIBUTES TO INTERNATIONAL COOPERATION,
Oesterreichische Elektrizitaetswirtschafts A.G., Vienna.
Rudolf Parth.
For the 8 Volume Proceedings, see Vol 2, No 9, Field 06B W69-03305. Int Conf on Water for Peace, Wash D C, Vol 5, pp 62-67, 1968. 6 p.

Descriptors: *International law, *International waters, *Water resources development, Hydroelectric power, Rivers, International commissions, Governments, Riparian rights, Legal aspects, Treaties, Networks.
Identifiers: Austria, Germany, Yugoslavia, International river developments, Danube River, Inn River.

The Danube and its tributary, the Inn river form a part of the boundary between Austria and Germany. In the early fifties 2 agreements were established between the governments of Austria on the one hand and of the German Federal Republic and the Free State of Bavaria on the other hand, in order to harness the water power potential of this region in a cordial way and to the equal benefit of both riparians. Both provide for the organization of a joint stock company, whose shares are equally placed in the 2 countries. The Osterreichische Elektrizitatswirtschafts AG - Verbundgesellschaft (Austrian Grid Corporation) holds the Austrian

shares in trust for the State Authority. The German shares are held by State Authorities and state-owned power companies. The agreements contain regulations as to the organization and the action of the companies' management. Stress is laid on the principle of equal partnership concerning the ownership of the plants as well as personnel, investments, costs and power output. The power stations have no influence on the boundary treaties, both riparians regard them as inland plants. The international powerplant agreements follow the principle that the design should be made as if no frontier exists on the spot. In fact, frontiers do not prevent a free exchange of power and cordial water use for power production in other places of Austria too. The power export scheme in the utmost west of this country, the well-known Vorarlberger Illwerke, did not stop the power deliveries into the German grid system even in the post-war time 1945-46, when nearly all other communications between the two countries were interupted for many months, and when the former German shares of this company were annulled. The cooperation of powerplants situated on both sides of the frontier on the Drava River was the aim of an agreement between Austria and Yugoslavia. A joint commission is settling the problems of this frontier-crossing river in a manner which overcome difficulties of the lack of international water law. (Knapp-USGS)
W69-04777

MANPOWER PROBLEMS IN WATER SUPPLY ORGANIZATION,
Marseilles Water Co. (France).
M. Feline.
For the 8 Volume Proceedjngs, see Vol 2, No 9, Field 06B, W69-03305. Int Conf on Water for Peace, Wash, D C, Vol 5, pp 923-930, 1968. 8 p.

Descriptors: *Manpower, *Administrative agencies, *Employee relations, *Wages, Labor unions, Personnel, Organizations, Operation and maintenance.
Identifiers: *Water-supply companies.

A detailed analysis of personnel problems which may arise in water-supply companies shows that the problems of personnel are closely tied to operating structures, and the solution of these problems depends upon the choice made regarding such structures. Management methods, the organization of operating companies, the definition of relationships between such companies and the municipalities or the State, and the search for a financial policy regarding both operation and investment -- all these must be carefully studied. In order to obtain personnel stability a list of job descriptions should be drawn up, containing a number of well-defined levels allowing both for flexibility in the use of personnel and for improvement in average income. Water-supply companies, taking into account the comparisons with other branches of the private sector, are led to reassess the problem of salaries and benefits, and to establish an incentive formula or a production-bonus system. The State, and local communities and private companies have important roles to play in the water-supply field, but the State must clarify its policy and set limits on its participation, while specifying the conditions under which the water-supply companies may operate. Communities should re-examine their problems, and above all relinquish local prerogatives that are completely outmoded. Private companies should reconsider their methods, and see the supplying of water not as a mere source of profit, but rather as an opportunity to demonstrate that they can support a humane solution to the problems of the company, and institute a new personnel policy. (Vorhis-USGS)
W69-04779

MARINE RESOURCES AND THE FREEDOM OF THE SEAS,
Resources for the Future, Inc., Washington, D. C.
Francis T. Christy, Jr.
Natural Resources Journal, Vol 8, No 3, pp 424-433, July 1968. 10 p.

Descriptors: *International law, Legal aspects, *Law of the sea, International waters, Resources, Water resources, Economic efficiency.
Identifiers: *Freedom of the sea, Freedom of access.

The principle of the freedom of the seas has been maintained for a long time. As long as the use of the seas and its resources by one did not significantly decrease the use by another, there was no reason to separate the right of access from a right to a share in the wealth. But for many resources and uses of marine environment, this basic condition of abundance has passed. To maintain free access in view of this change is to persist in the waste and inefficient use of the seas. Access must be closed, and there must be provisions under which a user can acquire a right to exclude others from participating directly in the same use. But the association of access with a share of wealth makes such controls difficult and leads inevitably to conflict. A redefinition of the freedom of the seas, which disassociates the right of access from the right to the sea's wealth, may resolve this dilemma. (Winn-Rutgers)
W69-04808

WATER LAW AND PRIVATE DECISION MAKING: A CRITIQUE,
Indiana Univ., Bloomington.
For primary bibliographic entry see Field 06B.
W69-04839

THE INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN; A STUDY OF ITS ROLE AS A PLANNING AGENCY ENGAGED IN THE POLITICAL PROCESS,
Maynard M. Hufschmidt.
The Interstate Commission on the Delaware River Basin, Mar 1956. 102 p, 6 tab, 175 ref, 1 append.

Descriptors: *Delaware River Basin Commission, *Interstate commissions, *River basin commissions, *Political aspects, Interstate compacts, Short-term planning, Water policy, River basin development, Future planning (Projected), Long-term planning, Water pollution control, Water allocation (Policy), Planning, Evaluation, Political constraints, Federal governments, State governments, Institutional constraints, Federal-state water rights conflicts.

A thorough discussion of the Interstate Commission on the Delaware River Basin, or Incodel, is presented. The background of Incodel is discussed in light of the problems which brought it into existence. Both the long-term and short-term planning functions of Incodel are examined. It is concluded that Incodel was more effective in dealing with immediate problems than in formulating and implementing comprehensive plans. The political composition of the Commission and its action in the political process, both state and national, are discussed in detail. The responsibility and effectiveness of Incodel as an interstate commission in the field of water resources are analyzed. It is concluded that in order to attain effectiveness, interstate water agencies must have broad authority, and to achieve responsibility, such agencies must have a membership directly responsible to state governments. The author notes that the greatest utility of agencies like Incodel, with only advisory powers, is in alerting state and local governments to the problems and opportunities involved in interstate river systems. (Pfeiffer-Fla)
W69-04856

CAIRO PICKLE CO V MUGGRIDGE (BRINE DISPOSAL POLLUTION BY UPPER RIPARIAN OWNER).
206 Ga 80, 55 S E 2d 562-564 (1949).

Descriptors: *Georgia, *Riparian rights, *Brine disposal, *Water pollution, Water rights, Industrial wastes, Chemical wastes, Odor, Fishkill, Remedies, Legal aspects, Judicial decisions, Water law, Waste water disposal, Waste disposal, Pollutants, Damages.

Defendant corporation was dumping approximately fifty thousand gallons of waste water per day from a pickle plant into a non-navigable creek. Several lower riparian land owners sought to enjoin defendant from allowing waste waters to flow into the creek. At a hearing, the evidence showed that during dry seasons, when the water in the creek was low, the discharged waste water caused an offensive odor, killed the fish in the creek, and caused some cattle and hogs of lower riparian land owners to refuse to drink the creek water. After some delay, an order was entered granting a temporary injunction. Defendant sought vacation of the order. The court held that the trial judge did not abuse his discretion in granting the temporary injunction. The owner of land is entitled to the use of water of a non-navigable stream flowing through his land, but lower riparian landowners may join in a petition to restrain an upper proprietor from adulterating the water and thus preserve their correlative right to a reasonable flow of non-polluted water. (Gabrielson-Fla)
W69-04857

CLARK V LINDSAY LIGHT AND CHEMICAL CO (RIPARIAN RIGHTS IN WATERS OF STREAM).
405 Ill 139, 89 NE 2d 900-903 (1950).

Descriptors: *Usufructuary right, *Riparian rights, *Streams, *Ownership of beds, Judicial decisions, Illinois, Legal aspects, Natural streams, Water pollution, Stream pollution, Jurisdiction, Water rights.
Identifiers: *Freehold estate, Injunctions (Prohibitory).

Plaintiffs originally brought suit to enjoin defendant from polluting a stream which ran through plaintiff's land. After the chancellor dismissed this action, plaintiff prosecuted a direct appeal to the Illinois Supreme Court on the assumption that a freehold was involved. In transferring plaintiff's cause, the court held that an action to enjoin pollution of a stream by riparian owner did not involve a 'freehold' so as to authorize a direct appeal. Rather, a riparian owner has no property in the water of a running natural stream, but he has a 'usufruct' in the water as it passes, which is an incident to his ownership of land; that is, a property right exists in the flow of water at that place for all beneficial uses that may result from it. (Logan-Fla)
W69-04858

LEGAL ASPECTS OF OFFSHORE OIL AND GAS OPERATIONS,
Oliver L. Stone.
Nat Resources J, Vol 8, No 3, pp 478-504, July 1968, 27 p, 92 ref.

Descriptors: *Oil industry, *Continental shelf, *Treaties, *Submerged lands act, Exploitation, Exploration, International waters, Drilling, Natural gas, Federal jurisdiction, International law, Foreign waters, Federal government, Continental slope, United Nations, Coastal areas, Offshore platforms, Florida, Texas, Alabama, Louisiana, California, Beds, Legislation.

The broad areas of law affecting offshore oil and gas operations are discussed. The areas touched are relevant to state, national, and international interests. On the national level, there has been a growing controversy as to the ownership of the submarine areas off the coast; as between the state and federal governments which has the better right. The Submerged Land Act of 1953 vests title to such areas in the coastal states. Another problem area dealt with is that relative to the Continental Shelf. The 1945 Proclamation on the Continental Shelf extended national jurisdiction out to a depth of 600 feet. The Outer Continental Shelf Lands Act of 1953 enacted into law the 1945 Proclamation. On the international level, the Convention on the Continental Shelf was approved by the United States in 1960 and went into effect in 1964. It extends national jurisdiction over submerged land out to a depth of 200 meters. Many other problems, however, have not as yet been resolved, including

exploitation of the sub-soil of the highs and jurisdiction and control of the ocean floor. Finally, re is a dispute as to what law is applicable on the er Continental Shelf. (Heckerling-Fla)
69-04859

PARIAN RIGHTS... ACTION BY STATE TO JOIN LANDOWNER FROM FILLING IN KE.
pany Law School, N. Y.

pany L Rev, Vol 32, No 3, pp 677-682, Spring 68. 6 p, 23 ref.

scriptors: *Vermont, *Riparian rights, *Low ter mark, *Ownership of beds, Riparian lands, gh water mark, Public lands, Dikes, Navigable ters, Boundaries, Banks, Water law, Judicial isions.

fendants constructed a dike on a lake immediately in front of their shore property. The state ght to enjoin construction as an encroachment state land. The trial court held the average of lowest water levels reached over a period to be ordinary low-water mark. This constitutes the undary between public and riparian land, and endants had not encroached. The supreme rt, on this basis, stated that the test stated by the er court was for the extraordinary low water rk, but it did not reverse the case on this theory. e case was said to turn on the right of the public se the water regardless of ownership of the bed. e decision is criticized as being based on improper interpretation of precedent and as presenting a shift in state policy with regard to arian rights. State power to control water use y be based either on ownership of beds of vigable waters or on a claim to an easement. The e that the riparian owner owns land to the low ter mark is threatened if the state claims the nt to control the use of water between the high d low water marks regardless of ownership. (Hel-Fla)
69-04860

E ROLE OF U S TRANSPORTATION POLY IN THE DEVELOPMENT OF INLAND ATERWAY NAVIGATION,
E. Franklin.
ernational Conference on Water for Peace, Vol pp 944-951, 1968. 8 p. For 8 volume ceedings see Vol 2, No 9, Field 06B, W69-305.

scriptors: *Inland waterways, *Transportation, lultiple-purpose projects, *Navigation, Chans, Canals, River basin development, Water ources development.

mmercially navigable waterways in the U S total out 25,000 miles. Inland water transportation accunts for 15% of the tonnage and 10% of the ton les of the inter-city freight traffic. Petroleum is leading commodity transported. Major waterway traffic has increased 300% since 1945. Other ts and historical data are given. Canals veloped rapidly int the U S until the introduction the railroad. The waterway system has been mpteitive because there is no direct cost to the rrier and there has been little ICC regulation. ese factors are the main current policy issues ncerning the system. Multi-purpose river basin ojects combining navigation, irrigation, power neration, flood control, drought control, bank ntrol, pollution control and recreation are in ogress, stimulating regional development. The ajor problem facing the waterway system is its condary role in water resources planning. The oblem can best be met through the multi-purpose ter basin projects on an inter-agency cost-shar basis. The Department of Transportation and e Water Resources Council are developing teria for a benefit/cost ratio to justify public instment in the system. (Helwig-Fla)
69-04862

BARBER PURE MILK CO V YOUNG (OBSTRUCTION OF SURFACE WATER FLOW).
81 So 2d 328-331 (Ala 1955), aff'g 81 So 2d 324-328 (Ct App Ala 1954).

Descriptors: *Alabama, *Natural flow doctrine, *Obstruction to flow, *Surface runoff, Water law, Streams, Culverts, Overflow, Judicial decisions, Streamflow, Alteration of flow, Ditches, Diversion, Running waters.
Identifiers: *Negligence, Nuisance.

Plaintiff brought action for damages for negligence of adjoining owner in causing water to overflow onto plaintiff's property. The complaint arose upon defendant's construction of a straight channel in place of an old meandering watercourse with resulting clogging of a culvert into which both the old and substituted channels were connected. The entire project of relocating the ditch was carried out by independent contractors. The appellate court affirmed the lower decision in favor of plaintiff. After defining surface water as 'water casually on land from natural precipitations and flowing in no fixed channel,' the court observed that the following maxims apply to both surface water and stream diversion: (1) Property should be used so as not to injure that of another; (2) Water ought to flow in its natural path. The court held that negligently obstructing the flow of waters, so as to divert its natural flow to the injury of others, constituted a tort in the nature of a private nuisance. The question of foreseeability was held to be properly for the jury, and the question of who performed the work irrelevant. (Wheeler-Fla)
W69-04863

MCHENRY V FORD MOTOR CO (EROSION BY WATERS OF RESERVOIR).

146 F Supp 896-905 (ED MKH 1956).

Descriptors: *Michigan, *Erosion, *Impounded waters, *Easements, Water storage, Water rights, Water levels, Watercourses, Erosion control, Flooding, Flood damage, Reservoirs, Reservoir operation, Rivers, Impoundments, Right-of-way, Boundaries, Competing uses, Judicial decisions, Riparian rights, Legal aspects.
Identifiers: Huron River, Easement of flowage.

Plaintiff owned about 190 acres of land bordering Michigan's Huron River. In 1925, plaintiff conveyed 155 acres of this tract to defendant with concomitant flowage rights. Included in the deed to defendant was a restrictive use covenant providing that no part of the land deeded should be used in any manner which would render the remaining 35 acres undesirable for 'high-class' residence purposes. The land was purchased for the express purposes of creating a reservoir. Natural action of the impounded waters eroded part of the 35 acres retained by the grantors. Plaintiff then brought suit to enjoin this alleged flooding and erosion and for damages. Defendant moved for summary judgment on the ground that the rule of Rylands v Fletcher, relied on by plaintiff was not applicable in Michigan. The motion was granted. (Carruthers-Fla)
W69-04864

STATE V ANDERSON (ACTION TO ESTABLISH FLOWAGE EASEMENT).

87 N W 2d 839-844 (Minn 1958).

Descriptors: *Easements, *Minnesota, *Condemnation, *Flood damage, Judicial decisions, Legal aspects, Backwater, Flood routing, Dams, Eminent domain, Control structures, State governments, Rivers, Damages, Flood control, Project planning.

In order to control waters in the Minnesota Valley, the State had erected a series of control works on the Minnesota River. Because of these control works, including dams, plaintiff's property became flooded periodically. The State brought condemnation proceedings. Plaintiff filed petition in intervention to recover damage from the State for the taking of land. The lower court ruled that the State had taken a flowage easement upon plaintiff's land to a certain elevation, and awarded damages. The Supreme Court of Minnesota affirmed. The decision concerned mostly the attack by the State as to whether the evidence was sufficient to sustain the finding of the easement. The court ruled also that the imposition of an easement did not involve usurpation of legislative power. (Wheeler-Fla)
W69-04865

LIPPMAN V HUHN (RIGHT TO ESTABLISH PUBLIC DRAINAGE DITCHES).
81 N W 2d 100-109 (Minn 1957).

Descriptors: *Minnesota, *Drainage, *Ditches, Legislation, Judicial decisions, Legal aspects, Water law, Laterals, Drainage systems, Natural streams, Natural watercourses, Drainage districts, Public benefits.

Pursuant to the procedure outlined in the Drainage Code, respondent Lippman filed a petition and received a final order from the district court for establishment of Lateral A and its outlet into previously established Judicial Ditch no 13. Appellant, Huhn, questioned the validity of the final order. Appellant claimed that Lateral A would drain a watershed area different than the area served by Judicial Ditch no 13, that it would require diverting the natural drainage system previously draining the area, and that the only groups to be benefited by its establishment would be its proponents. However, the court upheld the final order, saying that lateral A was justified by the fact that it would promote the general health and public welfare and be of public benefit, this being the purpose behind the enactment of the drainage code. (Holt-Fla)
W69-04866

STATE V PUBLIC SERVICE COMM'N (RECREATION FACILITIES).
For primary bibliographic entry see Field 06B.
W69-04867

RUBIN V STATE (DRAINAGE WATER DIVERSION).
168 N Y S 2d 378-384 (NY Ct Cl 1957).

Descriptors: *New York, *Condemnation, *Highway effects, *Drainage water, Legal aspects, Judicial decisions, Highways, Surface runoff, Surface waters.

Plaintiff is the owner of land on which she operates a hotel. Defendant appropriated, by condemnation proceeding, certain portions of the land and nearby adjacent land for purposes of a thruway overpass. Plaintiff sought payment for certain consequential damages resulting from the taking, having already been compensated for the value of her property. The court allowed a recovery in favor of the plaintiff as compensation for an increased flow of drainage water upon her land caused by the construction of an embankment by the defendant as part of the thruway project. (Molica-Fla)
W69-04868

BOSTICK V SMOOT SAND AND GRAVEL CORP (DREDGING IN RIVER AS CREATING NUISANCE FOR OTHER RIPARIAN OWNERS).
154 F Supp 744-767 (D Md 1957).

Descriptors: *Riparian rights, *Virginia, *Interstate rivers, *Dredging, Judicial decisions, Maryland, Industries, Ownership of beds, Riparian land, State governments, State jurisdiction, Rivers, River beds, Navigable rivers, Legal aspects, Legislation.

Plaintiffs, landowners in Virginia, brought suit against defendant gravel company for an injunction and for damages stemming from drilling operations

in the Potomac River, upon which their property abutted. The State of Maryland granted defendant a license to dredge sand, gravel, and other materials between the low water mark and the outer line of the channel on the Virginia side. The court recited the applicable state statutes, the history of disputes and agreements between the two states, judicial considerations and the opinions of the attorney general. It held that the plaintiffs had no cause of action against defendant because the Maryland statute, which granted riparian owners of lands bordering on any navigable rivers, the right to dredge sand, applied only to Maryland property owners, not to landowners in Virginia. Injunctive relief was denied. The dredging operation was also held not to constitute a nuisance. (Heckerling-Fla)
W69-04869

KOCH V WICK (PRIVATE OWNER MAY ENJOIN COUNTY'S ATTEMPT TO USE GROUNDWATER ON OTHER THAN OVERLYING LAND).
87 So 2d 47-49 (Fla 1956).

Descriptors: *Florida, *Wells, *Overlying proprietor, *Reasonable use, Judicial decisions, Competing uses, Water rights, Legal aspects, Water allocation (Policy), Relative rights, Water utilization, Water transfer, Percolating water, Groundwater, Local governments, Municipal water, Beneficial use, Consumptive use, Withdrawal, Preferences (Water rights).

Plaintiff, a landowner, sought an injunction preventing the defendant county commissioners from using adjoining lands as a municipal well field for supplying water to land areas not overlying the well field. The county had leased four acres adjoining plaintiff's 2600 acre tract and was pumping in excess of 4,000.000 gallons of water daily from this 4 acre site for sale in surrounding county municipalities. Plaintiff alleged that his orange groves would soon become a wasteland if the county was permitted to draw off such quantities of percolating groundwaters for commercial purposes. This court reversed and remanded the lower court's decision for defendant. The county was not in a favorable position merely because the water it pumped was for a public use. The county as a lessee was bound by the rights possessed by the owner-lessor to draw only so much water from beneath the surface of its tract as could be deemed reasonable and in accordance with the beneficial use of that amount of land. Plaintiff could not be made to wait until the extent of damages could be ascertained before being permitted to seek injunctive relief from damage. (Blunt-Fla)
W69-04870

OBSTRUCTING AND PREVENTING FISH FROM RUNNING UP RIVERS OR CREEKS; POISONING STREAM OR USING EXPLOSIVES TO CATCH FISH.
Ala Code tit 8, secs 78-79 (1958).

Descriptors: *Alabama, *Fish barriers, *Fishkill, Legislation, Fish, Fish management, Fish passages, Fish conservation, Dams

Section 78 imposes a fine of not more than $100.00 for preventing the passage of fish up the waters of any river or creek by means of any obstruction other than a dam on a non-navigable stream for impounding private waters. Section 79 imposes a fine of $50 to $200 for the taking or attempting to take fish by means of poison or explosives. Section 79 (1) imposes fines of $50 to $200 for the taking or stunning of fish by electrical equipment or any other device not expressly authorized. Possession of any such device on the bank of any public water or in a boat on such water is prima facie evidence of its illegal use. (Kahle-Fla)
W69-04871

LIBBY, MCNEIL AND LIBBY V ROBERTS (INTERFERENCE WITH NATURAL DRAINAGE COURSE).
110 So 2d 82-85 (2d DCA Fla 1959).

Descriptors: *Florida, *Natural streams, *Drainage water, *Surface drainage, Surface waters, Surface runoff, Judicial decisions, Water law, Lakes.
Identifiers: *Natural drainage course, *Artificial drainage course.

Plaintiffs, owners of property on the bed of a body of water known as Little Everglades, built culverts and ditches to drain its waters, which ultimately flowed through a natural drainage course on defendant's land. Defendant, not wanting the level of the waterbody to be lowered, dammed the drainage course. Plaintiff was successful in enjoining defendant from destructing the drainage from plaintiffs' lands, and defendant appealed. The appellate court found Little Everglades to be surface water or a watercourse, but not a lake. This conclusion was reached after definitions of 'surface water,' 'natural watercourse' and 'lake' were set forth. As to plaintiff's right to link artificial drains into the natural drainage course running through defendant's property, it was held that an increase in the volume of water caused thereby is not actionable on the part of the owner of a lower estate, even though the increased volume makes the stream exceed the capacity of its channel. (Patterson-Fla)
W69-04872

LIABILITY, AS REGARDS SURFACE WATERS, FOR RAISING SURFACE LEVEL OF LAND,
W. E. Shipley.
12 ALR 2d 1338-1352 (1950).

Descriptors: *Repulsion (Legal aspects), *Civil law, *Surface runoff, *Reasonable use, Surface waters, Natural flow, Drainage water, Adjudication procedure, Easements, Judicial decisions, Proprietary power, Urban sociology, Remedies.

The legal problems arising when surface water is diverted by improvements resulting in a general elevation of the land are discussed. Many courts have adopted what is called the 'common enemy' rule, under which each landowner is entitled to take whatever steps he sees fit to protect his land from the flow of surface water. In these jurisdictions, including Kansas, Mass, Mo, N J and N Y any act of either an upper or lower owner in raising the surface of his land will not create any liability. In some jurisdictions the 'common enemy' rule has been modified by the doctrine of 'reasonable use' -- property must be used so as not to unnecessarily injure others. These jurisdictions include Mo, Del, Va, and N Y. Georgia, Ky, Md, Tenn, and Texas have adopted the civil law rule that lower land must accept natural drainage from upper land. The upper owner cannot change the flow so as to cause drainage upon the lower land in a different place or volume. In several jurisdictions it has been held that the 'common enemy' rule is preferable where urban property is involved since its enjoyment depends upon the ability to improve by raising its surface. Cases from Ala, Ark, Kan, N Y, Pa are discussed. (Kahle-Fla)
W69-04873

FISCHER V TOWN OF ALBIN (TOWN MAY NOT ALTER DRAINAGE DISTRICT WITHOUT CONSIDERING RIGHTS OF DISTRICT LANDOWNERS).
104 N W 2d 32-35 (Minn 1960).

Descriptors: *Minnesota, *Drainage systems, *Benefits, Judicial decisions, Estimated benefits, Project benefits, Alteration of flow, Relative rights, Assessments, Appreciation, Culverts, Roads, Cities.
Identifiers: Constitutional law.

Plaintiffs, owners of land within a drainage district, brought suit to require the defendant town to remove certain culverts placed in a township road adjacent to the plaintiffs' property. The plaintif claimed that the town culverts altered the cond tion of the existing drainage district. The tow claimed that its culverts did not, in any way, affe the property rights of the plaintiffs. The lower cou ordered the town to remove its culverts, and th court affirmed the decision. Owners of land with a drainage system who have been assessed for th benefits drained from its construction have a veste property right in the maintenance of the system the same condition as when it was originall established. This right extends not only to th ditches themselves but to all of the condition shown to have existed at the time the system wa established and upon which the project wa founded and assessments made. The town may no defeat the plaintiffs' property right in the system a it originally existed by claiming that some of th benefits which accrued to plaintiffs by virtue of th system were not foreseen when the system wa completed, and hence cannot be protected now (Blunt-Fla)
W69-04874

FOURTH CLASS CITIES - SEWER BONDS.

Mich Comp Laws Ann sec 115.1 (1967).

Descriptors: *Michigan, *Cities, *Financing, *Lo cal government, Legislation, Debt.
Identifiers: *Bonds, *Ratification.

All sewer bonds heretofore attempted to b authorized by any fourth class city pursuant to sec tions 3308, 3309, and 3313 of the Compiled Law of Michigan are hereby declared to be legal an binding obligations if approved by 2/3 of the elec tors voting in the city with ten days notice. Any de fects of form in enabling ordinances or notices wil not invalidate such bonds if within statutory limits (Harris-Fla)
W69-04875

HOME RULE CITIES - BORROWING FOR PUBLIC WORKS.

Mich Comp Laws Ann sec, 117.4a, 117.4b, 117.4e 117.4f, 117.4h (1967).

Descriptors: *Michigan, *Cities, *Public utilities *Local governments, Financing, Flood control Navigable water, Bridges, Dams, Water supply Sewage system, Parks, Recreation, Levees, Con duits, Riparian rights, Riparian land, Docks, Ease ments, Legislation, Legal aspects.
Identifiers: *City charters.

Each city may in its charter provide for: (1) bor rowing money for relief and preservation of proper ty in case of floods or calamity; (2) refunding money advanced on assessments imposed for wate main extensions; (3) installation of sewers and waterworks; (4) acquisition of public parks, recrea tion grounds, public landings on navigable waters levees, embankments, waterworks and sewage systems; (5) the purchase or condemnation of public utility property or franchises. Each city may provide for: (1) contracts to own and operate exist ing public utilities if approved by the electors; (2) domestic, commercial, and municipal utility ser vice, (3) acquisition and operation of sewage disposal systems within or without corporate limits; (4) fixing charges for services, including return on the fair value of property devoted to service; (5) use of property located in streets and public places by utilities; (6) control of watercourses within its boundaries, but not to conflict with the law thereunder where a navigable stream is dammed or bridged, or with riparian or littoral rights outside corporate limits; (7) securing easements in proper ty abutting or adjacent to navigable streams for construction of pedestrian or vehicular passageways; and (8) for acquiring and operating facilities for docking of pleasure craft and hydroplanes within corporate limits. (Harris-Fla)
W69-04876

BLIC PARKS - PLAYGROUNDS - JOINT RKS.

Stat Ann secs 40:61-27 to 40:61-29 (1967).

scriptors: *Legislation, *New Jersey, *Recreal facilities, *Cities, Outdoor recreation, Local ernments, Project purposes, Contracts, Lakes, nds, Public recreation, Legal aspects, Public efits, Streams.

nicipalities in the same or adjacent counties cooperate in providing public parks, resorts, recreation areas. Any municipality may con- t with any other municipality for improvement anks and shores as places for public recreation. h contracts are to include provisions necessary ulfill the joint improvement. Any two or more nicipalities lying within adjacent counties may uire land, lakes, streams, and other rights and erect and maintain dams to impound water. h land, lakes and streams shall be maintained as lic parks and recreation areas. In order to uire land, lakes, streams and other rights for lic purposes, the governing bodies of the mupalities may, by majority vote, pass an orance adopting the previously mentioned provis. (Stewart-Fla)
9-04877

BLIC PARKS - PLAYGROUNDS.
Stat Ann sec 40:61-22.20 (1967).

criptors: *Legislation, *New Jersey, *Recrea- facilities, *Cities, Beaches, Outdoor recrea-, Swimming, Access routes, Land use, Safety, al governments, Regulation, Legal aspects, ancing, Eminent domain, State governments, sion control.

governing body of any municipality bordering the Atlantic Ocean or bay areas shall have the t to exclusive control, and care of any board- k, bathing, and recreational facilities. The mupality must acquire and own the lands. In addi-, such municipality may, by ordinance, make enforce rules and regulations for the governt and policing of such lands, boardwalk, ning facilities and equipment; provided, that n power of control, government, and policing l not be construed to exclude or interfere with e law or authority with respect to such lands, perty, and facilities. The municipality may, in er to provide funds to improve, maintain, and ce the area and protect it from erosion or enachment, and to provide facilities and guards for public bathing, by ordinance make enforce rules and regulations and provide for rging of reasonable fees of persons using the lities as well as access to the beach. No fees l be charged or collected from children under lve. (Stewart-Fla)
9-04878

ANSPLANTING OF SHELLS AND OYSTERS.
Stat Ann sec 50:1-14 (1955).

criptors: *Legislation, *New Jersey, *Shellfish, sters, Commercial shellfish, Dredging, roduction, Administrative agencies, Regula-, Legal aspects.
ntifiers: *Shellfish transplanting, Oyster bed.

enever the board deems it necessary for pagation purposes, it may plant shells upon any ter bed or may dredge and transplant shells and ters from one bed to another, employing boats vessels propelled either by sails or mechanical ver. The board may purchase oysters from ther state and plant them on the natural oyster s of this state for the benefit of seed production. ckerling-Fla)
9-04879

TLE V PENNSYLVANIA RR (BRIDGE CONRUCTION AND OBSTRUCTION TO FLOW).

N E 2d 72-76 (Ct App Ohio 1951).

Descriptors: *Ohio, *Flooding, *Bridges, *Bridge design, Obstruction to flow, Natural flow doctrine, Floods, Relative rights, Rainfall, Judicial decisions, Legal aspects, Streams, Damages, Backwater.
Identifiers: *Acts of God, *Duty of care, *Negligence, Proximate cause.

Property of the plaintiff was damaged by overflow from a natural watercourse. Plaintiff alleged negligence by the defendant railroad company in constructing a new bridge across the watercourse which passed through plaintiff's land. During a heavy rain, water backed up onto plaintiff's land. Plaintiff claimed this backup was due to the fact that the bridge, as constructed, interfered with the flow of water. A jury verdict was in favor of the plaintiff, and defendant appealed. The court of appeals held that a duty desolves upon the builder of a bridge to maintain openings for the natural flow of water and to exercise reasonable care to prevent such floods as may be expected to occur. The duty owed is one of due care in guarding against reasonably foreseeable flooding and does not extend to extraordinary or unprecedented flood. In order to affix liability, it must be shown that negligence concurred with the act of God in causing injury. If injury would occur without the negligence, then it cannot be the proximate cause of the damage. An instruction to this effect was erroneously refused below. (Harris-Fla)
W69-04880

COUNTY CONTROL OF DAM CONSTRUCTION.

Mich Comp Laws Ann secs 46.21, 46.22 (1967).

Descriptors: *Michigan, *Obstruction to flow, *Dam construction, *Navigable waters, Local governments, Legal aspects, Water law, Streams, Bridge construction, Bridges, Boats, Regulations, Boating regulation, Administrative decisions, Legislation.

The board of supervisors of the several townships and cities have the power to regulate bridge and dam construction across navigable streams. They also have the power to provide for removal of any obstructions in a stream, and to direct the time and places where boats, logs, and rafts shall remain or be removed. Penalties may be imposed to enforce regulations. Any party wishing to construct a dam across a navigable stream must file a petition with the board of supervisors detailing the dam's description and purpose. Notice by newspaper and registered mail must also be given to all persons whose lands will be affected by such dam. The board shall hold a hearing before granting or denying permission to construct the dam. Once permission is granted, the dam is built, if such dam subsequently is destroyed, the petitioners or their heirs or assigns may reconstruct the dam according to the original specifications without making re-application to the board. The board has no power to grant the right to any petitioners to injure the lands of any person as a result or consequence of constructing a dam. (Holt-Fla)
W69-04881

LEASED UNITED STATES LANDS; APPROPRIATION FOR FLOOD CONTROL.
Mich Comp Laws Ann sec, 45.491 (1967).

Descriptors: *Financing, *Flood control, *Michigan, *Navigation, Water law, Legal aspects, Appropriation, Local governments, Federal government.

All sums of money received from the United States under an act of Congress providing for 75 per cent of all moneys received for leases of land situated within the various states to which the United States owns fee simple title for flood control and navigational purposes is to be appropriated to the board of supervisors of the county in which the land is situated. The board shall expend the money in accordance with the acts of Congress providing for distribution to states and counties. Within a reasonable time of receipt of the money, the state treasurer shall issue his warrant to the treasurer of the county entitled thereto. (Holt-Fla)
W69-04882

FENCES ACROSS WATER; NEGLECT, REMEDY.
Mich Comp Laws Ann sec 43.16 (1967).

Descriptors: *Michigan, *Bodies of water, *Riparian rights, Construction, Legislation, Remedies, Legal aspects, Maintenance, Construction costs, Replacement costs.
Identifiers: *Fences.

Where it becomes necessary to construct a partition fence running into the water, the same shall be constructed in equal shares, unless otherwise agreed by the parties, and in case either party shall refuse or neglect to make or maintain the share belonging to him, similar proceedings shall be had, as in case of other fences, and with the like effect. (Shevin-Fla)
W69-04883

SOUTHLAND V AARON (RIPARIAN OWNER'S ACTION FOR DAMAGES FROM OIL WASTE POLLUTION OF STREAM).

80 So 2d 823-827 (Miss 1955).

Descriptors: *Water pollution, *Riparian rights, *Waste disposal, *Mississippi, Streams, Riparian land, Legal aspects, Artificial use, Oil wastes, By-products, Pollution abatement, Water pollution control, Judicial decisions.

The original action was brought to recover damages suffered by appellee Aaron due to pollution of appellee's water supply by appellant's upstream operation of a gasoline refinery. Appellant continued to pollute the stream after the original judgment for appellee. This appeal was taken from a second suit, and was based upon an alleged error by the trial court in allowing punitive damages and greater damages than requested by appellee. After a discussion of the procedure in the lower court, the appellate court found that the error below was harmless, and that appellant's continued pollution of the stream constituted a nuisance. The court found willful misconduct despite the construction by appellant of ponds to control the escape of petroleum products into the stream, since they were inadequate. (Kelly-Fla)
W69-04884

SEWERS AND DRAINS.
N J Stat Ann secs 40:96-1 to 40:96-10 (1967).

Descriptors: *New Jersey, *Legislation, *Sewage districts, Sewage systems, Sewers, Sewage, Outlets, Cesspools, Drains, Surveys, Assessments, Legal aspects.

Chapter 96 deals with the incorporated camp meeting associations or seaside resort areas and their procedures, plans, etc, for construction of district sewerage systems. These districts consist of one or more main sewers with the necessary branches or connections, the main or principal sewers having their outlet in the ocean or other proper place. The board authorized to handle this work has the following powers and obligations: to require that plans and specifications be prepared showing size, location, depth below the surface, and inclination of the proposed sewers; to assess the cost of local and main sewers and outlets therefor upon the real estate benefited; to provide for the construction of proper house and privy connections and branches leading into all main or branch sewers; and require owners of any cesspool, drain, privy, water closet, or accumulation of water or sewage matter which is prejudicial or injurious to public health to drain, alter or improve its condition. (Logan-Fla)
W69-04885

CANALS AND CANAL BEDS.
N J Stat Ann secs 40:67-47, 40:67-48 (1967).

Descriptors: *New Jersey, Legislation, State governments, Canals, Beds, Public rights, Cities, Navigation, Transportation, Legal aspects.

A municipality in which a canal or canal bed lies, in whole or part, has the power to vacate or release all public rights - in that canal or canal bed by ordinance. Prior to exercise of this power, the following facts must be found: (1) The canal or canal bed is not vested in any public body (State, Municipal, etc.); (2) It has not been used for navigation purposes for a period of twenty years or more; and (3) that the public interest will not be injured by this release. Also, such ordinance will be filed in the land recording office. (Logan-Fla)
W69-04886

COMMONWEALTH EX REL SHUMAKER V NEW YORK AND PENNSYLVANIA CO, INC (JURISDICTION OF SANITARY WATER BOARD OVER STREAM POLLUTION).
61 Dauphin County Reports 156-172 (CP Pa 1949).

Descriptors: *Water pollution, *Pollution abatement, *Pennsylvania, Water pollution treatment, Judicial decisions, Legal aspects, State jurisdiction, Industrial wastes, Pulp wastes, Administrative agencies, Permits, Acids, Organic wastes, Streams.
Identifiers: *Sanitary water board, *Pure streams law.

Plaintiff sought an injunction to restrain the defendant from discharging industrial waste into a river on the grounds of public nuisance. The sanitary water board had found the alleged pollution to be minimal and not of such degree as to warrant labeling as a public nuisance under the Pure Streams Law of Pennsylvania, PL 1987 (1937), and refused to enjoin the defendant's pulpmill from operation. Plaintiff contended that under the Pure Streams Law, the court has the authority to declare the existence of a public nuisance and grant proper relief. The court held that the legislature intended the Sanitary Water Board to have exclusive jurisdiction over public nuisance determinations under the Pure Streams Law and accordingly dismissed the bill. (Katz-Fla)
W69-04887

SAWYER V SHADER (OBSTRUCTION TO FLOW).

75 N E 2d 647-649 (Mass 1947).

Descriptors: *Massachusetts, *Flooding, *Surface drainage, *Obstruction to flow, Natural stream, Damages, Remedies, Legal aspects, Judicial decisions, Water law, Backwater.

Plaintiff had purchased a low from defendant. This lot was drained by a natural watercourse which ran across defendant's adjacent lot. Plaintiffs sought to restrain defendant from obstructing the watercourse and to compel the removal of existing obstructions allegedly placed in the stream by defendant. Plaintiff also sought damages for flooding allegedly caused by defendant's acts. The case was referred to a master who, after hearing, found that the filling of the watercourse was due to natural causes and was in no way attributable to acts of defendant. After overruling plaintiff's exception to the findings of the master, the judge confirmed the report and entered a decree dismissing the bill. Plaintiffs appealed. The court assumed that the master established that both parties had rights and obligations incident to the watercourse flowing through their respective properties even though no mention of such rights was made in plaintiff's deed. But the court found no inconsistency between this finding and the master's ultimate finding that defendant's actions had no appreciable effect on the watercourse and that the flooding of which plaintiffs complained was due to natural causes. (Gabrielson-Fla)
W69-04888

CRAWFORD V SPRINGVIEW CORP (SURFACE DRAINAGE OVER LOWER ADJACENT TRACT).
39 Delaware County Reports 356-361 (CP Pa 1952).

Descriptors: *Pennsylvania, *Drainage effects, *Natural flow, *Surface runoff, Watersheds, Surface waters, Drainage, Drainage systems, Water conveyance, Reasonable use, Relative rights, Slopes, Topography, Drainage practices, Judicial decisions, Legal aspects, Ditches, Culverts, Landfills, Diversions, Alternation of flow.

Plaintiff owned land adjacent to property upon which defendant corporation constructed a housing subdivision. Plaintiff claimed that land filling operations carried on by defendant had changed the natural grade of the land to such an extent that drainage of surface water was impaired and that the natural flow had been diverted onto plaintiff's farmland. The court found that some surface water had drained naturally onto plaintiff's land before defendant had begun construction. Defendant had the right to make reasonable use of its land so long as surface runoff was not diverted from its natural course or substantially altered in quantity or quality. The court decided that the increase in volume of surface drainage onto plaintiff's property was not of a substantial character and that the condition, as it existed, did not warrant injunctive relief. Damages to plaintiff's land were nominal. The court further found that while the municipality of Springview could compel defendant to construct storm drains to prevent surface runoff, there was no legal requirement that such action be taken. (Kelly-Fla)
W69-04889

BISHOP V RICHARD (OBSTRUCTION OF DRAINAGE BY LOWER LANDOWNER).
65 A 2d 334-337 (Md Ct App 1949).

Descriptors: *Maryland, *Natural flow, *Drainage, *Obstruction to flow, Ditches, Slopes, Surface runoff, Reasonable use, Judicial decisions, Legal aspects, Relative rights, Topography, Surface water, Drainage practices, Barriers, Water conveyance, Conduits, Watersheds, Drainage systems, Drainage effects.

Appellant owned land adjacent to, and lower than, appellee's land. Surface runoff caused by falling rain and melting snow had naturally drained from appellee's higher land over appellee's land and into a river for at least thirty years. A series of well-defined ditches extended across appellant's land through which the water had naturally drained. Appellant refused to remove debris from the ditches, forcing backwater to accumulate on appellee's land. The court found that since the natural slope of the land favored drainage across appellant's property, the latter could not impede the flow of water so as to cause accumulation on appellee's land. Maryland adheres to the 'civil law rule,' under which the upper land owner has the right to have water drain from his land in its natural course over lands of a lower landowner. In assessing the propriety of such 'right' in a given case, the reasonableness of the upper landowner's use of his land is taken into account. In the instant case, the court found no detriment to the lower landowner in permitting appellee to keep the drainage ditches clean and unimpaired. (Kelly-Fla)
W69-04890

GIBSON V SHARP (DRAINAGE DITCH RIGHT OF WAY)
277 S W 2d 672-680 (Mo Ct App 1955).

Descriptors: *Obstruction to flow, *Ditches, *Missouri, *Surface drainage, Standing waters, Culverts, Easements, Right of way, Drainage water, Drainage systems, Laterals, Surface waters, Repulsion (Legal aspects), Riddance (Legal aspects), Water conveyance, Judicial decisions, Legal aspects, Relative rights, Damages, Permits, Prescriptive rights.
Identifiers: Implied easements, Estoppel, Prescriptive easements, Remote grantees.

Plaintiff sought an injunction restraining defendants from obstructing a ditch carrying surface runoff from plaintiff's land across land owned by defendant. The ditch had originally been constructed in 1912 by the parties' predecessors in title and had subsequently been periodically improved by plaintiff's predecessor in title. The court found that a bare license to maintain the ditch ran with plaintiff's tract. However, since plaintiff and his predecessor in title had expended valuable consideration in maintaining the ditch, an equity court would now estop the defendant from obstructing the flow. The court recognized that a contract might also be implied by virtue of the conduct and relation of the parties in regard to the ditch. (Katz-Fla)
W69-04891

GOTT V FRANKLIN (BARRICADE TO NATURAL SURFACE WATER FLOW).

211 S W 2d 680-683 (Ky Ct App 1948).

Descriptors: *Kentucky, *Natural flow doctrine, *Watercourses (Legal), *Obstruction to flow, Water law, Judicial decisions, Damages, Backwater, Surface runoff, Drainage systems, Surface waters, Diversion structures, Relative rights, Ditches, Tile drains, Sewage, Drainage water, Legal aspects.

An open drainage ditch, in existence for more than thirty years, carried surface waters from a boundary of plaintiff's land and across defendant's lower adjacent land. Plaintiff caused increase of the flow through this natural drain by the addition of tile drains. Defendant placed a barricade in the ditch which diverted water onto plaintiff's garden. Plaintiff brought suit, praying for an injunction to compel opening of the ditch. Defendant counterclaimed, alleging that plaintiff was running sewage through the ditch and that the tile drains increased the flow; the relief prayed for was an injunction against both these activities. The lower court ordered removal of the barricade, but refused to order plaintiff to take up the drains. The appellate court affirmed regarding removal of the barricade, but ordered removal of the tile drains also. Evidence of sewage was ruled insufficient. (Wheeler-Fla)
W69-04892

DAVIS V ATLANTIC COAST LINE RR (DRAINAGE FLOW EASEMENTS).
227 NC 561, 42 SE 2d 905-910 (1947).

Descriptors: *North Carolina, *Easements, *Natural flow doctrine, *Surface runoff, Drainage systems, Water spreading, Precipitation excess, Repulsion (Legal aspects), Riddance (Legal aspects), Judicial decisions, Legal aspects, Hydraulic structures, Pipes, Relative rights.

Plaintiff who owned land below that of defendant, brought this action to recover for damage to his property allegedly caused by the wrongful accumulation, acceleration, and diversion of surface water by the defendant onto and over plaintiff's tract. The court held that where two tracts of land adjoin each other, one being lower than the other, the lower tract is burdened with an easement to receive waters from the upper tract which naturally flow therefrom. The upper proprietor may increase the natural flow of water and accelerate such flow as long as he does not divert the water or cause it to flow upon the lands of the lower proprietor in a manner or at a place different from that which is 'natural' under the circumstances. (Katz-Fla)
W69-04893

MASON V LAMB (ACTION TO RECOVER DAMAGES FROM SURFACE WATER RUNOFF ONTO PLAINTIFFS' PROPERTY).
189 Va 348, 53 SE 2d 7-11 (1949).

criptors: *Surface waters, *Storm runoff, ainage, *Virginia, Relative rights, Watersheds, inage effects, Drainage practices, Ditches, Sur- runoff, Flood control, Diversion, Surface nage, Judicial decisions, Legal aspects, Flood age.

ntiffs brought this action seeking damages for ries to their land and building caused by surface er which was diverted onto their land when de- ant filled in a low area on his property. The ression, which filled with water after heavy s, had been located mainly on defendant's pro- y, but had also extended to plaintiff's property to parts of other lots. Defendant took no spe- steps to provide a new drainage receptacle or ue for collection or conveyance of surface er. During subsequent heavy rains, surface er drained from defendant's lot, among others, from plaintiffs' own lot into plaintiff's building, ing considerable damage. The court found that er the common law as adopted by Virginia, landowner may protect his property from sur- water damage as he sees fit, so long as he does act wantonly or carelessly at the expense of r landowners. Plaintiffs failed to show igence in defendant's filling and grading. The t held that defendant need not maintain a h basin on his property for plaintiff's benefit. ly-Fla)
-04894

EST LAND CO V BLACK (ACTION TO EN- N OPERATION OF MOTOR BOAT ON VATE LAKE).
E 2d 420-427 (SC 1950).

criptors: *South Carolina, *Recreation, arian rights, *Reasonable use, Safety, Legal cts, Judicial decisions, Competing uses, Water zation, Lakes, Boating, Regulation.

ellant, Black, purchased land adjoining a lake appellee land company. Appellant's deed per- ed him to operate a motorboat on the lake, sub- to any reasonable restrictions on its use which llee should make. Appellee attempted to per- ently enjoin appellant from operating his boat ne lake, alleging that the use of any motorboat tituted a nuisance because of noise, rbance of fish beds, and erosion of shoreline beaches. The lower court allowed the injunc- but the supreme court reversed, stating that appellee had reserved only the right to onably restrict appellant's use of a motorboat, not the right to completely prohibit it. The t further found that the elements of nuisance ed by appellee were speculative, and that no n for nuisance could lie without more definite f. (Kelly-Fla)
-04895

TE V NICHOLS (MISTAKE - FEDERAL NCY JURIS).
W 2d 49-59 (Iowa 1950).

criptors: *Iowa, *Surveys, *Ownership of beds, leral jurisdiction, State jurisdiction, State rnments, Federal government, Administrative cies, Legal aspects, Judicial decisions, Islands, ndaries (Property), Patents, Navigable waters, -navigable waters, Riparian rights, Meanders, es, High water mark.

State of Iowa brought suit in equity against de- ant seeking vacation of a decree quieting title e land in controversy. The land in question was sland which, because of mistake or inad- ance, was not described in a federal govern- t survey of the lake made in 1852, when Iowa a territory. Around 1900, the federal govern- t resurveyed the lake, and upon discovery of existence of the island, conveyed a patent eof to the defendant's remote grantor. The e contended that the lake in question was a gable body of water and that the property in tion was a part of the bed of that lake. It was efore alleged that title to the island passed to the state by virtue of its admission to the Union as a sovereign state. The court found that the lake was meandered and non-navigable, and that the plaintiff had failed to establish its title to the land. Since defendant's property was adjacent to a non-navigable lake, his title extended, under Iowa law, only to the ordinary high water mark. (Katz-Fla)
W69-04896

SCHMITT V KIRKPATRICK (DRAINAGE EASEMENT).
63 NW 2d 228-233 (Iowa 1954).

Descriptors: *Iowa, *Drainage water, *Overland flow, *Natural flow doctrine, Pipes, Tiles, Easements, Surface runoff, Ditches, Reasonable use, Judicial decisions, Legal aspects, Standing waters, Lakes, Farm ponds, Legislation, Precipitation excess, Relative rights.
Identifiers: Injunctions (Prohibitory).

Plaintiff sought to restrain an adjoining landowner from maintaining open ditches draining two ponds into a swale and thence onto plaintiff's land. The court held that the Iowa rule concerning drainage easements is that an upper proprietor may drain his land through natural watercourses in such a manner as to increase the flow over the servient estate, provided that such increase is not too great or in such unnatural quantities as to cause substantial injury. Plaintiff's evidence tended to show that the defendant was casting off excess water through an artificial, rather than a natural, watercourse but the court held that this fact alone was immaterial in view of the plaintiff's failure to allege and prove that he would be substantially damaged by the increased flowage. (Katz-Fla)
W69-04897

BENNETT V COUNTY OF EATON (CONCENTRATED DRAINAGE ONTO LOWER LANDS).

340 Mich 330, 65 NW 2d 794-798 (1954).

Descriptors: *Michigan, *Natural flow doctrine, *Surface drainage, *Culverts, Alteration of flow, Groundwater movement, Dispersion, Surface runoff, Flow, Precipitation excess, Excess water (Soils), Water rights, Legal aspects, Judicial decisions, Water law, Remedies, Damages, Diversion structures.

Plaintiff sought an injunction compelling removal of culverts across a road which ran adjacent to his land. It was alleged that these structures diverted water from its natural course, causing it to flow onto plaintiff's land in such amounts as to render a portion thereof unfit for farming. A surveyor's testimony supported the theory that surface water which would normally have drained onto plaintiff's land in a diffused state was artificially concentrated by the existing culverts. The court held that plaintiff was entitled to an injunction. Plaintiff, as owner of the lower estate, must receive the natural flow of surface water from the upper estate, but the owner of the upper estate cannot lawfully concentrate such flow, by means of an artificial drain, to the detriment of the lower owner. Highway commissioners have the right to drain surface waters which naturally flow onto a highway; such drainage may be through natural and usual channels upon and over lower lands. However, upland owners may not concentrate surface waters, which would naturally flow in a diffused state over a large area and cast them upon the lands of abutting owner to his damage without liability. (Gabrielson-Fla)
W69-04898

YOUNG V MOORE (LANDOWNERS RIGHT TO DRAIN EXCESS SURFACE WATER).
236 SW 2d 740-745 (Ct App Mo 1951).

Descriptors: *Missouri, *Surface waters, *Repulsion (Legal aspects), *Drainage, Surface runoff, Furrow drainage, Ditches, Wetlands, Judicial decisions, Water law, Excess water (Soils), Agricultural watersheds, Remedies, Legal aspects, Lakes, Bayous, Relative rights.
Identifiers: Injunctions (Prohibitory).

Plaintiff brought action to enjoin defendant from causing excess surface water to flow onto plaintiff's land. Plaintiff's land was situated 1/4 mile southwest of defendant's agricultural land. In 1948, defendant cleaned a drainage ditch on his property, which had been constructed 40 years previously, for the purpose of draining his land. The ditch followed the natural flow and emptied into a slough located wholly on defendant's land. The court held for defendant, basing its decision on the common enemy doctrine and construction of a state statute. The statute declared that, for agricultural purposes, a landowner was entitled to drain his land by constructing a drainage ditch on his property which would empty into a lake, bayou, etc. Procedures were also available to procure intervening lands for this purpose. The court stated that surface water was a common enemy and that a land proprietor may ward it off, even onto his neighbor's property, if he acts reasonably so as not to needlessly injure the servient tenements. Cleaning and widening, but not deepening, the ditch so as to drain an additional five acres of land was deemed reasonable by the court. (Holt-Fla)
W69-04899

CLARK V CITY OF SPRINGFIELD (NUISANCE ABATEMENT SEWAGE AND SURFACE WATER).

241 S W 2d 100-109 (Ct App Mo 1951).

Descriptors: *Missouri, *Pipes, *Surface runoff, *Rainwater, Drainage water, Surface waters, Sewage disposal, Sewage sludge, Sewers, Drainage systems, Waste water, Easements, Local governments, Nuisance (Water law), Operations, Judicial decisions, Legal aspects, Damage, Diversion structures, Ditches, Operation and Maintenance.

Plaintiff brought this action for damages alleged to have been caused by the overflow of surface and sewage waters onto and across his premises. The evidence indicated that plaintiff's property was directly in the path of the natural flow of surface water in the area but that the city had installed a storm drain channeling the surface runoff into a ditch running toward plaintiff's property and directly above the city's sanitary sewer line. The result of maintenance of these tandem ditches was to increase the pressure in the sewer pipes by the infiltration of surface water from the ditch. Consequently, in periods of even light rain, the sewage contained in the pipes would boil up, flow through manhole covers, and mix with the surface water which was running across plaintiff's premises. The court recognized the common enemy doctrine which allows an upland owner to divert water from his premises by casting it upon the land of another. The city was found to have artificially impounded the surface water and to have cast it upon the plaintiff's servient estate in a destructive manner, thus violating a recognized qualification of the doctrine. Accordingly, damages were awarded in favor of the plaintiff. (Katz-Fla)
W69-04900

SCAMP V STATE (ACTION FOR NEGLIGENT HIGHWAY CONSTRUCTION OBSTRUCTING NATURAL SURFACE WATER FLOW).
70 NYS 2d 752-758 (Ct Cl 1947).

Descriptors: *New York, *Relative rights, *Surface runoff, *Repulsion (Legal aspects), Alteration of flow, Road construction, Surface drainage, Surface water, Rainwater, Storms, Drainage effects, Culverts, Artificial watercourses, Judicial decisions, Drainage engineering, Streams, Drainage systems, Water law, Riddance (Legal aspects).

Plaintiff Scamp, a landowner, alleged negligent highway construction and failure to maintain drainage facilities in an action for damages against

the defendant. An obstructed culvert had caused water to accumulate on the highway and then flow across municipally owned land, which was graded toward claimants property, onto claimant's land. The court dismissed plaintiff's case for failure to sustain his burden of proof. Although it is true that when a plan of sewerage is effectuated by a municipal corporation the municipality is liable for damages resulting from either negligent construction or maintenance, the municipality is not, however, liable for an increase in surface water flow resulting solely from the grading of streets, erection of buildings, or improvements to private property. When, without the creation of a defined watercourse or the alteration of an existing one, the result is to change the natural contour of the land causing surface water to collect in a highway and overflow onto a neighbor's property, the act is lawful. Since it is not cast upon their lands by drains or ditches, the upper owners may get rid of it any way they can. (Kelly-Fla)
W69-04901

DIVELBISS V PHILLIPS PETROL CO (ACTION FOR DAMAGES TO DAIRY HERD BY STREAM POLLUTION).
272 SW 2d 839-845 (Ct App Mo 1954).

Descriptors: *Water pollution, *Oil wastes, *Missouri, Dairy industry, Contaminents, Judicial decisions, Legal aspects, Water pollution effects, Cattle, Pastures, Water pollution sources, Pollutant identification.

Plaintiff brought this action for damages to his dairy herd caused by defendant's pollution of a stream running through plaintiff's pastures. The appellate court upheld the jury's decision in favor of plaintiff on the ground that defendant had permitted petroleum products to pollute the stream, this constituting a private nuisance. It was unnecessary for plaintiff to allege or prove any negligence on the part of defendant. Plaintiff need only prove that defendant's pumping station was the source of the pollution. The court permitted damages for any of plaintiff's injuries which could be attributed to the polluted stream, including value of cattle which died, depreciation of value of the remaining cattle, and loss of profits. (Kelly-Fla)
W69-04902

PEOPLE V SYSTEM PROPERTIES (OWNERSHIP OF DAMSITE; STATE'S POWER TO CONTROL LAKE LEVEL).
160 NYS 2d 859-869 (1957).

Descriptors: *New York, *Damsites, *Ownership of beds, *Water levels, Judicial decisions, Backwater, Lakes, Navigable rivers, Flow control, Floods, Reservoirs, Impounded waters, Beds under water, Navigable waters, Riparian rights, Streambeds, Prescriptive rights.

The state and numerous intervening private owners brought suit to gain control of defendant's dam so as to regulate the water level of Lake George. This court modified and affirmed a lower court decision holding, inter alia, that defendant owned the bed at the damsite. In New York the bed of a stream is subject to private ownership regardless of its navigability. The defendant's earliest predecessor held a grant of lands, on both sides of the river, directly from the English Sovereign. Where there is no express inclusion or exclusion of the bed in a grant which touches the water, title extends to the middle of the river. The defendant has earned, by adverse possession of 160 years, the right to maintain a dam across the river. The state, however, has the power to regulate the use of the lake and river in the public interest. The defendant could never gain any prescriptive right over such control. Private owners along the lake and river may not now assert a right to prevent flooding caused by the dam, but the state legislature through its unimpaired sovereignty may act to remedy the problem. (Blunt-Fla)
W69-04903

HARBORS, WHARVES AND HARBOR MASTERS.
Mich Comp Laws Ann secs 97.1-97.6 (1967).

Descriptors: *Michigan, *Cities, *Docks, *Harbors, Port authorities, Navigable waters, Levees, Piers, Boating regulations, Water pollution control, Legislation, Canals, Lake shores, Banks.
Identifiers: *Harbormaster, Safety regulations.

The council of any city located on any navigable waters shall have power to establish and control public wharves, levees, basins and canals upon any land under city control. Requirements for construction and material may be established for public or private landings. The council may lease privileges to lands or shore under city control, but for no longer than five years. The council is empowered to regulate use and rates and collect dockage on all public and private landings. City ordinances may provide for preservation of pure waters within the city and as far as 1/2 mile from the corporate boundaries. Violators of such ordinances may be punished. Regulations for safety of harbors, landings and navigable waters may be established by ordinance or through a harbormaster. (Harris-Fla)
W69-04904

RAILWAY COMPANIES, DRAINAGE REPAIRS: FAILURE, EXPENSE OF COMPANY.

Mich Comp Laws Ann sec 91.7 (1967).

Descriptors: *Michigan, *Railroads, *Right-of-way, *Surface drainages, Cities, Sewers, Culverts, Legislation, Local governments, Remedies, Controlled drainage, Water control.

The city council of an incorporated city shall have power to require any railroad or street railway company to make and keep in repair such drainage facilities as are necessary along, under and across their grounds and right of way to insure proper drainage. The council may also insure that the natural drainage of adjacent property is not impeded. If any such company neglects its duty according to the council requirements the council may cause the work to be done at the expense of the company. The amount expended may be collected by a suit of the city against the company. (Harris-Fla)
W69-04905

FOURTH CLASS CITIES - GENERAL POWERS OF CITY CORPORATIONS.
Mich Comp Laws Ann sec 91.1 (1967).

Descriptors: *Michigan, *Cities, *Water law, *Legislation, Permits, Harbors, Boating regulation, Boats, Bridges, Rates, Sewers, Cisterns, Drains, Pollution, Pumps, Hydrants, Reservoirs, Local governments.
Identifiers: *Tugboats, *Wharfboats, *Ferries, *Vaults, Bathing.

Every city incorporated as a fourth class city shall have general powers and authority, and may pass ordinances to license and regulate wharf boats and tugboats used in and about harbors within the city's jurisdiction; to authorize, license and regulate ferries and to regulate rates thereon; to regulate and license toll bridges and prescribe rates for passage; to regulate construction, repair and use of vaults, cisterns, areas, hydrants, pumps, sewers and gutters; to regulate bathing in waters of the city; to provide for the clearing of noxious matter from waters and to prevent pollution; to regulate construction of drains, sinks and privies; to establish and regulate public fountains and reservoirs. (Harris-Fla)
W69-04906

VANCE V DAVIS (ADJUDICATION OF WATER RIGHTS).

195 Va 730, 80 SE 2d 396-401 (1954).

Descriptors: *Clay pipes, *Pipe flow, *Virgin Reservoirs, Hydraulic structures, Easements, Ad dication procedure, Legal aspects, Judicial de sions, Springs, Spring waters, Water sourc Usufructuary right, Water utilization, Water tan Domestic water.

A partition decree gave the owner of a portion tract, knows as lot 2, the right to use and dr spring water from another portion of the tra known as lot 4. The residence of two new famil on lot 4 has created a water shortage, and the pellee contends that the commissioner creating easement in question intended for the appellee have use of all the water from the spring, to the clusion of all others, as may be necessary for domestic needs. The court examined the langua in the appellee's deed and determined that original grantee of tract 4 was entitled to sh equally in the spring water. The two new famili having taken from that grantee, were entitled share in the spring flow in such a manner as not restrict the appellee's supply. The appellee found to be entitled only to that water stric necessary for domestic needs and was required install spigots to prevent waste. (Katz-Fla)
W69-04907

HOLLAND V FT PIERCE FINANCING AN CONSTR CO (ACTION TO SEIZE LANDFI CONSTRUCTED IN NAVIGABLE STREAM).
27 So 2d 76-83 (Fla 1956).

Descriptors: *Navigable waters, *Landfi *Riparian rights, *Florida, High water mark, Su merged lands, Judicial decisions, Legal aspec Dredging, Channels, Channel improvement, Bu heads, Bays, Harbors, Land reclamation, Sa bars, Navigation.

Appellant, Holland, representing the state, alleg that appellee construction company had illega filled in and bulkheaded part of a navigable strea and that appellee had no title to the filled land. T Florida Supreme Court found, however, that appe lee was acting within the provisions of Florida la Florida statue 271.01 (1945) vests qualified title riparian owners to land beneath navigable strea from the high water mark to the beginning of t channel. Title becomes absolute when the ripari owner fills in the area and erects improvemen Appellee's improvements were beneficial and d not obstruct commerce or navigation. The cou held a later special act passed by the Florida legis ture unconstitutional in that it attempted speci cally to seize appellee's property for the state aft the requisite improvements had been made. (Kell Fla)
W69-04908

LABRUZZO V ATLANTIC DREDGING AN CONST CO (ACTION TO RECOVER DAMAGE FOR DISRUPTION OF UNDERGROUN STREAM).
54 So 2d 673-678 (Fla 1951).

Descriptors: *Obstruction to flow, *Relative right *Underground streams, *Florida, Percolati water, Groundwater movements, Excavatio Springs, Water flow, Reasonable use, Diversio Groundwater barriers, Judicial decisions, Leg aspects, Competing uses, Water rights, Water law.

Plaintiff brought this action for damages, allegin that defendant, while conducting excavation oper tions on its property, had permanently diverted an disrupted an underground stream that flowe beneath defendant's property to plaintiff's prope ty, where it erupted as a spring. The court state that although defendant's operation did not co stitute a competing use of the water from the u derground stream, his use of the land incidentall affected the stream, creating a duty of care. Th court held that in the absence of surface indicatio an interference with subterranean water is co sidered unintentional and is non-actionable. If de fendant knew his actions might permanentl disrupt plaintiff's water supply, however, liabilit

be found for megligence. The court noted a iff's allegation that defendent discovered the ground stream in time to prevent permanent ge but proceeded with his excavation. Acng to the court, evidence supporting this alon created a question for a jury, and plaintiff's laint was improperly dismissed. (Kelly-Fla)
04909

RUZZO V ATLANTIC DREDGING CONICTION CO (EXCAVATION DIVERTING ERGROUND WATERS).
2d 228-231 (Fla 1954).

iptors: *Florida, *Springs, *Rock excavation, ration of flow, Diversion, Underground ns, Subsurface waters, Water rights, ges.
fiers: *Stoppage, Capping.

iffs brought action for damages for allegedly upting and diverting the natural flow of unound waters that fed plaintiffs' spring. Plainwere owners of land on which there formerly ed a spring, and its water was bottled and sold em. Defendant's land was contiguous thereto; uring course of excavation work undertaken fendant the subterranean stream which supplaintiffs' spring was uncovered and the flow the spring ceased. Evidence on issue of er defendant was negligent in respect to ng concrete into crevice which had been d by excavation on defendant's land and gh which water had been diverted from plainspring did not justify jury's finding for defand case was reversed and remanded for new Defendant's potential liability was said to be on its responsibility for an intentional invaf palintiffs' water rights if its conduct was in unreasonable considering all the circumes. (Reed-Fla)
04910

TGOMERY LIMESTONE CO V BEARDEN ION TO ENJOIN POLLUTION OF A AM BY QUARRY OPERATION).

2d 571-575 (Ala 1951).

iptors: *Water pollution, *Pollution abate*Riparian rights, *Alabama, Judicial deci-Legal aspects, Water pollution effects, Public its, Quarries, Natural flow, Livestock, Cattle, nels, Streams, Pollutants, Water pollution es, Air pollution.

lee, Bearden, sued to collect damages and to appellant from conducting quarry operawhich, according to appellee, resulted in pollution of a stream flowing onto appellee's rty from appellant's property. Appellee ically claimed that appellant was discharging quantities of sludge, rock, limestone, and impurities into the stream as to render it unfit nsumption by appellee's cattle and livestock. ourt stated that in deciding whether injuncelief for water pollution was warranted, it balance the private injury suffered by appelth the public benefit to be derived from apt's operation. The pollution must be conble, not just a minor annoyance or inconnce, before equity will act. The court found ppellant's quarry operation resulted in subl impairment of the value of the stream to tream riparian owners, that the pollution ng from the operation went beyond the perle scope of public benefit, and that appellee ated a good cause of action. (Kelly-Fla)
04911

KHARDT V ROCKY (DEPOSIT OF DEBRIS REAMS - OVERFLOW).
nd C 271-275 (Com Pl 1949).

iptors: *Pennsylvania, *Streamflow, *Obion to flow, *Floods, Land tenure, Judicial decisions, Diversion, Relative rights, Legal aspects, Damages, Backwater.
Identifiers: *Acts of God, *Natural disasters, *Trespass, Proximate cause, Debris.

Plaintiff and defendant own adjacent tracts of land. A stream ran through defendant's property very near the boundary of plaintiff's land. A tenant of defendant moved brush, dirt, and other debris into the bed of the creek. Plaintiff advised the defendant of this fact, and defendant agreed to remedy the situation. Before the debris was removed, a heavy rainfall occurred, and the debris dammed the creek causing damage to plaintiff's property. Such an overflow had never occurred under similar circumstances. Plaintiff seeks damages. A jury verdict for plaintiff was had below. The court held it was for the jury to determine whether the defendant was liable or whether the injury was due to an act of God. The verdict below was fully sustained by the weight of the testimony, and defendant's motion for new trial and judgment not withstanding the verdict were refused. (Harris-Fla)
W69-04912

CONGDON V PIONEER CITY COAL CO (RAINWATER RUNOFF).

56 Lackawanna Jurist 9-12 (Com Pl 1952).

Descriptors: *Surface drainage, *Groundwater movement, *Natural flow, *Alteration of flow, Easements, Judicial decisions, Legal aspects, Rainfall disposition, Precipitation excess, Surface runoff.
Identifiers: *Lower land owners, Upland owners.

Plaintiff owned land adjacent to and lower than the land of defendant coal company. During certain seasons, water from heavy rains was permitted to run onto plaintiff's property. Plaintiff claimed injury to the land and his dwelling house and sought a restraining order and damages. The court held that the owner of high-level land has a right to have water flow from his land and be discharged in a natural watercourse upon lower, adjacent land. He may not make new channels or concentrate or increase the flow by artificial means. To this extent, the upper owner possesses an easement to discharge all water which rises in, flows over, or falls on the higher ground. (Harris-Fla)
W69-04913

SPARTAN DRILLING CO V BULL (INJUNCTION TO CURE SALT WATER POLLUTION AND INSECT BREEDING).

252 SW 2d 408-411 (Ark 1952).

Descriptors: *Remedies, *Arkansas, *Water pollution, *Mosquitoes, Judicial decisions, Saline water, Riparian rights, Oil wells, Brine disposal, Administrative agencies, Streams, Legal aspects, Damages, Riparian land.
Identifiers: Injunction (Mandatory), Injunction (Prohibitory), Jurisdiction.

Several oil wells produced salt water which was allowed to escape into area streams and creeks. The subsequent pollution caused the breeding of large quantities of salt water mosquitoes. Thirteen home owners filed suit to restrain the owners and operators of the wells from creating a condition which rendered it impossible for them to enjoy their property. The chancellor overruled a demurrer and permanently restrained the owners from permitting salt to escape into the creeks. A prayer for a mandatory injunction to clean the polluted area was denied. The well owners appealed. The supreme court held that every man must use his property so as not to injure that of his neighbor. Riparian owners harmed by another's use or misuse of his property may obtain an injunction to prevent such abusive practices even though the defendant is thereby put to expense. Pollution which causes detrimental breeding of mosquitoes constitutes a nuisance which may be attacked without exhausting administrative remedies. The order of the lower court was affirmed. (Harris-Fla)
W69-04914

W G DUNCAN COAL CO V JONES (PRESCRIPTIVE RIGHTS TO MINEWATER POLLUTION).

254 SW 2d 720-724 (Ky 1953).

Descriptors: *Kentucky, *Mine water, *Water pollution, *Prescriptive rights, Coal mine wastes, Riparian rights, Judicial decisions, Crops, Water injury, Overflow, Legal aspects, Damages, Pollutants, Streams.
Identifiers: *Private nuisance, *Public nuisance, *Trespass.

Plaintiff brought action to recover for crop damage allegedly caused by deposit of mine water in a stream. The circut court rendered judgment for plaintiff. The defendant mining company had discharged mine water into a stream since 1920. The stream overflowed onto plaintiff's land, and the mine water poisoned his crops. The defendant argued on appeal that it had obtained a 'prescriptive right' to discharge into the stream through its long and continued use. The court of appeals held that since the nuisance complained of is only a private nuisance, if defendant had used the stream for the statutory 15 year period for the same purpose, to the same extent, and under the same circumstances, it had acquired a prescriptive right. If any change in nature or volume of the discharged mine water is proved, the prescriptive rights may not be available. Reversed for further proceedings. (Harris-Fla)
W69-04915

DE VORE FARMS V BUTLER HUNTING CLUB (DAMS AND OBSTRUCTION TO FLOW).

286 SW 2d 491-494 (Ark 1956).

Descriptors: *Arkansas, *Obstruction to flow, *Reasonable use, *Natural flow doctrine, Dams, Spillways, Riparian rights, Bayous, Non-navigable waters, Streams, Lumber, Judicial decisions, Damages, Flood damage, Flooding, Relative rights, Legal aspects.
Identifiers: Injunctions (Mandatory).

One riparian owner brought suit against another to restrain the maintenance of a dam and to collect damages for injury to timber due to flooding. Defendant hunting club maintained a dam which plaintiff claimed caused an obstruction to the natural drainage of his land. Plaintiff alleged that by blocking Mill Bayou, a shallow, non-navigable stream, the defendant had rendered plaintiff's land valueless for purposes of growing timber. Plaintiff also asked $20,000 in damages for merchantable timber already destroyed by flooding allegedly caused by the dam. The chancery court dismissed plaintiff's complaint. The Supreme Court of Arkansas affirmed, holding that, under the 'natural flow' or 'reasonable use' doctrines, it was well settled that one riparian owner had no right to interfere with the flow of a stream to the detriment of another. The question whether an obstruction is detrimental is purely one of fact, and a preponderance of the evidence had not proved appellant's case. (Harris-Fla)
W69-04916

LARSON V REMEIKIS (ACCELERATION AND DIVERSION OF NATURAL DRAINAGE RELATIVE RIGHTS).

76 NE 2d 922-924 (Ct App Ohio).

Descriptors: *Ohio, *Drainage ditches, *Natural flow, *Diversion, Damages, Judicial decisions, Erosion, Land Tenure, Boundaries, Groundwater movement, Legal aspects, Surface drainage, Surface runoff.

Identifiers: *Acceleration of flow, *Adjacent land, *Upper landowner, *Lower landowner, Injunction (Prohibitory).

Plaintiff and defendant owned adjoining farms. Plaintiff's land was higher than defendants', and normal drainage of surface waters was over defendants' land. Defendant constructed a ditch along the boundary which accelerated and diverted the water back onto plaintiff's land, damaging his fence and causing injury to cattle which fell into the ditch. The court below entered a permanent restraining order against trespass by defendant and awarded damages for injury to the cattle and the fence. Defendant appealed. The court of appeals held that where two parcels of land lie adjacent to each other, and one lies lower than the other, the lower land is burdened with a servitude in favor of the upper tract to receive water which naturally runs from such tract, provided the industry of man has not created the servitude. A mere acceleration of natural flow by the owner of upper land is not actionable. However, acceleration plus diversion will give rise to a cause of action. Damages for injury to cattle and boundary fences are collectable when the injury is caused by an acceleration and diversion by a ditch. A mandatory injunction may also issue to restrain further trespass and to compel restoration of surface land to its original condition. (Harris-Fla)
W69-04917

THE POLITICS OF WATER IN ARIZONA,
Arizona Univ., Tucson.
Dean E. Mann.
University of Arizona Press,, 1963, 288 pp, 5 map, 37 illus, 1 tab, abt 720 ref.

Descriptors: *Water supply, *Political aspects, *Planning, *Arizona, Federal government, State government, Legislation, Legal aspects, Electric power, Land management, Conservation, Research facilities, Geological surveys, Inter-agency cooperation.
Identifiers: U.S. Department of Agriculture.

Arizona faces a water crisis. Surface and stored waters are fully exploited. Costs of pumping underground water are fast becoming prohibitive. Urban areas are experiencing water shortages or diverting water from agricultural use. Mann begins by describing Arizona physically. He then discusses national and state political issues affecting water resources. The discussion includes: contemporary water resources planning; surface water law; ground water law; the politics of water; political and legal issues in the Colorado River controversy; the problem of electric power and governmental responsibilities; state management of water resources; federal activities in water management; governmental deficiencies in land management; soil and water conservation services; necessary management for recreation and conservation benefits; the divisions between the practices of agencies carrying on water research; research at the University of Arizona; work of the U.S. Geological Survey; the activities of and cooperation between various agencies of the U.S. Department of Agriculture. Rather than allocate water to the highest bidder in the economics of the market place, Mann recommends a change in governmental policy on resources. Public agencies must recognize some leadership that focuses attention and develops programs which take into account all factors of interrelated resources. (Gossen-Chicago)
W69-05112

THE WATER CRISIS,
For primary bibliographic entry see Field 06B.
W69-05113

WATER TRANSFER PROBLEMS: LAW,
New Mexico Univ., Albuquerque.
For primary bibliographic entry see Field 06B.
W69-05117

POLICY PROBLEMS IN THE FIELD OF WATER RESOURCES,
Resources for the Future, Inc., Washington, D. C.
For primary bibliographic entry see Field 06B.
W69-05119

CURRENT TRENDS IN WISCONSIN'S WATER LAW,
Wisconsin State Bar, Madison.
J. H. Beuscher.
Wis B Bul, Vol 40, No 4, pp 19-28, April 1967. 10 p.

Descriptors: *Wisconsin, *Surface runoff, *Riparian rights, *Repulsion, Judicial decisions, Surface drainage, Municipal water, Avulsion, Accretion, Legislation, Relative rights, Well permits, Public rights, Irrigation permits, Water quality standards, Administrative agencies, Pollution abatement.
Identifiers: *Absolute property doctrine, *Source of title test, *Co-sharing of riparian rights, Water Resources Act of 1966, Subsidies.

Water Law is divided into three parts: (1) the law of draining 'diffused' surface water; (2) the law of groundwater; and (3) riparian law, which applies to streams, lakes, and ponds. So far there has been no Wisconsin case law about ownership of and right to use captured diffused surface waters. The Wisconsin court has applied the Massachusetts common enemy rule of diffused surface water law. As to groundwater law, Wisconsin still holds to the absolute property doctrine and has refused to shift to the 'reasonable use' or American rule. Except for section 144.025, which requires a permit for wells with a capacity in excess of 100,000 gallons a day, no legislation regulating withdrawal of groundwater exists. As to the law of water in streams, lakes, and ponds, the Wisconsin court has played a principal part in declaring co-sharing of riparian rights and in delineating public rights in navigable water on behalf of non-riparians. The major recent development in the field has been the Water Resources Act of 1966 (Chapter 614, Laws of 1965-66), which united in the Department of Resource Development all water regulatory responsibilities. (Reed-Fla)
W69-05161

BROWARD COUNTY V HURWIT (MUNICIPAL WATER AND SEWER FACILITIES).

216 So 2d 225-227 (4th DCA Fla 1968).

Descriptors: *Florida, *Judicial decisions, *Utilities, *Water supply, Sewage districts, Public utilities, Water distribution (Applied), Water sources, Cities, Local governments, Sewerage, Water management (Applied).

In 1960, the City of Lauderhill granted a franchise to defendant county's predecessor to operate water and sewer facilities within the city limits. In 1963 when the franchise was assigned to defendant, the city limits did not extend to the area in question but defendant did hold certificates of public convenience and necessity for an adjacent area. In 1962, plaintiff acquired the assets of a water company and certificates for the area in question by an issuance of bonds and a pledge of the expected revenue. The certificates were cancelled by the public utilities commission. The plaintiff had no facilities located on the property when it was incorporated into the city limits in 1965. The court held that plaintiff had no right to operate a water and sewer system in the area. The Florida statutes provide that the consent of the city is necessary unless the facilities were located in the area prior to its incorporation into the city. Plaintiff's contract was not impaired in that no revenues pledged to the payment of the bonds have been diverted. (Molica-Fla)
W69-05162

NICHOLSON V HOLLOWAY PRINTING CO (ARTIFICIAL INCREASE OF SURFACE RUNOFF).
216 So 2d 562-576 (Ct App La 1968).

Descriptors: *Louisiana, *Surface runoff, *Natur flow, *Drainage, Judicial decisions, Surfac drainage, Ditches, Drainage water, Topograph Bayous, Gulf coastal plain, Deltas, Coastal plain Developed waters, Relative rights, Obstruction flow, Alteration of flow, Repulsion (Legal aspects Legal aspects, Riddance (Legal aspects).
Identifiers: Dominant estates, Servient estates.

Plaintiff sought affirmation of a right to dra waters from his upper estate over the defendan land through natural 'crevasse channels.' Defe dant contended that his land was not 'below' th plaintiff's, and therefore no drainage servitude e isted. The trial court found that defendant's la was of the same elevation as the plaintiff's a dismissed the plaintiff's petition. This court a firmed the lower court on other grounds. Ev though the plaintiff's land was of higher elevatio the basin areas he wished to drain could not b emptied through the natural channels without i stallation of extensive artificial facilities. The se vient owner has a duty to maintain all natural cha nels so that they will receive water from the upp estate, but the upper owner may not improve h estate by artificial means so as to add to the natur runoff and make the obligation of the servie estate more onerous. (R. Blunt-Fla)
W69-05163

WILSON V OWEN (EASEMENT - USE O LAKE).

261 SW 2d 19-26 (Mo 1953).

Descriptors: *Missouri, *Reasonable use, *Lak *Easements, Recreation facilities, Public benefi Riparian lands, Riparian rights, Real propert Water rights, Prescriptive rights, Relative righ Judicial decisions, Legal aspects, Adjudicati procedure, Remedies, Contracts, Swimming, Boa ing, Fishing.
Identifiers: Advertisements, Restrictive covenants

The plaintiff appellee brought this action for declaratory judgment. He asked the court to reco nize the cancellation of a restrictive covena running with certain realty. The deed conveyi the property had a reserved power of terminati as to covenants, restrictions and stipulations. T alleged restriction provided that purchasers of t property would have the privilege of using lakes the land for swimming, boating, and fishing pu poses. An advertisement announcing the sale of t property stated that these privileges would run wi the land and would be for the exclusive use of t purchasers. The court held that the alleged restri tion was actually an affirmative easement and privilege which was outside the reserved power termination under consideration. (Katz-Fla)
W69-05164

GAGNON V CARRIER (ABANDONMENT O EASEMENT FOR WATER SUPPLY).

77 A 2d 868-870 (N H 1951).

Descriptors: *New Hampshire, *Easemen *Water supply, *Recreation, Judicial decisio Adjudication procedure, Legal aspects, Lak Right-of-way, Access routes, Pipes, Pumps, Wat supply, Relative rights.
Identifiers: Equity.

Plaintiffs brought a bill in equity to determine t rights of the defendants in and over plaintiffs la with respect to right of way to a lake, and a right use, repair, and maintain pipes and a pump hou near the lake for water supply. The trial court he that the defendants had no right of way to the la for recreational purposes, and that the easeme they had for water supply had been abandone The Supreme Court of New Hampshire affirm the lower court as to its ruling that an easement water supply does not give a right to access recreation, but it reversed the lower court's de sion that the easement for water supply had be abandoned. The court stated that mere non-use

easement, however acquired, does not result in loss or destruction even if continued for a long e. The court felt that the non-use of the easent for four years was not such a clear, unequivoand decisive act as to constitute abandonment he easement. (Watson-Fla)
9-05165

RSON V ROANE (RIGHT TO USE OF AINAGE DITCH ON ANOTHER'S PROPER-).

So 2d 534-536 (Miss 1953).

scriptors: *Mississippi, *Easements, *Drainage, tches, Judicial decisions, Adjudication cedure, Legal aspects, Drains, Surface runoff, face drainage, Damages, Obstruction to flow, scriptive rights, Land ownership, Land tenure.
ntifiers: Equity, Injunction.

ntiff brought this action against an adjoining downer for damages for entering on the plains land and setting off explosives, and for an inction to restrain further trespasses. The defent entered a cross-bill for an injunction to rain the plaintiff from obstructing a drainage h. The trial court granted the plaintiff's injunc- and dismissed the defendant's cross-bill. The reme Court of Mississippi held that the decision he chancellor, who viewed the premises, was ported by the evidence. Damages were not rded because the plaintiff had not been injured. dence showed that the use of the ditch by the ndant and his predecessor was with the permis- of the plaintiff and not under adverse claim. e the plaintiff had maintained his dominion r the ditch while allowing the defendants to use o easement had been acquired. (Watson-Fla)
9-05166

ENS V FAYETTE COUNTY (DRAINAGE ISANCE ABATEMENT).

NW 2d 602-607 (Iowa 1950).

criptors: *Iowa, *Roadbed, *Diversion dams, pulsion (Legal aspects), Culverts, Riddance gal aspects), Ditches, Drainage systems, islation, Hydraulic structures, Embankments, sion control, Overland flow, Runoff, Surface ers, Judicial decisions, Legal aspects, Relative ts, Damages, Obstruction to flow.
ntifiers: Injunctions (Prohibitory), Servient tes, Dominant estates.

ntiff brought suit for damages and to enjoin delants from causing damage to plaintiff's lands wrongfully concentrating water flowing from inant lands. The trial court issued the injunc- and ordered removal of the culverts and dams gedly causing the concentrated flow. The ewing court found that the plaintiff's lands were ient as to drainage from the lands now rated by the raised highway. The court held the evidence indicated that the county, an er proprietor, had diverted the water in such a ner as to follow the natural drainage pattern that no evidence was introduced to show accuation and concentration in amounts greater the natural rate of flow. (Katz-Fla)
9-05167

CULLOUGH V HARTPENCE (DIVERSION DIFFUSED SURFACE WATER).

A 2d 233-235 (Ch N J 1948).

criptors: *New Jersey, *Repulsion, *Natural doctrine, *Surface runoff, Rain water, inage water, Natural flow, Encroachment, itable apportionment, Surface water, Diver-
ntifiers: Capstones, Injunction.

Plaintiff brought suit to require defendants to remove an encroachment upon plaintiff's realty and defendants counterclaimed. The parties were owners of contiguous residential properties upon which they had each erected a garage near the dividing line of their properties. A capstone on the top wall of defendants' garage, which was above a like capstone on complainant's garage, caused rainwater falling on defendants' capstone to discharge on complainant's capstone where by reason of a counter incline, the water was directed against defendants' wall from which a quantity rebounded against complainant's wall. Under the common law, 'surface waters,' which embraces waters derived from falling rain is regarded as a common enemy that every proprietor is privileged to resist to the best of his ability, provided he does not alter the natural discharge of surface water from his land onto that of his neighbor. In addition, the pleadings alleged that each capstone overreaches the property line, and the proofs sustain the verity of both contentions. Therefore, the court directed both parties to remove the capstone for which they were respectively responsible. (Reed-Fla)
W69-05168

F A BARTLETT TREE EXPERT CO V STAMPER (DAMAGES FROM LOGS AND BRUSH ON RIVER BANK).

306 Ky 311, 207 SW 2d 752-755 (1948).

Descriptors: *Kentucky, *Brush, *Bridges, *Water pollution, Trees, Judicial decisions, Adjudication procedure, Legal aspects, Streamflow, Streams, Banks, Rain, Crops, Damages, High water mark, Lumber, Precipitation excess, Riparian rights, Rainfall.
Identifiers: Negligence.

Plaintiff brought an action against the defendant company for leaving trees and debris piled on a streambank in a negligent manner. The trees and debris washed downstream injuring the plaintiff's bridge, crops and lumber. In a jury trial the lower court held in favor of the plaintiff. The Court of Appeals of Kentucky reversed and remanded the case but only as to the amount of damages. The Court of Appeals stated that question of negligence in placing the trees and brush on the streambank was a jury question and it would not attempt to disturb the decision of the jury. (Watson-Fla)
W69-05169

FONTENOT V SMITH (CONTRACT AGREEMENTS AND RIGHTS TO NATURAL FLOW).

37 So 2d 872-874 (La Ct App 1948).

Descriptors: *Louisiana, *Natural flow doctrine, *Contracts, *Obstruction to flow, Legal aspects, Relative rights, Levees, Embankments, Canals, Surface drainage, Ditches, Spoil banks, Judicial decisions, Backwater, Floods, Remedies, Drainage, Engineering structures, Drainage engineering, Excessive precipitation, Rainfall excess, Surface runoff, Easements.
Identifiers: *Spoil dirt, *Injunction.

Plaintiff brought this action to require removal of an embankment. Plaintiff sold defendant an adjacent tract of land, and contracted for a mutual drainage ditch on the boundary of their lands. The ditch, to be maintained by defendant, was to adequately drain plaintiff's land. A ditch was dug which proved unsatisfactory. Both plaintiff and defendant made arrangements for drainage of their lands, with defendant digging a canal and depositing spoil dirt in an embankment facing plaintiff's land. The embankment caused water to back up on plaintiff's land during hard rains. The defendant contended that the agreement replaced the normal rights of servitude of drain, and made the ditch plaintiff's only enforceable method of drainage. Affirming a judgment for the plaintiff, the court of appeal held that the individual activities of the parties evidenced a return to the original status of natural drainage rights. As a result, defendant's land owned a servitude to plaintiff's to receive natural drainage not concentrated by man's industry. The court held that even if the agreement was not abrogated by individual action, defendant had no right to obstruct natural drainage. (Harris-Fla)
W69-05170

MCCORMICK COAL CO V R R SCHUBERT (NATURAL FLOW AND DIVERSION OF STREAM BED).

379 Pa 309, 108 A 2d 723-725 (1954).

Descriptors: *Pennsylvania, *Surface drainage, *Diversion, *Natural flow doctrine, Strip mining, Relative rights, Legal aspects, Judicial decisions, Natural streams, Streambeds, Floods, Damages, Alteration of flow, Coal mines, Drainage, Mining engineering, Mineral industry, Streamflow.
Identifiers: *Concentration of flow, *Coursing.

Plaintiff mining company filed suit to recover for damages allegedly caused by defendants' negligence in its strip mining operations. Plaintiff operated a coal mine which sloped from its opening downward to certain coal deposits purchased by plaintiff. Defendant was engaged in strip mining on land separated from plaintiff's mine by a tract of land on which old abandoned workings remained. Defendant's operations included changing the bed of a stream on its property and cutting into the old openings on the intervening land. Plaintiff alleges defendant was negligent in diverting the stream and in failing to seal the old openings. Plaintiff claims rain water which would have been drained off by the old stream ran through the old workings and finally into his mine, making it unworkable. In affirming a judgment for defendant and denying plaintiff's motion for a new trial, the Supreme Court of Pennsylvania stated that an upper owner has a right of natural flowage, but may not by artificial means increase or concentrate the flow to another's detriment. A change in the course of the stream or diversion of water from its ordinary course would result in strict liability. (Affirmed on a procedural point). Plaintiff failed to plead the latter liability. (Harris-Fla)
W69-05171

LUNSFORD V STEWART (COMMON ENEMY DOCTRINE).

120 NE 2d 136-137 (Ohio Ct App 1953).

Descriptors: *Ohio, *Repulsion (Legal aspects), *Riddance (Legal aspects), *Diversion, Easements, Runoff, Precipitation excess, Surface runoff, Drainage water, Overland flow, Natural flow doctrine, Obstruction to flow, Surface waters, Relative rights, Reasonable use, Alteration of flow, Legal aspects, Judicial decisions, Remedies, Damages, Water law.
Identifiers: Common enemy doctrine.

The plaintiff brought action for an injunction and damages because defendants had filled their lot with dirt up to grade and thus prevented surface water from draining off of plaintiff's adjoining lot. The court held that the owner of an urban lot which receives the natural flow of surface water from an adjoining upper lot, may divert the natural flow of such surface water by filling his lot and erecting structures on it; this could be done without liability for blocking such natural flow provided that such erecting and filling was accomplished in a reasonable manner. (Katz-Fla)
W69-05172

HODGES MANOR CORP V MAYFLOWER PARK CORP (DAMAGE DUE TO DISCHARGE OF SURFACE WATERS THROUGH ARTIFICIAL CHANNELS).

197 Va 344, 89 SE 2d 59-63 (1955).

Descriptors: *Virginia, *Flow augmentation, *Riddance (Legal aspects), *Drainage systems, Water law, Judicial decisions, Damages, Pipes, Surface runoff, Outlets, Overlying proprietor, Alteration of flow, Surface drainage, Surface waters, Property values, Routing, Discharge (Waters), Repulsion (Legal aspects), Legal aspects.

Defendant installed a drainage system with pipes which collected and discharged a concentrated flow of surface waters onto plaintiff's land. Defendant also lowered a ditch on plaintiff's land to permit an unobstructed flow of drainage water. Plaintiff sued for damages to residential property. The trial court awarded damages, allowing the jury to consider diminution of land value and the cost of a drainage system necessary to correct the situation. The award was commensurate with the correction costs. The appellate court affirmed, following the Virginia modification of the common-enemy rule. Landowners may discharge surface waters as they see fit, though not wantonly, unnecessarily, or carelessly. However, one must use his own property so as not to injure the rights of another. The court recognized an exception to the general rule, holding that owners may not collect water into artificial channels and subsequently discharge it upon land of another to his injury. (Wheeler-Fla)
W69-05173

REDDMANN V REDDMANN (OBSTRUCTION TO SURFACE WATER FLOW).
255 SW 2d 668-670 (Ark 1953).

Descriptors: *Arkansas, *Repulsion (Legal aspects), *Surface waters, *Obstruction to flow, Backwater, Surface runoff, Flood water, Flood damage, Relative rights, Water law, Overlying proprietor, Surface drainage, Levees, Rain water, Watercourses (Legal), Judicial decisions, Legal aspects, Damages.
Identifiers: Injunctions (Mandatory), Injunctions (Prohibitory).

Plaintiff alleged that defendants had wrongfully constructed levees which blocked natural drainage, and prayed for a mandatory injunction requiring removal of the obstructions. The chancellor decreed that there had been no stoppage of natural drainage by defendants. The appellate court held that evidence was insufficient to establish a well-defined watercourse over or through defendants' property and affirmed the decisions below. Overflow water from a watercourse is flood or surface water, and it is not the duty of a landowner to provide a means by which flood water may be carried over and across his land. A landowner has the right to defendant against this 'common enemy' without subjecting himself to liability for damages unless he unnecessarily damages another for his own protection. (Wheeler-Fla)
W69-05174

CONDIFF V KOPSEIKER (EASEMENT - SURFACE DRAINAGE).

61 NW 2d 443-446 (Iowa 1953).

Descriptors: *Iowa, *Repulsion (Legal aspects), Riddance (Legal aspects), Surface waters, Drainage water, Surface runoff, Pipes, Ditches, Drainage systems, Hydraulic structures, Legal aspects, Judicial decisions, Legislation, Easements, Tile drains.
Identifiers: Demurrer.

Plaintiffs sought to enjoin the discharge of water from defendant's lands onto plaintiff's land in a greater volume than before installation of a tile drain system on defendant's land. The court noted that upper proprietors may drain their land by constructing open or covered drains discharging in the same manner as a natural watercourse. Absent allegations that additional water was made to flow upon plaintiff's land by reason of the drainage system and that such increased flow caused damage, the plaintiff had failed to state a cause of action. (Katz-Fla)
W69-05175

MUSGROVE V CICCO (MAINTENANCE OF WHARF OVER OBJECTION OF LITTORAL OWNER).

71 A 2d 495-496 (N H 1950).

Descriptors: *New Hampshire, *Riparian land, *Competing uses, *Riparian rights, Ownership of beds, Prescriptive rights, Relative rights, Piers, Lake beds, Public rights, High water mark, Nonconsumptive use.
Identifiers: *State property.

Plaintiffs brought suit to recover damages for defendant's use and occupation of a bathing beach on a lake. The trial court issued judgment for plaintiffs; and on appeal, this court overruled defendant's exceptions. It was held that plaintiffs, as littoral owners, had rights which were more extensive than those of one who was only a member of the public. While the bed of the lake was the property of the state to the natural high water mark, plaintiffs' rights to erect a wharf or other structure into the lake was superior to that of defendants', hotel owners in the vicinity, if the latter had only the rights of a member of the public. Thus, defendants had no right to maintain a wharf over the objection of plaintiffs, in the absence of a prescriptive right or an express grant from the public. (Reed-Fla)
W69-05176

ROBINSON V BELANGER (SURFACE WATER DRAINAGE RIGHTS).
For primary bibliographic entry see Field 04A.
W69-05177

WATTERS V NATIONAL DRIVE-IN (SURFACE WATER DRAINAGE DAMAGE).

63 NW 2d 708-711 (1954).

Descriptors: *Repulsion (Legal aspects), *Wisconsin, *Drainage systems, *Surface runoff, Overlying proprietor, Relative rights, Judicial decisions, Water law, Tile drains, Sewage, Drainage effects, Damages, Effluents, Surface waters, Alteration of flow, Drainage, Drainage water, Surface drainage, Riddance (Legal aspects), Rain water, Legal aspects.

Plaintiffs brought action against an adjacent upper land owner for damages resulting from drainage of surface waters and sewage onto plaintiffs' land. On appeal of order overruling defendant's demurrer, the appellate court held that plaintiffs had no cause of action based on either defendant's installation of tile drains or alteration of the natural flow of surface waters. The court followed the common enemy rule, holding that defendant could drain surface water any way he saw fit, regardless of injury to lower land, as long as the water was not collected first in a reservoir. The case was remanded in order to determine whether plaintiff had a cause of action due to the alleged sewage discharge. (Wheeler-Fla)
W69-05178

RUTHERFORD V LOUISVILLE AND NASHVILLE RR (FLOODING FROM OVERFLOWED CULVERT).
243 S W 2d 1017-1019 (Ky 1951).

Descriptors: *Kentucky, *Surface runoff, *Flood damage, Reasonable use, Relative rights, Diversion, Ditches, Culverts, Overflow, Right-of-way, Natural flow, Surface water, Surface drainage, Water law, Legal aspects.
Identifiers: *Upper estate, *Lower estate.

Plaintiffs sued railroad and individual defendant for damages caused by water overflowing their lands after passing through a drainage ditch constructed by the latter. Since the individual defendant's part of the ditch was constructed by him prior to the time plaintiffs bought their properties, and since there was no evidence he and the railroad acted in concert in creating the overflow, the trial court was held by this court to have properly directed a verdict for him. However, while a lower estate is subject to the servitude of the natural flow of surface water from upper estates, the owner of a lower estate may recover damages from the owner of an upper estate if the latter, among other things, unreasonably changes the natural course of the water. The court found that the questions of whether defendant railroad, by constucting a new drainage system after plaintiffs had purchased their estates unreasonably subjected plaintiffs' land to a servitude involving more than absorption of natural flow of water from upper estates, and whether plaintiffs at time of purchase were bound to anticipate such substantial change in the drainage situation, were for the jury. Thus the directed verdict for defendant railroad company was reversed. (Reed-Fla)
W69-05179

CRUTCHFIELD V F A SEBRING REALTY CO (INJUNCTION AGAINST REMOVAL OF LAKE WATER).

69 So 2d 328-330 (Fla 1954).

Descriptors: *Florida, *Lakes, *Non-navigable waters, *Riparian rights, Water rights, Judicial decisions, Water law, Bodies of water, Relative rights, Boundaries (Property), Irrigation systems, Pumping, Irrigation, Water levels, Water transfer, Ownership of beds.

Plaintiffs, as owners of a non-navigable lake and the land surrounding it, sued to permanently enjoin defendants from pumping water out of the lake across plaintiffs' land to irrigate citrus trees. Defendants based their right to remove water upon permission given defendants' predecessors in title to take limited amounts of lake water. The lower court, in granting the injunction, found that the volume of operation of defendants' pumps was endangering the level of the lake, and that the prior permission did not contemplate modern, large-scale removal. The appellate court in affirming the lower court stated that small lakes are susceptible of private ownership in Florida. It agreed that there was no intention to allow the large-scale irrigation. (Wheeler-Fla)
W69-05180

CAPES V BARGER (DAMAGES CAUSED BY DAM TO REPEL SURFACE WATERS).
109 NE 2d 725-727 (App Ct Ind 1953).

Descriptors: *Indiana, *Surface runoff, *Repulsion (Legal aspects), *Dams, Water low, Judicial decisions, Rain water, Surface waters, Surface drainage, Obstruction to flow, Legal aspects, Relative rights, Backwater, Damages, Overlying proprietor.

Plaintiff brought action against defendant, a lower adjacent landowner, for crop damage alleged resulting from construction of a dam which caused water to back up on plaintiff's land. The lower court found for the defendant, holding that the damage resulted from surface water. On appeal plaintiff argued that there was insufficient evidence to support a finding as to the nature of the water. The court overruled plaintiff's contention, holding that the evidence was sufficient to sustain the judgment below. The court followed the 'common enemy' rule allowing a landowner to dam against surface water draining onto his land, regardless of damage to upper owner by reason of accumulation of water above the obstruction. (Wheeler-Fla)
W69-05181

FAIRES V DUPREE (WATER POLLUTION FROM ANIMAL WASTES).
For primary bibliographic entry see Field 05B.
W69-05182

B CARTER V CHUQUATONCHEE CONOLIDATED DRAINAGE DISTRICT RAINAGE DISTRICT DISSOLUTION).
r primary bibliographic entry see Field 04A.
69-05183

RISH OF EAST BATON ROUGE V S AND H CATING CO (CONDEMNATION).
6 So 2d 360-364 (1st Ct App La 1968).

scriptors: *Louisiana, *Judicial decisions, minent domain, *Condemnation value, Streamds, Channels, Cost repayment, Drainage proms, Cities, Local governments, Severance, mages, Costs, Prices.

fendant owns certain property which extends to oint near the center of a creek bed. The portion hin the creek is burdened by a servitude of inage. Plaintiff in an expropriation suit sought to len the creek in furtherance of a drainage pro-m. The trail court awarded damages to defen-t for the expropriated property outside the ex-ng channel of the creek upon expert testimony ed upon the prices received for comparable es in the immediate vicinity. The court also arded severance damages based upon the rease in the permissive use that could be made of defendant's land after the taking. Upon ap-l the court held that the trial court's findings as he value of the expropriated property outside existing channel was not erroneous. However, severance damages are predicated on specula-and are not allowable. (Molica-Fla)
9-05184

ATE V REEDY CREEK IMPROVEMENT DISICT (PLEDGING OF PUBLIC CREDIT TO ANCE DRAINAGE PROJECTS).
So 2d 202-208 (Fla 1968).

criptors: *Florida, *Drainage districts, nancing, *Multiple-purpose projects, Drainage cts, Drainage, Legal aspects, Judicial decisions, d reclamation, Public benefits, Recreation, rism, Pest control, Public health, Taxation, islation, Beds, Flood control, Flood protection, e governments.
tifiers: Florida constitutional law.

state sought to have drainage revenue bonds ch were issued by the Reedy Creek Improvet District declared invalid. The District was blished by the state legislature, and its enabling authorized it to issue bonds to finance its nage projects. The state claimed that the imements primarily benefited private enterprise derogation of the constitutional prohibition nst pledging of public credit for private pures. The court found this argument untenable held that a public benefit would be derived as drainage project would promote tourism and eation. The legislature, in the exercise of its ary authority, may create a multipurpose dis- encompassing more than one county. The dis- in question was validly created. The court con-ed that the fees charged for the services of the ect were not arbitrary and that the bonds as is- were valid. (Shevin-Fla)
9-05185

THLAND CO V MCDONALD (POLLUTION WATERCOURSE BY ESCAPED CRUDE).
primary bibliographic entry see Field 05B.
9-05186

TED FUEL GAS CO V SAWYERS (WELL LUTION THROUGH PERCOLATING TERS).
primary bibliographic entry see Field 05B.
9-05187

LAGES - WATER WORKS.

n Comp Laws Ann secs 71.1-71.11 (1967).

Descriptors: *Michigan, *Local governments, *Water works, *Filtration, Legal aspects, Cities, Water supply, Water rates, Marketing, Water users, Treatment facilities, Condemnation, Canals, Reservoirs, Loans, Construction costs, Pipes, Distribution systems, Contracts.

Any village having a population of 200 or more may construct and operate a water works and filtration plant and for this purpose it may acquire reservoirs, canals, buildings, and real estate by condemnation, etc. The village council may borrow money for these purposes but not in excess of 10% of the assessed value of the property in the village. Serial bonds, the first payment on which shall not be due later than 3 years after the date of issue, shall be used for the loan at an interest rate not to exceed 6%. An estimate of the amount required to construct and operate the facilities and the question of raising money for such purposes shall be put to a referendum. Service pipes leading from the distributing pipes shall be at the customer's expense. The council shall establish a scale of variable water rates and steps to be taken to enforce payment thereof and any ordinances necessary for preservation of the facilities whether they be located within or without the village corporate limits. The council may contract with private persons for the supplying of water for periods not exceeding 10 years. (F. Molica-Fla)
W69-05188

IN RE CITY OF NEW YORK (STREAM BEDS).
2 N Y 2d 859, 161 NYS 2d 124-126 (1957).

Descriptors: *New York, *Ownership of beds, *Boundaries (Property), *Streambeds, Judicial decisions, Legal aspects, Navigable rivers, Tidal waters, High water mark, Cities, Condemnation, Eminent domain, Streams.

Claimant asserted title to a certain streambed on the basis of a patent from the state. The stream was included in damage parcels condemned by petitioner. The stream was included in damage parcels condemned by petitioner. The court held that a subsequent conveyance by the state granting all the land within certain boundaries, except that land previously granted, did not pass title to the streambed in question because it was a navigable stream. The patent to claimant is to be strictly construed and, in the absence of express grant of the land under the stream, the title to such land was not conveyed. (Molica-Fla)
W69-05189

ROUGHTON V THIELE KAOLIN CO (CHEMICAL POLLUTION BY UPPER RIPARIAN OWNER).
For primary bibliographic entry see Field 05B.
W69-05190

RIDDLE V BALTIMORE AND OHIO (FLOOD DAMAGE CAUSED BY INADEQUATE CULVERT).
For primary bibliographic entry see Field 04A.
W69-05191

WHITE V WOODARD (BOUNDARY LINE ALONG DITCH).
227 NC 332, 42 SE 2d 94-96 (1947).

Descriptors: *North Carolina, *Boundaries (Property), *Boundary disputes, *Ditches, Judicial decisions, Legal aspects, Rivers, Streams, Riparian rights, Ownership of beds.

Plaintiff and defendant each owned property with a common boundary. The deed to one parcel places the boundary line at a stake on a ditch and then with the ditch. The issue in this action is the establishment of the proper boundary line. The court stated that where a line is run to a stream or to a stake on a stream and thence with a stream, the intention is to extend the line to the middle of the stream, this being the true boundary unless language states otherwise. The court held that this rule should also apply to a ditch. A new trial was ordered to decide the issue of adverse possession. (Helwig-Fla)
W69-05192

RUFF V STIRES (ENTRANCE ON LAND TO REMOVE OBSTRUCTION TO FLOW).
82 NE 2d 116-118 (Ct App Ohio 1948).

Descriptors: *Ohio, *Legislation, *Obstruction to flow, *Excavation, Judicial decisions, Ditches, Drainage, Tile drainage, Weeds, Driftwood, Riparian rights, Land tenure, Legal aspects, Damages.
Identifiers: Trespass to land, Injunction (Prohibitory).

Plaintiff and defendant owned adjacent tracts of land through which flowed a creek. The defendant entered plaintiff's land to dredge out and enlarge the creek for land and tile drainage without the plaintiff's consent. Defendant claims to have entered under authority of an Ohio statute allowing any person to enter the land of another, after notice to the occupant, to remove any drift of wood or other substance forming an obstruction in a stream or watercourse, if such obstruction is injurious to the removing party (General Code sec 6727). A decree was entered for the plaintiff below, from which defendant appeals. The court of appeals held that the statute does not sanction the general excavation of a creek in order to insure drainage of adjacent land. When such an excavation causes injury not correctable by a damage award, an injunction may issue to prevent the trespass. When a statute sanctions what would otherwise be a trespass, it must be strictly construed. (Harris-Fla)
W69-05193

AUTHORITY TO LEVY TAXES FOR STREET IMPROVEMENTS.

Mich Comp Laws Ann sec 69.5 (1967).

Descriptors: *Michigan, *Local governments, *Taxes, *Sewage districts, Cities, Legal aspects, Legislation, Drains, Assessments, Costs, Cost sharing, Project planning, Financing, Annual costs, Construction costs.
Identifiers: *Street improvements.

A village council may use special assessments upon lands in sewer districts and special assessment districts to defray the cost of street improvements and drain and sewer construction and other local improvements. Such assessments shall be charged in proportion to frontage or benefits but may not exceed in any one year 5% of the assessed value of all property in the district chargeable with such expense. The money so raised may be held as a special fund to pay the costs of improvement or may be used to repay moneys borrowed therefore. (Molica-Fla)
W69-05194

POWERS OF COUNCIL.

Mich Comp Laws Ann secs 67.24-67.34 (1967).

Descriptors: *Michigan, *Drainage systems, *Sewers, *Local governments, Legal aspects, Legislation, Governments, Assessments, Government finance, Costs, Urbanization, Artificial watercourses, Taxes, Public utilities.

The council of any village may establish sewers, drains, and watercourses for drainage purposes; if necessary, private property may be used. Expenses for constructing these facilities may be defrayed by a general property tax and/or special assessments upon the lands benefited. The council may issue bonds bearing a maximum rate of 6% to fund the improvements. The council shall prepare and publish a map of those lands which will benefit from the drainage if a special assessment is used. The council may require owners and occupants of

land to construct private drains therefrom to connect with the public sewers and it can enforce such orders. Private owners and occupants have the right to connect to the public sewers at their own expense. An annual charge not exceeding $2.00 may be imposed as a sewer charge. Repair expenses of public sewers, etc., may be paid by a general tax. The council may enact ordinances necessary to carry into effect its powers and for the control and protection of the facilities. (F. Molica-Fla)
W69-05195

WATERWORKS.
Mich Comp Laws Ann sec 41.413a (1967).

Descriptors: *Michigan, *Waterworks, *Utilities, *Public utility districts, Public benefits, Legislation, Legal aspects, Administrative agencies, Local governments.

Any waterworks in any district shall be under the control of a Board of Public Service Commissioners. The Board shall consist of five members elected by the voters of said district. The members must be residents of the district. The terms of the board members shall be staggered. The Commission shall have the authority to hire necessary employees to carry out the purposes of this act. (Shevin-Fla)
W69-05196

NASS V TOWN OF DUXBURY (DIVERSION OF FLOW BY CHANNEL OBSTRUCTION).
For primary bibliographic entry see Field 04A.
W69-05197

BOROUGH OF COLLEGEVILLE V PHILADELPHIA SUBURAN WATER CO (ADMINISTRATIVE REMEDIES FOR WATER DIVERSION).
377 Pa 636, 105 A 2d 722-732 (1954).

Descriptors: *Pennsylvania, *Appropriation, *Diversion, *Administrative decisions, Leglislation, Dam construction, Water supply, Watershed management, Administrative agencies, Reservoirs, Permits, Judicial decisions, Legal aspects, Water conveyance, Public benefits, Water sources, Eminent domain, Condemnation.
Identifiers: *Water and Power Resources Board.

Plaintiffs brought suit against defendant water company seeking to enjoin it from appropriating and diverting water from a creek and from erecting a dam across the creek in order to create a reservoir for taking water. Plaintiffs also sought to enjoin defendant from condemning or acquiring by eminent domain or otherwise any water, lands or rights whatsoever within the watershed. The Water and Power Resources Board had issued a permit to the defendant to engage in the activities complained of by the plaintiffs. Numerous public hearings were conducted prior to the issuance of the permit. At issue was whether the plaintiffs had sufficiently exhausted all available administrative remedies and thus fulfilled the condition precedent to jurisdiction of an equity court. The court held that it lacked jurisdiction since plaintiffs had failed to appeal the Board decision to the court designated by the enabling statute and therefore had not exhausted all available administrative remedies. The order of the lower court dismissing the complaint was affirmed. (Katz-Fla)
W69-05198

PHILLIPS PETROLEUM CO V HARDEE (LIABILITY FOR DAMAGE BY POLLUTION).
For primary bibliographic entry see Field 05G.
W69-05199

DRUMMOND V FRANK (OBSTRUCTION OF SURFACE FLOW).
For primary bibliographic entry see Field 04A.
W69-05200

6F. Nonstructural Alternatives

A NEW METHOD OF MAPPING THE WATER RESOURCES,
Northern Research Inst. of Hydraulic Engineering and Reclamation, Kazan (USSR). Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 02E.
W69-04934

A METHOD OF DETERMINING THE AVAILABLE SURFACE WATER RESOURCES,
Institut fuer Wasserwirtschaft, Berlin (East Germany).
For primary bibliographic entry see Field 02E.
W69-04950

PLANNED UTILIZATION OF WATER RESOURCES,
TRW Systems, Redondo Beach, Calif.
For primary bibliographic entry see Field 02E.
W69-04952

OPTIMAL FLOOD DAMAGE MANAGEMENT: RETROSPECT AND PROSPECT,
Resources for the Future, Inc., Washington, D. C.; Chicago Univ., Ill.
For primary bibliographic entry see Field 06B.
W69-05118

6G. Ecologic Impact of Water Development

FIRST WORLD CONFERENCE ON NATIONAL PARKS.

National Park Service, Department of the Interior, Washington, D. C., June 30-July 7, 1962.

Descriptors: *National parks, *Wildlife conservation, *Ecology, Natural resources, Scenery, Federal reservations, Parks, Conservation.

Scientific, economic, and cultural values of national parks are analyzed by the delegates to the conference. The preservation of wildlife in its natural habitat is discussed. The public should be educated by the national parks to appreciate and preserve plant and animal life in its original habitat.
W69-04990

CHESAPEAKE COUNTRY,
Nathaniel T. Kenney.
National Geographic, Vol 126, No 3, September, 1964, pp 370-411.

Descriptors: *Maryland, *History, *Social impact, *Economic impact, *Bays, Appalachian Mountain region, Atlantic coastal plain, Coastal plains, Geographical regions, Northeast U. S., Regions, Social aspects, Bodies of water.

This article briefly covers social and economic aspects of the development of Chesapeake Bay.
W69-05010

07. RESOURCES DATA

7A. Network Design

BASIC DATA COLLECTION FOR WATER DEVELOPMENT IN EAST PAKISTAN,
East Pakistan Water and Power Development Authority, Dacca. Water Investigation.
A. Matin.
For the 8 Volume Proceedings, see Vol 2, No 9, Yield 06B, W69-03305. Int Conf on Water for Peace, Wash, D C, Vol 4, pp 298-308, 1968. 11 p, 2 fig, 2 tab.

Descriptors: *Planning, *Data collections, *River basin development, *Deltas, Water resources, Social aspects, Legal aspects, Land use, Topography, Geology, Economics, Meteorology, Irrigation, Agriculture, Industrial production.
Identifiers: Brahmaputra-Ganges-Meghna delta, Pakistan, East Pakistan.

Most of East Pakistan lies in the delta of the Ganges, Brahmaputra, and Meghna Rivers, one of the largest and most densely populated deltas in the world. The climate is tropical except in the winter when it may be classed as sub-tropical. During the summer, the region is subject to local flooding from monsoon rainfall and general flooding from the over-flow of the converging rivers whose total peak flow may be as great as 6 million cfs. During the winter, drought conditions prevail. From time to time devastating tropical cyclones (called hurricanes or typhoons elsewhere) accompanied by torrential rains have devastated the land. Large amounts of sediment are carried by the major streams, particularly the Brahmaputra. The extent of groundwater in East Pakistan has not been determined but needs detailed investigation. Food for an adequate diet for everyone has not been available in the Province for many years. Food production is increasing at a lower rate than population growth. Basic data must be collected for use in the planning which is necessary to develop the agriculture and industry necessary to support even the province's present population. Surface water data on water levels of streams, discharge, and suspended load and bed load are being collected. Studies relating to the optimum uses of irrigation water are being made at the Agricultural Experimental Farms in the various parts of the Province. Studies about population, general health and nutrition habits of various social groups need to be made. Data concerning education levels, employment and economic status of various groups supplies helpful planning information. Other socio-economic studies connected with the planning have also to be made. (Knapp-USGS)
W69-04755

CHEMICAL MEASUREMENT OF MEAN TEMPERATURE,
Pennsylvania State Univ., University Park.
Richard Lee, and E. B. Jones.
Water Resources Bull, Vol 4, No 4, pp 39-45, December 1968. 7 p, 3 fig, 1 tab, 8 ref.

Descriptors: *Temperature, *Hydrolysis, *Data collections, *Methodology, Analytical techniques, Heat budget, Hydrologic aspects, Solar radiation, Evaporation, Consumptive use, Thermal pollution, Climatology, Pennsylvania, Irrigation.
Identifiers: *Mean temperature, *Chemical method.

The significance of mean temperature to hydrology, methods of integrating temperature over time, problems involved, and appropriate application areas for the chemical mean temperature method are discussed. A versatile methodology, based on the temperature dependence of sucrose hydrolysis, was tested in Pennsylvania. The technique permits low-cost mass sampling of air, water, and soil temperatures. Because the sensing elements are transparent, short-wave radiation effects are negligible. In field tests duplicate sensors yield repeatedly the same values plus or minus 0.02 deg C. Data can be related directly to measurements obtained in standard climatological networks. The technique has good application in such hydrological studies as evaporation, consumptive use, thermal pollution, and soil moisture in irrigation practices. (La USGS)
W69-04765

SCIENTIFIC PARAMETERS OF MARINE WASTE DISCHARGE,
For primary bibliographic entry see Field 05A.
W69-05018

. Data Acquisition

ERMAL INFRARED IMAGERY FOR OLOGISTS,
vron Research Co., La Habra, Calif.
d F. Sabings, Jr.
, Chevron Oil Field Res Co, La Habra, Calif, 8. 21 p, 5 fig, 2 plate, 6 ref.

criptors: Thermal radiation, *Infrared radia-, Infrared rays, Thermal pollution, Aerial tography, Geological surveys, Engineering ogy, Geologic formations, *Geologic investiga-s, Geology, Remote sensing, *Geologic ping, Sensors, Instrumentation, *Reconnais-e surveys.
tifiers: Infrared sensors, *Infrared imagery, In-ed scanning, *Aerial reconnaissance, *Air-e surveying, Photointerpretation.

rmal infrared imagery is obtained by airborne ning devices that detect thermal radiation from earth's surface and record it as an image; bright s represent relatively warm radiometric tem-tures and dark tones represent relatively cool peratures. Scanners sensitive to wave lengths een 8 and 14 microns span the radiant power of the earth at 9.7 microns and coincide with tmospheric window. An example of 8-14 on nighttime infrared imagery from the Im-l Valley, Calif, is compared with aerial photo-hs of the same area. In this monotonous-ap-ing desert terrain the imagery exhibits greater rast and geologic detail than the photography. imagery distinguishes deformed tertiary sedi-ary bedrock (relatively cool) from recent blown sand cover (relatively warm). A faulted ging anticline in flat terrain is obscure on aerial ographs and to the ground observer. On time infrared imagery the fold is clearly shown e outcrop configuration of the individual silt-e and sandstone strata. The radiometric tem-ture differences between strata are sufficient tline the fold on the imagery. (USBR)
-04745

RMAL CONDUCTIVITY OF TWO-PHASE OUS MATERIALS: DRY SOILS,
sthan Univ., Jaipur (India). Dept. of Physics.
Chaudhary, and R. C. Bhandari.
l Appl Phys (J Phys D), Ser 2, Vol 2, No 4, pp 510, Apr 1969. 2 p, 1 fig, 3 ref.

riptors: *Thermal conductivity, *Porous a, *Heat flow, Geothermal studies, Physical erties, Methodology, Mathematical studies, sity.
ifiers: *Dry soils, Experimental values.

weighted geometric mean of maximum and num thermal conductivities for calculating ef-e thermal conductivities of porous media has applied to unconsolidated dry materials. The on was tested with values obtained experi-ally by Smith (1942) for Miami silt loam, and l to have fair agreement. For porosities rang-om 57 to 33 % the values of n lie between 42 1 %. This shows that the distribution phases in nconsolidated system is probably stratified and perpendicular to the direction of heat (Lang-USGS)
04949

METHODS OF ESTIMATING BASE W AT UNGAGED STREAM SITES IN KAN-AND ADJACENT STATES,
ogical Survey, Lawrence, Kan.; Geological y, Albany, N. Y.
rimary bibliographic entry see Field 02E.
04978

NETIC TAPE RECORDING OF PHYSICAL LOGS,
ogical Survey, Denver, Colo.
ott Keys.
Surv Res 1967, Prof Pap 575-C, pp C242-, 1967. 5 p, 4 fig, 4 ref.

Descriptors: *Logging (Recording), *Borehole geophysics, Research and development, Instrumentation, Electronic equipment, Geophysics.
Identifiers: Geophysical log tape recorder.

An inexpensive magnetic tape system has been developed and used for recording geophysical well logs. The unmodified signal from a logging probe is recorded simultaneously with the conventional graphic log. During tape playback, all adjustments normally made during logging are possible. These include independent changes in horizontal scale, vertical scale, zero positioning, and time constant. Use of this system reduces the time spent at the well. Correction of operator errors and equipment malfunctions can be done in the office, and logs can be plotted at any time in a format consistent with the planned use. This system also provides for the economical storage and retrieval of data. (USGS)
W69-04986

MEASUREMENT OF THE ABUNDANCE OF FRACTURE TRACES ON AERIAL PHOTOGRAPHS,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02F.
W69-04987

FIELD CORRELATION OF TWO NEUTRON-SCATTERING SOIL MOISTURE METERS,
Forest Service (USDA), Logan, Utah. Intermountain Forest and Range Experiment Station.
John D. Schultz.
U. S. D. A. Forest Serv. Res. Note INT-21, 1964, 7 pp.

Descriptors: *Nuclear meters, *Radioactivity, *Depth-area-duration analysis, *Instrumentation, Calibrations, Soil moisture meters, Water measurement, Moisture uptake, Hydrologic data, Moisture availability, Soil analysis, Linear programming.
Identifiers: *Probe correlation, *Depth referencing, *Field correlation, *Neutron-scattering method.

Operation of two neutron soil moisture probes of different design was compared under identical conditions. Reports development of a method for depth referencing one probe with respect to the other for obtaining moisture measurements at comparable depths. Correlation curves for data obtained with both probes indicate the best relative positioning of these two probes when one is employed in lieu of the other.
W69-05100

EVAPOTRANSPIRATION AND SOIL-MOISTURE DEPLETION,
Forest Service (USDA), Moscow, Idaho. Intermountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 02G.
W69-05102

A HEATING SYSTEM FOR STREAM GAGING STATIONS,
Forest Service (USDA), Logan Utah. Intermountain Forest and Range Experiment Station.
Robert D. Doty, and Robert S. Johnston.
Journal of Soil and Water Conservation, 1967, Vol 22, No 6, 2 pp.

Descriptors: *Stream gages, *Gaging stations, *Water measurement, *Structural design, *Heating, Infrared radiation, Propane, Flumes, Fuels, Operating cost, Total cost, Watershed management, Stilling basins.
Identifiers: *Streamflow measurement, *Stilling well heater.

A heating system was developed for keeping small mountain stream gaging stations free of ice. The system includes a propane heater for the stilling well, propane infrared heater for an 'H' type flume, and covers for the entire flume assembly. The stilling well heater is equipped with safety shutoff and operates on a minimum of fuel, while the flume heater utilizes approximately 300 gallons of fuel over a 6-month period in order to obtain a 12,000 BTU output. The paper explains the construction of all units of the system and includes cost of construction and operations.
W69-05110

THE INTERMOUNTAIN PRECIPITATION STORAGE GAGE,
Forest Service (USDA), Logan Utah. Intermountain Forest and Range Experiment Station.
Norbert V. DeByle, and Harold F. Haupt.
U.S.D.A. Forest Serv. Res. Note INT-34, 1965, 4 pp.

Descriptors: *Precipitation gages, *Rain gages, *Watershed management, *Water measurement, *Water management, Gaging stations, Rain water, Structural design, Water yield improvement, Antifreeze.

A modified standpipe is recommended as a rugged, vandalproof precipitation storage gage that is relatively easy to erect. It has proved satisfactory on sites receiving 60 inches or less of precipitation during the storage season.
W69-05111

GEOPHYSICAL STUDIES FOR VOLCANOLOGICAL GEOHYDROLOGY,
Hawaii Inst. of Geophysics, Honolulu.
William M. Adams.
Hawaii Water Resources Research Center, Contrib No. 18, Feb 1969. 23 p, 12 fig, 21 ref. OWRR Project B-008-HI.

Descriptors:
Identifiers: *Volcanology, *Geohydrology, Infrared, Gravity, Radar, Magnetics, Seismics, Resistivity, Algae, *Hawaii, Dikes.

Infrared scanning, when judiciously applied and interpreted with the aid of concomitant surface measurements, is an effective reconnaissance method for large regions. Radar imagery has been studied theoretically. Index algae are indicators of freshwater outflow and are not dependent on temperature. False-color procedures have been developed for locating the index algae from aircraft. Close-spaced gravity and electrical resistivity profiling seem to locate dike zones and hence define sectors of the ground-water table having approximately the same elevation. Depths to the water table are estimated from electrical resistivity sounding or audiomagnetotelluric soundings. Drilling at a few sites has confirmed estimated depths, however, estimates of porosity based on absolute resistivities do not seem reliable. Applications of aeromagnetics and seismic holography are being developed. For any given situation, the appropriate techniques depend on the environment and prior knowledge. For volcanological insular environments, electrical resistivity and aeromagnetics should be considered. Audiomagnetotellurics may be appropriate in a simple geometry at an elevation above a thousand feet.
W69-05145

7C. Evaluation, Processing and Publication

ELECTRONIC DATA PROCESSING SYSTEM FOR STREAMFLOW,
Southern Great Plains Watershed Research Center, Chickasha, Okla.
Russell R. Schoof, Edward H. Seely, Arlin D. Nicks, Carlton D. Edens, and Paul B. Allen.
Water Resources Bull, Vol 4, No 4, pp 54-63, Dec 1968. 10 p, 3 fig, 4 tab, 2 ref.

Descriptors: *Computer programs, *Digital computers, Hydrologic data, Data processing, Data collections, Streamflow, Runoff, Water levels, Sediment transport, Sediment load, Networks.
Identifiers: Hydrologic data processing.

A digital computer system was developed to calculate daily, monthly, and yearly summaries of streamflow and sediment transport from continuous gage height records and discrete sediment concentrations and discharge measurements. The system includes computer computation of discharge measurement notes and an accuracy check of gage height and time input data. Maximum volumes of runoff for selected time intervals up to 8 days and flow duration data can also be compiled. Electronic data processing equipment consists of a chart reader, card punch, computers, and card sorter, and the system software includes 12 Fortran programs. (Knapp-USGS)
W69-04759

LINEAR--A COMPUTER PROGRAM TO FIT DATA EASILY TO MANY MODELS BY THE WEIGHTED LINEAR LEAST-SQUARES METHOD,
Oak Ridge National Lab., Tenn.
E. Schonfeld.
July 1968 22 p W-7405-eng-26 ORNL-4264.

Descriptors: *Computer programs, *Digital computers, *Data processing, Computers, Programming languages, Regression analysis, Statistical methods.
Identifiers: *Weighted linear least-squares method, FORTRAN, LINEAR, Terminology, CDC-1604, FORTRAN II (IBM-7090), FORTRAN 62 (CDC-1604, -3600), FORTRAN 63 (CDC-1604,-3600), FORTRAN 360-ORNL (IBM-360), FORTRAN IV (IBM-7094/0), FORTRAN IV (IBM-360), FORTRAN IV (UNIVAC-1108), FORTRAN ASA.

Computer PROGRAM LINEAR, written in FORTRAN, permits convenient fitting of models, by weighted linear least-squares method, of polynomials involving up to 10 independent variables. Program includes sub-routines for eight procedures for regression of dependent variable (Y) on independent variables (X) thus: both variables coded, log-to-base-e of coded Y on coded X, log-to-base-e of coded Y on log-to-base-e of coded X, ratio of coded X to coded Y on coded X, coded Y on reciprocal of coded X, log-to-base-e of coded Y on reciprocal of coded X, reciprocal of coded Y on reciprocal of coded X, coded Y squared on coded X. Program permits option of introducing user's own data transformation and polynomial. Program includes matrix inversion routine which is easily modified to double precision. Execution on CDC-1604 requires about one minute; costs about $1-2. LINEAR can be used with different computers and FORTRAN languages including II (IBM-7090), 62 (CDC-1604, -3600), 63 (CDC-1604, -3600), 360-ORNL (IBM-360), IV (IBM-7094/0), IV (IBM-360), IV (UNIVAC-1108), ASA. Report includes simplified and complete instructions for program use; glossary; printout of PROGRAM LINEAR; and examples of input, selected output, and detailed output of procedures 1-4. (Eichhorn-Wis)
W69-04797

DOCUMENTATION: INFORMATION AND INSTRUCTION CONCERNING THE PROBLEMS OF WATER,
Centre Francais d'Information de l'Eau.
For primary bibliographic entry see Field 10.
W69-04940

AN OPTIMIZATION CRITERION FOR MULTISPECTRAL PHOTOGRAPHY,
Hawaii Inst. of Geophysics, Honolulu.
William M. Adams
Hawaii Water Resources Research Center, Contrib No. 12, Dec 1968. 37 p, 20 fig, 5 ref. OWRR Project B-008-HI.

Descriptors:
Identifiers: Multispectral photography, Optimization, Imagery, Pattern recognition, Spectral matching.

The procedures for gathering and processing information by multi-spectral photography have been heuristic and often limited by the equipment. The equipment limitations will probably continue. The purpose of this paper is to indicate that the procedures, especially the analysis, do not necessarily need to be heuristic. The problem is separated into two types of decision-making situations: the pure spectrum case, in which the desired signal is known and may be observed without noise contamination, and the mixed spectrum case, in which the desired signal is known but is not observed without some noise contamination. The pure-spectrum case is reduced to a problem of pattern recognition. The mixed spectrum case is studied for development of a 'best' system is found and three examples demonstrate the results. Exposure time is not considered as a variable in the theory.
W69-05144

08. ENGINEERING WORKS

8A. Structures

ANALYSIS OF THE FAILURE OF BRITTLE MODELS OF ARCH DAMS,
Ya K Kul'gavii.
Hydrotech Constr, No 4, pp 328-332, Apr 1968. 5 p, 4 fig, 1 tab, 8 ref.

Descriptors: *Arch dams, *Concrete dams, *Model studies, *Model tests, Models, Structural analysis, Structural behavior, Gypsum, Cracks, Safety factors, Elasticity modulus, Dam foundations, Failure (Mechanics), Load distribution, Hydrostatic pressure, Cracking, Deflection, Foreign research.
Identifiers: USSR, *Double-curvature arch dams, Design assumptions.

Failure tests on 13 brittle models of arch dams were performed in 1964-65 at the mechanical laboratory of the Leningrad Institute of Railroad Transportation Engineers. Since the height of the models was only 30 cm, the accuracy of numerical results is questionable. All models were made at a scale of 1:1000. Double-curvature arch and conical-section arch dams were modeled. Design loads were determined, assuming the specific weight of the fictitious liquid to be 100 tons/cu m and the unit weight of the concrete to be 240 tons/cu m. The models of the base and dams were cast from a gypsum-sand mix using a gypsum:sand:water ratio of 1:1:0.8. Two schemes of limit equilibrium of arch dams were developed: (1) when failure of models is caused by hydrostatic pressure, horizontal and perimetral cracks appear first and vertical cracks are secondary, and (2) when failure of models is due to total loads, vertical and perimetral cracks are characteristic and horizontal cracks are secondary. The deadweight of the structure upon failure caused by total load promotes a greater stability of the models and permits a more realistic estimate of the safety factor. The safety factor increases 10% for double-curvature models and 20% for models with a vertical upstream face. (USBR)
W69-04710

ELECTRIC-ARC EQUIPMENT FOR BURNING OPENINGS INTO BRICK AND REINFORCED CONTRETE STRUCTURES,
K. E. Gorianinov, and V. I. Antropov.
Transl from Russ, Bur Reclam Transl 721, Jan 1968. 8 p, 3 fig, 2 ref. Mekh Stroitel, No 2, pp 18-19, 1967.

Descriptors: *Electric arcs, *Cutting, Burning, Aperture, Electrodes, Costs, Electric power, Manpower, Field tests, Electric insulation, Beams (Structural), *Bricks, *Reinforced concrete, Slabs, Offsets, Apparatus, Construction, Foreign research, Circles, Electrical equipment, *Masonry, Fusion, Slags, Economics.
Identifiers: USSR, *Equipment design, Plasma jet.

USSR inventors have developed and successfully tested an apparatus for cutting openings, furrows, recesses, and offsets by electric-arc and plasm destruction of brick and reinforced concrete. Th equipment is equally adaptable to new constructio or remodeling existing structures. The electric ar can demolish concrete, reinforced concrete, c masonry; form passages, recesses, and furrows walls and slabs; cut concrete and rock to tru geometric shape; pierce communication opening and level concrete piles driven to refusal. Th operating principles is based on fusion of th material by an electric arc at 4000 to 8000 deg C forming an ionized zone and ejection of the fuse slag by electrodynamic forces. The equipment described, and savings in money, time, and ma power are indicated. The mobile apparatus weig 50 kg, requires 64 kw of power, and is operated b one worker using a standard welder's shield.
W69-04718

EARTHQUAKE BEHAVIOR OF RESERVOI DAM SYSTEMS,
California Univ., Berkeley.
Anil K. Chopra.
Proc Amer Soc Civ Eng, J Eng Mech Div, Vol 9 No EM6, pp 1475-1500, Dec 1968. 26 p, 8 fig, ref, 2 append.

Descriptors: Concrete dams, *Gravity dam *Seismic properties, *Dams, *Earthquake Earthquake engineering, Structural behavio Damping, Dam design, Seismic investigation Seismic studies, Vibrations, Excitation, Compress bility, Hydrodynamics, Reservoirs, Bibliographie Engineering mechanics.
Identifiers: Earthquake loads, Earthquake-resista struct, Seismic stability, Dynamic respons Hydrodynamic pressures.

Most analysis of earthquake effects on dams trea the dam and the reservoir as 2 uncoupled system Importance of interaction between the 2 systems investigated. The analysis is restricted to dams wi a vertical upstream face. This idealization is co sidered appropriate for concrete gravity dam Dam response is assumed to be satisfactori represented by the fundamental mode effects. E pressions are derived for complex frequen responses of a coupled system. For the coupl system, the complex frequency responses, the fu damental vibration period, and responses to st tionary white noise excitation are numerically ev uated for wide range of the basic parameters: (normalized excitation frequency, and (2) the ra of fundamental natural frequencies of the reserv and dam separately. Interaction effects have co siderable influence on the behavior of the syste Analysis of the coupled system is greatly simplifi when water compressibility is neglected. T earthquake response can then be determined as t response of a modified one-degree of freedo system. Compressibility of water can be ignored the dam is flexible enough compared to the res voir. (USBR)
W69-04726

THE MOSSYROCK DEVELOPMENT,
Harza Engineering Co., Chicago, Ill.; Taco Dept. of Public Utilities, Wash.
Earl J. Beck, and Frankland Smith.
Water Power, Vol 20, No 11, pp 431-438, N 1968. 8 p, 10 fig.

Descriptors: *Arch dams, *Hydroelectric pow Hydrology, Model tests, Engineering geolo Diversion tunnels, Laboratory tests, Powerhous Trial-load method, Foundation investigatio Spillway gates, Penstocks, Spillways, Fish passag Fish hatcheries, Construction, Concrete da Transmission (Electrical), Costs, Washington.
Identifiers: *Double-curvature arch dams, *M syrock Dam (Wash), Cowlitz River (Was Hydroelectric resources.

Mossyrock is the second of 2 developments on Cowlitz River owned by the City of Tacoma, Wa the first being Mayfield completed in 1963. M syrock has a double-curvature arch dam 606 ft h

ith a crest length of 1300 ft. The conventional in-oor powerplant, containing two 150-mw generat-ng units with provisions for a future unit of the ame size, is located on a bench in the right abut-ent of the dam. The dam is the highest in Vashington and the third highest concrete dam in ne U. S. Spillway crest gates are incorporated in ne arch with the discharge falling freely into a lunge pool below the dam. The hydrology of the ver basin, geology and foundation conditions, ver diversion, foundation treatment, arch dam nd spillway, powerplant, and fish facilities are scussed. The dam was analyzed by trial-load anal-sis, aided by a computer. Structural tests on a 400 scale model were conducted by Laboratorio acional de Engenharia Civil in Portugal. A spill-ay model was tested at the Hydraulic Laboratory, niversity of Washington. (USBR)
69-04737

HE SOLINA HYDRO PROJECT,
. Kurhanowicz.
Vater Power, Vol 20, No 12, pp 475-480, Dec 968. 6 p, 7 fig, 1 tab.

escriptors: *Water resources development, River sin development, *Hydroelectric power, ydroelectric plants, *Pump turbines, Penstocks, ancis turbines, Flood control, Industries, griculture, Concrete dams, Tourism, Gravity ms, Foreign design practices, Reservoirs, Peak wer, Reservoir operation.
entifiers: Poland, Carpathian Mountains, *Solina oject (Poland).

onstructing the dam and hydroelectric power-ant at Solina on the River San in Poland is one ge in developing the Carpathian water sources. This will be the second in a chain of 16 werplants in the cascade, and will be the largest Poland. The Solina reservoir is designed: (1) to ovide flood control on the upper San River; (2) produce peakload power for savings in coal, and entually provide the basic source for the power stem of Eastern Poland; and (3) to promote velopment of industry, agriculture, and tourism the Bieszczady region, Two 46-mw Francis tur-ne units and two 21.2-mw pump-turbine units will installed in the Solina powerplant. Geology of e region, technical and economic aspects of lecting a concrete gravity dam, alternative design nsidered for the powerplant structure and in-lled equipment, capacity and operation of the servoir, and the construction program are scussed with emphasis on the civil engineering pects of the project. The permanent-type con-uction village will be used as a health center after m completion. (USBR)
69-04738

OBABLE MAXIMUM PRECIPITATION VER SOUTH PLATTE RIVER, COLORADO ND MINNESOTA RIVER, MINNESOTA,
eather Bureau; Silver Spring, Md.
r primary bibliographic entry see Field 04A.
69-05158

ONTENOT V SMITH (CONTRACT AGREE-ENTS AND RIGHTS TO NATURAL FLOW).
r primary bibliographic entry see Field 06E.
69-05170

8. Hydraulics

UID DYNAMICS,
arkson Coll. of Technology, Potsdam, N. Y.; nsselaer Polytechnic Inst., Troy, N. Y.
lliam N. Gill, Robert Cole, and Joseph Estrin.
l Eng Chem, Vol 61, No 1, pp 41-75, Jan 1969. p, 704 ref.

scriptors: Fluid flow, *Hydraulics, ydrodynamics, Entrances, Jets, Gases, Laminar w, Non-Newtonian flow, Stratified flow, Cavita-n, Suspended solids, Air, Bubbles, Drops (Fluids), Suspended sediments, Solids, Sedimentation, Mixes, Mixing, Porous media, Flow around objects, Turbulent flow, Boundary layers, Bibliographies, Reviews.
Identifiers: *Fluid dynamics, Newtonian flow, Two-phase flow, Liquid films, Solid solutions, Fluidized-bed coating.

A critical review is given of fluid dynamics literature published from Jan to Dec 1967. An effort was made to include both breadth and depth of coverage. The reviewers also restricted coverage to papers emphasizing development and delineation of basic principles rather than practical applications. Among fields of fluid dynamics reviewed are single-phase laminar flow of Newtonian fluids in channels; entrance regions; isothermal flow; coupled flow; two-phase flow; cavitation; liquid films; stratified flow; bubble dynamics; drop formation and motion; solid-fluid systems; suspension behavior--sedimentation; fluidized beds; porous media; rotating flow; non-Newtonian fluids; natural convection and related flows; laminar flow past submerged objects; boundary layer flow; jets; turbulence; wakes; and turbulent non-Newtonian flow. (USBR)
W69-04701

ENTRY VELOCITY CONTROL LIMITS DRAIN SEDIMENTATION,
Agricultural Research Service, Brawley, Calif.; and Agricultural Research Service, Columbus, Ohio.
Lyman S. Willardson, James L. Fouss, and Ronald C. Reeve.
Proc Amer Soc Civ Eng, J Irrig Drain Div, Vol 94, No IR4, pp 455-463, Dec 1968. 9 p, 4 fig, 1 tab, 10 ref, append.

Descriptors: *Entrances, *Velocity, *Subsurface drains, *Drains, Fluid flow, Drain tiles, *Drainage, *Sedimentation, *Inlets (Waterways), *Sediment control, Design criteria, Laboratory tests, Hydraulics, Stokes Law, Channels, *Deposition (Sediments), Particle size, Cross-sections.
Identifiers: Openings.

Sedimentation of subsurface drains can be prevented by controlling water entry velocity. The essential element is an entrance flow channel for controlling direction and magnitude of the inflow velocity. This concept can be implemented in several ways using a variety of materials. The channel must flow directly upward opposite the gravity field for some distance before water enters the drain; the magnitude of the flow rate must be less than a critical limiting velocity that would dislodge and lift soil particles. The entry velocity can be limited by providing sufficient channel inflow cross-sectional area, varying either the size and number, or both, of channels, to meet the drainage discharge requirements. Laboratory tests show that uniform-size noncohesive particles will probably cause sedimentation problems. Graded materials and cohesive aggregated soils are less susceptible to movement by flowing water. Preliminary design criteria, based on the average Stokes Law settling velocity in upflow channels, were established. An average velocity in the entrance flow channel that is less than 10% of the Stokes Law settling velocity for the smallest size soil particle to be excluded appear safe. (USBR)
W69-04720

TENTATIVE DESIGN PROCEDURES FOR RIPRAP-LINED CHANNELS,
Minnesota Univ., Minneapolis.
Alvin G. Anderson, Amreek S. Paintal, and John T. Davenport.
Res Results Dig, Highw Res Board, Dig 1, Dec 1968. 24 p, 1 tab, 19 chart.

Descriptors: Channel erosion, *Channels, Design criteria, Hydraulics, Design tools, *Hydraulic design, Hydraulic properties, Linings, *Riprap, Canal design, *Canal linings, Ditches, Economics, Slope protection.
Identifiers: *Channel protection, Design assumptions, *Channel design, Design practices, *Lined canals.

Criteria are developed and procedures extended for designing roadside drainage channels for conditions intermediate between those for which easily established grass cover will suffice and those for which paved channels or pipe flumes are more economical. Design charts facilitate rapid and simple establishment of channel shape and size and properties of the riprap lining. Regular trapezoidal channels with a maximum discharge of 1000 cfs and median or side ditches with a maximum discharge of 100 cfs are the 2 primary types (both with a maximum slope of 0.10) chosen for preparing design charts. Side ditches are relatively wide and often approach a triangular cross section because of flat slopes. An equation is developed relating the discharge, longitudinal slope, riprap size, and shape of a regular trapezoidal channel. The channel shape can be eliminated as a design factor from wide triangular channels; erosion control will depend primarily on the discharge, longitudinal slope, and riprap size. (USBR)
W69-04727

VELOCITY DISTRIBUTION AND ITS EFFECT ON THE ACCURACY OF THE GIBSON METHOD OF WATER MEASUREMENT,
Allis-Chalmers Mfg. Co., York, Pa.
For primary bibliographic entry see Field 08C.
W69-04744

HORIZONTAL DIFFUSION FROM AN INSTANTANEOUS POINT SOURCE DUE TO OCEANIC TURBULENCE,
For primary bibliographic entry see Field 02L.
W69-05036

A REVIEW OF THEORETICAL MODELS OF TURBULENT DIFFUSION IN THE SEA,
For primary bibliographic entry see Field 02L.
W69-05037

MICROSCOPIC DETERMINATION OF BOUNDARY SHEAR AND SUBLAYER TURBULENCE CHARACTERISTICS IN AN OPEN CHANNEL,
Illinois Univ., Urbana.
Harry G. Wenzel, and Michael J. Mathews.
Illinois Water Resources Center, Research Report No 13, January 1968, vii + 78 p, 25 fig, 3 tab, 20 ref. OWRR Project A-006-ILL.

Descriptors: Boundaries (Surfaces), Boundary layers, *Flow profiles, Hydraulics, Laminar flow, Microscopy, *Open channel flow, Photography, *Shear stress, Turbulence, *Turbulent boundary layers, Turbulent flow, Velocity.
Identifiers: Boundary shear, *Rate of shear, Suspended particles, *Turbulence intensity, Two-dimensional flow.

The application of a method of velocity determination in an open channel using a microscope and camera to record the motion of small particles suspended in water is described. Velocity measurements were made in a series of thin planes orientated parallel to the channel bottom for the case of two-dimensional laminar and turbulent open channel flow. Velocity profiles near the boundary were plotted and boundary shear computed from the rate of shear thus determined. Turbulence intensity was computed and the distribution of particle velocities examined. It was concluded that the method yields boundary shear values to within plus or minus 15 percent and that this uncertainty can be reduced significantly. The maximum error is caused by uncertainty in the location of the focal plane and in the location of a particle within the focal plane. This difficulty causes an even greater error in computation of turbulence intensity. This error increases as the distance from the boundary decreases, creating a serious disadvantage of the method. Particle velocity distributions exhibit a

positive third moment which is in qualitative agreement with previous measurements. The results indicate that further investigation of the application of the method to open channel turbulent flow is justified. (Betchart-Ill)
W69-05150

HYDRAULIC GEOMETRY OF ILLINOIS STREAMS,
Illinois State Water Survey, Urbana; Illinois Univ., Urbana.
John B. Stall, and Yu-Si Fok.
Illinois Water Resources Center, Research Report No 15, July 1968, ii + 47 p, 26 fig, 10 tab, 39 ref. OWRR Project B-005-ILL.

Descriptors: *Channel morphology, Depth, Discharge, Geomorphology, *Hydraulic properties, Hydraulics, *Hydrology, Illinois, Reaeration, Streamflow, Velocity, Watersheds (Basins), Width.
Identifiers: *Hydraulic geometry.

A consistent pattern has been evaluated in which the width, depth, and velocity of flow in a stream change along the course of the stream with a constant frequency of discharge. These channel characteristics are termed hydraulic geometry and constitute an interdependent system which is described by a series of graphs having simple form, or by equations. The data from 166 stream gaging stations in Illinois have been assembled and used to develop the parameters to define the hydraulic geometry of these streams. Results are presented as separate sets of equations for 18 river basins in Illinois. Stream characteristics are related to frequency of discharge and to drainage area as independent variables. Stream velocities computed from hydraulic geometry equations check favorably with actual stream velocities measured by time-of-travel in streams determined by using dye tracers. These equations are used to predict the average depth and velocity of flow at problem locations on the stream where no measurements are available. This allows computation of the reoxygenation capacity of the stream at the problem location, and will be valuable for many purposes in water resources development. (Betchart-Ill)
W69-05153

8C. Hydraulic Machinery

FLOW AND CAVITATION CHARACTERISTICS OF CONTROL VALVES,
Glenfield and Kennedy Ltd., Kilmarnock (Scotland).
E. Miller.
J Inst Water Eng, Vol 22, No 7, pp 512-533, Oct 1968. 22 p, 11 fig, 6 tab, 11 ref, 4 append.

Descriptors: *Cavitation, *Hydraulic valves, Hydraulic engineering, Hydraulic systems, Head loss, Fluid mechanics, Fluid flow, Pressure, Erosion, Foreign research, *Valves, Characteristics, Control, Losses, Mechanical engineering, *Flow characteristics, Experimental data, Noise, *Hydraulic gates and valves.
Identifiers: Great Britian, Scotland, Valve vibration, Cavitation index.

The flow control equation for a valve under steady-state conditions is developed in terms of valve and system characteristics. The effect of each of 4 independent factors influencing flow control is examined. For practical application, experimentally determined values of the head loss coefficient for various types of valves are given. A numerical example shows the adaptability of the flow control equation to tabular analysis. Cavitation in control valves is defined in terms of the cavitation number and a minimum pressure coefficient. The form of this coefficient is adaptable to tabular analysis. Experimentally determined minimum pressure coefficient values for various types of valves are given. The effect of each of the 3 independent factors contributing to the cavitation potential is examined. Since the minimum pressure coefficient is not easily measured directly, an indirect method is described. (USBR)
W69-04716

SEMI-SYNCHRONOUS STARTING,
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
J. F. Meyers, and T. F. Armbruster.
Allis-Chalmers Eng Rev, Vol 33, No 3, pp 4-7, 1968. 4 p, 3 fig.

Descriptors: Pumped storage, *Pump turbines, Hydroelectric power, Peak power, Electrical equipment, Electric potential, Investment, *Electric generators, *Hydroelectric plants, Voltage regulators, Costs, Electrical impedance, *Electric motors, Electric currents, Excitation.
Identifiers: *Starting, *Generator-motors, *Synchronous machines, Electric machinery.

Sizeable savings are being made by specifying a new starting method for large generator-motors in multiunit pumped storage plants. Generator-motors in the 200-300-mw range cannot be started in the usual across-the-line method. Semisynchronous starting offers an attractive alternate to the high cost of separate starting devices when across-the-line starting is not possible. This method is limited to a multiunit plant, either of all pumped storage units, or a combination of pumped storage and conventional hydrounits. With this starting method a generator-motor is started as a motor on its starting winding by connecting it to a generating unit operating at or near synchronous speed and at reduced voltage. Both units are isolated from the system. After the units have been synchronized at reduced frequency, they are accelerated to rated speed and synchronized with the system. Semisynchronous starting does not require a separate source of excitation for each unit because each unit uses its own exciter. This starting method is compared with different starting methods. (USBR)
W69-04722

INDEX METHOD FOR PUMPING OPERATION OF REVERSIBLE PUMP-TURBINE,
Hitachi Ltd., Hitachi City (Japan).
M. Yamabe, and Y. Yamaguchi.
Pap No 68-WA/FE-5, Amer Soc Mech Eng, Winter Annu Meet, Dec 1968. 5 p, 8 fig, 1 tab, 2 ref.

Descriptors: Hydraulic turbines, *Pump turbines, *Model tests, Francis turbines, *Flow rates, Discharges, Measurement, Laboratory tests, *Flow measurement, *Pumping, Foreign research, Mechanical engineering, Draft tubes, *Discharge measurement, Hydraulics.
Identifiers: *Differential pressure, *Winter-Kennedy Method, Foreign testing, *Reversible turbines, *Draft tube index method, Japan.

This paper describes the applicability of the Winter-Kennedy method and draft tube index method for measuring the hydraulic output of Francis and diagonal flow pump turbines under pumping operations. Experimental data obtained on 2 Francis pump turbines and one diagonal flow pump turbine are given. Data clarify that the Winter-Kennedy method of measuring flow rate is applicable to Francis pump turbines, but is not suitable to apply on diagonal flow pump turbines with adjustable guide vanes. The draft tube index method, depending upon differential pressure between 2 pressure taps provided on the draft tube or on the airpipe, indicates sufficient accuracy to apply to Francis and diagonal flow pump turbines. (USBR)
W69-04743

VELOCITY DISTRIBUTION AND ITS EFFECT ON THE ACCURACY OF THE GIBSON METHOD OF WATER MEASUREMENT,
Allis-Chalmers Mfg. Co., York, Pa.
G. Dugan Johnson.
Pap No 68-WA/FE-3, Amer Soc Mech Eng, Winter Annu Meet, Dec 1968. 5 p, 6 fig, 6 ref.

Descriptors: *Water measurement, Flow rates, Efficiencies, *Hydraulic turbines, *Gibson Method, Velocity distribution, Penstocks, Model tests, Closed conduits, Errors, Field tests, Analysis, Hydraulics, *Performance tests, Turbulent flow, Momentum, Discharge measurement, Models, *Flow measurement, Laboratory tests.
Identifiers: Recommendations, Friction coefficient, (Hyd), Accuracy.

The Gibson method, used for many years in making efficiency tests on hydraulic turbines, applies only to measuring flow through pressure pipes or other closed conduits. The test is based on Newton's Second Law of Motion, which states that the rate of change of momentum of any body is equal to the force acting on that body. Significant basic errors are introduced into the Gibson method of measuring water flow rates, even in uniform straight pipes, by failure to consider velocity distribution in calculating results. Dr. Thoma's 1926 analysis of the method is quoted extensively, including his conclusion that long, straight lengths of pipe upstream and downstream from straight differential-diagram test sections would eliminate the effects of accessory motions, and his recommendations for establishing an experimental installation to determine the effects of various disturbed flow conditions. The need for correction factors or meter coefficients to avoid consistent errors of approximately 2% is emphasized. (USBR)
W69-04744

INVESTIGATION OF THE INTERNATIONAL PASSAMAQUODDY TIDAL PROJECT.
For primary bibliographic entry see Field 06B.
W69-05007

WATER REQUIREMENTS OF ELECTRIC UTILITY STEAM-ELECTRIC-GENERATING PLANTS IN 1959.

Report, Federal Power Commission, Bureau of Power, Washington, D. C., May, 1961.

Descriptors: *Electric power industry, *Electric powerplants, *Water requirements, Cooling water, Water utilization, Water supply, Industries, Engineering structures, Industrial plants, Powerplant Structures, Water types, Efficiencies, Supply, Recirculated water, Steam.

This report summarizes water use by steam-electric generating plants in the United States (excluding Alaska and Hawaii) for the year 1959. The data are summarized by geographic area, fresh or brackish supply, recirculation, losses, and amount discharged.
W69-05063

WATER RESOURCES ACTIVITIES IN THE UNITED STATES: ELECTRIC POWER IN RELATION TO THE NATION'S WATER RESOURCES.
Report, Senate Select Committee on Water Resources, United States Senate, Washington, D. C., Committee Print No. 10, 1960.

Descriptors: *Electric power, *Cooling water, *Forecasting, Electricity, Water types.

An analysis is made of the determinants of electric power production, by basic energy source, in the United States. Electric-power production is projected through 1980 by energy source and region. Cooling water requirements for electricity production are also projected.
W69-05064

8D. Soil Mechanics

SHORING FOR THE SEATTLE FIRST NATIONAL BANK BUILDING, SEATTLE, WASHINGTON,
Shannon and Wilson, Seattle, Wash.
William L. Shannon, and Robert J. Strazer.
Pap, Shannon and Wilson, Inc, Soil Mech and Found Eng, Seattle, Wash, 1968. 12 p, 5 fig.

criptors: *Shoring, *Anchors, Cut slopes, ts, Excavation, Safety factors, Foundations, uting, Shear strength, Soil properties, Piles undations), Soil stability, Extensometers, Soil hanics, Deflection, Construction.
tifiers: Pull-out tests, Deflection measurement.

50-story Seattle First National Bank Building, tallest structure in Seattle, Wash, rises above deepest excavation ever made in Seattle for a le building. Vertical cuts on the 4 sides of the k-square excavation ranged from 35 to 78 ft . An unobstructed construction area was pro- d by shoring with a system of soldier piles with back earth anchors. The soil consisted of hard tured clays, silts, and very dense silty sand with nsiderable number of peaty zones. The soldier were placed in augered uncased holes extend- 5 ft below the bottom of the excavation and encased for this depth in high-strength rete. The piles were 3 ft on centers and the between was coated with 1 to 3 applications of rayed membrane to prevent surface drying, ing, and soil erosion. The tiebacks were placed - or 16-in.-dia holes augered from the excava- In clay, several combinations of diameter and h of anchors were used, all based on develop- n allowable shear strength of 0.5 ton/sq ft at lay-anchor interface. Pullout tests were per- ed on 7 anchors. Each anchor was loaded in ements to failure or to twice the design load kips). (USBR)
-04721

TICLE SIZE AS A BASIS FOR PREDICT- FROST ACTION IN SOILS,
onal Research Council of Canada, Ottawa ario).
rimary bibliographic entry see Field 02C.
-04739

ECT OF CONTINUOUS SURCHARGE ON A AINING WALL,
. Vargin.
Mech Found Eng, No 3, pp 160-164, May- 1968. 5 p, 3 fig, 1 tab, 7 ref.

riptors: Soil mechanics, *Retaining walls, th pressure, Earth movements, Saturated soils, e loads, Soil pressure, Dry condition, *Pres- distribution, Deflection, Vertical loads, zontal loads, Foundations, Pressure gages.
ifiers: *Loading tests, Test results, Compres- stress, Coulomb Theory, Arch action, At rest ure, Surcharge.

es were made to clarify the problem of pres- on a retaining wall, with dry and saturated ill, with varying distances from the load to the and with deflection of the wall. The conclu- made from analysis of the tests are reported. curves differ from theoretical computed s for submerged soil. Water has little effect on ape of the pressure diagram. The increase in ure caused by full uniform live load harge) is 20-30% higher than the theoretical mb value with allowance for wall friction. effect of surcharge is not uniform for the t of the wall, but depends on the height of the he angle of influence of the surcharge at a ce from the wall is less than the angle of nse for dry and saturated fill. Surcharge be- the prism of rupture relieves pressure on the Action of a full uniform surcharge on a wall ases as the wall is shifted away from the fill; ressure intensity drops mostly at the lower f the wall, where pressure generally increases lowly with increased surcharge. (USBR)
04740

E ASPECTS OF DESIGN AND CONSTRUC- OF EARTH AND ROCKFILL DAMS IN A,
Yakovlev.
r Resour J, pp 1-16, Sept 1968. 19 p, 9 fig, 5

Descriptors: *Earth dams, Dam design, *Rockfill dams, Riprap, Drainage systems, Cutoff trenches, Cutoffs, Slope stability, Permeability, Cores, Impervious materials, *Foreign design practices, Slope protection, Dams, Foreign construction, Internal friction, Seepage, Cohesion.
Identifiers: Earthquake zones, Construction methods, Seepage control, India.

Design and construction practices for earth and rockfill dams in India are illustrated by 15 example dams, some still under construction. Ten are earth, 2 are composite, and 3 are rockfill dams; heights vary from 15 to 225 m and embankment volumes from 2 to 32 million cu m. Ten dams are located in seismic intensity areas of VII to IX on the modified Mercalli Scale. Most of the dams have an impervious clay core with a coefficient of permeability of the order of 1 to 0.01 ft/yr. The core forms 40 to 70% of the dam's cross-sectional area. Depth of cutoff trenches ranges from 15 to 46% of the dam height and the bottom width ranges from 20 to 50% of the height. Most existing dams have a downstream horizontal filter blanket with a toe drain. Some of the more recent dams have a vertical or inclined filter running almost throughout the height of the dam. Many of the dams are subjected to annual reservoir drawdowns (up to 80% of the dam height). Hand-placed rock riprap is widely used in India for protecting the upstream slope against wave action and scour. Technical features of the dams are given in a table; cross sections of 9 dams are included. (USBR)
W69-04742

INSTRUMENT FOR MEASURING SOIL DEFORMATIONS IN DEPTH,
B. N. Mel'nikov, and V. B. Shvetsov.
Soil Mech Found Eng, No 1, pp 19-21, Jan-Feb 1968. 3 p, 3 fig, 10 ref.

Descriptors: *Instrumentation, *Measuring instruments, Soil mechanics, *Settlement, *Deformation, Embankments, Foreign research, Earth dams, Boreholes, Sensors, Ammeters, Potentiometers, Recording systems.
Identifiers: Deformation meters, *Borehole deformation gage, USSR, Foreign testing.

Soil deformation in depth can be measured with an instrument that does not have a permanent mechanical connection with the ground surface. The instrument consists of 3 basic parts: sensor, display unit, and markers. The sensor is a resonance circuit with all elements sealed in an airtight, 15-mm-dia capsule of dielectric material. The display unit is mounted in a metal housing on the face panel containing a microammeter, potentiometers, tumbler switches, and a manual control level. Markers are 60-mm-dia and 4-6-mm-high continuous rings containing thrust springs for firm attachment to the soil. To measure soil deformation, the sensor is lowered into a borehole along a guide tube of a dielectric material on a special measuring tape. When the sensor passes through a marker ring containing a short-circuit coil, a maximum change in current is recorded by the microammeter. Soil deformation at a given depth is then determined by relating to a fixed surface benchmark. The instrument may be used as a portable unit when measuring soil deformation in various boreholes. Measurement accuracy is 1 mm. The technique used to place markers is described. (USBR)
W69-04746

SOIL DENSITY MEASUREMENTS WITH GAMMA-RAYS,
University of Strathclyde, Glasgow (Scotland).
E. Pirie, K. Lin, and D. Taylor.
Soil Sci, Vol 106, No 6, pp 411-414, Dec 1968. 4 p, 4 fig, 1 tab, 6 ref.

Descriptors: *Nuclear meters, *Soil density, *Gamma rays, Attenuation, *Gages, Soil mechanics, *Measuring instruments, Detectors, Calibrations, Soil physical properties, *Soil density probes, Nuclear meters, Energy, Radiation.
Identifiers: *Nuclear density meters, Compton scattering, Nuclear radiation, Backscattering.

The use of a gamma-radiation backscatter gage to measure soil density was studied. When the energy of backscattered radiation falls below 0.5 Mev, a soil-type effect occurs. This effect is a shift of the counting rate versus the density characteristic according to the mean value of the atomic number. The soil-type effect is substantially reduced by restricting the scattering angle to less than 90 deg, instead of allowing scattering angles up to 180 deg as in the conventional instrument. The maximum counting rate is obtained at some specific density equal to 16 divided by d, the source-detector distance. This formula may be used in choosing the appropriate geometry to cover any specific range of densities. An instrument with a variable source-detector separation and an adjustment for maximum response could be calibrated to read the density as a function of the separation d, independent of the type of material being tested. A calibration curve would not be required and instrument performance would be largely independent of various instabilities. (USBR)
W69-04747

8E. Rock Mechanics and Geology

AN ENERGY CRITERION FOR THE STRENGTH OF ROCK IN POLYAXIAL COMPRESSION,
Chamber of Mines, Johannesburg (South Africa).
G. A. Wiebols, and N. G. W. Cook.
Int J Rock Mech Mining Sci, Vol 5, No 6, pp 529-549, Nov 1968. 21 p, 24 fig, 14 ref, 3 append.

Descriptors: *Rock mechanics, Rock properties, Stress analysis, *Shear strain, Shear strength, *Compressive strength, Strength of materials, Triaxial compression, Triaxial shear, Mohr circle, Biaxial compression, Biaxial stress, Unconfined compression, Cracks.
Identifiers: Stress energy, *Strain energy, Triaxial tests, *Sliding friction, Foreign testing, South Africa, Griffith theory.

Rock strength is generally accepted as being influenced by the presence of flaws, usually known as Griffith cracks. Various criteria of strength fail to describe adequately the strength of rock under a general system of polyaxial compressive stresses. In particular, no account is taken of intermediate stress. Various strength criteria usually attribute the onset of failure to cracks at a particular orientation. A new criterion is proposed for rock strength, based on the additional energy stored around Griffith cracks caused by the sliding of crack surfaces over each other. Strength predictions based on this concept agree with the acknowledged behavior of rock under uniaxial and triaxial stress systems. Under polyaxial compression, intermediate stress has a pronounced and predictable effect. Cracks over a wide range of orientations contribute to the failure process; the limits are determined solely by the coefficient of sliding friction between crack surfaces. Polyaxial compressive strength of a rock can be predicted from uniaxial strength and the coefficient of sliding friction between crack surfaces. (USBR)
W69-04711

STATIC AND KINEMATIC CONDITIONS OF THE STABILITY OF JOINTED AND FISSURED ROCKY FOUNDATIONS OF ARCH DAMS,
Ljubljana Univ. (Yugoslavia).
J. Drnovsek.
J Int Soc Rock Mech, Vol 6, No 3, pp 126-132, 1968. 7 p, 2 fig, 4 tab, 2 ref.

Descriptors: Damsites, *Dam foundations, *Arch dams, Foundation rocks, Fissures (Geology), Joints (Geology), Foundations, *Stability analysis, Kinetics, Rigid foundations, Sliding, Equilibrium, Moments, Foreign design practices, Stress analysis, *Rock foundations, *Rock mechanics, Three-dimensional.

Identifiers: Static behavior, Sliding block mechanism, Yugoslavia, Mratinje Dam (Yugoslavia), Rock interfaces, Sliding friction.

A 3-dimensional stability analysis is presented for jointed and fissured rock foundations of arch dams. Polyhedral slip blocks with sides following the main joints or fissures are treated as rigid static systems. All 6 equilibrium conditions are used to get reaction forces on the block boundaries; these are necessary for checking assumed displacements and possible distribution of reactive forces along main joints. The supernumerary unknown components of the reaction forces and the vectors of their application points are eliminated by appropriate assumptions according to kinematic conditions. The necessity for considering moment equilibrium conditions is proven. The method is interpreted by application to the analysis of the rock foundation of the 200-m-high Mratinje arch dam in the Piva Valley of Yugoslavia. (USBR)
W69-04713

THERMAL INFRARED IMAGERY FOR GEOLOGISTS,
Chevron Research Co., La Habra, Calif.
For primary bibliographic entry see Field 07B.
W69-04745

8F. Concrete

FATIGUE TESTS OF REINFORCING BARS--EFFECT OF DEFORMATION PATTERN,
Portland Cement Association, Skokie, Ill.
John M. Hanson, Kenneth T. Burton, and Eivind Hognestad.
J Portland Cem Ass, Vol 10, No 3, pp 2-13, Sept 1968. 12 p, 9 fig, 2 tab, 29 ref.

Descriptors: *Reinforcing steel, *Reinforced concrete, Deformation, Fatigue (Mechanics), *Deformed bars, Concrete technology, Strength of materials, Concrete testing, Laboratory tests, Beams (Structural), Structural design, Bibliographies.
Identifiers: *Fatigue tests.

Results of fatigue tests are reported on concrete beams reinforced with No. 8 American- and European-made reinforcing bars. The American-made bars had cresent-shaped transverse lugs that did not merge into the longitudinal ribs. The European-made bars had inclined transverse lugs that did not merge into helical longitudinal ribs. Test results indicate that orientation of longitudinal ribs has little effect on the fatigue strength of reinforcing bars. The fatigue strengths are comparable to those of several different types of American-made bars with transverse lugs that merge into the longitudinal ribs. Geometry at the base of the lug has a significant influence on the fatigue strength. (USBR)
W69-04706

A REVIEW OF FIBER REINFORCEMENT OF PORTLAND CEMENT PASTE, MORTAR, AND CONCRETE,
Portland Cement Association, Skokie, Ill.
G. E. Monfore.
J Portland Cem Ass, Vol 10, No 3, pp 43-49, Sept 1968. 7 p, 7 fig, 7 tab, 12 ref.

Descriptors: *Reinforced concrete, Reinforcement, Reinforcing, Mortar, Reinforcing steel, Plastics, *Glass fibers, Portland cements, *Fibers, Concrete technology, Asbestos cement, *Composite materials, Materials engineering, Nylon.
Identifiers: Concrete products, Cement paste, *Reinforcing materials.

The development of fiber-reinforced portland cement paste, mortar, and concrete is reviewed. Reinforcing fibers under investigation include asbestos, glass, plastics, and steel. Asbestos fibers have been successfully combined with portland cement paste to form asbestos-cement products. The possibility of increasing the efficiency of asbestos fiber reinforcement by increasing the extensibility of portland cement paste appears remote. Glass fibers are under investigation in the development of a glass-fiber portland cement product comparable to asbestos-cement. Plastic fibers may be useful as energy absorbers in concrete subject to explosive loading. Because of the cost, using steel fibers in concrete will probably be limited to special applications where conventional reinforcement is not satisfactory. (USBR)
W69-04708

THE EFFECT OF MIX PROPORTIONS AND AGGREGATE DUST UPON THE COMPRESSIVE STRENGTH OF CONCRETE,
Birmingham Univ. (England).
B. P. Hughes, and J. E. Ash.
Mag Concr Res, Vol 20, No 63, pp 77-84, June 1968. 8 p, 7 fig, 3 tab, 6 ref.

Descriptors: *Concrete mixes, Concretes, *Concrete technology, *Fines, Concrete testing, Aggregates, *Fine aggregates, Shrinkage, *Compressive strength, Sands, Dusts, Water-cement ratio, Foreign research.
Identifiers: Concrete properties, *Aggregate cement ratio, *Cement content, Cement paste, Water content, Foreign testing, Great Britain.

The compressive strength of concrete at a constant cement-water ratio decreases with increasing cement content. The strength decrease is generally quite small, especially for uniaxial compressive strength. Two exceptions are possible, depending on sand content: (1) at high sand contents, a critical maximum sand-cement ratio is exceeded so that air voids become unavoidable and the strength decreases with decreasing cement content; and (2) at low sand contents, a critical minimum sand-cement ratio is not attained and large strength losses occur with increasing cement contents. A critical minimum sand-cement ratio exists because of extensive water gain and lack of adequate shrinkage restraint of the cement paste; the value depends upon the type and grading of the aggregate and mix proportions. These effects should be avoided in normal concrete. Dust in fine aggregates can be beneficial for low-strength concrete because of modifications of the cement past structure and reduction of water gain, but has little effect on high-strength concrete. (USBR)
W69-04715

A STUDY OF DEPASSIVATION OF STEEL IN CONCRETE,
Bureau of Reclamation, Denver, Colo.
L. O. Timblin, and T. E. Backstrom.
Pap, 25th Annu Meet Nat Ass Corros Eng, Houston, Tex, Mar 1969. 39 p, 7 fig, 1 tab, 14 ref.

Descriptors: *Corrosion, *Corrosion control, Concrete technology, Reinforced concrete, Prestressed concrete, Thin films, Electrolytes, *Chlorides, Slurries, Cements, Alkalinity, Solutions, Sulfates, Steel, Interfaces, *Reinforcing steel.
Identifiers: Concrete properties, Ion concentration, Corrosion tests, Activation, *Passivity, Corrosion inhibitors, Electrochemical corrosion.

Corrosion of steel embedded in concrete occurs when the passivating conditions normally protecting embedded steel are changed sufficiently to permit activation of the steel. One factor greatly influencing the activation process is the chloride ion. This study was made on the mechanism of passivation and depassivation of steel in a simulated concrete environment under the controlling influence of the chloride ion. Tests were performed to determine whether (1) passivated steel tends to maintain passivity when exposed to a nonpassivating environment, (2) chloride ions tend to accelerate depassivation of steel, or (3) film formation is retarded by the presence of chloride. Results indicated that: (1) depassivation of steel occurs quickly after removal of the passivating environment; (2) chloride accelerates film breakdown in the case of a passivated specimen and aids in establishing active corrosion cells in unpassiva
speciments; and (3) the presence of 0.0
chloride in normally passivating solutions of s
rated calcium hydroxide is sufficient to prev
passivation of steel, and corrosion can occur (s
ject to local conditions) at chloride concentrati
as low as 0.02M. (USBR)
W69-04725

**STRENGTH OF JOINTS AND JOINT ASSE
BLIES OF REINFORCED CONCRETE MULT
TORY FRAMES UNDER LOADS OF T
SEISMIC TYPE,**
S. P. Vasil'ev, Iu D. Bychenkov, and Iu E. Tiablikov.
Transl from Russ, Bur Reclam Transl 683, 1969. 17 p, 6 fig, 2 tab, 1 ref. Beton I Zhelezbet No 8, pp 2-7, 1968.

Descriptors: Joint fillers, *Reinforced concr
*Continuous frames, *Joints, Buildings, Conti
ous structures, Compression, *Seismic des
Columns, Reinforcing steel, Seismic studies, W
ing, Shear tests, Shear, Foreign design practi
Laboratory tests, Eccentric loading, Stren
Stress, Shear failures.
Identifiers: *Dynamic loads, *Multistory buildi
Destructive tests, USSR, *Cyclic loads, Earthqu
loads, Seismic stability.

The USSR Scientific-Research Institute for R
forced Concrete investigated the seismic stren
of several types of joint assemblies with continu
joints between precast columns and cross be
under cyclic loads with P min/P max = 0.1. S
cially constructed test joint assemblies, consis
of stub columns and cantilevered beams
welded reinforcement (with and without bracke
were tested to failure under eccentric compres
and compression with shearing force. Some ty
had ferrocement centerplates, some had steel c
tering pipes, and some had no centering c
ponent. Tables give full data on tests and natur
failure. Monolithized column joints (joints grou
with mortar and exposed ends of reinforcem
welded) for multistory buildings have adeq
strength and are recommended for seismic ar
but they must be located away from the con
edge of the joint assembly to reduce bending
ments. The tested joint-assembly designs, exc
Series IV, can be used for multistory buildings,
in seismic areas semiautomatic welding of r
forcement in copper and graphite forms
generally recommended, although several h
welding processes may be used under special c
ditions. (USBR)
W69-04735

8G. Materials

POLYAMIDE-IMIDE INSULATION VARNISH
Sumitomo Electric Industries Ltd., Osaka, (Jap
Shigeru Matsumura, Nobuyuki Asano, and Masahiro Izumi.
Sumitomo Elec Tech Rev, No 11, pp 43-48, 1968. 6 p, 14 fig, 2 tab.

Descriptors: *Electric insulation, *Varnis
Coatings, Impregnation, Solvents, Visco
Resins, Films, Electrical properties, Electr
equipment, Heat resistance, Electrical resista
Tensile strength, Flexural strength.
Identifiers: *Electrical insulation tests, Shelf
Test results, Japan, Foreign products, Elec
machinery, Bond strength.

Properties of a new electrical insulating varnish
described. This newly developed polyamide-in
varnish for coil impregnation is better than Cla
varnish for electrical machinery and appara
Test results of general properties of the varn
baking conditions, storage stability or shelf
bond and tensile strength, flexural strength,
electrical characteristics are compared with o
types of varnishes such as polyimide, silicone,
diphenyl oxide. This varnish will produce f
0.035-mm thick with one application and bakin

at-resistant, and has well-balanced properties.
SBR)
69-04719

. Fisheries Engineering

STRUCTING AND PREVENTING FISH OM RUNNING UP RIVERS OR CREEKS; ISONING STREAM OR USING EXPLOSIVES CATCH FISH.
r primary bibliographic entry see Field 06E
69-04871

. MANPOWER, GRANTS AND FACILITIES

. Grants, Contracts, and Research Act Allotments

DERAL ASSISTANCE IN OUTDOOR CREATION.

rnal of Soil and Water Conservation, Vol 18, 2, March/April, 1963, pp 57-60.

scriptors: *Recreation, *Government supports, nd management, *Cost sharing, *Credit, leral government, Recreation, Governments, creation demand, Management.

dit, cost sharing, technical, educational, or earch help in outdoor recreation is offered to es and their political subdivisions to organiza-s, and to individuals by a number of federal ncies. Summaries of the various assistance pro-ms available are given in this article.
9-04989

NUAL REPORT, FISCAL YEAR 1968,
o State Univ., Columbus. Water Resources ter.
. Hanna, Jr.
nual Report to Office of Water Resources earch, September 1, 1968. 118 p.

criptors: *Ohio, *Programs, Acid mine water, at Lakes, *Lake Erie, Eutrophication, Ground er, Hydrology, Small watersheds, Water quality, ae, Phosphates, Economics, Recreation de-nd, Taxes, Appalachia.

nt current allotment projects and seven ching grants projects are described. A strong ntation of the Center's activities toward the blems of water quality in Lake Erie is evidenced these projects. Four biological projects were designed to fill critical gaps in the available knowledge pertaining to chemical, physical and biological phenomena in Western Lake Erie and its tributary streams. Two projects involving the economics of the area also provides the broadening of our involvement in the Lake Erie basin. Two projects, associated with the Center's earlier emphasis on acid mine drainage, remain. Three hydrological projects are also included; one dealing with characteristics of small watersheds, the other two relating to ground-water flows. Completion of a study on strontium isotope and trace-element concentrations in Lake Huron is also reported. A sociological study is also underway to examine community reactions to water problems in relation to planning.
W69-05160

10. SCIENTIFIC AND TECHNICAL INFORMATION

FLUID DYNAMICS,
Clarkson Coll. of Technology, Potsdam, N. Y.; Rensselaer Polytechnic Inst., Troy, N. Y.
For primary bibliographic entry see Field 08B.
W69-04701

EVAPOTRANSPIRATION-REVIEW OF RESEARCH,
Nebraska Univ., Lincoln. Dept. of Horticulture and Forestry.
For primary bibliographic entry see Field 02D.
W69-04764

ALGAL GROWTH AQUEOUS FACTORS OTHER THAN NITROGEN AND PHOSPHORUS,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio.
For primary bibliographic entry see Field 05C.
W69-04801

NITROGEN AND PHOSPHORUS IN WATER; AN ANNOTATED BIBLIOGRAPHY OF THEIR BIOLOGICAL EFFECTS.
Public Health Service, Washington, D. C.
For primary bibliographic entry see Field 05C.
W69-04805

THERMAL DISCHARGE BIBLIOGRAPHY,
State Univ. of New York, Albany. Atmospheric Sciences Research Center.
For primary bibliographic entry see Field 05B.
W69-04937

DOCUMENTATION: INFORMATION AND INSTRUCTION CONCERNING THE PROBLEMS OF WATER,
Centre Francais d'Information de l'Eau.
R. Colas.
For the 8 Volume Proceedings, see Vol 2, No 9, Field 06B and W69-03305. Int Conf on Water for Peace, Wash, D C, Vol 4, pp 458-461, 1967. 4 p.

Descriptors: *Documentation, *Data storage and retrieval, *Information retrieval, Publications, Classification, Automation, Technical writing, Bibliographies, Translations, International commissions.
Identifiers: *Indexing data, France, Centre Francais d'Information de l'Eau.

In spite of the large amount of published material on water already gathered and currently being published at an accelerating rate, its very usefulness will be impaired unless the organization and methods of use are revised or changed. In France, a permanent office has been created for the study of the problems of water and in 1959, an organization was established, the 'Centre Francais d'Information de l'Eau' (CEFIE). This organization has concluded that as soon as possible an automatic system should be applied to documentation and that for this purpose the system of key words is indispensable for the indexing, classification, and utilization of documents. Consequently the 'thesaurus' method has been tried out in France and will be ready for use by the middle of 1967. An international organization is suggested having the mission of classifying the abundant documentation on all aspects of water; this might bring some order in storage and retrieval of current pertinent information on water and help avoid prejudicial confusion in the development of the science and technology of water. (Vorhis-USGS)
W69-04940

A BIBLIOGRAPHY ON PERIPHYTON,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Div. of Pollution Surveillance.
Cornelius I. Weber.
(Processed Document) Div Pollution Surveillance, Federal Water Pollution Control Admin, Washington, D.C. 246 ref.

Descriptors: *Bibliographies, *Periphyton, Benthos, Estuaries, Lakes, Ecology, Ecosystems, Microbiology, Microorganisms, Rivers, Streams.

This bibliography includes 246 citations of reports published between 1902 and 1966. of which 112 appeared during the period 1960–1966. The list contains all references in the compiler's file which deal directly with microflora, microfauna, and fungi that are found attached to natural or artificial substrates or are associated with these attached communities in lakes, streams, and estuarine habitats. Author states that list may be incomplete, and he desires to be made aware of omissions. (Eichhorn-Wisconsin)
W69-05140

SUBJECT INDEX

OLUTE PROPERTY DOCTRINE
URRENT TRENDS IN WISCONSIN'S WATER LAW,
9-05161 06E

CLERATION OF FLOW
RSON V REMEIKIS (ACCELERATION AND DIVERSION OF NATURAL
AINAGE RELATIVE RIGHTS).
9-04917 06E

OF GOD
DDLE V BALTIMORE AND OHIO (FLOOD DAMAGE CAUSED BY
ADEQUATE CULVERT).
9-05191 04A

OF GOD
TLE V PENNSYLVANIA RR (BRIDGE CONSTRUCTION AND OBSTRUCTION
FLOW).
9-04880 06E

RKHARDT V ROCKY (DEPOSIT OF DEBRIS IN STREAMS - OVERFLOW).
9-04912 06E

CENT LAND
RSON V REMEIKIS (ACCELERATION AND DIVERSION OF NATURAL
AINAGE RELATIVE RIGHTS).
9-04917 06E

NISTRATION
TER RESEARCH,
9-05115 06B

ONOMICS AND FINANCE OF WATER DEVELOPMENT IN ALBERTA,
NADA,
9-05122 06B

NISTRATIVE AGENCIES
NPOWER PROBLEMS IN WATER SUPPLY ORGANIZATION,
9-04779 06E

NISTRATIVE DECISIONS
ROUGH OF COLLEGEVILLE V PHILADELPHIA SUBURAN WATER CO
OMINISTRATIVE REMEDIES FOR WATER DIVERSION).
9-05198 06E

TION OF PRACTICES
HIEVING PUBLIC ACCEPTANCE OF A RIVER BASIN PLAN,
9-04861 06B

AL PHOTOGRAPHS
ASUREMENT OF THE ABUNDANCE OF FRACTURE TRACES ON AERIAL
OTOGRAPHS,
9-04987 02F

AL RECONNAISSANCE
ERMAL INFRARED IMAGERY FOR GEOLOGISTS,
9-04745 07B

EGATE CEMENT RATIO
EFFECT OF MIX PROPORTIONS AND AGGREGATE DUST UPON THE
MPRESSIVE STRENGTH OF CONCRETE,
9-04715 08F

EGATE PLANNING DECISION
DRATIC TEAMS, INFORMATION ECONOMICS, AND AGGREGATE
NNING DECISIONS,
-04843 06B

ULTURE
GENERAL DEVELOPMENT PLAN FOR THE ALBEMARLE REGION.
-04995 06B

EMPERATURE
LUENCE OF SOIL TEMPERATURE ON TRANSPIRATION UNDER VARIOUS
IRONMENTAL CONDITIONS,
-05099 02D

RME SURVEYING
ERMAL INFRARED IMAGERY FOR GEOLOGISTS,
-04745 07B

MA
BER PURE MILK CO V YOUNG (OBSTRUCTION OF SURFACE WATER
W).
-04863 06E

TRUCTING AND PREVENTING FISH FROM RUNNING UP RIVERS OR
EKS POISONING STREAM OR USING EXPLOSIVES TO CATCH FISH.
-04871 06E

TGOMERY LIMESTONE CO V BEARDEN (ACTION TO ENJOIN
LUTION OF A STREAM BY QUARRY OPERATION).
-04911 06E

MMOND V FRANK (OBSTRUCTION OF SURFACE FLOW).
-05200 04A

A
FUTURE OF ALASKA,
-05047 06B

O
, ALLWAVE RADIATION AS AN INDEX OF NATURAL SNOWMELT AND
WMELT ACCELERATED WITH ALBEDO REDUCING MATERIALS,
-05103 02C

TRIBUTION, ENVIRONMENTAL REQUIREMENTS AND SIGNIFICANCE OF
CLADOPHORA IN THE GREAT LAKES,
W69-04798 02H

ALGAL GROWTH AQUEOUS FACTORS OTHER THAN NITROGEN AND
PHOSPHORUS,
W69-04801 05C

MINERAL REQUIREMENTS FOR THE GROWTH OF ANABAENA SPIROIDES IN
VITRO,
W69-04802 05C

THE MECHANISM OF PHOTOSYNTHETIC USE OF BICARBONATE BY
HYDRODICTYON AFRICANUM,
W69-04803 02K

ALGAL CONTROL
DISTRIBUTION, ENVIRONMENTAL REQUIREMENTS AND SIGNIFICANCE OF
CLADOPHORA IN THE GREAT LAKES,
W69-04798 02H

ALKALINE WATER
ORIGIN OF THE CHEMICAL COMPOSITIONS OF SOME SPRINGS AND
LAKES,
W69-04969 02K

ALLUVIAL CHANNELS
HYDROGRAPHICAL INVESTIGATION OF THE BRAHMAPUTRA RIVER IN
EAST PAKISTAN,
W69-04752 02E

LOCALIZED SCOUR IN ERODIBLE-BED CHANNELS,
W69-04788 02J

ALTERATION OF FLOW
LABRUZZO V ATLANTIC DREDGING CONSTRUCTION CO (EXCAVATION
DIVERTING UNDERGROUND WATERS).
W69-04910 06E

CONGDON V PIONEER CITY COAL CO (RAINWATER RUNOFF).
W69-04913 06E

NASS V TOWN OF DUXBURY (DIVERSION OF FLOW BY CHANNEL
OBSTRUCTION).
W69-05197 04A

AMERICAN RULE
UNITED FUEL GAS CO V SAWYERS (WELL POLLUTION THROUGH
PERCOLATING WATERS).
W69-05187 05B

ANALYTICAL TECHNIQUES
MINERAL REQUIREMENTS FOR THE GROWTH OF ANABAENA SPIROIDES IN
VITRO,
W69-04802 05C

ORGANIC POLLUTION OF NEW YORK HARBOR APPLICATION,
W69-05026 05B

ANCHORS
SHORING FOR THE SEATTLE FIRST NATIONAL BANK BUILDING,
SEATTLE, WASHINGTON,
W69-04721 08D

ANIMAL WASTES
FAIRES V DUPREE (WATER POLLUTION FROM ANIMAL WASTES).
W69-05182 05B

APPALACHIAN MOUNTAIN REGION
IMPROVED EVALUATION PROCEDURES IN APPALACHIAN WATER RESOURCE
PLANNING,
W69-04817 06B

APPALACHIAN REGIONAL DEVELOPMENT ACT OF 1965
IMPROVED EVALUATION PROCEDURES IN APPALACHIAN WATER RESOURCE
PLANNING,
W69-04817 06B

APPLIED CLIMATOLOGY
CLIMATOLOGY OF SEVERE WINTER STORMS IN ILLINOIS,
W69-05159 02B

APPROPRIATION
BOROUGH OF COLLEGEVILLE V PHILADELPHIA SUBURAN WATER CO
(ADMINISTRATIVE REMEDIES FOR WATER DIVERSION).
W69-05198 06E

APPROPRIATIVE RIGHTS
WATER LAW AND PRIVATE DECISION MAKING A CRITIQUE,
W69-04839 06B

AQUATIC HABITATS
INSHORE MARINE CONSERVATION,
W69-05044 02L

AQUATIC PRODUCTIVITY
EFFECTS OF CIVILIZATION ON STRIPED BASS AND OTHER ESTUARINE
BIOTA IN CHESAPEAKE BAY AND TRIBUTARIES,
W69-05021 05C

AQUATIC WEED CONTROL
CONTROL OF SUBMERSED AQUATIC WEEDS IN IRRIGATION CANALS BY
DAILY APPLICATIONS OF LOW CONCENTRATIONS OF COPPER SULFATE,
W69-04729 04A

AQUATIC PLANT NUISANCES,
W69-05043 04A

AQUATIC WEEDS
AQUATIC PLANT NUISANCES,
W69-05043 04A

AQUEOUS SOLUTIONS
APPLICATION AND LIMITATIONS OF CHEMICAL THERMODYNAMICS IN NATURAL WATER SYSTEMS,
W69-04770 02K

MASTER VARIABLES AND ACTIVITY SCALES,
W69-04963 02K

GIBBS PHASE RULE AND MARINE SEDIMENTS,
W69-04964 02K

AQUICLUDES
THEORETICAL FRAMEWORK FOR ASCERTAINING PORE WATER PRESSURE IN CONFINING LAYERS IN THE VICINITY OF A PUMPING WELL,
W69-04767 02F

AQUIFERS
SURFACE AND SUBTERRANEAN HYDROLOGY IN ITS APPLICATION TO THE STUDY OF THE MODAVE KARSTIC AQUIFER IN BELGIUM (FRENCH),
W69-04762 02E

RATIO METHOD FOR DETERMINING CHARACTERISTICS OF IDEAL, LEAKY, AND BOUNDED AQUIFERS,
W69-04763 02F

INFLUENCE OF THE SOUTH SASKATCHEWAN RESERVOIR (CANADA) ON PIEZOMETRIC LEVELS IN UNDERLYING BEDROCK AQUIFERS,
W69-04774 02F

FURTHER STUDY OF AQUIFER PERFORMANCE,
W69-05149 02A

ARCH DAMS
ANALYSIS OF THE FAILURE OF BRITTLE MODELS OF ARCH DAMS,
W69-04710 08A

STATIC AND KINEMATIC CONDITIONS OF THE STABILITY OF JOINTED AND FISSURED ROCKY FOUNDATIONS OF ARCH DAMS,
W69-04713 08E

THE MOSSYROCK DEVELOPMENT,
W69-04737 08A

ARCTIC OCEAN
CAN WE CONTROL THE ARCTIC CLIMATE,
W69-04790 04A

ARID LANDS
PROSPECTS OF DESALINATION FOR SOLVING WATER PROBLEMS ON THE MAKRAN COAST,
W69-04776 03A

CAN WE CONTROL THE ARCTIC CLIMATE,
W69-04790 04A

ARIZONA
THE POLITICS OF WATER IN ARIZONA,
W69-05112 06E

ARKANSAS
SPARTAN DRILLING CO V BULL (INJUNCTION TO CURE SALT WATER POLLUTION AND INSECT BREEDING).
W69-04914 06E

DE VORE FARMS V BUTLER HUNTING CLUB (DAMS AND OBSTRUCTION TO FLOW).
W69-04916 06E

BEDDMANN V BEDDMANN (OBSTRUCTION TO SURFACE WATER FLOW).
W69-05174 06E

FAIRES V DUPREE (WATER POLLUTION FROM ANIMAL WASTES).
W69-05182 05B

ARTIFICIAL DRAINAGE COURSE
LIBBY, MCNEIL AND LIBBY V ROBERTS (INTERFERENCE WITH NATURAL DRAINAGE COURSE).
W69-04872 06E

ARTIFICIAL PRECIPITATION
A LOW INTENSITY RAIN SIMULATOR FOR LONG DURATION RAIN-ON-SNOW EVENTS,
W69-04939 02B

ASSOCIATION INDEX
PERPETUAL SUCCESSION OF STREAM-CHANNEL VEGETATION IN A SEMIARID REGION,
W69-05080 02D

BACKGROUND INFORMATION
BASIC DATA FOR WATER PROGRAMMES SOCIAL AND ECONOMIC CHARACTERISTICS FOR WATER PROGRAMMES.
W69-04842 06B

BALANCED ROAD BUDGET
ROAD PRICING, SOME TECHNICAL ASPECTS,
W69-04817 06C

BANK PROTECTION
CONTROLLING SOIL MOVEMENT FROM STEEP ROAD FILLS,
W69-05175 04A

BASE FLOW
TWO METHODS OF ESTIMATING BASE FLOW AT UNGAGED STREAM SITES IN KANSAS AND ADJACENT STATES,
W69-04779 02E

CHARACTERISTICS OF SUMMER BASE FLOW OF THE POTOMAC RIVER,
W69-04981 02E

BASINS
SEDIMENTARY HISTORY AND ECONOMIC GEOLOGY OF SAN JUAN BASIN, NEW MEXICO AND COLORADO,
W69-04948 05E

BAYESIAN ANALYSIS
BAYESIAN ANALYSIS OF HAAVELMO'S MODELS,
W69-04842 06A

BAYS
WATER BALANCE OF LAKE AFFECTED BY SEA (FRENCH),
W69-04960 02H

SPORT FISHING SURVEY OF THE LOWER POTOMAC ESTUARY,
W69-04992 02L

CHESAPEAKE COUNTRY,
W69-05010 06G

ECONOMIC IMPACT OF NARRAGANSETT BAY,
W69-05048 06B

BEANS
DETERMINATION OF THE REGIONAL COEFFICIENT 'K' FOR COMPUTING THE CONSUMPTIVE USE OF NATIVE BLACK KIDNEY BEAN IN THE IRRIGATION DISTRICTS OF VERACRUZ STATE,
W69-05086 02I

BED LOAD
BED-MATERIAL MOVEMENT, MIDDLE FORK EEL RIVER, CALIFORNIA,
W69-04980 02J

BEDS
A GUIDE TO THE CONSERVATION OF SHORELINES, SUBMERGED BOTTOMS AND SALTWATERS WITH SPECIAL REFERENCE TO BULKHEAD LINES, DREDGING AND FILLING,
W69-05068 04A

BENEFICIAL USE
CULTIVATING FISH FOR FOOD AND SPORT IN POWER-STATION WATER,
W69-05006 05C

BENEFITS
IMPROVED EVALUATION PROCEDURES IN APPALACHIAN WATER RESOURCE PLANNING,
W69-04817 06B

THE ROLE OF ECONOMICS IN PLAN FORMULATION,
W69-04835 06B

FISCHER V TOWN OF ALBIN (TOWN MAY NOT ALTER DRAINAGE DISTRICT WITHOUT CONSIDERING RIGHTS OF DISTRICT LANDOWNERS
W69-04874 06E

BENTHOS
ECOLOGICAL EFFECTS OF SEWAGE POLLUTION IN BISCAYNE BAY, FLORIDA SEDIMENTS AND THE DISTRIBUTION OF BENTHIC AND FOULING MACRO-ORGANISMS,
W69-05030 05C

BIAS
NOTE ON THE UNBIASEDNESS OF A MIXED REGRESSION ESTIMATOR,
W69-04845 06A

BIBLIOGRAPHIES
EVAPOTRANSPIRATION-REVIEW OF RESEARCH,
W69-04764 02D

ALGAL GROWTH AQUEOUS FACTORS OTHER THAN NITROGEN AND PHOSPHORUS,
W69-04801 05C

NITROGEN AND PHOSPHORUS IN WATER AN ANNOTATED BIBLIOGRAPH OF THEIR BIOLOGICAL EFFECTS.
W69-04805 05C

THERMAL DISCHARGE BIBLIOGRAPHY,
W69-04937 05B

BENEFIT-COST ANALYSIS AND WATER POLLUTION CONTROL,
W69-04998 05G

THE EFFECTS OF TEMPERATURE AND SALINITY ON MARINE AND BRACKISH WATER ANIMALS--I. TEMPERATURE,
W69-05011 05C

WATER QUALITY CRITERIA, 2ND EDITION,
W69-05028 05G

A BIBLIOGRAPHY ON PERIPHYTON,
W69-05140 10

BICARBONATES
THE MECHANISM OF PHOTOSYNTHETIC USE OF BICARBONATE BY HYDRODICTYON AFRICANUM,
W69-04803 02K

BIOASSAY
MINERAL REQUIREMENTS FOR THE GROWTH OF ANABAENA SPIROIDES IN VITRO,
W69-04802 05C

BIOCHEMICAL OXYGEN DEMAND
WATER QUALITY IN THE POTOMAC ESTUARY,
W69-05027 05G

ORGANIC POLLUTION OF NEW YORK HARBOR - THEORETICAL CONSIDERATIONS,

9-05034 05B

YGEN BALANCE OF AN ESTUARY,
9-05035 05B

HEMISTRY
OLOGICAL ACTIVITY IN RELATION TO THE CHEMICAL EQUILIBRIUM
MPOSITION OF NATURAL WATERS,
9-04974 02K

OGICAL COMMUNITIES
E BIOLOGY OF POLLUTED WATERS,
9-05004 05C

S
TER POLLUTION BY OUTBOARD MOTORS,
9-04936 02H

ES OF WATER
NCES ACROSS WATER NEGLECT, REMEDY.
9-04883 06E

S
URTH CLASS CITIES - SEWER BONDS.
9-04875 06E

ER IRRIGATION
TERMINATION OF THE REGIONAL COEFFICIENT 'K' FOR COMPUTING
E CONSUMPTIVE USE OF NATIVE BLACK KIDNEY BEAN IN THE
RIGATION DISTRICTS OF VERACRUZ STATE,
9-05086 02I

HOLE DEFORMATION GAGE
STRUMENT FOR MEASURING SOIL DEFORMATIONS IN DEPTH,
9-04746 08D

HOLE GEOPHYSICS
GNETIC TAPE RECORDING OF GEOPHYSICAL LOGS,
9-04986 07B

D WATER
TIO METHOD FOR DETERMINING CHARACTERISTICS OF IDEAL,
AKY, AND BOUNDED AQUIFERS,
9-04763 02F

DARIES(PROPERTY)
RE CITY OF NEW YORK (STREAM BEDS).
9-05189 06E

ITE V WOODARD (BOUNDARY LINE ALONG DITCH).
9-05192 06E

DARY CONDITIONS
RTHER STUDY OF AQUIFER PERFORMANCE,
9-05149 02A

DARY DISPUTES
ITE V WOODARD (BOUNDARY LINE ALONG DITCH).
9-05192 06E

KISH WATER
ONOMIC ASPECTS OF SALINE-WATER CONVERSION,
9-05017 03A

KISH-WATER FISH
E EFFECTS OF TEMPERATURE AND SALINITY ON MARINE AND
ACKISH WATER ANIMALS--I. TEMPERATURE,
9-05011 05C

GE DESIGN
TLE V PENNSYLVANIA RR (BRIDGE CONSTRUCTION AND OBSTRUCTION
FLOW).
9-04880 06E

GES
TLE V PENNSYLVANIA RR (BRIDGE CONSTRUCTION AND OBSTRUCTION
FLOW).
9-04880 06E

BARTLETT TREE EXPERT CO V STAMPER (DAMAGES FROM LOGS AND
USH ON RIVER BANK).
9-05169 06E

E DISPOSAL
RO PICKLE CO V MUGGRIDGE (BRINE DISPOSAL POLLUTION BY
ER RIPARIAN OWNER).
9-04857 06E

BARTLETT TREE EXPERT CO V STAMPER (DAMAGES FROM LOGS AND
USH ON RIVER BANK).
9-05169 06E

EN OF PROOF
SS V TOWN OF DUXBURY (DIVERSION OF FLOW BY CHANNEL
STRUCTION).
9-05197 04A

NG
ECTS OF HERBICIDES, BURNING, AND SEEDING DATE IN
EEDING AN ARID RANGE.
9-05082 02A

REOUS SOILS
ECT OF SEAWEED ON THE LEVELS OF AVAILABLE PHOSPHORUS AND
ROGEN IN A CALCAREOUS SOIL,
9-05136 02K

ORNIA
ANNED UTILIZATION OF WATER RESOURCES,
9-04952 02E

SOME EFFECTS OF SEWER EFFLUENT ON MARINE LIFE,
W69-05069 05C

CALORIFIC CONTENT
CALORIFIC VALUES OF SOME INVERTEBRATES IN LAKE MENDOTA,
WISCONSIN,
W69-04799 02H

CANADA
SEDIMENT DATA FOR CANADIAN RIVERS, WATER YEAR 1966.
W69-04766 02J

CANAL LININGS
TENTATIVE DESIGN PROCEDURES FOR RIPRAP-LINED CHANNELS,
W69-04727 08B

CAPILLARY CONDUCTIVITY
CAPILLARY CONDUCTIVITY AND SOIL WATER DIFFUSIVITY VALUES
FROM VERTICAL COLUMNS,
W69-05093 02G

CAPITAL ACCUMULATION
CAPITAL ACCUMULATION AND TECHNICAL PROGRESS (GERMAN),
W69-04847 06B

CAPITAL DEVELOPMENT PROJECTS
WATER AND ECONOMIC DEVELOPMENT.
W69-04825 06B

CAPITAL INVESTMENT
ECONOMICS AND THE CONSERVATION QUESTION,
W69-04841 03B

CARBON DIOXIDE
THE MECHANISM OF PHOTOSYNTHETIC USE OF BICARBONATE BY
HYDRODICTYON AFRICANUM,
W69-04803 02K

CARBONATE ROCKS
HYDROGEOLOGIC SIGNIFICANCE OF CALCIUM-MAGNESIUM RATIOS IN
GROUND WATER FROM CARBONATE ROCKS IN THE LANCASTER
QUADRANGLE, SOUTHEASTERN PENNSYLVANIA,
W69-04985 02F

CARBONATES
THE MECHANISM OF PHOTOSYNTHETIC USE OF BICARBONATE BY
HYDRODICTYON AFRICANUM,
W69-04803 02K

CAVITATION
FLOW AND CAVITATION CHARACTERISTICS OF CONTROL VALVES,
W69-04716 08C

CEMENT CONTENT
THE EFFECT OF MIX PROPORTIONS AND AGGREGATE DUST UPON THE
COMPRESSIVE STRENGTH OF CONCRETE,
W69-04715 08F

CHANNEL DESIGN
TENTATIVE DESIGN PROCEDURES FOR RIPRAP-LINED CHANNELS,
W69-04727 08B

CHANNEL IMPROVEMENT
REVIEW REPORT ON JAMES RIVER, VIRGINIA.
W69-05045 04A

CHANNEL IMPROVEMENTS
PREDICTION OF THE EXTENT OF SALTWATER INTRUSION INTO
ESTUARIES AND SEAS,
W69-04782 02L

CHANNEL MORPHOLOGY
HYDRAULIC GEOMETRY OF ILLINOIS STREAMS,
W69-05153 08B

CHANNEL PROTECTION
TENTATIVE DESIGN PROCEDURES FOR RIPRAP-LINED CHANNELS,
W69-04727 08B

CHANNELS
TENTATIVE DESIGN PROCEDURES FOR RIPRAP-LINED CHANNELS,
W69-04727 08B

PRECONSTRUCTION STUDY OF THE FISHERIES OF THE ESTUARINE
AREAS TRAVERSED BY THE MISSISSIPPI RIVER-GULF OUTLET
PROJECT,
W69-05049 02L

PERPETUAL SUCCESSION OF STREAM CHANNEL VEGETATION IN A
SEMIARID REGION,
W69-05080 02D

CHEMICAL ANALYSIS
TRACE INORGANICS IN WATER,
W69-04962 02K

CHEMICAL METHOD
CHEMICAL MEASUREMENT OF MEAN TEMPERATURE,
W69-04765 07A

CHEMICAL POTENTIAL
AQUEOUS SURFACE CHEMISTRY OF OXIDES AND COMPLEX OXIDE
MINERALS,
W69-04966 02K

CHLORIDES
A STUDY OF DEPASSIVATION OF STEEL IN CONCRETE,
W69-04725 08F

CHLORINATION

A COMPARISON OF THE INACTIVATION OF ESCHERICHIA COLI AND POLIOVIRUS IN POLLUTED AND UNPOLLUTED WATERS BY CHLORINATION,
W69-04778 05D

COOLING WITH SEAWATER,
W69-04999 03C

CITIES
FOURTH CLASS CITIES - SEWER BONDS.
W69-04875 06E

HOME RULE CITIES - BORROWING FOR PUBLIC WORKS.
W69-04876 06E

PUBLIC PARKS - PLAYGROUNDS - JOINT PARKS.
W69-04877 06E

PUBLIC PARKS - PLAYGROUNDS.
W69-04878 06E

HARBORS, WHARVES AND HARBOR MASTERS.
W69-04904 06E

FOURTH CLASS CITIES - GENERAL POWERS OF CITY CORPORATIONS.
W69-04906 06E

CITY CHARTERS
HOME RULE CITIES - BORROWING FOR PUBLIC WORKS.
W69-04876 06E

CIVIL LAW
LIABILITY, AS REGARDS SURFACE WATERS, FOR RAISING SURFACE LEVEL OF LAND,
W69-04873 06E

CLADOPHORA
DISTRIBUTION, ENVIRONMENTAL REQUIREMENTS AND SIGNIFICANCE OF CLADOPHORA IN THE GREAT LAKES,
W69-04798 02H

CLAY PIPES
VANCE V DAVIS (ADJUDICATION OF WATER RIGHTS).
W69-04907 06E

CLIMATIC ZONES
CAN WE CONTROL THE ARCTIC CLIMATE,
W69-04790 04A

CLIMATOLOGY
CAN WE CONTROL THE ARCTIC CLIMATE,
W69-04790 04A

CLOGGING
FACTORS AFFECTING BIOLOGICAL CLOGGING OF SAND ASSOCIATED WITH GROUND WATER RECHARGE,
W69-05075 03C

CLOUD SEEDING
AREAL SPREAD OF THE EFFECT OF CLOUD SEEDING AT THE WHITETOP EXPERIMENT,
W69-04775 03B

COASTS
DISCHARGE OF WASTES INTO THE SEA IN EUROPEAN COASTAL AREAS,
W69-05015 05E

COBB-DOUGLAS FUNCTION
THE INTERPRETATION AND ESTIMATION OF COBB-DOUGLAS FUNCTIONS,
W69-04853 06A

COLORADO
POTENTIAL OF DENVER BASIN FOR DISPOSAL OF LIQUID WASTES,
W69-04947 05E

SEDIMENTARY HISTORY AND ECONOMIC GEOLOGY OF SAN JUAN BASIN, NEW MEXICO AND COLORADO,
W69-04948 05E

COLORADO RIVER BASIN
SOME NEIGHBORHOOD EFFECTS OF OIL-SHALE DEVELOPMENT,
W69-04854 06C

COMMERCIAL FISHING
THE GULF OF MEXICO MENHADEN FISHERY IN RELATION TO THE SPORTS FISHERY,
W69-04996 06B

REPORT ON THE 1961 TRANSPORTATION RESEARCH AND SERVICE ACTIVITIES OF THE BUREAU OF COMMERCIAL FISHERIES,
W69-05001 03E

COMMERCIAL AND SPORT FISHERIES,
W69-05002 03E

THE CONFLICT BETWEEN FISH AND POWER RESOURCES IN THE PACIFIC NORTHWEST,
W69-05024 06B

THE FUTURE OF ALASKA,
W69-05047 06B

PRODUCERS' MARGINS FOR FOOD FISH AND SHELLFISH,
W69-05053 06C

INDUSTRIAL FISHERY TECHNOLOGY,
W69-05054 06B

COMMERCIAL SHELLFISH
RECONSTRUCTION STUDY OF THE FISHERIES OF THE ESTUARINE AREAS TRAVERSED BY THE MISSISSIPPI RIVER-GULF OUTLET PROJECT,
W69-05049 02L

PRODUCERS' MARGINS FOR FOOD FISH AND SHELLFISH,
W69-05053 06C

COMPETING USES
THE GULF OF MEXICO MENHADEN FISHERY IN RELATION TO THE SPORTS FISHERY,
W69-04996 06B

ECONOMIC IMPACT OF NARRAGANSETT BAY,
W69-05048 06B

MUSGROVE V CICCO (MAINTENANCE OF WHARF OVER OBJECTION OF LITTORAL OWNER).
W69-05176 06E

COMPOSITE MATERIALS
A REVIEW OF FIBER REINFORCEMENT OF PORTLAND CEMENT PASTE, MORTAR, AND CONCRETE,
W69-04708 08F

COMPREHENSIVE PLANNING
THE HYDROGEOLOGIST'S RESPONSIBILITY -- METROPOLITAN WATER RESOURCE PLANNING,
W69-05114 06B

COMPRESSIVE STRENGTH
AN ENERGY CRITERION FOR THE STRENGTH OF ROCK IN POLYAXIAL COMPRESSION,
W69-04711 08E

THE EFFECT OF MIX PROPORTIONS AND AGGREGATE DUST UPON THE COMPRESSIVE STRENGTH OF CONCRETE,
W69-04715 08F

COMPUTER MODELS
ESTIMATION OF MAXIMUM DISCHARGES AND HYDROGRAPHS OF FLOOD
W69-04955 02E

COMPUTER PROGRAMS
ELECTRONIC DATA PROCESSING SYSTEM FOR STREAMFLOW,
W69-04759 07C

LINEAR--A COMPUTER PROGRAM TO FIT DATA EASILY TO MANY MOD BY THE WEIGHTED LINEAR LEAST-SQUARES METHOD,
W69-04797 07C

OPTIMUM OPERATIONS FOR PLANNING OF A COMPLEX WATER RESOUR SYSTEM,
W69-05123 06A

CONCENTRATION OF FLOW
MCCORMICK COAL CO V R R SCHUBERT (NATURAL FLOW AND DIVERS OF STREAM BED).
W69-05171 06E

CONCRETE DAMS
ANALYSIS OF THE FAILURE OF BRITTLE MODELS OF ARCH DAMS,
W69-04710 08A

CONCRETE MIXES
THE EFFECT OF MIX PROPORTIONS AND AGGREGATE DUST UPON THE COMPRESSIVE STRENGTH OF CONCRETE,
W69-04715 08F

CONCRETE TECHNOLOGY
THE EFFECT OF MIX PROPORTIONS AND AGGREGATE DUST UPON THE COMPRESSIVE STRENGTH OF CONCRETE,
W69-04715 08F

CONDEMNATION
STATE V ANDERSON (ACTION TO ESTABLISH FLOWAGE EASEMENT).
W69-04865 06E

RUBIN V STATE (DRAINAGE WATER DIVERSION).
W69-04868 06E

CONDEMNATION VALUE
PARISH OF EAST BATON ROUGE V S AND H HEATING CO (CONDEMNATION).
W69-05184 06E

CONGESTION
CONGESTION, TOLLS, AND THE ECONOMIC CAPACITY OF A WATERWA
W69-04838 06C

CONJUNCTIVE USE
INTRODUCTION TO 'THE CONJUNCTIVE USE OF SURFACE AND GROUNDWATERS',
W69-05134 06A

THE CONJUNCTIVE USE OF SURFACE AND GROUND WATERS,
W69-05135 06A

CONNATE WATER
IMMOBILITY OF CONNATE WATER IN PERMEABLE SANDSTONE,
W69-04977 02F

CONSERVATION
ECONOMICS AND THE CONSERVATION QUESTION,
W69-04841 03B

A GUIDE TO THE CONSERVATION OF SHORELINES, SUBMERGED BOTTO AND SALTWATERS WITH SPECIAL REFERENCE TO BULKHEAD LINES, DREDGING AND FILLING,
W69-05068 04A

CONSOLIDATION
H B CARTER V CHUQUATONCHEE CONSOLIDATED DRAINAGE DISTRICT

DRAINAGE DISTRICT DISSOLUTION).
W69-05183 04A

ISTRUCTION
SEDIMENT,
W69-05029 04D

PRECONSTRUCTION STUDY OF THE FISHERIES OF THE ESTUARINE AREAS TRAVERSED BY THE MISSISSIPPI RIVER-GULF OUTLET PROJECT,
W69-05049 02L

ISTRUCTION FUNDS
ECONOMICS AND FINANCE OF WATER PROGRAMMES ECONOMIC ANALYSIS, FINANCIAL ANALYSIS, FINANCING.
W69-04833 06D

SUMPTIVE USE
DETERMINATION OF THE REGIONAL COEFFICIENT 'K' FOR COMPUTING THE CONSUMPTIVE USE OF NATIVE BLACK KIDNEY BEAN IN THE IRRIGATION DISTRICTS OF VERACRUZ STATE,
W69-05086 02I

ONSUMPTIVE USE OF WATER FOR SOME MAJOR CROPS IN U.A.R. (EGYPT),
W69-05087 02I

ONSUMPTIVE USE COMPUTATIONS FROM EVAPORATION PAN DATA,
W69-05092 02D

STIMATING CONSUMPTIVE USE - MUNSON P. E. INDEX METHOD,
W69-05094 02D

TINENTAL SHELF
EGAL ASPECTS OF OFFSHORE OIL AND GAS OPERATIONS,
W69-04859 06E

TINUOUS FRAMES
TRENGTH OF JOINTS AND JOINT ASSEMBLIES OF REINFORCED ONCRETE MULTISTORY FRAMES UNDER LOADS OF THE SEISMIC TYPE,
W69-04735 08F

TRACTS
ONTENOT V SMITH (CONTRACT AGREEMENTS AND RIGHTS TO NATURAL LOW).
W69-05170 06E

LING
OOLING WITH SEAWATER,
W69-04999 03C

LING WATER
BSERVATIONS ON THE RESPONSE OF SOME BENTHONIC ORGANISM TO OWER STATION COOLING,
W69-05023 05C

ATER RESOURCES ACTIVITIES IN THE UNITED STATES ELECTRIC OWER IN RELATION TO THE NATION'S WATER RESOURCES.
W69-05064 08C

RDINATION CHEMISTRY
OORDINATION CHEMISTRY OF THE OCEANS,
W69-04971 02K

PER SULFATE
ONTROL OF SUBMERSED AQUATIC WEEDS IN IRRIGATION CANALS BY AILY APPLICATIONS OF LOW CONCENTRATIONS OF COPPER SULFATE,
W69-04729 04A

RESPONDENCE PRINCIPLE
UALITATIVE ECONOMICS AND THE SCOPE OF THE CORRESPONDENCE RINCIPLE,
W69-04806 06B

ROSION
STUDY OF DEPASSIVATION OF STEEL IN CONCRETE,
W69-04725 08F

EVELOPMENT OF A LOW-COST IRON-BASE ALLOY TO RESIST ORROSION IN HOT SEA WATER,
W69-04771 03A

ROSION CONTROL
STUDY OF DEPASSIVATION OF STEEL IN CONCRETE,
W69-04725 08F

T COMPARISONS
IGH-CAPACITY DUAL-PURPOSE PLANT FOR GENERATING ELECTRICITY ND PRODUCING FRESH WATER FROM SEA WATER,
W69-04754 03A

T PROJECTION
OST PROJECTIONS FOR LARGE DESALTING SYSTEMS WITH VARIOUS YPES OF COUPLING,
W69-04814 03A

T REDUCTION
OST REDUCTION IN DESALTING SEA WATER,
W69-04826 03A

T SHARING
EDERAL ASSISTANCE IN OUTDOOR RECREATION.
W69-04989 09D

TS
OST REDUCTION IN DESALTING SEA WATER,
W69-04826 03A

TRIPED BASS IN MARYLAND TIDEWATER,
W69-05022 06B

MODERN SEWAGE TREATMENT PLANTS--HOW MUCH DO THEY COST.
W69-05031 05D

POLICIES, STANDARDS, AND PROCEDURES IN THE FORMULATION, EVALUATION, AND REVIEW OF PLANS FOR USE AND DEVELOPMENT OF WATER AND RELATED LAND RESOURCES.
W69-05039 06B

GROUNDWATER UTILIZATION AND TAX POLICY,
W69-05126 06C

COST-BENEFIT ANALYSIS
BENEFIT-COST ANALYSIS AND WATER POLLUTION CONTROL,
W69-04998 05G

PASSAMAQUODDY-ST. JOHN.
W69-05005 06B

INVESTIGATION OF THE INTERNATIONAL PASSAMAQUODDY TIDAL PROJECT.
W69-05007 06B

REVIEW REPORT ON JAMES RIVER, VIRGINIA.
W69-05045 04A

ECONOMIC IMPACT OF NARRAGANSETT BAY,
W69-05048 06B

ECONOMICS AND FINANCE OF WATER DEVELOPMENT IN ALBERTA, CANADA,
W69-05122 06B

AN EFFICIENT PROGRAM OF WATER RESOURCE DEVELOPMENT IN A FRAMEWORK OF GROWTH AND TRADE,
W69-05127 06B

COST-BENEFIT RATIO
THE BENEFIT-COST RATIO CONCEPTIONS AND MISCONCEPTIONS,
W69-04812 06B

PASSAMAQUODDY-ST. JOHN.
W69-05005 06B

COUPLING
COST PROJECTIONS FOR LARGE DESALTING SYSTEMS WITH VARIOUS TYPES OF COUPLING,
W69-04814 03A

COURSING
MCCORMICK COAL CO V R R SCHUBERT (NATURAL FLOW AND DIVERSION OF STREAM BED).
W69-05171 06E

CO-SHARING OF RIPARIAN RIGHTS
CURRENT TRENDS IN WISCONSIN'S WATER LAW,
W69-05161 06E

CREDIT
FEDERAL ASSISTANCE IN OUTDOOR RECREATION.
W69-04989 09D

CREEL CENSUS
A SURVEY OF SALT-WATER SPORT FISHING IN VIRGINIA 1955-1960,
W69-05046 06B

CROP PRODUCTION
A CLIMATOLOGICAL-TECHNOLOGICAL METHOD FOR ESTIMATING IRRIGATION WATER REQUIREMENTS FOR MAXIMUM CROP YIELDS,
W69-04750 03F

DETERMINATION OF THE REGIONAL COEFFICIENT 'K' FOR COMPUTING THE CONSUMPTIVE USE OF NATIVE BLACK KIDNEY BEAN IN THE IRRIGATION DISTRICTS OF VERACRUZ STATE,
W69-05086 02I

CONSUMPTIVE USE OF WATER FOR SOME MAJOR CROPS IN U.A.R. (EGYPT),
W69-05087 02I

CROPS
CONSUMPTIVE USE COMPUTATIONS FROM EVAPORATION PAN DATA,
W69-05092 02D

CULTIVATION
TILLAGE INFLUENCES WATER INTAKE,
W69-05089 02G

CULVERTS
BENNETT V COUNTY OF EATON (CONCENTRATED DRAINAGE ONTO LOWER LANDS).
W69-04898 06E

CURRENTS(WATER)
WIND-DRIVEN SUMMER CIRCULATION IN THE GREAT LAKES,
W69-04789 02H

ON THE MECHANISM OF LANGMUIR CIRCULATIONS AND THEIR ROLE IN EPILIMNION MIXING,
W69-04929 02H

THERMAL STRUCTURE AND VERTICAL HEAT TRANSPORT IN LANGMUIR CIRCULATIONS,
W69-04931 02H

CUTS
SHORING FOR THE SEATTLE FIRST NATIONAL BANK BUILDING, SEATTLE, WASHINGTON,
W69-04721 08D

CUTTING
ELECTRIC-ARC EQUIPMENT FOR BURNING OPENINGS INTO BRICK AND

CUT-DIP

REINFORCED CONTRETE STRUCTURES,
W69-04718 08A

CYCLIC LOADS
STRENGTH OF JOINTS AND JOINT ASSEMBLIES OF REINFORCED CONCRETE MULTISTORY FRAMES UNDER LOADS OF THE SEISMIC TYPE,
W69-04735 08F

CYCLING NUTRIENTS
UNUSUAL PHOSPHORUS SOURCE FOR PLANKTON ALGAE,
W69-04800 05B

DEVELOPMENT AND STATUS OF POND FERTILIZATION IN CENTRAL EUROPE,
W69-04804 05G

SEASONAL VARIATION IN CONTENT OF NITROGENOUS COMPOUNDS AND PHOSPHATE IN THE WATER OF TAKASUKA POND, SAITAMA, JAPAN,
W69-05142 02H

DAM CONSTRUCTION
COUNTY CONTROL OF DAM CONSTRUCTION.
W69-04881 06E

DAM FOUNDATIONS
STATIC AND KINEMATIC CONDITIONS OF THE STABILITY OF JOINTED AND FISSURED ROCKY FOUNDATIONS OF ARCH DAMS,
W69-04713 08E

DAMAGES
PHILLIPS PETROLEUM CO V HARDEE (LIABILITY FOR DAMAGE BY POLLUTION).
W69-05199 05G

DAMAGES(LEGAL ASPECTS)
FAIRES V DUPREE (WATER POLLUTION FROM ANIMAL WASTES).
W69-05182 05B

PHILLIPS PETROLEUM CO V HARDEE (LIABILITY FOR DAMAGE BY POLLUTION).
W69-05199 05G

DAMS
EARTHQUAKE BEHAVIOR OF RESERVOIR-DAM SYSTEMS,
W69-04726 08A

CAPES V BARGER (DAMAGES CAUSED BY DAM TO REPEL SURFACE WATERS).
W69-05181 06E

DAMSITES
PEOPLE V SYSTEM PROPERTIES (OWNERSHIP OF DAMSITE STATE'S POWER TO CONTROL LAKE LEVEL).
W69-04903 06E

DAPHNIA
FACTORS INFLUENCING RADIOSTRONTIUM ACCUMULATION IN DAPHNIA,
W69-05141 05C

DARCYS LAW
CAPILLARY CONDUCTIVITY AND SOIL WATER DIFFUSIVITY VALUES FROM VERTICAL COLUMNS,
W69-05093 02G

DATA COLLECTIONS
BASIC DATA COLLECTION FOR WATER DEVELOPMENT IN EAST PAKISTAN,
W69-04755 07A

CHEMICAL MEASUREMENT OF MEAN TEMPERATURE,
W69-04765 07A

SEDIMENT DATA FOR CANADIAN RIVERS, WATER YEAR 1966.
W69-04766 02J

SURFACE WATER DATA, QUEBEC, WATER YEAR 1964.
W69-04768 02E

SURFACE WATER DATA, BRITISH COLUMBIA, WATER YEAR 1966.
W69-04792 02E

BASIC DATA FOR WATER PROGRAMMES SOCIAL AND ECONOMIC CHARACTERISTICS FOR WATER PROGRAMMES.
W69-04832 06B

ANNUAL PEAK DISCHARGES FROM SMALL DRAINAGE AREAS IN MONTANA THROUGH SEPTEMBER 1968,
W69-04927 02E

SCIENTIFIC PARAMETERS OF MARINE WASTE DISCHARGE,
W69-05018 05A

DATA PROCESSING
LINEAR--A COMPUTER PROGRAM TO FIT DATA EASILY TO MANY MODELS BY THE WEIGHTED LINEAR LEAST-SQUARES METHOD,
W69-04797 07C

DATA STORAGE AND RETRIEVAL
DOCUMENTATION INFORMATION AND INSTRUCTION CONCERNING THE PROBLEMS OF WATER,
W69-04940 10

DECISION MAKING
QUADRATIC TERMS, INFORMATION ECONOMICS, AND AGGREGATE PLANNING DECISIONS,
W69-04843 06B

TOWARD THE OPTIMIZATION OF INVESTMENT-PRICING DECISIONS A MODEL FOR URBAN WATER SUPPLY TREATMENT FACILITIES,
W69-05128 05F

W69-05129 05F

W69-05130 05F

DEFORMATION
INSTRUMENT FOR MEASURING SOIL DEFORMATIONS IN DEPTH,
W69-04746 08D

DEGRADATION(DECOMPOSITION)
FACTORS AFFECTING BIOLOGICAL CLOGGING OF SAND ASSOCIATED WITH GROUND WATER RECHARGE,
W69-05075 03C

DELAWARE RIVER
OXYGEN BALANCE OF AN ESTUARY,
W69-05035 05B

THE VALUE OF A TON OF GENERAL CARGO TO THE AREA'S ECONOMY--DELAWARE RIVER PORT.
W69-05061 06C

DELAWARE RIVER BASIN COMMISSION
THE INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN A STUDY OF ITS ROLE AS A PLANNING AGENCY ENGAGED IN THE POLITICAL PROCESS,
W69-04856 06E

DELTAS
BASIC DATA COLLECTION FOR WATER DEVELOPMENT IN EAST PAKISTAN,
W69-04755 07A

WATER BALANCE OF LAKE AFFECTED BY SEA (FRENCH),
W69-04960 02H

DENVER BASIN
POTENTIAL OF DENVER BASIN FOR DISPOSAL OF LIQUID WASTES,
W69-04947 05E

DEPOSITION(SEDIMENTS)
ENTRY VELOCITY CONTROL LIMITS DRAIN SEDIMENTATION,
W69-04720 08B

DEPRESSED AREAS
THE IMPACTS OF WATER INVESTMENTS IN DEPRESSED AREAS,
W69-05120 06B

DEPTH REFERENCING
FIELD CORRELATION OF TWO NEUTRON-SCATTERING SOIL MOISTURE METERS,
W69-05100 07B

DEPTH-AREA-DURATION ANALYSIS
FIELD CORRELATION OF TWO NEUTRON-SCATTERING SOIL MOISTURE METERS,
W69-05100 07B

DESALINATION
DEVELOPMENT OF A LOW-COST IRON-BASE ALLOY TO RESIST CORROSION IN HOT SEA WATER,
W69-04771 03A

PROSPECTS OF DESALINATION FOR SOLVING WATER PROBLEMS ON THE MAKRAN COAST,
W69-04776 03A

COST REDUCTION IN DESALTING SEA WATER,
W69-04826 03A

ANALYSIS OF THE COST OF WATER TRANSMISSION BY PIPELINE,
W69-04827 03A

DESALINIZATION AND FUTURE WATER SUPPLY IN THE UNITED STATES,
W69-04988 03A

ECONOMIC ASPECTS OF SALINE-WATER CONVERSION,
W69-05017 03A

OUTLOOK FOR ECONOMIC USE OF FRESH WATER FROM THE SEA,
W69-05032 03A

DEVELOPMENT OF TRANSPORT DEPLETION PROCESSES,
W69-05156 03A

DESALINATION PLANTS
HIGH-CAPACITY DUAL-PURPOSE PLANT FOR GENERATING ELECTRICITY AND PRODUCING FRESH WATER FROM SEA WATER,
W69-04754 03A

COST PROJECTIONS FOR LARGE DESALTING SYSTEMS WITH VARIOUS TYPES OF COUPLING,
W69-04814 03A

DESERT PLANTS
SPATIAL PATTERN OF SHRUBS ON A DESERT PLAIN IN ETHIOPIA,
W69-05077 02I

DESIGN CRITERIA
PROBABLE MAXIMUM PRECIPITATION OVER SOUTH PLATTE RIVER, COLORADO AND MINNESOTA RIVER, MINNESOTA,
W69-05158 04A

DEVELOPING COUNTRIES
ECONOMIC AND SOCIAL ASPECTS OF PLANNING OF WATER RESOURCES IN DEVELOPING COUNTRIES.
W69-04741 06B

DIFFERENTIAL PRESSURE
INDEX METHOD FOR PUMPING OPERATION OF REVERSIBLE PUMP-TURBINE,
W69-04743 08C

FFUSION
HORIZONTAL DIFFUSION FROM AN INSTANTANEOUS POINT SOURCE DUE TO OCEANIC TURBULENCE,
W69-05036 02L

A REVIEW OF THEORETICAL MODELS OF TURBULENT DIFFUSION IN THE SEA,
W69-05037 02L

FFUSIVITY
CAPILLARY CONDUCTIVITY AND SOIL WATER DIFFUSIVITY VALUES FROM VERTICAL COLUMNS,
W69-05093 02G

GITAL COMPUTERS
ELECTRONIC DATA PROCESSING SYSTEM FOR STREAMFLOW,
W69-04759 07C

LINEAR--A COMPUTER PROGRAM TO FIT DATA EASILY TO MANY MODELS BY THE WEIGHTED LINEAR LEAST-SQUARES METHOD,
W69-04797 07C

SCHARGE MEASUREMENT
INDEX METHOD FOR PUMPING OPERATION OF REVERSIBLE PUMP-TURBINE,
W69-04743 08C

ANALYTICAL APPROACHES TO COMPUTATION OF DISCHARGE OF AN ICE-COVERED STREAM,
W69-04975 02E

SCHARGE(WATER)
PREDICTION OF TEMPERATURE IN RIVERS AND RESERVOIRS,
W69-05042 05B

SINFECTION
A COMPARISON OF THE INACTIVATION OF ESCHERICHIA COLI AND POLIOVIRUS IN POLLUTED AND UNPOLLUTED WATERS BY CHLORINATION,
W69-04778 05D

SSOLVED OXYGEN
THE EFFECT OF PHOTOSYNTHESIS ON THE OXYGEN BALANCE IN A MIDWESTERN STREAM,
W69-04780 05C

ENVIRONMENTAL CHARACTERISTICS OF RARITAN BAY, A POLLUTED ESTUARY,
W69-05008 05C

ORGANIC POLLUTION OF NEW YORK HARBOR APPLICATION,
W69-05026 05B

ORGANIC POLLUTION OF NEW YORK HARBOR - THEORETICAL CONSIDERATIONS,
W69-05034 05B

OXYGEN BALANCE OF AN ESTUARY,
W69-05035 05B

MATHEMATICAL MODEL FOR DISSOLVED OXYGEN,
W69-05058 05B

STILLATION
ECONOMIC ASPECTS OF SALINE-WATER CONVERSION,
W69-05017 03A

STRIBUTION PATTERNS
BAYESIAN ANALYSIS OF HAAVELMO'S MODELS,
W69-04842 06A

SPATIAL PATTERN OF SHRUBS ON A DESERT PLAIN IN ETHIOPIA,
W69-05077 02I

STRICT OF COLUMBIA
WATER QUALITY IN THE POTOMAC ESTUARY,
W69-05027 05G

TCHES
LIPPMAN V HUHN (RIGHT TO ESTABLISH PUBLIC DRAINAGE DITCHES).
W69-04866 06E

GIBSON V SHARP (DRAINAGE DITCH RIGHT OF WAY)
W69-04891 06E

PERSON V ROANE (RIGHT TO USE OF DRAINAGE DITCH ON ANOTHER'S PROPERTY).
W69-05166 06E

WHITE V WOODARD (BOUNDARY LINE ALONG DITCH).
W69-05192 06E

URNAL RATES
EVAPORATION RATES IN MOUNTAINOUS TERRAIN,
W69-05098 02D

VERSION
LARSON V REMEIKIS (ACCELERATION AND DIVERSION OF NATURAL DRAINAGE RELATIVE RIGHTS).
W69-04917 06E

MCCORMICK COAL CO V R R SCHUBERT (NATURAL FLOW AND DIVERSION OF STREAM BED).
W69-05171 06E

LUNSFORD V STEWART (COMMON ENEMY DOCTRINE).
W69-05172 06E

BOROUGH OF COLLEGEVILLE V PHILADELPHIA SUBURAN WATER CO (ADMINISTRATIVE REMEDIES FOR WATER DIVERSION).
W69-05198 06E

DIVERSION DAMS
OWENS V PAYETTE COUNTY (DRAINAGE NUISANCE ABATEMENT).
W69-05167 06E

DOCKS
HARBORS, WHARVES AND HARBOR MASTERS.
W69-04904 06E

DOCUMENTATION
DOCUMENTATION INFORMATION AND INSTRUCTION CONCERNING THE PROBLEMS OF WATER,
W69-04940 10

DOLOMITE
HYDROGEOLOGIC SIGNIFICANCE OF CALCIUM-MAGNESIUM RATIOS IN GROUND WATER FROM CARBONATE ROCKS IN THE LANCASTER QUADRANGLE, SOUTHEASTERN PENNSYLVANIA,
W69-04985 02F

DOUBLE-CURVATURE ARCH DAMS
ANALYSIS OF THE FAILURE OF BRITTLE MODELS OF ARCH DAMS,
W69-04710 08A

THE MOSSYROCK DEVELOPMENT,
W69-04737 08A

DRAFT TUBE INDEX METHOD
INDEX METHOD FOR PUMPING OPERATION OF REVERSIBLE PUMP-TURBINE,
W69-04743 08C

DRAINAGE
ENTRY VELOCITY CONTROL LIMITS DRAIN SEDIMENTATION,
W69-04720 08B

LIPPMAN V HUHN (RIGHT TO ESTABLISH PUBLIC DRAINAGE DITCHES).
W69-04866 06E

BISHOP V RICHARD (OBSTRUCTION OF DRAINAGE BY LOWER LANDOWNER).
W69-04890 06E

MASON V LAMB (ACTION TO RECOVER DAMAGES FROM SURFACE WATER RUNOFF ONTO PLAINTIFFS' PROPERTY).
W69-04894 06E

YOUNG V MOORE (LANDOWNERS RIGHT TO DRAIN EXCESS SURFACE WATER).
W69-04899 06E

NICHOLSON V HOLLOWAY PRINTING CO (ARTIFICIAL INCREASE OF SURFACE RUNOFF).
W69-05163 06E

PERSON V ROANE (RIGHT TO USE OF DRAINAGE DITCH ON ANOTHER'S PROPERTY).
W69-05166 06E

DRAINAGE BASINS
EFFECTS OF MULTIPLE USES OF WATERSHEDS ON WATER QUALITY,
W69-04702 05B

DRAINAGE DISTRICTS
H B CARTER V CHUQUATONCHEE CONSOLIDATED DRAINAGE DISTRICT (DRAINAGE DISTRICT DISSOLUTION).
W69-05183 04A

STATE V REEDY CREEK IMPROVEMENT DISTRICT (PLEDGING OF PUBLIC CREDIT TO FINANCE DRAINAGE PROJECTS).
W69-05185 06E

DRAINAGE DITCHES
LARSON V REMEIKIS (ACCELERATION AND DIVERSION OF NATURAL DRAINAGE RELATIVE RIGHTS).
W69-04917 06E

DRAINAGE EFFECTS
CRAWFORD V SPRINGVIEW CORP (SURFACE DRAINAGE OVER LOWER ADJACENT TRACT).
W69-04889 06E

DRAINAGE SYSTEMS
FISCHER V TOWN OF ALBIN (TOWN MAY NOT ALTER DRAINAGE DISTRICT WITHOUT CONSIDERING RIGHTS OF DISTRICT LANDOWNERS).
W69-04874 06E

HODGES MANOR CORP V MAYFLOWER PARK CORP (DAMAGE DUE TO DISCHARGE OF SURFACE WATERS THROUGH ARTIFICIAL CHANNELS).
W69-05173 06E

WATTERS V NATIONAL DRIVE-IN (SURFACE WATER DRAINAGE DAMAGE).
W69-05178 06E

POWERS OF COUNCIL.
W69-05195 06E

DRAINAGE WATER
RUBIN V STATE (DRAINAGE WATER DIVERSION).
W69-04868 06E

LIBBY, MCNEIL AND LIBBY V ROBERTS (INTERFERENCE WITH NATURAL DRAINAGE COURSE).
W69-04872 06E

SCHMITT V KIRKPATRICK (DRAINAGE EASEMENT).
W69-04897 06E

CALCULATION MODEL FOR THE ACTUAL EVAPOTRANSPIRATION FROM CROPPED AREAS AND OTHER TERMS OF THE WATER BALANCE EQUATION,

W69-05072 02D

DRAINS
ENTRY VELOCITY CONTROL LIMITS DRAIN SEDIMENTATION,
W69-04720 08B

DRAWDOWN
THEORETICAL FRAMEWORK FOR ASCERTAINING PORE WATER PRESSURE IN CONFINING LAYERS IN THE VICINITY OF A PUMPING WELL,
W69-04767 02F

DREDGING
BOSTICK V SMOOT SAND AND GRAVEL CORP (DREDGING IN RIVER AS CREATING NUISANCE FOR OTHER RIPARIAN OWNERS).
W69-04869 06E

SEDIMENTATION FROM A HYDRAULIC DREDGE IN A BAY,
W69-05000 04D

DRY SOILS
THERMAL CONDUCTIVITY OF TWO-PHASE POROUS MATERIALS DRY SOILS,
W69-04949 07B

DRYING
INFLUENCE OF THE THICKNESS AND FREE POROSITY OF A DRIED LAYER ON EVAPORATION,
W69-05083 02D

DUTY OF CARE
LYTLE V PENNSYLVANIA RR (BRIDGE CONSTRUCTION AND OBSTRUCTION TO FLOW).
W69-04880 06E

DYE RELEASES
DETERMINATION, EVALUATION AND ABATEMENT OF COLOR IN TEXTILE PLANT EFFLUENTS,
W69-04756 05B

DYNAMIC LOADS
STRENGTH OF JOINTS AND JOINT ASSEMBLIES OF REINFORCED CONCRETE MULTISTORY FRAMES UNDER LOADS OF THE SEISMIC TYPE,
W69-04735 08F

DYNAMIC PROGRAMMING
TOWARD THE OPTIMIZATION OF INVESTMENT-PRICING DECISIONS A MODEL FOR URBAN WATER SUPPLY TREATMENT FACILITIES,
W69-05128 05F

W69-05130 05F

OPERATING POLICIES FOR IRRIGATION SYSTEMS UNDER STOCHASTIC REGIMES,
W69-05131 06A

OPERATING POLICIES FOR IRRIGATION SYSTEMS UNDER STOCHASTIC REGIMES DYNAMIC PROGRAMMING MODEL,
W69-05132 06A

INTRODUCTION TO 'THE CONJUNCTIVE USE OF SURFACE AND GROUNDWATERS',
W69-05134 06A

THE CONJUNCTIVE USE OF SURFACE AND GROUND WATERS,
W69-05135 06A

EARTH DAMS
SOME ASPECTS OF DESIGN AND CONSTRUCTION OF EARTH AND ROCKFILL DAMS IN INDIA,
W69-04742 08D

ROBINSON V BELANGER (SURFACE WATER DRAINAGE RIGHTS).
W69-05177 04A

EARTH PRESSURE
EFFECT OF CONTINUOUS SURCHARGE ON A RETAINING WALL,
W69-04740 08D

EARTHQUAKES
EARTHQUAKE BEHAVIOR OF RESERVOIR-DAM SYSTEMS,
W69-04726 08A

EASEMENTS
MCHENRY V FORD MOTOR CO (EROSION BY WATERS OF RESERVOIR).
W69-04864 06E

STATE V ANDERSON (ACTION TO ESTABLISH FLOWAGE EASEMENT).
W69-04865 06E

DAVIS V ATLANTIC COAST LINE RR (DRAINAGE FLOW EASEMENTS).
W69-04893 06E

WILSON V OWEN (EASEMENT - USE OF LAKE).
W69-05164 06E

GAGNON V CARRIER (ABANDONMENT OF EASEMENT FOR WATER SUPPLY).
W69-05165 06E

PERSON V ROANE (RIGHT TO USE OF DRAINAGE DITCH ON ANOTHER'S PROPERTY).
W69-05166 06E

ECOLOGICAL DISTRIBUTION
SPATIAL PATTERN OF SHRUBS ON A DESERT PLAIN IN ETHIOPIA,
W69-05077 02I

ECOLOGY
FIRST WORLD CONFERENCE ON NATIONAL PARKS.
W69-04990 06G

THE BIOLOGY OF POLLUTED WATERS,
W69-05004 05C

SCIENTIFIC PARAMETERS OF MARINE WASTE DISCHARGE,
W69-05018 05A

REALISM IN THE MANAGEMENT OF ESTUARIES,
W69-05050 02L

ECONOMIC EFFICIENCY
THE CONJUNCTIVE USE OF SURFACE AND GROUND WATERS,
W69-05135 06A

ECONOMIC FEASIBILITY
ECONOMIC AND SOCIAL ASPECTS OF PLANNING OF WATER RESOURCES IN DEVELOPING COUNTRIES.
W69-04741 06B

INVESTIGATION OF THE INTERNATIONAL PASSAMAQUODDY TIDAL PROJECT.
W69-05007 06B

ECONOMIC ASPECTS OF SALINE-WATER CONVERSION,
W69-05017 03A

OUTLOOK FOR ECONOMIC USE OF FRESH WATER FROM THE SEA,
W69-05032 03A

ECONOMIC IMPACT
CHESAPEAKE COUNTRY,
W69-05010 06G

ECONOMIC IMPACT OF NARRAGANSETT BAY,
W69-05048 06B

WHAT IS HAPPENING TO OUR ESTUARIES,
W69-05060 06B

THE VALUE OF A TON OF GENERAL CARGO TO THE AREA'S ECONOMY--DELAWARE RIVER PORT.
W69-05061 06C

ECONOMIC LIFE
THE FUTURE OF ALASKA,
W69-05047 06B

ECONOMICS
THE ROLE OF ECONOMICS IN PLAN FORMULATION,
W69-04835 06B

ECONOMIES OF SCALE
THE ECONOMIES OF SCALE,
W69-04840 06C

EFFECTS
WEATHER MODIFICATION, PRESENT AND FUTURE,
W69-04717 03B

EFFLUENTS
SOUTHLAND CO V MCDONALD (POLLUTION OF WATERCOURSE BY ESCAPED CRUDE OIL).
W69-05186 05B

ELECTRIC ARCS
ELECTRIC-ARC EQUIPMENT FOR BURNING OPENINGS INTO BRICK AND REINFORCED CONCRETE STRUCTURES,
W69-04718 08A

ELECTRIC GENERATORS
SEMI-SYNCHRONOUS STARTING,
W69-04722 08C

HIGH-CAPACITY DUAL-PURPOSE PLANT FOR GENERATING ELECTRICITY AND PRODUCING FRESH WATER FROM SEA WATER,
W69-04754 03A

ELECTRIC INSULATION
POLYAMIDE-IMIDE INSULATION VARNISH,
W69-04719 08G

ELECTRIC MOTORS
SEMI-SYNCHRONOUS STARTING,
W69-04722 08C

ELECTRIC POWER
INVESTIGATION OF THE INTERNATIONAL PASSAMAQUODDY TIDAL PROJECT.
W69-05007 06B

THE CONFLICT BETWEEN FISH AND POWER RESOURCES IN THE PACIFIC NORTHWEST.
W69-05024 06B

WATER RESOURCES ACTIVITIES IN THE UNITED STATES ELECTRIC POWER IN RELATION TO THE NATION'S WATER RESOURCES.
W69-05064 08C

ELECTRIC POWER INDUSTRY
ESTIMATED USE OF WATER IN THE UNITED STATES, 1960,
W69-05019 06B

WATER REQUIREMENTS OF ELECTRIC UTILITY STEAM-ELECTRIC-GENERATING PLANTS IN 1959.
W69-05063 08C

ELECTRIC POWERPLANTS
WATER REQUIREMENTS OF ELECTRIC UTILITY STEAM-ELECTRIC-GENERATING PLANTS IN 1959.
W69-05063 08C

ELECTRICAL INSULATION TESTS
POLYAMIDE-IMIDE INSULATION VARNISH,

W69-04719 08G

ELECTRODIALYSIS
ECONOMIC ASPECTS OF SALINE-WATER CONVERSION,
W69-05017 03A

DEVELOPMENT OF TRANSPORT DEPLETION PROCESSES,
W69-05156 03A

ELEVATION
SOIL MOISTURE DEPLETION BY GAMBEL OAK IN CENTRAL UTAH,
W69-05107 02G

EMINENT DOMAIN
PARISH OF EAST BATON ROUGE V S AND H HEATING CO (CONDEMNATION).
W69-05184 06E

EMPIRICAL STUDIES
THE ECONOMIES OF SCALE,
W69-04840 06C

EMPLOYEE RELATIONS
MANPOWER PROBLEMS IN WATER SUPPLY ORGANIZATION,
W69-04779 06E

ENERGY
INFLUENCE OF SOIL WATER POTENTIAL AND ATMOSPHERIC EVAPORATIVE DEMAND ON TRANSPIRATION AND THE ENERGY STATUS OF WATER IN PLANTS.
W69-05088 02I

ENERGY BUDGET
CALORIFIC VALUES OF SOME INVERTEBRATES IN LAKE MENDOTA, WISCONSIN,
W69-04799 02H

ENERGY CONVERSION
WEATHER MODIFICATION, PRESENT AND FUTURE,
W69-04717 03B

ENERGY FLOW
CALORIFIC VALUES OF SOME INVERTEBRATES IN LAKE MENDOTA, WISCONSIN,
W69-04799 02H

ENERGY TRANSFER
NET, ALLWAVE RADIATION AS AN INDEX OF NATURAL SNOWMELT AND SNOWMELT ACCELERATED WITH ALBEDO REDUCING MATERIALS,
W69-05103 02C

ENGINEERING
WATER RESEARCH,
W69-05115 06B

ENTRANCES
ENTRY VELOCITY CONTROL LIMITS DRAIN SEDIMENTATION,
W69-04720 08B

ENVIRONMENTAL EFFECTS
DEVELOPMENT AND STATUS OF POND FERTILIZATION IN CENTRAL EUROPE,
W69-04804 05G

THE FISHERIES--A NEGLECTED ASPECT OF ESTUARINE RESEARCH,
W69-05025 02L

INFLUENCE OF SOIL TEMPERATURE ON TRANSPIRATION UNDER VARIOUS ENVIRONMENTAL CONDITIONS,
W69-05099 02D

EQUATIONS
CALCULATION MODEL FOR THE ACTUAL EVAPOTRANSPIRATION FROM CROPPED AREAS AND OTHER TERMS OF THE WATER BALANCE EQUATION,
W69-05072 02D

EQUILIBRIUM
APPLICATION AND LIMITATIONS OF CHEMICAL THERMODYNAMICS IN NATURAL WATER SYSTEMS,
W69-04770 02K

MASTER VARIABLES AND ACTIVITY SCALES,
W69-04963 02K

GIBBS PHASE RULE AND MARINE SEDIMENTS,
W69-04964 02K

HETEROGENEOUS EQUILIBRIA INVOLVING OXIDES, HYDROXIDES, CARBONATES, AND HYDROXIDE CARBONATES,
W69-04968 02K

EQUILIBRIUM MODELS AND COMPOSITION OF THE GREAT LAKES,
W69-04970 02K

REDOX EQUILIBRIA AND MEASUREMENTS OF POTENTIALS IN THE AQUATIC ENVIRONMENT,
W69-04972 02K

BIOLOGICAL ACTIVITY IN RELATION TO THE CHEMICAL EQUILIBRIUM COMPOSITION OF NATURAL WATERS,
W69-04974 02K

EQUIPMENT DESIGN
ELECTRIC-ARC EQUIPMENT FOR BURNING OPENINGS INTO BRICK AND REINFORCED CONTRETE STRUCTURES,
W69-04718 08A

ERODIBLE-BED CHANNELS
LOCALIZED SCOUR IN ERODIBLE-BED CHANNELS,
W69-04788 02J

EROSION
MCHENRY V FORD MOTOR CO (EROSION BY WATERS OF RESERVOIR).
W69-04864 06E

EROSION CONTROL
SHORELINE RECREATION RESOURCES OF THE UNITED STATES.
W69-05054 02L

EFFECTS OF SEEDBED TREATMENT ON GRASS ESTABLISHMENT ON LOGGING ROADBEDS IN CENTRAL IDAHO,
W69-05096 04A

EFFECT OF EXPOSURE AND LOGGING ON RUNOFF AND EROSION,
W69-05104 04D

CONTROLLING SOIL MOVEMENT FROM STEEP ROAD FILLS,
W69-05105 04A

ESSENTIAL NUTRIENTS
DISTRIBUTION, ENVIRONMENTAL REQUIREMENTS AND SIGNIFICANCE OF CLADOPHORA IN THE GREAT LAKES,
W69-04798 02H

MINERAL REQUIREMENTS FOR THE GROWTH OF ANABAENA SPIROIDES IN VITRO,
W69-04802 05C

DEVELOPMENT AND STATUS OF POND FERTILIZATION IN CENTRAL EUROPE,
W69-04804 05G

ESTIMATING
INLET HYDROGRAPH ESTIMATION FOR LINEAR FLOW MODELS ACCORDING TO OUTLET HYDROGRAPH,
W69-04961 02A

TWO METHODS OF ESTIMATING BASE FLOW AT UNGAGED STREAM SITES IN KANSAS AND ADJACENT STATES,
W69-04978 02E

ESTIMATING SEWAGE TREATMENT PLANT OPERATION AND MAINTENANCE COSTS,
W69-05051 05D

ESTIMATING CONSUMPTIVE USE - MUNSON P. E. INDEX METHOD,
W69-05094 02D

ESTUARIES
ESTUARIES AND SOUNDS OF NORTH CAROLINA,
W69-04758 02L

PREDICTION OF THE EXTENT OF SALTWATER INTRUSION INTO ESTUARIES AND SEAS,
W69-04782 02L

ESTUARINE FISHERIES
THE FISHERIES--A NEGLECTED ASPECT OF ESTUARINE RESEARCH,
W69-05025 02L

MULTIPLE UTILIZATION OF GULF COAST ESTUARIES,
W69-05057 02L

WHAT IS HAPPENING TO OUR ESTUARIES,
W69-05060 06B

ETHIOPIA
SPATIAL PATTERN OF SHRUBS ON A DESERT PLAIN IN ETHIOPIA,
W69-05077 02I

EUCALYPTUS
PHENOLOGICAL ASPECTS OF A FEW PROMISING EUCALYPTUS IN THE ARID ZONE,
W69-05091 02I

EUTROPHICATION
DISTRIBUTION, ENVIRONMENTAL REQUIREMENTS AND SIGNIFICANCE OF CLADOPHORA IN THE GREAT LAKES,
W69-04798 02H

ALGAL GROWTH AQUEOUS FACTORS OTHER THAN NITROGEN AND PHOSPHORUS,
W69-04801 05C

NITROGEN AND PHOSPHORUS IN WATER AN ANNOTATED BIBLIOGRAPHY OF THEIR BIOLOGICAL EFFECTS.
W69-04805 05C

THE NEW POLLUTION,
W69-04828 05C

EVALUATION PROBLEMS
WATER RESEARCH,
W69-05115 06B

EVAPORATION
THE DETERMINATION OF THE EVAPORATION FROM THE PLANT COVER AND THE SURFACE OF THE SOIL BY RELATING LYSIMETER AND SOIL MOISTURE MEASUREMENTS TO POTENTIAL EVAPORATION,
W69-05073 02D

INFLUENCE OF THE THICKNESS AND FREE POROSITY OF A DRIED LAYER ON EVAPORATION,
W69-05083 02D

CONSUMPTIVE USE OF WATER FOR SOME MAJOR CROPS IN U.A.R. (EGYPT),
W69-05087 02I

INFLUENCE OF SOIL WATER POTENTIAL AND ATMOSPHERIC EVAPORATIVE DEMAND ON TRANSPIRATION AND THE ENERGY STATUS OF WATER IN PLANTS.

W69-05088 02I

CAPILLARY CONDUCTIVITY AND SOIL WATER DIFFUSIVITY VALUES FROM VERTICAL COLUMNS,
W69-05093 02G

EVAPORATION RATES IN MOUNTAINOUS TERRAIN,
W69-05098 02D

EVAPORATION PANS
CONSUMPTIVE USE COMPUTATIONS FROM EVAPORATION PAN DATA,
W69-05092 02D

EVAPORATION RATES
EVAPORATION RATES IN MOUNTAINOUS TERRAIN,
W69-05098 02D

EVAPORATION STATIONS
EVAPORATION RATES IN MOUNTAINOUS TERRAIN,
W69-05098 02D

EVAPORTANSPIRATION
ON INVESTIGATIONS CONCERNING THE INFLUENCE OF AGRICULTURAL UTILIZATION ON THE RUNOFF FORMATION BY MEANS OF GROUNDWATER-LYSIMETERS,
W69-04951 02G

EVAPOTRANSPIRATION
EVAPOTRANSPIRATION-REVIEW OF RESEARCH,
W69-04764 02D

CALCULATION MODEL FOR THE ACTUAL EVAPOTRANSPIRATION FROM CROPPED AREAS AND OTHER TERMS OF THE WATER BALANCE EQUATION,
W69-05072 02D

THE DETERMINATION OF THE EVAPORATION FROM THE PLANT COVER AND THE SURFACE OF THE SOIL BY RELATING LYSIMETER AND SOIL MOISTURE MEASUREMENTS TO POTENTIAL EVAPORATION,
W69-05073 02D

CONSUMPTIVE USE COMPUTATIONS FROM EVAPORATION PAN DATA,
W69-05092 02D

ESTIMATING CONSUMPTIVE USE - MONSON P. E. INDEX METHOD,
W69-05094 02D

EVAPOTRANSPIRATION AND SOIL-MOISTURE DEPLETION,
W69-05102 02G

SOIL MOISTURE DEPLETION BY ASPEN IN CENTRAL UTAH,
W69-05106 02G

SOIL MOISTURE DEPLETION BY GAMBEL OAK IN CENTRAL UTAH,
W69-05107 02G

SOIL MOISTURE DEPLETION BY GAMBEL OAK IN NORTHERN UTAH,
W69-05108 02G

EXCAVATION
BUFF V STIRES (ENTRANCE ON LAND TO REMOVE OBSTRUCTION TO FLOW).
W69-05193 06E

EXPERT TESTIMONY
NASS V TOWN OF DUXBURY (DIVERSION OF FLOW BY CHANNEL OBSTRUCTION).
W69-05197 04A

EXTERNAL ECONOMIES
THE ANATOMY OF MARKET FAILURE,
W69-04855 06C

EXTERNALITY
CONGESTION, TOLLS, AND THE ECONOMIC CAPACITY OF A WATERWAY,
W69-04838 06C

F CLASS
NOTE ON THE UNBIASEDNESS OF A MIXED REGRESSION ESTIMATOR,
W69-04845 06A

FATIGUE TESTS
FATIGUE TESTS OF REINFORCING BARS--EFFECT OF DEFORMATION PATTERN,
W69-04706 08F

FEASIBILITY
ECONOMICS AND FINANCE OF WATER DEVELOPMENT IN ALBERTA, CANADA,
W69-05122 06B

FEASIBILITY STUDIES
IMPORTANCE OF THE ECONOMIC FEASIBILITY OF THE WATER SUPPLY AND SEWER SYSTEM PROJECTS,
W69-04811 06B

CONSIDERATIONS INVOLVED IN THE PLANNING, ORGANIZATION, MANAGEMENT, AND DESIGN OF PUBLIC WATER SUPPLIES,
W69-04814 06B

FEDERAL GOVERNMENT
REPORT ON THE 1963 TRANSPORTATION RESEARCH AND SERVICE ACTIVITIES OF THE BUREAU OF COMMERCIAL FISHERIES,
W69-05001 03E

REVISING NATIONAL POLICIES GOVERNING OUTDOOR RECREATION IN FEDERAL WATER DEVELOPMENT PROJECTS,
W69-05041 06B

POLICIES, STANDARDS, AND PROCEDURES IN THE FORMULATION, EVALUATION, AND REVIEW OF PLANS ... USE AND DEVELOPMENT OF WATER AND RELATED LAND RESOURCES.
W69-05039 06B

THE WATER CRISIS,
W69-05113 06B

ECONOMICS IN REGIONAL WATER RESEARCH AND POLICY,
W69-05124 06B

FEDERAL JURISDICTION
STATE V NICHOLS (MISTAKE - FEDERAL AGENCY JURIS).
W69-04896 06E

FENCES
FENCES ACROSS WATER NEGLECT, REMEDY.
W69-04883 06E

FERRIES
FOURTH CLASS CITIES - GENERAL POWERS OF CITY CORPORATIONS.
W69-04906 06E

FERTILIZER
EFFECTS OF CIVILIZATION ON STRIPED BASS AND OTHER ESTUARINE BIOTA IN CHESAPEAKE BAY AND TRIBUTARIES,
W69-05021 05C

FESCUES
EFFECTS OF PHENYLMERCURIC ACETATE ON TRANSPIRATION AND GROWTH OF SMALL PLOTS OF GRASS,
W69-05071 02D

FIBERS
A REVIEW OF FIBER REINFORCEMENT OF PORTLAND CEMENT PASTE, MORTAR, AND CONCRETE,
W69-04708 08F

FIELD CORRELATION
FIELD CORRELATION OF TWO NEUTRON-SCATTERING SOIL MOISTURE METERS,
W69-05100 07B

FILAMENTOUS ALGAE
CONTROL OF SUBMERSED AQUATIC WEEDS IN IRRIGATION CANALS BY DAILY APPLICATIONS OF LOW CONCENTRATIONS OF COPPER SULFATE,
W69-04729 04A

FILTERS
MODERN SEWAGE TREATMENT PLANTS--HOW MUCH DO THEY COST.
W69-05031 05D

FILTRATION
VILLAGES - WATER WORKS.
W69-05188 06E

FINANCIAL ANALYSIS
ECONOMIC AND SOCIAL ASPECTS OF PLANNING OF WATER RESOURCES IN DEVELOPING COUNTRIES.
W69-04741 06B

WATER AND ECONOMIC DEVELOPMENT.
W69-04825 06B

FINANCING
WATER SYSTEMS FINANCING--FOUR BASIC APPROACHES,
W69-04824 06C

WATER AND ECONOMIC DEVELOPMENT.
W69-04829 06B

ECONOMICS AND FINANCE OF WATER PROGRAMMES ECONOMIC ANALYSIS, FINANCIAL ANALYSIS, FINANCING.
W69-04833 06D

FOURTH CLASS CITIES - SEWER BONDS.
W69-04875 06E

LEASED UNITED STATES LANDS APPROPRIATION FOR FLOOD CONTROL.
W69-04882 06E

STATE V REEDY CREEK IMPROVEMENT DISTRICT (PLEDGING OF PUBLIC CREDIT TO FINANCE DRAINAGE PROJECTS).
W69-05185 06E

FINE AGGREGATES
THE EFFECT OF MIX PROPORTIONS AND AGGREGATE DUST UPON THE COMPRESSIVE STRENGTH OF CONCRETE,
W69-04715 08F

FINES
THE EFFECT OF MIX PROPORTIONS AND AGGREGATE DUST UPON THE COMPRESSIVE STRENGTH OF CONCRETE,
W69-04715 08F

FISH
DEVELOPMENT AND STATUS OF POND FERTILIZATION IN CENTRAL EUROPE,
W69-04804 05G

INDUSTRIAL FISHERY TECHNOLOGY,
W69-05055 06B

FISH BARRIERS
OBSTRUCTING AND PREVENTING FISH FROM RUNNING UP RIVERS OR CREEKS POISONING STREAM OR USING EXPLOSIVES TO CATCH FISH.
W69-04871 06E

FISH CONSERVATION
STRIPED BASS IN MARYLAND TIDEWATER,
W69-05022 06B

INSHORE MARINE CONSERVATION,
W69-05044 02L

INDUSTRIAL FISHERY TECHNOLOGY,
W69-05055 06B

FISH HARVEST
SPORT FISHING SURVEY OF THE LOWER POTOMAC ESTUARY,
W69-04992 02L

INDUSTRIAL FISHERY TECHNOLOGY,
W69-05055 06B

WHAT IS HAPPENING TO OUR ESTUARIES,
W69-05060 06B

FISH MANAGEMENT
THE FISHERIES--A NEGLECTED ASPECT OF ESTUARINE RESEARCH.
W69-05025 02L

REALISM IN THE MANAGEMENT OF ESTUARIES,
W69-05050 02L

FISH STOCKING
CULTIVATING FISH FOR FOOD AND SPORT IN POWER-STATION WATER,
W69-05006 05C

FISHERIES
DEVELOPMENT AND STATUS OF POND FERTILIZATION IN CENTRAL EUROPE,
W69-04804 05G

AN ECONOMIC EVALUATION OF ALTERNATIVE METHODS OF FISHERY REGULATION,
W69-04849 06B

THE GENERAL DEVELOPMENT PLAN FOR THE ALBEMARLE REGION.
W69-04995 06B

INDUSTRIAL FISHERY TECHNOLOGY,
W69-05055 06B

FISHING GEAR
THE GULF OF MEXICO MENHADEN FISHERY IN RELATION TO THE SPORTS FISHERY,
W69-04996 06B

FISHKILL
OBSTRUCTING AND PREVENTING FISH FROM RUNNING UP RIVERS OR CREEKS POISONING STREAM OR USING EXPLOSIVES TO CATCH FISH.
W69-04871 06E

FLOOD CONTROL
WATER AND ECONOMIC DEVELOPMENT.
W69-04825 06B

LEASED UNITED STATES LANDS APPROPRIATION FOR FLOOD CONTROL.
W69-04882 06E

FLOOD DAMAGE
FLOOD PLAIN INFORMATION, SANTA FE RIVER, SANTA FE, NEW MEXICO.
W69-04783 04A

FLOOD PLAIN INFORMATION, CROW RIVER, ROCKFORD, MINNESOTA.
W69-04784 04A

FLOOD PLAIN INFORMATION, LOWER LAS VEGAS WASH, CLARK COUNTY, NEVADA.
W69-04785 04A

FLOOD PLAIN INFORMATION, MISSISSIPPI AND YAZOO RIVERS, VICKSBURG, MISSISSIPPI.
W69-04786 04A

FLOOD PLAIN INFORMATION, SOUTH FORK OF THE CROW RIVER, DELANO, MINNESOTA.
W69-04787 04A

STATE V ANDERSON (ACTION TO ESTABLISH FLOWAGE EASEMENT).
W69-04865 06E

FLOOD PLAIN INFORMATION, CHARLOTTE AND NORTH LEE COUNTIES, FLORIDA.
W69-04918 04A

FLOOD PLAIN INFORMATION, CAMPBELL CREEK, ANCHORAGE, ALASKA.
W69-04919 04A

FLOOD PLAIN INFORMATION, PUPUKEA, OAHU, HAWAII.
W69-04920 04A

FLOOD PLAIN INFORMATION, AGUA FRIA RIVER, MARICOPA COUNTY, ARIZONA.
W69-04921 04A

FLOOD PLAIN INFORMATION, CHESTER CREEK, ANCHORAGE, ALASKA.
W69-04922 04A

FLOOD PLAIN INFORMATION, CHAGRIN RIVER, LAKE AND CUYAHOGA COUNTIES, OHIO.
W69-04923 04A

FLOOD PLAIN INFORMATION OF PURPLE CREEK IN VICINITY OF JACKSON, MISSISSIPPI.
W69-04924 04A

FLOOD PLAIN INFORMATION, CUYAHOGA RIVER, BIG CREEK AND TINKERS CREEK, CUYAHOGA COUNTY, OHIO.
W69-04925 04A

FLOOD PLAIN INFORMATION, BLACK HAWK CREEK, BLACK HAWK COUNTY, IOWA.
W69-04926 04A

RUTHERFORD V LOUISVILLE AND NASHVILLE RR (FLOODING FROM OVERFLOWED CULVERT).
W69-05179 06E

RIDDLE V BALTIMORE AND OHIO (FLOOD DAMAGE CAUSED BY INADEQUATE CULVERT).
W69-05191 04A

FLOOD FORECASTING
ESTIMATION OF MAXIMUM DISCHARGES AND HYDROGRAPHS OF FLOOD,
W69-04955 02E

FLOOD PLAINS
FLOOD PLAIN INFORMATION, CHARLOTTE AND NORTH LEE COUNTIES, FLORIDA.
W69-04918 04A

FLOOD PLAIN INFORMATION, AGUA FRIA RIVER, MARICOPA COUNTY, ARIZONA.
W69-04921 04A

FLOOD PLAIN INFORMATION, CHESTER CREEK, ANCHORAGE, ALASKA.
W69-04922 04A

FLOOD PLAIN INFORMATION, CHAGRIN RIVER, LAKE AND CUYAHOGA COUNTIES, OHIO.
W69-04923 04A

FLOOD PLAIN INFORMATION OF PURPLE CREEK IN VICINITY OF JACKSON, MISSISSIPPI.
W69-04924 04A

FLOOD PLAIN INFORMATION, CUYAHOGA RIVER, BIG CREEK AND TINKERS CREEK, CUYAHOGA COUNTY, OHIO.
W69-04925 04A

FLOOD PLAIN INFORMATION, BLACK HAWK CREEK, BLACK HAWK COUNTY, IOWA.
W69-04926 04A

FLOODING
LYTLE V PENNSYLVANIA RR (BRIDGE CONSTRUCTION AND OBSTRUCTION TO FLOW).
W69-04880 06E

SAWYER V SHADER (OBSTRUCTION TO FLOW).
W69-04888 06E

FLOODS
HYDROGRAPHICAL INVESTIGATION OF THE BRAHMAPUTRA RIVER IN EAST PAKISTAN,
W69-04752 02E

FLOOD PLAIN INFORMATION, SANTA FE RIVER, SANTA FE, NEW MEXICO.
W69-04783 04A

FLOOD PLAIN INFORMATION, CROW RIVER, ROCKFORD, MINNESOTA.
W69-04784 04A

FLOOD PLAIN INFORMATION, LOWER LAS VEGAS WASH, CLARK COUNTY, NEVADA.
W69-04785 04A

FLOOD PLAIN INFORMATION, MISSISSIPPI AND YAZOO RIVERS, VICKSBURG, MISSISSIPPI.
W69-04786 04A

FLOOD PLAIN INFORMATION, SOUTH FORK OF THE CROW RIVER, DELANO, MINNESOTA.
W69-04787 04A

BURKHARDT V ROCKY (DEPOSIT OF DEBRIS IN STREAMS - OVERFLOW).
W69-04912 06E

FLOOD PLAIN INFORMATION, CHARLOTTE AND NORTH LEE COUNTIES, FLORIDA.
W69-04918 04A

FLOOD PLAIN INFORMATION, CAMPBELL CREEK, ANCHORAGE, ALASKA.
W69-04919 04A

FLOOD PLAIN INFORMATION, PUPUKEA, OAHU, HAWAII.
W69-04920 04A

FLOOD PLAIN INFORMATION, AGUA FRIA RIVER, MARICOPA COUNTY, ARIZONA.
W69-04921 04A

FLOOD PLAIN INFORMATION, CHESTER CREEK, ANCHORAGE, ALASKA.
W69-04922 04A

FLOOD PLAIN INFORMATION, CHAGRIN RIVER, LAKE AND CUYAHOGA COUNTIES, OHIO.
W69-04923 04A

FLOOD PLAIN INFORMATION OF PURPLE CREEK IN VICINITY OF JACKSON, MISSISSIPPI.
W69-04924 04A

FLOOD PLAIN INFORMATION, CUYAHOGA RIVER, BIG CREEK AND TINKERS CREEK, CUYAHOGA COUNTY, OHIO.
W69-04925 04A

FLOOD PLAIN INFORMATION, BLACK HAWK CREEK, BLACK HAWK COUNTY, IOWA.
W69-04926 04A

DETERMINING STREAMFLOW ABSTRACTIONS FROM ANTECEDENT

CONDITIONS,
W69-04933 02E

FLORIDA
KOCH V WICK (PRIVATE OWNER MAY ENJOIN COUNTY'S ATTEMPT TO USE GROUNDWATER ON OTHER THAN OVERLYING LAND).
W69-04870 06E

LIBBY, MCNEIL AND LIBBY V ROBERTS (INTERFERENCE WITH NATURAL DRAINAGE COURSE).
W69-04872 06E

HOLLAND V FT PIERCE FINANCING AND CONSTR CO (ACTION TO SEIZE LANDFILL CONSTRUCTED IN NAVIGABLE STREAM).
W69-04908 06E

LABRUZZO V ATLANTIC DREDGING AND CONST CO (ACTION TO RECOVER DAMAGES FOR DISRUPTION OF UNDERGROUND STREAM).
W69-04909 06E

LABRUZZO V ATLANTIC DREDGING CONSTRUCTION CO (EXCAVATION DIVERTING UNDERGROUND WATERS).
W69-04910 06E

ECOLOGICAL EFFECTS OF SEWAGE POLLUTION IN BISCAYNE BAY, FLORIDA SEDIMENTS AND THE DISTRIBUTION OF BENTHIC AND FOULING MACRO-ORGANISMS,
W69-05030 05C

BROWARD COUNTY V HURWIT (MUNICIPAL WATER AND SEWER FACILITIES).
W69-05162 06E

CRUTCHFIELD V F A SEBRING REALTY CO (INJUNCTION AGAINST REMOVAL OF LAKE WATER).
W69-05180 06E

STATE V REEDY CREEK IMPROVEMENT DISTRICT (PLEDGING OF PUBLIC CREDIT TO FINANCE DRAINAGE PROJECTS).
W69-05185 06E

FLOW AROUND OBJECTS
LOCALIZED SCOUR IN ERODIBLE-BED CHANNELS,
W69-04788 02J

FLOW AUGMENTATION
HODGES MANOR CORP V MAYFLOWER PARK CORP (DAMAGE DUE TO DISCHARGE OF SURFACE WATERS THROUGH ARTIFICIAL CHANNELS).
W69-05173 06E

FLOW CHARACTERISTICS
FLOW AND CAVITATION CHARACTERISTICS OF CONTROL VALVES,
W69-04716 08C

CONTRIBUTION CONCERNING THE FLOW RATES OF RIVERS TRANSPORTING DRAIN WATERS OF OPEN-CAST MINES,
W69-04956 04C

FLOW MEASUREMENT
INDEX METHOD FOR PUMPING OPERATION OF REVERSIBLE PUMP-TURBINE,
W69-04743 08C

VELOCITY DISTRIBUTION AND ITS EFFECT ON THE ACCURACY OF THE GIBSON METHOD OF WATER MEASUREMENT,
W69-04744 08C

FLOW RATES
INDEX METHOD FOR PUMPING OPERATION OF REVERSIBLE PUMP-TURBINE,
W69-04743 08C

FLOWERING
PHENOLOGICAL ASPECTS OF A FEW PROMISING EUCALYPTUS IN THE ARID ZONE,
W69-05091 02I

FLOW-CHART
OPTIMUM OPERATIONS FOR PLANNING OF A COMPLEX WATER RESOURCES SYSTEM,
W69-05123 06A

FLUID DYNAMICS
FLUID DYNAMICS,
W69-04701 08B

FLUID MECHANICS
FLUID MECHANICS OF DEEP-WELL DISPOSALS,
W69-04928 05E

FLUORIDATION
WATER FOR FLUORIDES,
W69-04769 05F

FLUORIDES
WATER FOR FLUORIDES,
W69-04769 05F

FORECASTING
WATER QUALITY IN THE POTOMAC ESTUARY,
W69-05027 05G

ESTUARINE WATER QUALITY MANAGEMENT AND FORECASTING,
W69-05059 05B

FORECASTING HEAT LOSS IN PONDS AND STREAMS,
W69-05062 05B

WATER RESOURCES ACTIVITIES IN THE UNITED STATES ELECTRIC POWER IN RELATION TO THE NATION'S WATER RESOURCES.
W69-05068 08C

WATER RESOURCES ACTIVITIES IN THE UNITED STATES WATER SUPPLY AND DEMAND.
W69-05065 06D

FOREIGN COUNTRIES
IMPORTANCE OF THE ECONOMIC FEASIBILITY OF THE WATER SUPPLY AND SEWER SYSTEM PROJECTS,
W69-04811 06B

POLLUTION OF LONDON'S RIVER,
W69-04993 05C

RIVER POLLUTION II, CAUSES AND EFFECTS,
W69-05012 02A

DISCHARGE OF WASTES INTO THE SEA IN EUROPEAN COASTAL AREAS,
W69-05015 05E

THE CALCULATION OF POLLUTION OF THE THAMES ESTUARY AS A THEORY OF QUANTIZED MIXING,
W69-05041 05B

FOREIGN DESIGN PRACTICES
SOME ASPECTS OF DESIGN AND CONSTRUCTION OF EARTH AND ROCKFILL DAMS IN INDIA,
W69-04742 08D

FOREST SOILS
WATER HOLDING CAPACITY OF PONDEROSA PINE FOREST FLOOR LAYERS,
W69-04751 03B

FORESTRY
THE GENERAL DEVELOPMENT PLAN FOR THE ALBEMARLE REGION.
W69-04995 06B

FORMULAS
CONSUMPTIVE USE COMPUTATIONS FROM EVAPORATION PAN DATA,
W69-05092 02D

FRACTURE TRACES
MEASUREMENT OF THE ABUNDANCE OF FRACTURE TRACES ON AERIAL PHOTOGRAPHS,
W69-04987 02F

FRACTURES(GEOLOGY)
MEASUREMENT OF THE ABUNDANCE OF FRACTURE TRACES ON AERIAL PHOTOGRAPHS,
W69-04987 02F

FREE SURFACES
FURTHER STUDY OF AQUIFER PERFORMANCE,
W69-05149 02A

FREEDOM OF THE SEA
MARINE RESOURCES AND THE FREEDOM OF THE SEAS,
W69-04808 06E

FREEHOLD ESTATE
CLARK V LINDSAY LIGHT AND CHEMICAL CO (RIPARIAN RIGHTS IN WATERS OF STREAM).
W69-04858 06E

FROST ACTION
PARTICLE SIZE AS A BASIS FOR PREDICTING FROST ACTION IN SOILS,
W69-04739 02C

FROST HEAVING
PARTICLE SIZE AS A BASIS FOR PREDICTING FROST ACTION IN SOILS,
W69-04739 02C

FROZEN GROUND
A LOW INTENSITY RAIN SIMULATOR FOR LONG DURATION RAIN-ON-SNOW EVENTS.
W69-04939 02B

FURROW IRRIGATION
POPULATION, GROWTH RATE, AND MATURITY OF VEGETABLE CROPS IN RELATION TO SOIL SALINITY AND TEXTURE UNDER SPRINKLER AND FURROW IRRIGATION,
W69-05074 02I

GAGES
SOIL DENSITY MEASUREMENTS WITH GAMMA-RAYS,
W69-04747 08D

GAGING STATIONS
EVAPORATION RATES IN MOUNTAINOUS TERRAIN,
W69-05098 02D

A HEATING SYSTEM FOR STREAM GAGING STATIONS,
W69-05110 07B

GAME AND FISH COMM'N CERTIFICATE
SOUTHLAND CO V MCDONALD (POLLUTION OF WATERCOURSE BY ESCAPED CRUDE OIL).
W69-05186 05B

GAMMA RAYS
SOIL DENSITY MEASUREMENTS WITH GAMMA-RAYS,
W69-04747 08D

GENERAL EQUILIBRIUM MODEL
AN EFFICIENT PROGRAM OF WATER RESOURCE DEVELOPMENT IN A FRAMEWORK OF GROWTH AND TRADE,
W69-05127 06B

GENERATOR-MOTORS

SEMI-SYNCHRONOUS STARTING,
W69-04722 08C

GENETICS
PHENOLOGICAL ASPECTS OF A FEW PROMISING EUCALYPTUS IN THE ARID ZONE,
W69-05091 02I

GEOGRAPHICAL REGIONS
WATER USE IN MANUFACTURING, 1963 CENSUS OF MANUFACTURES.
W69-05066 06D

GEOHYDROLOGY
GEOPHYSICAL STUDIES FOR VOLCANOLOGICAL GEOHYDROLOGY,
W69-05145 07B

GEOLOGIC INVESTIGATIONS
THERMAL INFRARED IMAGERY FOR GEOLOGISTS,
W69-04745 07B

GEOLOGIC MAPPING
THERMAL INFRARED IMAGERY FOR GEOLOGISTS,
W69-04745 07B

GEOMORPHOLOGY
INTERRELATIONSHIP BETWEEN PHYSIOGRAPHY, HYDROLOGY, SEDIMENTATION, AND SALINIZATION OF THE LODDEN RIVER PLAINS, AUSTRALIA,
W69-05079 02A

GEORGIA
CAIRO PICKLE CO V MUGGRIDGE (BRINE DISPOSAL POLLUTION BY UPPER RIPARIAN OWNER).
W69-04857 06E

ROUGHTON V THIELE KAOLIN CO (CHEMICAL POLLUTION BY UPPER RIPARIAN OWNER).
W69-05190 05B

GERMINATION
GERMINATION OF FOURWING SALTBUSH SEEDS AT DIFFERENT LEVELS OF MOISTURE STRESS,
W69-05081 02I

MEASUREMENT OF THE WATER POTENTIAL OF INTACT PLANT TISSUES III. THE WATER POTENTIALS OF GERMINATING PEAS (PISUM SATIVUM L.),
W69-05095 02I

GIBSON METHOD
VELOCITY DISTRIBUTION AND ITS EFFECT ON THE ACCURACY OF THE GIBSON METHOD OF WATER MEASUREMENT,
W69-04744 08C

GLASS FIBERS
A REVIEW OF FIBER REINFORCEMENT OF PORTLAND CEMENT PASTE, MORTAR, AND CONCRETE,
W69-04708 08F

GLAZE
CLIMATOLOGY OF SEVERE WINTER STORMS IN ILLINOIS,
W69-05159 02B

GOVERNMENT REGULATION
AN ECONOMIC EVALUATION OF ALTERNATIVE METHODS OF FISHERY REGULATION,
W69-04849 06B

GOVERNMENT SUPPORTS
FEDERAL ASSISTANCE IN OUTDOOR RECREATION.
W69-04989 09D

GRAIN SIZES
PARTICLE SIZE AS A BASIS FOR PREDICTING FROST ACTION IN SOILS,
W69-04739 02C

GRASSES
EFFECTS OF PHENYLMERCURIC ACETATE ON TRANSPIRATION AND GROWTH OF SMALL PLOTS OF GRASS,
W69-05071 02D

GRAVELS
BED-MATERIAL MOVEMENT, MIDDLE FORK EEL RIVER, CALIFORNIA,
W69-04990 02J

GRAVITY DAMS
EARTHQUAKE BEHAVIOR OF RESERVOIR-DAM SYSTEMS,
W69-04726 08A

GREAT LAKES
WIND-DRIVEN SUMMER CIRCULATION IN THE GREAT LAKES,
W69-04789 02H

EQUILIBRIUM MODELS AND COMPOSITION OF THE GREAT LAKES,
W69-04970 02K

GROSS PROFIT
PRODUCERS' MARGINS FOR FOOD FISH AND SHELLFISH,
W69-05053 06C

GROUNDWATER
CONCEPTS IN GROUND WATER MANAGEMENT,
W69-04704 04B

A STUDY OF WATER RESOURCES IN THE CANBERRA AREA AND THE QUEANBEYAN RIVER WATERSHED (GOOGONG DAM CATCHMENT),
W69-04757 02E

RATIO METHOD FOR DETERMINING CHARACTERISTICS OF IDEAL, LEAKY, AND BOUNDED AQUIFERS,
W69-04763 02F

WATER RESOURCES APPRAISAL OF THOUSAND SPRINGS VALLEY, ELKO COUNTY, NEVADA,
W69-04791 02E

NEW THRUSTS IN GROUND WATER,
W69-04793 02F

GROUND WATER PERSPECTIVES AND PROSPECTS,
W69-04794 02F

GROUNDWATER UTILIZATION AND TAX POLICY,
W69-05126 06C

GROUNDWATER FLOW
FURTHER STUDY OF AQUIFER PERFORMANCE,
W69-05149 02A

GROUNDWATER MANAGEMENT
CONCEPTS IN GROUND WATER MANAGEMENT,
W69-04704 04B

GROUNDWATER MOVEMENT
CONGDON V PIONEER CITY COAL CO (RAINWATER RUNOFF).
W69-04913 06E

FLUID MECHANICS OF DEEP-WELL DISPOSALS,
W69-04928 05E

GROUNDWATER RECHARGE
OPERATION OF A RECHARGE BOREHOLE,
W69-04723 04B

FACTORS AFFECTING BIOLOGICAL CLOGGING OF SAND ASSOCIATED WITH GROUND WATER RECHARGE,
W69-05075 03C

GROWTH MEDIA
THE INFLUENCE OF GROWTH MEDIA, TEMPERATURES, AND LIGHT INTENSITIES ON ASPEN ROOT AND TOP GROWTH,
W69-05101 02G

GROWTH RATES
WATER QUALITY IN THE POTOMAC ESTUARY,
W69-05027 05G

GULF COASTAL PLAINS
SEDIMENTATION FROM A HYDRAULIC DREDGE IN A BAY,
W69-05000 04D

GULF OF MEXICO
THE GULF OF MEXICO MENHADEN FISHERY IN RELATION TO THE SPORTS FISHERY,
W69-04996 06B

MULTIPLE UTILIZATION OF GULF COAST ESTUARIES,
W69-05057 02L

HAAVELMO'S MODELS
BAYESIAN ANALYSIS OF HAAVELMO'S MODELS,
W69-04842 06A

HARBORMASTER
HARBORS, WHARVES AND HARBOR MASTERS.
W69-04904 06E

HARBORS
HARBORS, WHARVES AND HARBOR MASTERS.
W69-04904 06E

SUMMARY AND ANALYSIS OF SEDIMENT RECORDS IN RELATION TO ST. LOUIS HARBOR SEDIMENTATION PROBLEM,
W69-04938 02J

ORGANIC POLLUTION OF NEW YORK HARBOR APPLICATION,
W69-05026 05B

FINAL REPORT ON BALITMORE HARBOR STUDY,
W69-05056 05F

THE VALUE OF A TON OF GENERAL CARGO TO THE AREA'S ECONOMY--DELAWARE RIVER PORT.
W69-05061 06C

HAWAII
GEOPHYSICAL STUDIES FOR VOLCANOLOGICAL GEOHYDROLOGY,
W69-05145 07B

HEAT BALANCE
FORECASTING HEAT LOSS IN PONDS AND STREAMS,
W69-05062 05B

HEAT FLOW
THERMAL CONDUCTIVITY OF TWO-PHASE POROUS MATERIALS DRY SOILS,
W69-04949 07B

HEATED WATER
EFFECTS OF HEATED DISCHARGES IN THE TEMPERATURE OF THE THAMES ESTUARY II,
W69-04994 05C

CULTIVATING FISH FOR FOOD AND SPORT IN POWER-STATION WATER,
W69-05006 05C

HEATING
A HEATING SYSTEM FOR STREAM GAGING STATIONS,
W69-05110 07B

HERBICIDES

CONTROL OF SUBMERSED AQUATIC WEEDS IN IRRIGATION CANALS BY DAILY APPLICATIONS OF LOW CONCENTRATIONS OF COPPER SULFATE,
W69-04729 04A

EFFECTS OF HERBICIDES, BURNING, AND SEEDING DATE IN RESEEDING AN ARID RANGE.
W69-05082 02A

HERB-SHRUB COVER
PROPERTIES OF SOIL UNDER ASPEN AND HERB-SHRUB COVER,
W69-05097 02G

HIGHWAY EFFECTS
RUBIN V STATE (DRAINAGE WATER DIVERSION).
W69-04868 06E

HIRSCHMAN DEVELOPMENT THEORY
ECONOMICS IN REGIONAL WATER RESEARCH AND POLICY,
W69-05124 06B

HISTORY
POLLUTION OF LONDON'S RIVER,
W69-04993 05C

CHESAPEAKE COUNTRY,
W69-05010 06G

HOGS
FAIRFS V DUPREE (WATER POLLUTION FROM ANIMAL WASTES).
W69-05182 05B

HOMOGENEITY
HOMOGENEOUS, ESPECIALLY LINEAR HOMOGENEOUS, PRODUCTION FUNCTIONS AND THE LAW OF YIELD (GERMAN),
W69-04846 06B

HUDSON RIVER
ORGANIC POLLUTION OF NEW YORK HARBOR - THEORETICAL CONSIDERATIONS,
W69-05034 05B

HUMAN POPULATION
WATER QUALITY IN THE POTOMAC ESTUARY,
W69-05027 05G

HYDRAULIC DESIGN
TENTATIVE DESIGN PROCEDURES FOR RIPRAP-LINED CHANNELS,
W69-04727 08B

RISING ACTIVE WATER FLOW IN THE OSIRIS REACTOR POOL (FRENCH),
W69-04959 05C

HYDRAULIC FRACTURING
IMPORTANCE OF DEEP PERMEABLE DISPOSAL FORMATIONS IN LOCATION OF A LARGE NUCLEAR-FUEL REPROCESSING PLANT,
W69-04942 05E

HYDRAULIC GATES AND VALVES
FLOW AND CAVITATION CHARACTERISTICS OF CONTROL VALVES,
W69-04716 08C

HYDRAULIC GEOMETRY
HYDRAULIC GEOMETRY OF ILLINOIS STREAMS,
W69-05153 08B

HYDRAULIC PROPERTIES
1967 AN EXCEPTIONAL YEAR IN THE LIFE OF THE DE BERRE POND (FRENCH),
W69-04958 05C

HYDRAULIC GEOMETRY OF ILLINOIS STREAMS,
W69-05153 08B

HYDRAULIC TURBINES
VELOCITY DISTRIBUTION AND ITS EFFECT ON THE ACCURACY OF THE GIBSON METHOD OF WATER MEASUREMENT,
W69-04744 08C

HYDRAULIC VALVES
FLOW AND CAVITATION CHARACTERISTICS OF CONTROL VALVES,
W69-04716 08C

HYDRAULICS
FLUID DYNAMICS,
W69-04701 08B

HYDRODYNAMICS
FLUID DYNAMICS,
W69-04701 08B

HYDROELECTRIC PLANTS
SEMI-SYNCHRONOUS STARTING,
W69-04722 08C

HYDROELECTRIC POWER
THE MOSSYROCK DEVELOPMENT,
W69-04737 08A

THE SOLINA HYDRO PROJECT,
W69-04738 08A

WATER AND ECONOMIC DEVELOPMENT.
W69-04825 06B

FINANCING WATER PROJECTS IN LATIN AMERICA,
W69-04836 06B

HYDROGEN ION CONCENTRATION
SOME PH-CONTROLLING REDOX REACTIONS IN NATURAL WATERS,
W69-04771 02K

HYDROGEOLOGY
THE HYDROGEOLOGIST'S RESPONSIBILITY -- METROPOLITAN WATER RESOURCE PLANNING,
W69-05114 06B

HYDROGRAPH
HYDROGRAPHICAL INVESTIGATION OF THE BRAHMAPUTRA RIVER IN EAST PAKISTAN,
W69-04752 02E

HYDROGRAPH ANALYSIS
THE DISCHARGE RECESSION AS CRITERION ON THE RETENTION CAPACITY OF BASINS,
W69-04953 02E

HYDROGRAPHS
INLET HYDROGRAPH ESTIMATION FOR LINEAR FLOW MODELS ACCORDING TO OUTLET HYDROGRAPH,
W69-04961 02A

THE CONSTRUCTION AND USE OF FLOW-VOLUME CURVES,
W69-04979 02E

HYDROGRAPHY
PROCEEDINGS OF THE FIRST INTERNATIONAL CONFERENCE ON WASTE DISPOSAL IN THE MARINE ENVIRONMENT,
W69-05038 05E

HYDROLOGIC BUDGET
A STUDY OF WATER RESOURCES IN THE CANBERRA AREA AND THE QUEANBEYAN RIVER WATERSHED (GOOGONG DAM CATCHMENT),
W69-04757 02E

GEOLOGY OF THE REGOLITH AQUIFERS OF THE NISHNABOTNA BASIN,
W69-04781 02F

AN HOURLY WATER BALANCE MODEL AS A BASIS FOR CONTINUOUS WATER RESOURCES ASSESSMENT ON A WATERSHED,
W69-04954 02A

WATER BALANCE OF LAKE AFFECTED BY SEA (FRENCH),
W69-04960 02H

HYDROLOGIC CYCLE
HYDROLOGIC MINI-CYCLE FOR SOIL MOISTURE AND SALT CONTROL IN IRRIGATED AGRICULTURE,
W69-05076 03F

EVAPOTRANSPIRATION AND SOIL-MOISTURE DEPLETION,
W69-05102 02G

HYDROLOGIC DATA
EVAPORATION RATES IN MOUNTAINOUS TERRAIN,
W69-05098 02D

HYDROLOGIC PROPERTIES
1967 AN EXCEPTIONAL YEAR IN THE LIFE OF THE DE BERRE POND (FRENCH),
W69-04958 05C

HYDROLOGY
INTERRELATIONSHIP BETWEEN PHYSIOGRAPHY, HYDROLOGY, SEDIMENTATION, AND SALINIZATION OF THE LODDEN RIVER PLAINS, AUSTRALIA,
W69-05079 02A

HYDRAULIC GEOMETRY OF ILLINOIS STREAMS,
W69-05153 08B

HYDROLYSIS
CHEMICAL MEASUREMENT OF MEAN TEMPERATURE,
W69-04765 07A

THE NATURE OF INORGANIC SOLUTE SPECIES IN WATER,
W69-04967 02K

HYDROMETRY
MEASUREMENT OF THE WATER POTENTIAL OF INTACT PLANT TISSUES III. THE WATER POTENTIALS OF GERMINATING PEAS (PISUM SATIVUM L.),
W69-05095 02I

HYGROMETRY
EXPERIENCE WITH THREE VAPOUR METHODS FOR MEASURING WATER POTENTIAL IN PLANTS,
W69-05085 02I

ICE-WATER INTERFACES
THE UNDERSIDE OF RIVER ICE, ST. CROIX RIVER, WISCONSIN,
W69-04976 02C

IDEAL AQUIFER
RATIO METHOD FOR DETERMINING CHARACTERISTICS OF IDEAL, LEAKY, AND BOUNDED AQUIFERS,
W69-04763 02F

ILLINOIS
CLIMATOLOGY OF SEVERE WINTER STORMS IN ILLINOIS,
W69-05159 02B

ILLINOIS WATERWAY
CONGESTION, TOLLS, AND THE ECONOMIC CAPACITY OF A WATERWAY,
W69-04838 06C

IMPOUNDED WATERS
MCHENRY V FORD MOTOR CO (EROSION BY WATERS OF RESERVOIR).
W69-04864 06E

INCOME DISTRIBUTION
INFLATION AND INCOME DISTRIBUTION (GERMAN),

W69-04851 06C

INCOME TAX
DIRECT VERSUS INDIRECT TAXATION,
W69-04848 06C

INDEXING DATA
DOCUMENTATION INFORMATION AND INSTRUCTION CONCERNING THE PROBLEMS OF WATER,
W69-04940 10

INDIANA
CAPES V BARGER (DAMAGES CAUSED BY DAM TO REPEL SURFACE WATERS).
W69-05181 06E

INDIRECT COSTS
PRODUCERS' MARGINS FOR FOOD FISH AND SHELLFISH,
W69-05053 06C

INDIRECT TAX
DIRECT VERSUS INDIRECT TAXATION,
W69-04848 06C

INDUSTRIAL PLANTS
WATER USE IN MANUFACTURING, 1963 CENSUS OF MANUFACTURES.
W69-05066 06D

INDUSTRIAL WASTES
ON OYSTERS AND SULFITE WASTE LIQUOR,
W69-04997 05C

INDUSTRIAL WATER
RISING ACTIVE WATER FLOW IN THE OSIRIS REACTOR POOL (FRENCH),
W69-04959 05C

INDUSTRIES
THE FUTURE OF ALASKA,
W69-05047 06B

INFILTRATION
WATER HOLDING CAPACITY OF PONDEROSA PINE FOREST FLOOR LAYERS,
W69-04751 03B

TILLAGE INFLUENCES WATER INTAKE,
W69-05089 02G

EFFECT OF EXPOSURE AND LOGGING ON RUNOFF AND EROSION,
W69-05104 04D

CHARACTERIZATION OF THE RATE OF WATER INFILTRATION INTO SOIL,
W69-05143 02G

INFILTROMETERS
EFFECT OF EXPOSURE AND LOGGING ON RUNOFF AND EROSION,
W69-05104 04D

CHARACTERIZATION OF THE RATE OF WATER INFILTRATION INTO SOIL,
W69-05143 02G

INFLATION
INFLATION AND INCOME DISTRIBUTION (GERMAN),
W69-04851 06C

INFLATION(ECONOMIC)
THE VALUE OF A TON OF GENERAL CARGO TO THE AREA'S ECONOMY--DELAWARE RIVER PORT.
W69-05061 06C

INFLOW
PREDICTION OF TEMPERATURE IN RIVERS AND RESERVOIRS,
W69-05042 05B

INFORMATION ECONOMICS
QUADRATIC TEAMS, INFORMATION ECONOMICS, AND AGGREGATE PLANNING DECISIONS,
W69-04843 06B

INFORMATION RETRIEVAL
DOCUMENTATION INFORMATION AND INSTRUCTION CONCERNING THE PROBLEMS OF WATER,
W69-04940 10

INFRARED IMAGERY
THERMAL INFRARED IMAGERY FOR GEOLOGISTS,
W69-04745 07B

INFRARED RADIATION
THERMAL INFRARED IMAGERY FOR GEOLOGISTS,
W69-04745 07B

INHIBITORS
EFFECTS OF PHENYLMERCURIC ACETATE ON TRANSPIRATION AND GROWTH OF SMALL PLOTS OF GRASS,
W69-05071 02D

INJECTION WELLS
FLUID MECHANICS OF DEEP-WELL DISPOSALS,
W69-04928 05F

SUBSURFACE DISPOSAL OF LIQUID INDUSTRIAL WASTES BY DEEP-WELL INJECTION,
W69-04941 05F

IMPORTANCE OF DEEP PERMEABLE DISPOSAL FORMATIONS IN LOCATION OF A LARGE NUCLEAR-FUEL REPROCESSING PLANT,
W69-04942 05E

POSSIBILITIES FOR DISPOSAL OF INDUSTRIAL WASTES IN SUBSURFACE ROCKS OF NORTH FLANK OF APPALACHIAN BASIN IN NEW YORK,
W69-04943 05E

POSSIBILITIES FOR SUBSURFACE WASTE DISPOSAL IN A STRUCTURAL SYNCLINE IN PENNSYLVANIA,
W69-04944 05E

GEOLOGY OF SUBSURFACE WASTE DISPOSAL IN MICHIGAN BASIN,
W69-04945 05E

SUBSURFACE WASTE-DISPOSAL POTENTIAL IN SALINA BASIN OF KANSAS,
W69-04946 05E

POTENTIAL OF DENVER BASIN FOR DISPOSAL OF LIQUID WASTES,
W69-04947 05E

SEDIMENTARY HISTORY AND ECONOMIC GEOLOGY OF SAN JUAN BASIN, NEW MEXICO AND COLORADO,
W69-04948 05E

INJUNCTION
FONTENOT V SMITH (CONTRACT AGREEMENTS AND RIGHTS TO NATURAL FLOW).
W69-05170 06E

INLAND WATERWAYS
WATER AND ECONOMIC DEVELOPMENT.
W69-04825 06B

THE ROLE OF U S TRANSPORTATION POLICY IN THE DEVELOPMENT OF INLAND WATERWAY NAVIGATION,
W69-04862 06E

INLETS(WATERWAYS)
ENTRY VELOCITY CONTROL LIMITS DRAIN SEDIMENTATION,
W69-04720 08B

INORGANIC COMPOUNDS
TRACE INORGANICS IN WATER,
W69-04962 02K

INSTRUMENTATION
INSTRUMENT FOR MEASURING SOIL DEFORMATIONS IN DEPTH,
W69-04746 08D

FIELD CORRELATION OF TWO NEUTRON-SCATTERING SOIL MOISTURE METERS,
W69-05100 07B

INTERAMERICAN DEVELOPMENT BANK
FINANCING WATER PROJECTS IN LATIN AMERICA,
W69-04836 06B

INTERFACES
FURTHER STUDY OF AQUIFER PERFORMANCE,
W69-05149 02A

INTERNATIONAL LAW
WATER POWER LINKS RIPARIANS - AUSTRIA CONTRIBUTES TO INTERNATIONAL COOPERATION,
W69-04777 06E

MARINE RESOURCES AND THE FREEDOM OF THE SEAS,
W69-04808 06E

INTERNATIONAL WATERS
WATER POWER LINKS RIPARIANS - AUSTRIA CONTRIBUTES TO INTERNATIONAL COOPERATION,
W69-04777 06E

INTERSTATE COMMISSIONS
THE INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN A STUDY OF ITS ROLE AS A PLANNING AGENCY ENGAGED IN THE POLITICAL PROCESS,
W69-04856 06E

ACHIEVING PUBLIC ACCEPTANCE OF A RIVER BASIN PLAN,
W69-04861 06B

INTERSTATE RIVERS
BOSTICK V SMOOT SAND AND GRAVEL CORP (DREDGING IN RIVER AS CREATING NUISANCE FOR OTHER RIPARIAN OWNERS).
W69-04869 06E

INTER-BASIN TRANSFERS
PLANNED UTILIZATION OF WATER RESOURCES,
W69-04952 02E

INVERTEBRATES
CALORIFIC VALUES OF SOME INVERTEBRATES IN LAKE MENDOTA, WISCONSIN,
W69-04799 02H

INVESTMENT
BAYESIAN ANALYSIS OF HAAVELMO'S MODELS,
W69-04842 06A

OUTDOOR RECREATION DEMANDS AND BENEFITS,
W69-05014 06D

ECONOMICS IN REGIONAL WATER RESEARCH AND POLICY,
W69-05124 06B

TOWARD THE OPTIMIZATION OF INVESTMENT-PRICING DECISIONS A MODEL FOR URBAN WATER SUPPLY TREATMENT FACILITIES,
W69-05129 05F

INVESTOR-OWNED WATER UTILITIES
THE ROLE OF INVESTOR-OWNED WATER UTILITIES IN NATIONAL DEVELOPMENT,
W69-04830 06B

IONS
MASTER VARIABLES AND ACTIVITY SCALES,
W69-04963 02K

THE NATURE OF INORGANIC SOLUTE SPECIES IN WATER,
W69-04967 02K

IOWA
THE EFFECT OF PHOTOSYNTHESIS ON THE OXYGEN BALANCE IN A MIDWESTERN STREAM,
W69-04780 05C

STATE V NICHOLS (MISTAKE - FEDERAL AGENCY JURIS).
W69-04896 06E

SCHMITT V KIRKPATRICK (DRAINAGE EASEMENT).
W69-04897 06E

OWENS V FAYETTE COUNTY (DRAINAGE NUISANCE ABATEMENT).
W69-05167 06E

CONDIFF V KOPSEIKER (EASEMENT - SURFACE DRAINAGE).
W69-05175 06E

IRAN
THE GENERAL POLICY OF THE IRANIAN MINISTRY OF WATER AND POWER IN DEVELOPMENT OF WATER RESOURCES,
W69-04753 04A

IRON-BASE ALLOYS
DEVELOPMENT OF A LOW-COST IRON-BASE ALLOY TO RESIST CORROSION IN HOT SEA WATER,
W69-04771 03A

IRRIGATION
WATER AND ECONOMIC DEVELOPMENT.
W69-04825 06B

IRRIGATION EFFICIENCY
A CLIMATOLOGICAL-TECHNOLOGICAL METHOD FOR ESTIMATING IRRIGATION WATER REQUIREMENTS FOR MAXIMUM CROP YIELDS,
W69-04750 03F

OPERATING POLICIES FOR IRRIGATION SYSTEMS UNDER STOCHASTIC REGIMES,
W69-05131 06A

OPERATING POLICIES FOR IRRIGATION SYSTEMS UNDER STOCHASTIC REGIMES DYNAMIC PROGRAMMING MODEL,
W69-05132 06A

OPERATING POLICIES FOR IRRIGATION SYSTEMS UNDER STOCHASTIC REGIMES SEQUENTIAL LINEAR PROGRAMMING MODEL,
W69-05133 06A

IRRIGATION PROGRAMS
ECONOMIC AND SOCIAL ASPECTS OF PLANNING OF WATER RESOURCES IN DEVELOPING COUNTRIES.
W69-04741 06B

FINANCING WATER PROJECTS IN LATIN AMERICA,
W69-04836 06B

IRRIGATION SYSTEMS
OPERATING POLICIES FOR IRRIGATION SYSTEMS UNDER STOCHASTIC REGIMES,
W69-05131 06A

OPERATING POLICIES FOR IRRIGATION SYSTEMS UNDER STOCHASTIC REGIMES DYNAMIC PROGRAMMING MODEL,
W69-05132 06A

OPERATING POLICIES FOR IRRIGATION SYSTEMS UNDER STOCHASTIC REGIMES SEQUENTIAL LINEAR PROGRAMMING MODEL,
W69-05133 06A

IRRIGATION WATER
A CLIMATOLOGICAL-TECHNOLOGICAL METHOD FOR ESTIMATING IRRIGATION WATER REQUIREMENTS FOR MAXIMUM CROP YIELDS,
W69-04750 03F

JOINT AND SEVERAL LIABILITY
PHILLIPS PETROLEUM CO V HARDEE (LIABILITY FOR DAMAGE BY POLLUTION).
W69-05139 05G

JOINTS
STRENGTH OF JOINTS AND JOINT ASSEMBLIES OF REINFORCED CONCRETE MULTISTORY FRAMES UNDER LOADS OF THE SEISMIC TYPE,
W69-04735 08F

JUDICIAL DECISIONS
BROWARD COUNTY V HURWIT (MUNICIPAL WATER AND SEWER FACILITIES).
W69-05162 06E

H B CARTER V CHOCTAWCHEE CONSOLIDATED DRAINAGE DISTRICT (DRAINAGE DISTRICT DISSOLUTION).
W69-05183 04A

PARISH OF EAST BATON ROUGE V S AND H HEATING CO (CONDEMNATION).
W69-05184 06E

KANSAS
SUBSURFACE WASTE-DISPOSAL POTENTIAL IN SALINA BASIN OF KANSAS,
W69-04946 05E

KARST
SURFACE AND SUBTERRANEAN HYDROLOGY IN ITS APPLICATION TO THE STUDY OF THE MODAVE KARSTIC AQUIFER IN BELGIUM (FRENCH),
W69-04762 02E

KENTUCKY
GOTT V FRANKLIN (BARRICADE TO NATURAL SURFACE WATER FLOW).
W69-04892 06E

W G DUNCAN COAL CO V JONES (PRESCRIPTIVE RIGHTS TO MINEWATER POLLUTION).
W69-04915 06E

F A BARTLETT TREE EXPERT CO V STAMPER (DAMAGES FROM LOGS AND BRUSH ON RIVER BANK).
W69-05169 06E

RUTHERFORD V LOUISVILLE AND NASHVILLE RR (FLOODING FROM OVERFLOWED CULVERT).
W69-05179 06E

UNITED FUEL GAS CO V SAWYERS (WELL POLLUTION THROUGH PERCOLATING WATERS).
W69-05187 05B

KIDNEY BEANS
DETERMINATION OF THE REGIONAL COEFFICIENT 'K' FOR COMPUTING THE CONSUMPTIVE USE OF NATIVE BLACK KIDNEY BEAN IN THE IRRIGATION DISTRICTS OF VERACRUZ STATE,
W69-05086 02I

LABOR SUPPLY
DIRECT VERSUS INDIRECT TAXATION,
W69-04848 06C

LAKE ERIE
ANNUAL REPORT, FISCAL YEAR 1968,
W69-05160 09D

LAKE MENDOTA
CALOBIPIC VALUES OF SOME INVERTEBRATES IN LAKE MENDOTA, WISCONSIN,
W69-04799 02H

LAKE SHORES
SHORELINE FEATURES AS INDICATORS OF HIGH LAKE LEVELS,
W69-04984 02H

LAKES
ON THE MECHANISM OF LANGMUIR CIRCULATIONS AND THEIR ROLE IN EPILIMNION MIXING,
W69-04929 02H

WAVE INTERACTION AND LANGMUIR CIRCULATIONS,
W69-04930 02H

THERMAL STRUCTURE AND VERTICAL HEAT TRANSPORT IN LANGMUIR CIRCULATIONS,
W69-04931 02H

WATER POLLUTION BY OUTBOARD MOTORS,
W69-04936 02H

HYDROLOGIC BASES OF WATER RESOURCES UTILIZATION OF LAKES,
W69-04957 02H

WATER BALANCE OF LAKE AFFECTED BY SEA (FRENCH),
W69-04960 02H

SHORELINE FEATURES AS INDICATORS OF HIGH LAKE LEVELS,
W69-04984 02H

OBSERVATIONS ON THE FORMATION AND BREAKDOWN OF THE OXIDIZED MICROZONE AT THE MUD SURFACE IN LAKES,
W69-05139 02H

WILSON V OWEN (EASEMENT - USE OF LAKE).
W69-05164 06E

CRUTCHFIELD V F A SEBRING REALTY CO (INJUNCTION AGAINST REMOVAL OF LAKE WATER).
W69-05180 06E

LAND MANAGEMENT
FEDERAL ASSISTANCE IN OUTDOOR RECREATION.
W69-04989 09D

LAND RECLAMATION
WHAT IS HAPPENING TO OUR ESTUARIES,
W69-05060 06B

LAND RESOURCES
POLICIES, STANDARDS, AND PROCEDURES IN THE FORMULATION, EVALUATION, AND REVIEW OF PLANS FOR USE AND DEVELOPMENT OF WATER AND RELATED LAND RESOURCES.
W69-05039 06B

LANDFILLS
HOLLAND V FT PIERCE FINANCING AND CONSTR CO (ACTION TO SEIZE LANDFILL CONSTRUCTED IN NAVIGABLE STREAM).
W69-04908 06E

LAW OF THE SEA
MARINE RESOURCES AND THE FREEDOM OF THE SEAS,
W69-04808 06E

LEAF TEMPERATURES
INFLUENCE OF SOIL TEMPERATURE ON TRANSPIRATION UNDER VARIOUS

ENVIRONMENTAL CONDITIONS,
W69-05099 02D

LEAKAGE
RATIO METHOD FOR DETERMINING CHARACTERISTICS OF IDEAL, LEAKY, AND BOUNDED AQUIFERS,
W69-04763 02F

LEAVES
EXPERIENCE WITH THREE VAPOUR METHODS FOR MEASURING WATER POTENTIAL IN PLANTS,
W69-05085 02I

LEGAL ASPECTS
PHILLIPS PETROLEUM CO V HARDEE (LIABILITY FOR DAMAGE BY POLLUTION).
W69-05199 05G

LEGISLATION
PUBLIC PARKS - PLAYGROUNDS - JOINT PARKS.
W69-04877 06E

PUBLIC PARKS - PLAYGROUNDS.
W69-04878 06E

TRANSPLANTING OF SHELLS AND OYSTERS.
W69-04879 06E

SEWERS AND DRAINS.
W69-04885 06E

FOURTH CLASS CITIES - GENERAL POWERS OF CITY CORPORATIONS.
W69-04906 06E

BOAT AND MARINA WASTES,
W69-05009 05G

WATER TRANSFER PROBLEMS LAW,
W69-05117 06B

THE NATIONAL WATER RESOURCE ASSESSMENT AND REGIONAL FRAMEWORK PLANS,
W69-05125 06B

BUFF V STIBES (ENTRANCE ON LAND TO REMOVE OBSTRUCTION TO FLOW).
W69-05193 06E

LEISURE
DIRECT VERSUS INDIRECT TAXATION,
W69-04848 06C

LEONTIEF MODELS
AN EFFICIENT PROGRAM OF WATER RESOURCE DEVELOPMENT IN A FRAMEWORK OF GROWTH AND TRADE,
W69-05127 06B

LIMESTONES
HYDROGEOLOGIC SIGNIFICANCE OF CALCIUM-MAGNESIUM RATIOS IN GROUND WATER FROM CARBONATE ROCKS IN THE LANCASTER QUADRANGLE, SOUTHEASTERN PENNSYLVANIA,
W69-04985 02F

LINEAR HOMOGENEOUS
HOMOGENEOUS, ESPECIALLY LINEAR HOMOGENEOUS, PRODUCTION FUNCTIONS AND THE LAW OF YIELD (GERMAN),
W69-04846 06B

LINEAR PROGRAMMING
OPERATING POLICIES FOR IRRIGATION SYSTEMS UNDER STOCHASTIC REGIMES SEQUENTIAL LINEAR PROGRAMMING MODEL,
W69-05133 06A

LINEARING PROGRAMMING
OPERATING POLICIES FOR IRRIGATION SYSTEMS UNDER STOCHASTIC REGIMES,
W69-05131 06A

LINED CANALS
TENTATIVE DESIGN PROCEDURES FOR RIPRAP-LINED CHANNELS,
W69-04727 08B

LIQUID WASTES
SUBSURFACE DISPOSAL OF LIQUID INDUSTRIAL WASTES BY DEEP-WELL INJECTION,
W69-04941 05E

LIVE LOADS
EFFECT OF CONTINUOUS SURCHARGE ON A RETAINING WALL,
W69-04740 08D

LOADING TESTS
EFFECT OF CONTINUOUS SURCHARGE ON A RETAINING WALL,
W69-04740 08D

LOANS
FINANCING WATER PROJECTS IN LATIN AMERICA,
W69-04836 06B

LOCAL GOVERNMENT
FOURTH CLASS CITIES - SEWER BONDS.
W69-04875 06E

LOCAL GOVERNMENTS
HOME RULE CITIES - BORROWING FOR PUBLIC WORKS.
W69-04876 06E

VILLAGES - WATER WORKS.
W69-05188 06E

AUTHORITY TO LEVY TAXES FOR STREET IMPROVEMENTS.
W69-05194 06E

POWERS OF COUNCIL.
W69-05195 06E

LOCKS
CONGESTION, TOLLS, AND THE ECONOMIC CAPACITY OF A WATERWAY,
W69-04838 06C

LODDEN RIVER PLAINS
INTERRELATIONSHIP BETWEEN PHYSIOGRAPHY, HYDROLOGY, SEDIMENTATION, AND SALINIZATION OF THE LODDEN RIVER PLAINS, AUSTRALIA,
W69-05079 02A

LOGGING(FOREST)
EFFECT OF EXPOSURE AND LOGGING ON RUNOFF AND EROSION,
W69-05104 04D

LOGGING(RECORDING)
MAGNETIC TAPE RECORDING OF GEOPHYSICAL LOGS,
W69-04986 07B

LOUISIANA
PRECONSTRUCTION STUDY OF THE FISHERIES OF THE ESTUARINE AREAS TRAVERSED BY THE MISSISSIPPI RIVER-GULF OUTLET PROJECT,
W69-05049 02L

NICHOLSON V HOLLOWAY PRINTING CO (ARTIFICIAL INCREASE OF SURFACE RUNOFF).
W69-05163 06E

FONTENOT V SMITH (CONTRACT AGREEMENTS AND RIGHTS TO NATURAL FLOW).
W69-05170 06E

PARISH OF EAST BATON ROUGE V S AND H HEATING CO (CONDEMNATION).
W69-05184 06E

PHILLIPS PETROLEUM CO V HARDEE (LIABILITY FOR DAMAGE BY POLLUTION).
W69-05199 05G

LOW WATER MARK
RIPARIAN RIGHTS... ACTION BY STATE TO ENJOIN LANDOWNER FROM FILLING IN LAKE.
W69-04860 06E

LOWER ESTATE
RUTHERFORD V LOUISVILLE AND NASHVILLE RR (FLOODING FROM OVERFLOWED CULVERT).
W69-05179 06E

LOWER LAND OWNERS
CONGDON V PIONEER CITY COAL CO (RAINWATER RUNOFF).
W69-04913 06E

LOWER LANDOWNER
LARSON V REMEIKIS (ACCELERATION AND DIVERSION OF NATURAL DRAINAGE RELATIVE RIGHTS).
W69-04917 06E

LYSIMETERS
ON INVESTIGATIONS CONCERNING THE INFLUENCE OF AGRICULTURAL UTILIZATION ON THE RUNOFF FORMATION BY MEANS OF GROUNDWATER-LYSIMETERS,
W69-04951 02G

MANAGEMENT
REALISM IN THE MANAGEMENT OF ESTUARIES,
W69-05050 02L

OPTIMAL FLOOD DAMAGE MANAGEMENT RETROSPECT AND PROSPECT,
W69-05118 06B

MANGANESE
DEEP SEA MANGANESE NODULES FROM SCIENTIFIC PHENOMENON TO WORLD RESOURCE,
W69-04810 06B

MANGANESE NODULES
DEEP SEA MANGANESE NODULES FROM SCIENTIFIC PHENOMENON TO WORLD RESOURCE,
W69-04810 06B

MANPOWER
MANPOWER PROBLEMS IN WATER SUPPLY ORGANIZATION,
W69-04779 06E

MARINAS
BOAT AND MARINA WASTES,
W69-05009 05G

MARINE FISH
THE EFFECTS OF TEMPERATURE AND SALINITY ON MARINE AND BRACKISH WATER ANIMALS--I. TEMPERATURE,
W69-05011 05C

A SURVEY OF SALT-WATER SPORT FISHING IN VIRGINIA 1955-1960,
W69-05046 06B

SOME EFFECTS OF SEWER EFFLUENT ON MARINE LIFE,
W69-05069 05C

MARINE FISHERIES
MASSACHUSETTS MARINE SPORT FISHERIES INVENTORY,
W69-04991 06B

MARKETING

PRODUCERS' MARGINS FOR FOOD FISH AND SHELLFISH,
W69-05053 06C

MARYLAND
BISHOP V RICHARD (OBSTRUCTION OF DRAINAGE BY LOWER LANDOWNER).
W69-04890 06E

COMMERCIAL AND SPORT FISHERIES,
W69-05002 03E

OXYGENATION OF BALTIMORE HARBOR BY PLANKTONIC ALGAE,
W69-05003 05G

BOAT AND MARINA WASTES,
W69-05009 05G

CHESAPEAKE COUNTRY,
W69-05010 06G

EFFECTS OF CIVILIZATION ON STRIPED BASS AND OTHER ESTUARINE BIOTA IN CHESAPEAKE BAY AND TRIBUTARIES,
W69-05021 05C

STRIPED BASS IN MARYLAND TIDEWATER,
W69-05022 06B

SEDIMENT,
W69-05029 04D

AQUATIC PLANT NUISANCES,
W69-05043 04A

THE SEDIMENTS OF CHESAPEAKE BAY,
W69-05052 02L

FINAL REPORT ON BALITMORE HARBOR STUDY,
W69-05056 05F

MASSACHUSETTS
SAWYER V SHADER (OBSTRUCTION TO FLOW).
W69-04888 06E

MASSACHUSETTS MARINE SPORT FISHERIES INVENTORY,
W69-04991 06B

NASS V TOWN OF DUXBURY (DIVERSION OF FLOW BY CHANNEL OBSTRUCTION).
W69-05197 04A

MATERIAL TESTING
DEVELOPMENT OF A LOW-COST IRON-BASE ALLOY TO RESIST CORROSION IN HOT SEA WATER,
W69-04771 03A

MATHEMATICAL ANALYSIS
OUTDOOR RECREATION DEMANDS AND BENEFITS,
W69-05014 06D

MATHEMATICAL MODELS
SURFACE AND SUBTERRANEAN HYDROLOGY IN ITS APPLICATION TO THE STUDY OF THE MODAVE KARSTIC AQUIFER IN BELGIUM (FRENCH),
W69-04762 02E

RATIO METHOD FOR DETERMINING CHARACTERISTICS OF IDEAL, LEAKY, AND BOUNDED AQUIFERS,
W69-04763 02F

THEORETICAL FRAMEWORK FOR ASCERTAINING PORE WATER PRESSURE IN CONFINING LAYERS IN THE VICINITY OF A PUMPING WELL,
W69-04767 02F

LOCALIZED SCOUR IN ERODIBLE-BED CHANNELS,
W69-04788 02J

EFFECTS OF HEATED DISCHARGES IN THE TEMPERATURE OF THE THAMES ESTUARY II,
W69-04994 05C

OXYGEN BALANCE OF AN ESTUARY,
W69-05035 05B

A REVIEW OF THEORETICAL MODELS OF TURBULENT DIFFUSION IN THE SEA,
W69-05037 02L

THE CALCULATION OF POLLUTION OF THE THAMES ESTUARY AS A THEORY OF QUANTIZED MIXING,
W69-05041 05B

PREDICTION OF TEMPERATURE IN RIVERS AND RESERVOIRS,
W69-05042 05B

MATHEMATICAL MODEL FOR DISSOLVED OXYGEN,
W69-05058 05B

MATHEMATICAL STUDIES
SURFACE AND SUBTERRANEAN HYDROLOGY IN ITS APPLICATION TO THE STUDY OF THE MODAVE KARSTIC AQUIFER IN BELGIUM (FRENCH),
W69-04762 02E

ORGANIC POLLUTION OF NEW YORK HARBOR - THEORETICAL CONSIDERATIONS,
W69-05034 05B

OPTIMUM OPERATIONS FOR PLANNING OF A COMPLEX WATER RESOURCES SYSTEM,
W69-05121 06A

MATRIX
A NOTE ON THE VARIANCE OF A MATRIX,
W69-04844 06A

MEAN TEMPERATURE
CHEMICAL MEASUREMENT OF MEAN TEMPERATURE,
W69-04765 07A

MEASUREMENT
THE DETERMINATION OF THE EVAPORATION FROM THE PLANT COVER AND THE SURFACE OF THE SOIL BY RELATING LYSIMETER AND SOIL MOISTURE MEASUREMENTS TO POTENTIAL EVAPORATION,
W69-05073 02D

MEASUREMENT OF THE WATER POTENTIAL OF INTACT PLANT TISSUES III. THE WATER POTENTIALS OF GERMINATING PEAS (PISUM SATIVUM L.),
W69-05095 02I

MEASURING INSTRUMENTS
INSTRUMENT FOR MEASURING SOIL DEFORMATIONS IN DEPTH,
W69-04746 08D

SOIL DENSITY MEASUREMENTS WITH GAMMA-RAYS,
W69-04747 08D

MEMBRANE PROCESSES
DEVELOPMENT OF TRANSPORT DEPLETION PROCESSES,
W69-05156 03A

METEOROLOGICAL DATA
EVAPORATION RATES IN MOUNTAINOUS TERRAIN,
W69-05098 02D

METHODOLOGY
CHEMICAL MEASUREMENT OF MEAN TEMPERATURE,
W69-04765 07A

MEXICO
DETERMINATION OF THE REGIONAL COEFFICIENT 'K' FOR COMPUTING THE CONSUMPTIVE USE OF NATIVE BLACK KIDNEY BEAN IN THE IRRIGATION DISTRICTS OF VERACRUZ STATE,
W69-05086 02I

MICHIGAN
MCHENRY V FORD MOTOR CO (EROSION BY WATERS OF RESERVOIR).
W69-04864 06E

FOURTH CLASS CITIES - SEWER BONDS.
W69-04875 06E

HOME RULE CITIES - BORROWING FOR PUBLIC WORKS.
W69-04876 06E

COUNTY CONTROL OF DAM CONSTRUCTION.
W69-04881 06E

LEASED UNITED STATES LANDS APPROPRIATION FOR FLOOD CONTROL.
W69-04882 06E

FENCES ACROSS WATER NEGLECT, REMEDY.
W69-04883 06E

BENNETT V COUNTY OF EATON (CONCENTRATED DRAINAGE ONTO LOWER LANDS).
W69-04898 06E

HARBORS, WHARVES AND HARBOR MASTERS.
W69-04904 06E

RAILWAY COMPANIES, DRAINAGE REPAIRS FAILURE, EXPENSE OF COMPANY.
W69-04905 06E

FOURTH CLASS CITIES - GENERAL POWERS OF CITY CORPORATIONS.
W69-04906 06E

GEOLOGY OF SUBSURFACE WASTE DISPOSAL IN MICHIGAN BASIN,
W69-04945 05E

ROBINSON V BELANGER (SURFACE WATER DRAINAGE RIGHTS).
W69-05177 04A

VILLAGES - WATER WORKS.
W69-05188 06E

AUTHORITY TO LEVY TAXES FOR STREET IMPROVEMENTS.
W69-05194 06E

POWERS OF COUNCIL.
W69-05195 06E

WATERWORKS.
W69-05196 06E

MINE DRAINAGE
CONTRIBUTION CONCERNING THE FLOW RATES OF RIVERS TRANSPORTING DRAIN WATERS OF OPEN-CAST MINES,
W69-04956 04C

MINE WATER
W G DUNCAN COAL CO V JONES (PRESCRIPTIVE RIGHTS TO MINEWATER POLLUTION).
W69-04915 06E

MINERALOGY
GIBBS PHASE RULE AND MARINE SEDIMENTS,
W69-04964 02K

MINNESOTA
STATE V ANDERSON (ACTION TO ESTABLISH FLOWAGE EASEMENT).
W69-04865 06E

LIPPMAN V HUHN (RIGHT TO ESTABLISH PUBLIC DRAINAGE DITCHES).
W69-04866 06E

FISCHER V TOWN OF ALBIN (TOWN MAY NOT ALTER DRAINAGE DISTRICT WITHOUT CONSIDERING RIGHTS OF DISTRICT LANDOWNERS).
W69-04874 06F

MISSISSIPPI
SOUTHLAND V AARON (RIPARIAN OWNER'S ACTION FOR DAMAGES FROM OIL WASTE POLLUTION OF STREAM).
W69-04884 06E

PERSON V ROANE (RIGHT TO USE OF DRAINAGE DITCH ON ANOTHER'S PROPERTY).
W69-05166 06E

H B CARTER V CHUQUATONCHEE CONSOLIDATED DRAINAGE DISTRICT (DRAINAGE DISTRICT DISSOLUTION).
W69-05183 04A

SOUTHLAND CO V MCDONALD (POLLUTION OF WATERCOURSE BY ESCAPED CRUDE OIL).
W69-05186 05B

MISSISSIPPI RIVER
FLOOD PLAIN INFORMATION, MISSISSIPPI AND YAZOO RIVERS, VICKSBURG, MISSISSIPPI.
W69-04786 04A

SUMMARY AND ANALYSIS OF SEDIMENT RECORDS IN RELATION TO ST. LOUIS HARBOR SEDIMENTATION PROBLEM,
W69-04938 02J

PRECONSTRUCTION STUDY OF THE FISHERIES OF THE ESTUARINE AREAS TRAVERSED BY THE MISSISSIPPI RIVER-GULF OUTLET PROJECT,
W69-05049 02L

MISSOURI
GIBSON V SHARP (DRAINAGE DITCH RIGHT OF WAY)
W69-04891 06E

YOUNG V MOORE (LANDOWNERS RIGHT TO DRAIN EXCESS SURFACE WATER).
W69-04899 06E

CLARK V CITY OF SPRINGFIELD (NUISANCE ABATEMENT SEWAGE AND SURFACE WATER).
W69-04900 06E

DIVELBISS V PHILLIPS PETROL CO (ACTION FOR DAMAGES TO DAIRY HERD BY STREAM POLLUTION).
W69-04902 06E

WILSON V OWEN (EASEMENT - USE OF LAKE).
W69-05164 06E

MISSOURI RIVER
SUMMARY AND ANALYSIS OF SEDIMENT RECORDS IN RELATION TO ST. LOUIS HARBOR SEDIMENTATION PROBLEM,
W69-04938 02J

MIXING
THE CALCULATION OF POLLUTION OF THE THAMES ESTUARY AS A THEORY OF QUANTIZED MIXING,
W69-05041 05B

MODEL STUDIES
ANALYSIS OF THE FAILURE OF BRITTLE MODELS OF ARCH DAMS,
W69-04710 08A

A SCALE MODEL STUDY OF SILTING IN THE VILAINE RIVER DUE TO THE ARZAL DAM (FRENCH),
W69-04795 02A

AN HOURLY WATER BALANCE MODEL AS A BASIS FOR CONTINUOUS WATER RESOURCES ASSESSMENT ON A WATERSHED,
W69-04954 02A

MODEL TESTS
ANALYSIS OF THE FAILURE OF BRITTLE MODELS OF ARCH DAMS,
W69-04710 08A

INDEX METHOD FOR PUMPING OPERATION OF REVERSIBLE PUMP-TURBINE,
W69-04743 08C

MOISTURE CONTENT
CALCULATION MODEL FOR THE ACTUAL EVAPOTRANSPIRATION FROM CROPPED AREAS AND OTHER TERMS OF THE WATER BALANCE EQUATION,
W69-05072 02D

THE DETERMINATION OF THE EVAPORATION FROM THE PLANT COVER AND THE SURFACE OF THE SOIL BY RELATING LYSIMETER AND SOIL MOISTURE MEASUREMENTS TO POTENTIAL EVAPORATION,
W69-05073 02D

MOISTURE STRESS
GERMINATION OF FOURWING SALTBUSH SEEDS AT DIFFERENT LEVELS OF MOISTURE STRESS,
W69-05081 02I

MORTALITY
STUDIES ON OYSTER MORTALITY IN RELATION TO NATURAL ENVIRONMENTS AND TO OIL FIELDS IN LOUISIANA,
W69-05020 05C

MOSQUITOES
SPARTAN DRILLING CO V BULL (INJUNCTION TO CURB SALT WATER POLLUTION AND INSECT BREEDING).
W69-04914 06E

MOSSYROCK DAM(WASH)
THE MOSSYROCK DEVELOPMENT,
W69-04737 08A

MOUNTAINS
EVAPORATION RATES IN MOUNTAINOUS TERRAIN,
W69-05098 02D

MUD-WATER INTERFACES
OBSERVATIONS ON THE FORMATION AND BREAKDOWN OF THE OXIDIZED MICROZONE AT THE MUD SURFACE IN LAKES,
W69-05139 02H

MULTIPLE PURPOSE PROJECTS
STATE V PUBLIC SERVICE COMM'N (RECREATION FACILITIES).
W69-04867 06B

MULTIPLE USE
EFFECTS OF MULTIPLE USES OF WATERSHEDS ON WATER QUALITY,
W69-04702 05B

MULTIPLE-PURPOSE PROJECTS
THE ROLE OF U S TRANSPORTATION POLICY IN THE DEVELOPMENT OF INLAND WATERWAY NAVIGATION,
W69-04862 06E

EMERGING NATIONAL POLICIES GOVERNING OUTDOOR RECREATION IN FEDERAL WATER DEVELOPMENT PROJECTS,
W69-05033 06B

STATE V REEDY CREEK IMPROVEMENT DISTRICT (PLEDGING OF PUBLIC CREDIT TO FINANCE DRAINAGE PROJECTS).
W69-05185 06E

MULTISTORY BUILDINGS
STRENGTH OF JOINTS AND JOINT ASSEMBLIES OF REINFORCED CONCRETE MULTISTORY FRAMES UNDER LOADS OF THE SEISMIC TYPE,
W69-04735 08F

MUNICIPAL WATER
WATER SUPPLY SCHEME OF GREATER TEHRAN CITY,
W69-04761 06D

THE HYDROGEOLOGIST'S RESPONSIBILITY -- METROPOLITAN WATER RESOURCE PLANNING,
W69-05114 06B

MUNSON P
ESTIMATING CONSUMPTIVE USE - MUNSON P. E. INDEX METHOD,
W69-05094 02D

NATIONAL PARKS
FIRST WORLD CONFERENCE ON NATIONAL PARKS.
W69-04990 06G

NATURAL DISASTERS
BURKHARDT V ROCKY (DEPOSIT OF DEBRIS IN STREAMS - OVERFLOW).
W69-04912 06E

NATURAL DRAINAGE COURSE
LIBBY, MCNEIL AND LIBBY V ROBERTS (INTERFERENCE WITH NATURAL DRAINAGE COURSE).
W69-04872 06E

NATURAL FLOW
CRAWFORD V SPRINGVIEW CORP (SURFACE DRAINAGE OVER LOWER ADJACENT TRACT).
W69-04889 06E

BISHOP V RICHARD (OBSTRUCTION OF DRAINAGE BY LOWER LANDOWNER).
W69-04890 06E

CONGDON V PIONEER CITY COAL CO (RAINWATER RUNOFF).
W69-04913 06E

LARSON V REMBIKIS (ACCELERATION AND DIVERSION OF NATURAL DRAINAGE RELATIVE RIGHTS).
W69-04917 06E

NICHOLSON V HOLLOWAY PRINTING CO (ARTIFICIAL INCREASE OF SURFACE RUNOFF).
W69-05163 06E

NATURAL FLOW DOCTRINE
BARBER PURE MILK CO V YOUNG (OBSTRUCTION OF SURFACE WATER FLOW).
W69-04863 06E

GOTT V FRANKLIN (BARRICADE TO NATURAL SURFACE WATER FLOW).
W69-04892 06E

DAVIS V ATLANTIC COAST LINE RR (DRAINAGE FLOW EASEMENTS).
W69-04893 06E

SCHMITT V KIRKPATRICK (DRAINAGE EASEMENT).
W69-04897 06E

BENNETT V COUNTY OF EATON (CONCENTRATED DRAINAGE ONTO LOWER LANDS).
W69-04898 06E

DE VORE FARMS V BUTLER HUNTING CLUB (DAMS AND OBSTRUCTION TO FLOW).
W69-04916 06E

MCCULLOUGH V HARTPENCE (DIVERSION OF DIFFUSED SURFACE WATER).
W69-05168 06E

FONTENOT V SMITH (CONTRACT AGREEMENTS AND RIGHTS TO NATURAL FLOW).
W69-05170 06E

MCCORMICK COAL CO V R R SCHUBERT (NATURAL FLOW AND DIVERSION OF STREAM BED).
W69-05171 06E

NATURAL RESOURCES
ECONOMICS AND THE CONSERVATION QUESTION,
W69-04841 03B

NATURAL STREAMS
LIBBY, MCNEIL AND LIBBY V ROBERTS (INTERFERENCE WITH NATURAL DRAINAGE COURSE).
W69-04872 06E

NAVIGABLE WATERS
COUNTY CONTROL OF DAM CONSTRUCTION.
W69-04881 06E

HOLLAND V FT PIERCE FINANCING AND CONSTR CO (ACTION TO SEIZE LANDFILL CONSTRUCTED IN NAVIGABLE STREAM).
W69-04908 06E

NAVIGATION
THE ROLE OF U S TRANSPORTATION POLICY IN THE DEVELOPMENT OF INLAND WATERWAY NAVIGATION,
W69-04862 06E

STATE V PUBLIC SERVICE COMM'N (RECREATION FACILITIES).
W69-04867 06B

LEASED UNITED STATES LANDS APPROPRIATION FOR FLOOD CONTROL.
W69-04882 06E

NEGLIGENCE
BARBER PURE MILK CO V YOUNG (OBSTRUCTION OF SURFACE WATER FLOW).
W69-04863 06E

LYTLE V PENNSYLVANIA RR (BRIDGE CONSTRUCTION AND OBSTRUCTION TO FLOW).
W69-04880 06E

NEIGHBORHOOD EFFECTS
SOME NEIGHBORHOOD EFFECTS OF OIL-SHALE DEVELOPMENT,
W69-04854 06C

NETTING(SOIL COVER)
CONTROLLING SOIL MOVEMENT FROM STEEP ROAD FILLS,
W69-05105 04A

NEUTRAL MEMBRANES
DEVELOPMENT OF TRANSPORT DEPLETION PROCESSES,
W69-05156 03A

NEUTRON-SCATTERING METHOD
FIELD CORRELATION OF TWO NEUTRON-SCATTERING SOIL MOISTURE METERS,
W69-05100 07B

NEVADA
WATER RESOURCES APPRAISAL OF THOUSAND SPRINGS VALLEY, ELKO COUNTY, NEVADA,
W69-04791 02E

NEW HAMPSHIRE
GAGNON V CARRIER (ABANDONMENT OF EASEMENT FOR WATER SUPPLY).
W69-05165 06E

MUSGROVE V CICCO (MAINTENANCE OF WHARF OVER OBJECTION OF LITTORAL OWNER).
W69-05176 06E

NEW JERSEY
PUBLIC PARKS - PLAYGROUNDS - JOINT PARKS.
W69-04877 06E

PUBLIC PARKS - PLAYGROUNDS.
W69-04878 06E

TRANSPLANTING OF SHELLS AND OYSTERS.
W69-04879 06E

SEWERS AND DRAINS.
W69-04885 06E

CANALS AND CANAL BEDS.
W69-04886 06E

ENVIRONMENTAL CHARACTERISTICS OF RARITAN BAY, A POLLUTED ESTUARY,
W69-05008 05C

MCCULLOUGH V HARTPENCE (DIVERSION OF DIFFUSED SURFACE WATER).
W69-05164 06E

NEW MEXICO
SEDIMENTARY HISTORY AND ECONOMIC GEOLOGY OF SAN JUAN BASIN, NEW MEXICO AND COLORADO,
W69-04948 05F

NEW POLLUTION
THE NEW POLLUTION,
W69-04828 05C

NEW YORK
PERIN V STATE (DRAINAGE WATER DIVERSION).
W69-04864 06E

SCAMP V STATE (ACTION FOR NEGLIGENT HIGHWAY CONSTRUCTION OBSTRUCTING NATURAL SURFACE WATER FLOW).
W69-04901 06E

PEOPLE V SYSTEM PROPERTIES (OWNERSHIP OF LAKESITE STATE'S POWER TO CONTROL LAKE LEVEL).
W69-04903 06E

POSSIBILITIES FOR DISPOSAL OF INDUSTRIAL WASTES IN SUBSURFACE ROCKS OF NORTH FLANK OF APPALACHIAN BASIN IN NEW YORK,
W69-04943 05E

ORGANIC POLLUTION OF NEW YORK HARBOR APPLICATION,
W69-05026 05B

ORGANIC POLLUTION OF NEW YORK HARBOR - THEORETICAL CONSIDERATIONS,
W69-05034 05B

IN RE CITY OF NEW YORK (STREAM BEDS).
W69-05189 06E

NITRATES
THE FATE OF NITRATE NITROGEN IN SOME TROPICAL SOILS FOLLOWING SUBMERGENCE,
W69-05138 02K

NITROGEN
THE NEW POLLUTION,
W69-04828 05C

NITROGEN COMPOUNDS
NITROGEN AND PHOSPHORUS IN WATER AN ANNOTATED BIBLIOGRAPHY OF THEIR BIOLOGICAL EFFECTS.
W69-04805 05C

EFFECT OF SEAWEED ON THE LEVELS OF AVAILABLE PHOSPHORUS AND NITROGEN IN A CALCAREOUS SOIL,
W69-05136 02K

THE DIFFERENTIATION, ANALYSIS, AND PRESERVATION OF NITROGEN AND PHOSPHORUS FORMS IN NATURAL WATERS,
W69-05137 05A

THE FATE OF NITRATE NITROGEN IN SOME TROPICAL SOILS FOLLOWING SUBMERGENCE,
W69-05138 02K

SEASONAL VARIATION IN CONTENT OF NITROGENOUS COMPOUNDS AND PHOSPHATE IN THE WATER OF TAKASUKA POND, SAITAMA, JAPAN,
W69-05142 02H

NON-EQUILIBRIUM THERMODYNAMICS
FURTHER STUDY OF AQUIFER PERFORMANCE,
W69-05149 02A

NON-NAVIGABLE WATERS
CRUTCHFIELD V F A SEBRING REALTY CO (INJUNCTION AGAINST REMOVAL OF LAKE WATER).
W69-05180 06E

NORTH CAROLINA
ESTUARIES AND SOUNDS OF NORTH CAROLINA,
W69-04758 02L

DAVIS V ATLANTIC COAST LINE RR (DRAINAGE FLOW EASEMENTS).
W69-04893 06E

THE GENERAL DEVELOPMENT PLAN FOR THE ALBEMARLE REGION.
W69-04995 06B

WHITE V WOODARD (BOUNDARY LINE ALONG DITCH).
W69-05192 06E

NORTH CAROLINA ESTUARIES
ESTUARIES AND SOUNDS OF NORTH CAROLINA,
W69-04758 02L

NUCLEAR DENSITY METERS
SOIL DENSITY MEASUREMENTS WITH GAMMA-RAYS,
W69-04747 08D

NUCLEAR METERS
SOIL DENSITY MEASUREMENTS WITH GAMMA-RAYS,
W69-04747 08D

FIELD CORRELATION OF TWO NEUTRON-SCATTERING SOIL MOISTURE METERS,
W69-05100 07B

NUCLEAR MOISTURE METERS
EVAPOTRANSPIRATION AND SOIL-MOISTURE DEPLETION,
W69-05102 02G

NUCLEAR POWERPLANTS
HIGH-CAPACITY DUAL-PURPOSE PLANT FOR GENERATING ELECTRICITY AND PRODUCING FRESH WATER FROM SEA WATER,
W69-04754 03A

PROSPECTS OF DESALINATION FOR SOLVING WATER PROBLEMS ON THE MAKRAN COAST,
W69-04776 03A

NUCLEAR REACTORS
RISING ACTIVE WATER FLOW IN THE OSIRIS REACTOR POOL (FRENCH),
W69-04959 05C

NUISANCE ALGAE

DISTRIBUTION, ENVIRONMENTAL REQUIREMENTS AND SIGNIFICANCE OF CLADOPHORA IN THE GREAT LAKES,
W69-04798 02H

MERICAL METHODS
FURTHER STUDY OF AQUIFER PERFORMANCE,
W69-05149 02A

TRIENT POLLUTION
THE NEW POLLUTION,
W69-04828 05C

TRIENT REQUIREMENTS
MINERAL REQUIREMENTS FOR THE GROWTH OF ANABAENA SPIROIDES IN VITRO,
W69-04802 05C

TRIENTS
NITROGEN AND PHOSPHORUS IN WATER AN ANNOTATED BIBLIOGRAPHY OF THEIR BIOLOGICAL EFFECTS.
W69-04805 05C

ENVIRONMENTAL CHARACTERISTICS OF RARITAN BAY, A POLLUTED ESTUARY,
W69-05008 05C

SERVATION WELLS
DEVELOPING AN IRRIGATION WATER SUPPLY IN THE COASTAL PLAIN,
W69-04749 02F

STRUCTION TO FLOW
BARBER PURE MILK CO V YOUNG (OBSTRUCTION OF SURFACE WATER FLOW).
W69-04863 06E

COUNTY CONTROL OF DAM CONSTRUCTION.
W69-04881 06E

SAWYER V SHADER (OBSTRUCTION TO FLOW).
W69-04888 06E

BISHOP V RICHARD (OBSTRUCTION OF DRAINAGE BY LOWER LANDOWNER).
W69-04890 06E

GIBSON V SHARP (DRAINAGE DITCH RIGHT OF WAY)
W69-04891 06E

GOTT V FRANKLIN (BARRICADE TO NATURAL SURFACE WATER FLOW).
W69-04892 06E

LABRUZZO V ATLANTIC DREDGING AND CONST CO (ACTION TO RECOVER DAMAGES FOR DISRUPTION OF UNDERGROUND STREAM).
W69-04909 06E

OURKHARDT V ROCKY (DEPOSIT OF DEBRIS IN STREAMS - OVERFLOW).
W69-04912 06E

DE VORE FARMS V BUTLER HUNTING CLUB (DAMS AND OBSTRUCTION TO FLOW).
W69-04916 06E

CONTENOT V SMITH (CONTRACT AGREEMENTS AND RIGHTS TO NATURAL FLOW).
W69-05170 06E

REDDMANN V REDDMANN (OBSTRUCTION TO SURFACE WATER FLOW).
W69-05174 06E

OBINSON V BELANGER (SURFACE WATER DRAINAGE RIGHTS).
W69-05177 04A

IDDLE V BALTIMORE AND OHIO (FLOOD DAMAGE CAUSED BY INADEQUATE CULVERT).
W69-05191 04A

UFF V STIBES (ENTRANCE ON LAND TO REMOVE OBSTRUCTION TO FLOW).
W69-05193 06E

PUMMOND V FRANK (OBSTRUCTION OF SURFACE FLOW).
W69-05200 04A

AN CIRCULATION
ORIZONTAL DIFFUSION FROM AN INSTANTANEOUS POINT SOURCE DUE O OCEANIC TURBULENCE,
W69-05036 02L

REVIEW OF THEORETICAL MODELS OF TURBULENT DIFFUSION IN THE EA,
W69-05037 02L

ANS
ISCHARGE OF WASTES INTO THE SEA IN EUROPEAN COASTAL AREAS,
W69-05015 05F

O
YTLE V PENNSYLVANIA RR (BRIDGE CONSTRUCTION AND OBSTRUCTION O FLOW).
W69-04880 06E

ARSON V REMEIKIS (ACCELERATION AND DIVERSION OF NATURAL RAINAGE RELATIVE RIGHTS).
W69-04917 06E

NNUAL REPORT, FISCAL YEAR 1968,
W69-05160 09D

UNSFORD V STEWART (COMMON ENEMY DOCTRINE).
W69-05172 06E

RUFF V STIBES (ENTRANCE ON LAND TO REMOVE OBSTRUCTION TO FLOW).
W69-05193 06E

OIL INDUSTRY
LEGAL ASPECTS OF OFFSHORE OIL AND GAS OPERATIONS,
W69-04859 06E

OIL SHALE
SOME NEIGHBORHOOD EFFECTS OF OIL-SHALE DEVELOPMENT,
W69-04854 06C

OIL WASTES
DIVELBISS V PHILLIPS PETROL CO (ACTION FOR DAMAGES TO DAIRY HERD BY STREAM POLLUTION).
W69-04902 06E

STUDIES ON OYSTER MORTALITY IN RELATION TO NATURAL ENVIRONMENTS AND TO OIL FIELDS IN LOUISIANA,
W69-05020 05C

SOUTHLAND CO V MCDONALD (POLLUTION OF WATERCOURSE BY ESCAPED CRUDE OIL).
W69-05186 05B

OILY WASTES
THE OCCURRENCE, EFFECTS, AND FATE OF OIL POLLUTING THE SEA,
W69-05070 05C

OPERATING COSTS
ESTIMATING SEWAGE TREATMENT PLANT OPERATION AND MAINTENANCE COSTS,
W69-05051 05D

OPERATION AND MAINTENANCE
ESTIMATING SEWAGE TREATMENT PLANT OPERATION AND MAINTENANCE COSTS,
W69-05051 05D

OPTIMAL UTILIZATION
AN ECONOMIC EVALUATION OF ALTERNATIVE METHODS OF FISHERY REGULATION,
W69-04849 06B

OPTIMIZATION
TOWARD THE OPTIMIZATION OF INVESTMENT-PRICING DECISIONS A MODEL FOR URBAN WATER SUPPLY TREATMENT FACILITIES,
W69-05129 05F

OPTIMIZING
OPTIMUM OPERATIONS FOR PLANNING OF A COMPLEX WATER RESOURCES SYSTEM,
W69-05123 06A

OPTIMUM DEVELOPMENT PLANS
THE GENERAL POLICY OF THE IRANIAN MINISTRY OF WATER AND POWER IN DEVELOPMENT OF WATER RESOURCES,
W69-04753 04A

OPTIMUM SIZE
THE ECONOMIES OF SCALE,
W69-04840 06C

OVERLAND FLOW
SCHMITT V KIRKPATRICK (DRAINAGE EASEMENT).
W69-04897 06E

EFFECT OF EXPOSURE AND LOGGING ON RUNOFF AND EROSION,
W69-05104 04D

CHARACTERIZATION OF THE RATE OF WATER INFILTRATION INTO SOIL,
W69-05143 02G

OVERLYING PROPRIETOR
KOCH V WICK (PRIVATE OWNER MAY ENJOIN COUNTY'S ATTEMPT TO USE GROUNDWATER ON OTHER THAN OVERLYING LAND).
W69-04870 06E

OWNERSHIP OF BEDS
CLARK V LINDSAY LIGHT AND CHEMICAL CO (RIPARIAN RIGHTS IN WATERS OF STREAM).
W69-04858 06E

RIPARIAN RIGHTS... ACTION BY STATE TO ENJOIN LANDOWNER FROM FILLING IN LAKE.
W69-04860 06E

STATE V NICHOLS (MISTAKE - FEDERAL AGENCY JURIS).
W69-04896 06E

PEOPLE V SYSTEM PROPERTIES (OWNERSHIP OF DAMSITE STATE'S POWER TO CONTROL LAKE LEVEL).
W69-04903 06E

IN RE CITY OF NEW YORK (STREAM BEDS).
W69-05189 06E

OXIDATION
REDOX EQUILIBRIA AND MEASUREMENTS OF POTENTIALS IN THE AQUATIC ENVIRONMENT,
W69-04972 02K

SOME PH-CONTROLLING REDOX REACTIONS IN NATURAL WATERS,
W69-04973 02K

OXYGEN REQUIREMENTS
OXYGENATION OF BALTIMORE HARBOR BY PLANKTONIC ALGAE,
W69-05003 05G

OYSTERS

TRANSPLANTING OF SHELLS AND OYSTERS.
W69-04879 06E

ON OYSTERS AND SULFITE WASTE LIQUOR,
W69-04997 05C

STUDIES ON OYSTER MORTALITY IN RELATION TO NATURAL ENVIRONMENTS AND TO OIL FIELDS IN LOUISIANA,
W69-05020 05C

THE SEDIMENTS OF CHESAPEAKE BAY,
W69-05052 02L

PACIFIC NORTHWEST U
THE CONFLICT BETWEEN FISH AND POWER RESOURCES IN THE PACIFIC NORTHWEST,
W69-05024 06B

PARETO EFFICIENCY
POSITIVE ECONOMICS, WELFARE ECONOMICS, AND POLITICAL ECONOMY,
W69-04852 06B

THE ANATOMY OF MARKET FAILURE,
W69-04855 06C

PASSIVITY
A STUDY OF DEPASSIVATION OF STEEL IN CONCRETE,
W69-04725 08F

PEAS
MEASUREMENT OF THE WATER POTENTIAL OF INTACT PLANT TISSUES III. THE WATER POTENTIALS OF GERMINATING PEAS (PISUM SATIVUM L.),
W69-05095 02I

PENNSYLVANIA
COMMONWEALTH EX REL SHUMAKER V NEW YORK AND PENNSYLVANIA CO, INC (JURISDICTION OF SANITARY WATER BOARD OVER STREAM POLLUTION).
W69-04887 06E

CRAWFORD V SPRINGVIEW CORP (SURFACE DRAINAGE OVER LOWER ADJACENT TRACT).
W69-04889 06E

BURKHARDT V BOCKY (DEPOSIT OF DEBRIS IN STREAMS - OVERFLOW).
W69-04912 06E

POSSIBILITIES FOR SUBSURFACE WASTE DISPOSAL IN A STRUCTURAL SYNCLINE IN PENNSYLVANIA,
W69-04944 05E

MCCORMICK COAL CO V R R SCHUBERT (NATURAL FLOW AND DIVERSION OF STREAM BED).
W69-05171 06E

BOROUGH OF COLLEGEVILLE V PHILADELPHIA SUBURAN WATER CO (ADMINISTRATIVE REMEDIES FOR WATER DIVERSION).
W69-05198 06E

PERCOLATING WATER
WATER LAW AND PRIVATE DECISION MAKING A CRITIQUE,
W69-04839 06B

PERCOLATING WATERS
UNITED FUEL GAS CO V SAWYERS (WELL POLLUTION THROUGH PERCOLATING WATERS).
W69-05187 05B

PERFORMANCE TESTS
VELOCITY DISTRIBUTION AND ITS EFFECT ON THE ACCURACY OF THE GIBSON METHOD OF WATER MEASUREMENT,
W69-04744 08C

PERIPHYTON
A BIBLIOGRAPHY ON PERIPHYTON,
W69-05140 10

PERMEABILITY
IMMOBILITY OF CONNATE WATER IN PERMEABLE SANDSTONE,
W69-04977 02F

PHENOLOGY
PHENOLOGICAL ASPECTS OF A FEW PROMISING EUCALYPTUS IN THE ARID ZONE,
W69-05091 02I

PHENYLMERCURIC ACETATE(PMA)
EFFECTS OF PHENYLMERCURIC ACETATE ON TRANSPIRATION AND GROWTH OF SMALL PLOTS OF GRASS,
W69-05071 02D

PHOSPHATES
THE NEW POLLUTION,
W69-04828 05C

PHOSPHORUS
EFFECT OF SEAWEED ON THE LEVELS OF AVAILABLE PHOSPHORUS AND NITROGEN IN A CALCAREOUS SOIL,
W69-05116 02K

PHOSPHORUS COMPOUNDS
UNUSUAL PHOSPHORUS SOURCE FOR PLANKTON ALGAE,
W69-04800 05B

NITROGEN AND PHOSPHORUS IN WATER - AN ANNOTATED BIBLIOGRAPHY OF THEIR BIOLOGICAL EFFECTS.
W69-04805 05C

THE DIFFERENTIATION, ANALYSIS, AND PRESERVATION OF NITROGEN AND PHOSPHORUS FORMS IN NATURAL WATERS,
W69-05137 05A

SEASONAL VARIATION IN CONTENT OF NITROGENOUS COMPOUNDS AND PHOSPHATE IN THE WATER OF IAKASUKA POND, SAITAMA, JAPAN,
W69-05142 02H

PHOTOSYNTHESIS
THE EFFECT OF PHOTOSYNTHESIS ON THE OXYGEN BALANCE IN A MIDWESTERN STREAM,
W69-04780 05C

THE MECHANISM OF PHOTOSYNTHETIC USE OF BICARBONATE BY HYDRODICTYON AFRICANUM,
W69-04803 02K

OXYGENATION OF BALTIMORE HARBOR BY PLANKTONIC ALGAE,
W69-05003 05G

PHYSICAL PROPERTIES
A SCALE MODEL STUDY OF SILTING IN THE VILAINE RIVER DUE TO THE ARZAL DAM (FRENCH),
W69-04795 02A

A STUDY OF THE PHYSICAL PROPERTIES OF VARIOUS FORMS OF VERY FINE SEDIMENTS AND THEIR BEHAVIOR UNDER HYDRODYNAMIC ACTION (FRENCH),
W69-04796 02J

PHYTOPLANKTON
UNUSUAL PHOSPHORUS SOURCE FOR PLANKTON ALGAE,
W69-04800 05B

MINERAL REQUIREMENTS FOR THE GROWTH OF ANABAENA SPIROIDES I VITRO,
W69-04802 05C

PIPE FLOW
VANCE V DAVIS (ADJUDICATION OF WATER RIGHTS).
W69-04907 06E

PIPELINES
ANALYSIS OF THE COST OF WATER TRANSMISSION BY PIPELINE,
W69-04827 03A

PIPES
CLARK V CITY OF SPRINGFIELD (NUISANCE ABATEMENT SEWAGE AND SURFACE WATER).
W69-04900 06E

PLANNING
BASIC DATA COLLECTION FOR WATER DEVELOPMENT IN EAST PAKISTAN,
W69-04755 07A

NEW THRUSTS IN GROUND WATER,
W69-04793 02F

IMPROVED EVALUATION PROCEDURES IN APPALACHIAN WATER RESOUR PLANNING,
W69-04817 06B

THE ROLE OF ECONOMICS IN PLAN FORMULATION,
W69-04835 06B

QUADRATIC TEAMS, INFORMATION ECONOMICS, AND AGGREGATE PLANNING DECISIONS,
W69-04843 06B

PLANNED UTILIZATION OF WATER RESOURCES,
W69-04952 02E

RECREATION--A PURPOSE OF WATER RESOURCES DEVELOPMENT,
W69-05067 06B

THE POLITICS OF WATER IN ARIZONA,
W69-05112 06E

THE WATER CRISIS,
W69-05113 06B

PLANNING A WATER QUALITY MANAGEMENT SYSTEM THE CASE OF T POTOMAC ESTUARY,
W69-05116 06B

OPTIMUM OPERATIONS FOR PLANNING OF A COMPLEX WATER RESOURC SYSTEM,
W69-05123 06A

PLANT GROWTH
ALGAL GROWTH AQUEOUS FACTORS OTHER THAN NITROGEN AND PHOSPHORUS,
W69-04801 05C

EFFECTS OF PHENYLMERCURIC ACETATE ON TRANSPIRATION AND GROWTH OF SMALL PLOTS OF GRASS,
W69-05071 02D

MEASUREMENT OF THE WATER POTENTIAL OF INTACT PLANT TISSUES III. THE WATER POTENTIALS OF GERMINATING PEAS (PISUM SATIV L.),
W69-05095 02I

PLANT PHYSIOLOGY
EXPERIENCE WITH THREE VAPOUR METHODS FOR MEASURING WATER POTENTIAL IN PLANTS,
W69-05085 02I

PLANT TISSUES
EXPERIENCE WITH THREE VAPOUR METHODS FOR MEASURING WATER POTENTIAL IN PLANTS,

W69-05085 02I

ANTING MANAGEMENT
EFFECTS OF SEEDBED TREATMENT ON GRASS ESTABLISHMENT ON LOGGING ROADBEDS IN CENTRAL IDAHO,
W69-05096 04A

CONTROLLING SOIL MOVEMENT FROM STEEP ROAD FILLS,
W69-05105 04A

STICS
HYDROLOGIC MINI-CYCLE FOR SOIL MOISTURE AND SALT CONTROL IN IRRIGATED AGRICULTURE,
W69-05076 03F

YAS
INTER LOSS AND SPRING RECOVERY OF DISSOLVED SOLIDS IN TWO PRAIRIE-POTHOLE PONDS IN NORTH DAKOTA,
W69-04983 02J

ITICAL ASPECTS
HE INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN A TUDY OF ITS ROLE AS A PLANNING AGENCY ENGAGED IN THE OLITICAL PROCESS,
W69-04856 06E

HE POLITICS OF WATER IN ARIZONA,
W69-05112 06E

HE WATER CRISIS,
W69-05113 06B

ATER RESEARCH,
W69-05115 06B

LUTANTS
ETERMINATION, EVALUATION AND ABATEMENT OF COLOR IN TEXTILE LANT EFFLUENTS,
W69-04756 05B

LUTION ABATEMENT
OMMONWEALTH EX REL SHOMAKER V NEW YORK AND PENNSYLVANIA CO, NC (JURISDICTION OF SANITARY WATER BOARD OVER STREAM OLLUTION).
W69-04887 06E

ONTGOMERY LIMESTONE CO V BEARDEN (ACTION TO ENJOIN OLLUTION OF A STREAM BY QUARRY OPERATION).
W69-04911 06E

HERMAL DISCHARGE BIBLIOGRAPHY,
W69-04937 05B

YSACCHARIDES
ACTORS AFFECTING BIOLOGICAL CLOGGING OF SAND ASSOCIATED ITH GROUND WATER RECHARGE,
W69-05075 03C

OS
967 AN EXCEPTIONAL YEAR IN THE LIFE OF THE DE BERRE POND FRENCH),
W69-04958 05C

ISING ACTIVE WATER FLOW IN THE OSIRIS REACTOR POOL FRENCH),
W69-04959 05C

INTER LOSS AND SPRING RECOVERY OF DISSOLVED SOLIDS IN TWO RAIRIE-POTHOLE PONDS IN NORTH DAKOTA,
W69-04983 02J

NOMALOUS' THERMAL CONDITIONS IN A HYPERSALINE INLAND POND,
W69-05078 02H

DWEEDS
ONTROL OF SUBMERSED AQUATIC WEEDS IN IRRIGATION CANALS BY AILY APPLICATIONS OF LOW CONCENTRATIONS OF COPPER SULFATE,
W69-04729 04A

ULUS SPECIES
HE INFLUENCE OF GROWTH MEDIA, TEMPERATURES, AND LIGHT NTENSITIES ON ASPEN ROOT AND TOP GROWTH,
W69-05101 02G

OIL MOISTURE DEPLETION BY ASPEN IN CENTRAL UTAH,
W69-05106 02G

GEOMETRY
RTHER STUDY OF AQUIFER PERFORMANCE,
W69-05149 02A

PRESSURE
EORETICAL FRAMEWORK FOR ASCERTAINING PORE WATER PRESSURE CONFINING LAYERS IN THE VICINITY OF A PUMPING WELL,
W69-04767 02F

SITY
FLUENCE OF THE THICKNESS AND FREE POROSITY OF A DRIED YER ON EVAPORATION,
W69-05083 02D

US MEDIA
ERMAL CONDUCTIVITY OF TWO-PHASE POROUS MATERIALS DRY ILS,
W69-04949 07B

RTHER STUDY OF AQUIFER PERFORMANCE,
W69-05149 02A

ERIOR DISTRIBUTION
YESIAN ANALYSIS OF HAAVELMO'S MODELS,
W69-04842 06A

POTENTIAL EVAPORATION
THE DETERMINATION OF THE EVAPORATION FROM THE PLANT COVER AND THE SURFACE OF THE SOIL BY RELATING LYSIMETER AND SOIL MOISTURE MEASUREMENTS TO POTENTIAL EVAPORATION,
W69-05073 02D

POTENTIOSTATIC TECHNIQUES
DEVELOPMENT OF A LOW-COST IRON-BASE ALLOY TO RESIST CORROSION IN HOT SEA WATER,
W69-04771 03A

POTHOLES
WINTER LOSS AND SPRING RECOVERY OF DISSOLVED SOLIDS IN TWO PRAIRIE-POTHOLE PONDS IN NORTH DAKOTA,
W69-04983 02J

POTOMAC RIVER ESTUARY
PLANNING A WATER QUALITY MANAGEMENT SYSTEM THE CASE OF THE POTOMAC ESTUARY,
W69-05116 06B

POWERPLANTS
OBSERVATIONS ON THE RESPONSE OF SOME BENTHONIC ORGANISM TO POWER STATION COOLING,
W69-05023 05C

PRECIPITATION EXCESS
RIDDLE V BALTIMORE AND OHIO (FLOOD DAMAGE CAUSED BY INADEQUATE CULVERT).
W69-05191 04A

PRECIPITATION GAGES
THE INTERMOUNTAIN PRECIPITATION STORAGE GAGE,
W69-05111 07B

PRECIPITATION(ATMOSPHERIC)
CHEMICAL CHARACTERISTICS OF BULK PRECIPITATION IN THE MOJAVE DESERT REGION, CALIFORNIA,
W69-04982 02K

PRESCRIPTIVE RIGHTS
W G DUNCAN COAL CO V JONES (PRESCRIPTIVE RIGHTS TO MINEWATER POLLUTION).
W69-04915 06E

DRUMMOND V FRANK (OBSTRUCTION OF SURFACE FLOW).
W69-05200 04A

PRESSURE DISTRIBUTION
EFFECT OF CONTINUOUS SURCHARGE ON A RETAINING WALL,
W69-04740 08D

PRICES
GROUNDWATER UTILIZATION AND TAX POLICY,
W69-05126 06C

PRICING
ROAD PRICING, SOME TECHNICAL ASPECTS,
W69-04837 06C

TOWARD THE OPTIMIZATION OF INVESTMENT-PRICING DECISIONS A MODEL FOR URBAN WATER SUPPLY TREATMENT FACILITIES,
W69-05128 05F

W69-05129 05F

W69-05130 05F

PRIVATE NUISANCE
W G DUNCAN COAL CO V JONES (PRESCRIPTIVE RIGHTS TO MINEWATER POLLUTION).
W69-04915 06E

PRIVATE PRODUCT
THE PROBLEM OF SOCIAL COST,
W69-04850 06C

PROBABILITY
BAYESIAN ANALYSIS OF HAAVELMO'S MODELS,
W69-04842 06A

PROBABLE MAXIMUM PRECIPITATION
PROBABLE MAXIMUM PRECIPITATION OVER SOUTH PLATTE RIVER, COLORADO AND MINNESOTA RIVER, MINNESOTA,
W69-05158 04A

PROBE CORRELATION
FIELD CORRELATION OF TWO NEUTRON-SCATTERING SOIL MOISTURE METERS,
W69-05100 07B

PRODUCTION FUNCTION
HOMOGENEOUS, ESPECIALLY LINEAR HOMOGENEOUS, PRODUCTION FUNCTIONS AND THE LAW OF YIELD (GERMAN),
W69-04846 06B

PRODUCTIVITY
COMMERCIAL AND SPORT FISHERIES,
W69-05002 03E

MULTIPLE UTILIZATION OF GULF COAST ESTUARIES,
W69-05057 02L

PROGRAMS
ANNUAL REPORT, FISCAL YEAR 1968,
W69-05160 09D

PROJECT PLANNING
ECONOMIC AND SOCIAL ASPECTS OF PLANNING OF WATER RESOURCES

IN DEVELOPING COUNTRIES.
W69-04741 06B

IMPORTANCE OF THE ECONOMIC FEASIBILITY OF THE WATER SUPPLY AND SEWER SYSTEM PROJECTS,
W69-04811 06B

ACHIEVING PUBLIC ACCEPTANCE OF A RIVER BASIN PLAN,
W69-04861 06B

TOWARD THE OPTIMIZATION OF INVESTMENT-PRICING DECISIONS A MODEL FOR URBAN WATER SUPPLY TREATMENT FACILITIES,
W69-05129 05F

PROVINCE OF ALBERTA
ECONOMICS AND FINANCE OF WATER DEVELOPMENT IN ALBERTA, CANADA,
W69-05122 06B

PSEUDORIPARIAN
PERPETUAL SUCCESSION OF STREAM-CHANNEL VEGETATION IN A SEMIARID REGION,
W69-05080 02D

PSYCHROMETERS
EXPERIENCE WITH THREE VAPOUR METHODS FOR MEASURING WATER POTENTIAL IN PLANTS,
W69-05085 02I

PUBLIC BENEFITS
OUTDOOR RECREATION DEMANDS AND BENEFITS,
W69-05014 06D

PUBLIC HEALTH
WATER FOR FLUORIDES,
W69-04769 05F

PUBLIC NUISANCE
W G DUNCAN COAL CO V JONES (PRESCRIPTIVE RIGHTS TO MINEWATER POLLUTION).
W69-04915 06E

PUBLIC OWNERSHIP
WATER LAW AND PRIVATE DECISION MAKING A CRITIQUE,
W69-04839 06B

PUBLIC TRUST DOCTRINE
STATE V PUBLIC SERVICE COMM'N (RECREATION FACILITIES).
W69-04867 06B

PUBLIC UTILITIES
IMPROVEMENT OF WATER RESOURCES UTILIZATION FOR PUBLIC WATER SUPPLY IN TAIWAN,
W69-04760 06B

WATER AND ECONOMIC DEVELOPMENT.
W69-04829 06B

THE ROLE OF INVESTOR-OWNED WATER UTILITIES IN NATIONAL DEVELOPMENT,
W69-04830 06B

HOME RULE CITIES - BORROWING FOR PUBLIC WORKS.
W69-04876 06E

PUBLIC UTILITY DISTRICTS
WATERWORKS.
W69-05196 06E

PUBLIC WATER SUPPLIES
WATER FOR FLUORIDES,
W69-04769 05F

PUBLIC WATER SUPPLY PROGRAM
CONSIDERATIONS INVOLVED IN THE PLANNING, ORGANIZATION, MANAGEMENT, AND DESIGN OF PUBLIC WATER SUPPLIES,
W69-04834 06B

PULP WASTES
ON OYSTERS AND SULFITE WASTE LIQUOR,
W69-04997 05C

PUMP TURBINES
SEMI-SYNCHRONOUS STARTING,
W69-04722 08C

THE SOLINA HYDRO PROJECT,
W69-04738 08A

INDEX METHOD FOR PUMPING OPERATION OF REVERSIBLE PUMP-TURBINE,
W69-04743 08C

PUMPING
INDEX METHOD FOR PUMPING OPERATION OF REVERSIBLE PUMP-TURBINE,
W69-04743 08C

PURE STREAMS LAW
COMMONWEALTH EX REL SHUMAKER V NEW YORK AND PENNSYLVANIA CO, INC (JURISDICTION OF SANITARY WATER BOARD OVER STREAM POLLUTION).
W69-04887 06E

QUADRATIC TEAMS
QUADRATIC TEAMS, INFORMATION ECONOMICS, AND AGGREGATE PLANNING DECISIONS,
W69-04843 06B

QUALITATIVE ECONOMICS
QUALITATIVE ECONOMICS AND THE SCOPE OF THE CORRESPONDENCE PRINCIPLE,
W69-04806 06B

QUATERNARY PERIOD
INTERRELATIONSHIP BETWEEN PHYSIOGRAPHY, HYDROLOGY, SEDIMENTATION, AND SALINIZATION OF THE LODDEN RIVER PLAINS, AUSTRALIA,
W69-05079 02A

QUERCUS
SOIL MOISTURE DEPLETION BY GAMBEL OAK IN CENTRAL UTAH,
W69-05107 02G

SOIL MOISTURE DEPLETION BY GAMBEL OAK IN NORTHERN UTAH,
W69-05108 02G

QUEUING TIME
CONGESTION, TOLLS, AND THE ECONOMIC CAPACITY OF A WATERWAY,
W69-04838 06C

RADIOACTIVE ACCUMULATION
FACTORS INFLUENCING RADIOSTRONTIUM ACCUMULATION IN DAPHNIA,
W69-05141 05C

RADIOACTIVE UPTAKE
FACTORS INFLUENCING RADIOSTRONTIUM ACCUMULATION IN DAPHNIA,
W69-05141 05C

RADIOACTIVE WASTE DISPOSAL
IMPORTANCE OF DEEP PERMEABLE DISPOSAL FORMATIONS IN LOCATION OF A LARGE NUCLEAR-FUEL REPROCESSING PLANT,
W69-04942 05E

RADIOACTIVITY
FIELD CORRELATION OF TWO NEUTRON-SCATTERING SOIL MOISTURE METERS,
W69-05100 07B

RADIOECOLOGY
FACTORS INFLUENCING RADIOSTRONTIUM ACCUMULATION IN DAPHNIA,
W69-05141 05C

RAILROADS
RAILWAY COMPANIES, DRAINAGE REPAIRS FAILURE, EXPENSE OF COMPANY.
W69-04905 06E

RAIN GAGES
THE INTERMOUNTAIN PRECIPITATION STORAGE GAGE,
W69-05111 07B

RAINFALL RUNOFF RELATIONSHIPS
A LOW INTENSITY RAIN SIMULATOR FOR LONG DURATION RAIN-ON-SNOW EVENTS,
W69-04939 02B

RAINFALL SIMULTAORS
A LOW INTENSITY RAIN SIMULATOR FOR LONG DURATION RAIN-ON-SNOW EVENTS,
W69-04939 02B

RAINFALL-RUNOFF RELATIONSHIPS
ON INVESTIGATIONS CONCERNING THE INFLUENCE OF AGRICULTURAL UTILIZATION ON THE RUNOFF FORMATION BY MEANS OF GROUNDWATER-LYSIMETERS,
W69-04951 02G

RAINWATER
CLARK V CITY OF SPRINGFIELD (NUISANCE ABATEMENT SEWAGE AND SURFACE WATER).
W69-04900 06E

RANGE GRASSES
EFFECTS OF HERBICIDES, BURNING, AND SEEDING DATE IN RESEEDING AN ARID RANGE.
W69-05082 02A

RANGES
PROPERTIES OF SALINE RANGE SOILS OF THE RIO GRANDE PLAIN,
W69-05084 02G

RATE OF SHEAR
MICROSCOPIC DETERMINATION OF BOUNDARY SHEAR AND SUBLAYER TURBULENCE CHARACTERISTICS IN AN OPEN CHANNEL,
W69-05150 08B

RATES
FINANCIAL ASPECTS OF POTABLE WATER AND SEWERAGE SYSTEMS,
W69-04821 05D

RATIFICATION
FOURTH CLASS CITIES - SEWER BONDS.
W69-04875 06E

REAERATION
OXYGENATION OF BALTIMORE HARBOR BY PLANKTONIC ALGAE,
W69-05003 05G

REASONABLE USE
KOCH V WICK (PRIVATE OWNER MAY ENJOIN COUNTY'S ATTEMPT TO USE GROUNDWATER ON OTHER THAN OVERLYING LAND).
W69-04870 06E

LIABILITY, AS REGARDS SURFACE WATERS, FOR RAISING SURFACE LEVEL OF LAND,
W69-04873 06E

FOREST LAND CO V BLACK (ACTION TO ENJOIN OPERATION OF MOTOR BOAT ON PRIVATE LAKE).
W69-04895 06E

DE VORE FARMS V BUTLER HUNTING CLUB (DAMS AND OBSTRUCTION TO FLOW).
W69-04916 06E

WILSON V OWEN (EASEMENT - USE OF LAKE).
W69-05164 06E

UNITED FUEL GAS CO V SAWYERS (WELL POLLUTION THROUGH PERCOLATING WATERS).
W69-05187 05B

CESSION CURVES
THE DISCHARGE RECESSION AS CRITERION ON THE RETENTION CAPACITY OF BASINS,
W69-04953 02E

CHARGE WELLS
OPERATION OF A RECHARGE BOREHOLE,
W69-04723 04B

CLAIMED WATER
WASTE WATER CONSERVATION AND RENOVATION RESEARCH,
W69-04748 05D

DESALINIZATION AND FUTURE WATER SUPPLY IN THE UNITED STATES,
W69-04988 03A

CONNAISSANCE SURVEYS
THERMAL INFRARED IMAGERY FOR GEOLOGISTS,
W69-04745 07B

CREATION
STATE V PUBLIC SERVICE COMM'N (RECREATION FACILITIES).
W69-04867 06B

FOREST LAND CO V BLACK (ACTION TO ENJOIN OPERATION OF MOTOR BOAT ON PRIVATE LAKE).
W69-04895 06E

FEDERAL ASSISTANCE IN OUTDOOR RECREATION.
W69-04989 09D

THE GENERAL DEVELOPMENT PLAN FOR THE ALBEMARLE REGION.
W69-04995 06B

EMERGING NATIONAL POLICIES GOVERNING OUTDOOR RECREATION IN FEDERAL WATER DEVELOPMENT PROJECTS,
W69-05033 06B

AGNON V CARRIER (ABANDONMENT OF EASEMENT FOR WATER SUPPLY).
W69-05165 06E

REATION DEMAND
OUTDOOR RECREATION DEMANDS AND BENEFITS,
W69-05014 06D

ECREATION--A PURPOSE OF WATER RESOURCES DEVELOPMENT,
69-05067 06B

EMAND FOR WATER RECREATION,
69-05121 06D

REATION FACILITIES
UBLIC PARKS - PLAYGROUNDS.
69-04878 06E

HORELINE RECREATION RESOURCES OF THE UNITED STATES.
69-05054 02L

ECREATION--A PURPOSE OF WATER RESOURCES DEVELOPMENT,
69-05067 06B

REATION WASTES
OAT AND MARINA WASTES,
69-05009 05G

REATIONAL FACILITIES
UBLIC PARKS - PLAYGROUNDS - JOINT PARKS.
69-04877 06E

UCTION(CHEMICAL)
EDOX EQUILIBRIA AND MEASUREMENTS OF POTENTIALS IN THE QUATIC ENVIRONMENT,
69-04972 02K

OME PH-CONTROLLING REDOX REACTIONS IN NATURAL WATERS,
69-04973 02K

IONAL ANALYSIS
ATER RESOURCES ACTIVITIES IN THE UNITED STATES WATER UPPLY AND DEMAND.
69-05065 06D

IONAL COEFFICIENT
ETERMINATION OF THE REGIONAL COEFFICIENT 'K' FOR COMPUTING HE CONSUMPTIVE USE OF NATIVE BLACK KIDNEY BEAN IN THE RRIGATION DISTRICTS OF VERACRUZ STATE,
69-05086 02I

RESSION ANALYSIS
OTE ON THE UNBIASEDNESS OF A MIXED REGRESSION ESTIMATOR,
69-04845 06A

HE INTERPRETATION AND ESTIMATION OF COBB-DOUGLAS FUNCTIONS,
69-04853 06A

RESSIONAL ANALYSIS
N ECONOMIC ANALYSIS OF WATER UTILIZATION IN PENNSYLVANIA,
69-05154 06D

ULATION
INSHORE MARINE CONSERVATION,
W69-05044 02L

REINFORCED CONCRETE
FATIGUE TESTS OF REINFORCING BARS--EFFECT OF DEFORMATION PATTERN,
W69-04706 08F

A REVIEW OF FIBER REINFORCEMENT OF PORTLAND CEMENT PASTE, MORTAR, AND CONCRETE,
W69-04708 08F

STRENGTH OF JOINTS AND JOINT ASSEMBLIES OF REINFORCED CONCRETE MULTISTORY FRAMES UNDER LOADS OF THE SEISMIC TYPE,
W69-04735 08F

REINFORCING MATERIALS
A REVIEW OF FIBER REINFORCEMENT OF PORTLAND CEMENT PASTE, MORTAR, AND CONCRETE,
W69-04708 08F

REINFORCING STEEL
FATIGUE TESTS OF REINFORCING BARS--EFFECT OF DEFORMATION PATTERN,
W69-04706 08F

A STUDY OF DEPASSIVATION OF STEEL IN CONCRETE,
W69-04725 08F

RELATIVE HUMIDITY
INFLUENCE OF SOIL TEMPERATURE ON TRANSPIRATION UNDER VARIOUS ENVIRONMENTAL CONDITIONS,
W69-05099 02D

RELATIVE RIGHTS
SCAMP V STATE (ACTION FOR NEGLIGENT HIGHWAY CONSTRUCTION OBSTRUCTING NATURAL SURFACE WATER FLOW).
W69-04901 06E

LABRUZZO V ATLANTIC DREDGING AND CONST CO (ACTION TO RECOVER DAMAGES FOR DISRUPTION OF UNDERGROUND STREAM).
W69-04909 06E

ROUGHTON V THIELE KAOLIN CO (CHEMICAL POLLUTION BY UPPER RIPARIAN OWNER).
W69-05190 05B

REMEDIES
SPARTAN DRILLING CO V BULL (INJUNCTION TO CURE SALT WATER POLLUTION AND INSECT BREEDING).
W69-04914 06E

NASS V TOWN OF DUXBURY (DIVERSION OF FLOW BY CHANNEL OBSTRUCTION).
W69-05197 04A

RENOVATING
WASTE WATER CONSERVATION AND RENOVATION RESEARCH,
W69-04748 05D

REPARIAN RIGHTS
WATER LAW AND PRIVATE DECISION MAKING A CRITIQUE,
W69-04839 06B

REPRODUCTION
PHENOLOGICAL ASPECTS OF A FEW PROMISING EUCALYPTUS IN THE ARID ZONE,
W69-05091 02I

REPULSION
CURRENT TRENDS IN WISCONSIN'S WATER LAW,
W69-05161 06E

MCCULLOUGH V HARTPENCE (DIVERSION OF DIFFUSED SURFACE WATER).
W69-05168 06E

REPULSION(LEGAL ASPECTS)
LIABILITY, AS REGARDS SURFACE WATERS, FOR RAISING SURFACE LEVEL OF LAND,
W69-04873 06E

YOUNG V MOORE (LANDOWNERS RIGHT TO DRAIN EXCESS SURFACE WATER).
W69-04899 06E

SCAMP V STATE (ACTION FOR NEGLIGENT HIGHWAY CONSTRUCTION OBSTRUCTING NATURAL SURFACE WATER FLOW).
W69-04901 06E

OWENS V FAYETTE COUNTY (DRAINAGE NUISANCE ABATEMENT).
W69-05167 06E

LUNSFORD V STEWART (COMMON ENEMY DOCTRINE).
W69-05172 06E

REDDMANN V REDDMANN (OBSTRUCTION TO SURFACE WATER FLOW).
W69-05174 06E

CONDIFF V KOPSEIKER (EASEMENT - SURFACE DRAINAGE).
W69-05175 06E

WATTERS V NATIONAL DRIVE-IN (SURFACE WATER DRAINAGE DAMAGE).
W69-05178 06E

CAPES V BARGER (DAMAGES CAUSED BY DAM TO REPEL SURFACE WATERS).
W69-05181 06E

RESEARCH PROGRAMS
WATER RESEARCH,

W69-05115 06B

RESEEDING
EFFECTS OF HERBICIDES, BURNING, AND SEEDING DATE IN RESEEDING AN ARID RANGE.
W69-05082 02A

RESERVOIRS
INFLUENCE OF THE SOUTH SASKATCHEWAN RESERVOIR (CANADA) ON PIEZOMETRIC LEVELS IN UNDERLYING BEDROCK AQUIFERS,
W69-04774 02F

RECREATION--A PURPOSE OF WATER RESOURCES DEVELOPMENT,
W69-05067 06B

RESOURCE ALLOCATION
WATER LAW AND PRIVATE DECISION MAKING A CRITIQUE,
W69-04839 06B

THE PROBLEM OF SOCIAL COST,
W69-04850 06C

RETAINING WALLS
EFFECT OF CONTINUOUS SURCHARGE ON A RETAINING WALL,
W69-04740 08D

REVEGETATION
EFFECTS OF HERBICIDES, BURNING, AND SEEDING DATE IN RESEEDING AN ARID RANGE.
W69-05082 02A

PROPERTIES OF SALINE RANGE SOILS OF THE RIO GRANDE PLAIN,
W69-05084 02G

REVERSE OSMOSIS
SYNTHESIS AND EVALUATION OF NEW MEMBRANE CANDIDATES FOR APPLICATION IN REVERSE OSMOSIS,
W69-05157 03A

REVERSIBLE TURBINES
INDEX METHOD FOR PUMPING OPERATION OF REVERSIBLE PUMP-TURBINE,
W69-04743 08C

REVIEWS
EVAPOTRANSPIRATION-REVIEW OF RESEARCH,
W69-04764 02D

RHODE ISLAND
ECONOMIC IMPACT OF NARRAGANSETT BAY,
W69-05048 06B

RICE
FACTORS AFFECTING BIOLOGICAL CLOGGING OF SAND ASSOCIATED WITH GROUND WATER RECHARGE,
W69-05075 03C

RIDDANCE(LEGAL ASPECTS)
LUNSFORD V STEWART (COMMON ENEMY DOCTRINE).
W69-05172 06E

HODGES MANOR CORP V MAYFLOWER PARK CORP (DAMAGE DUE TO DISCHARGE OF SURFACE WATERS THROUGH ARTIFICIAL CHANNELS).
W69-05173 06E

RIGHT-OF-WAY
RAILWAY COMPANIES, DRAINAGE REPAIRS FAILURE, EXPENSE OF COMPANY.
W69-04905 06E

RIPARIAN LAND
MUSGROVE V CICCO (MAINTENANCE OF WHARF OVER OBJECTION OF LITTORAL OWNER).
W69-05176 06E

RIPARIAN RIGHTS
CAIRO PICKLE CO V MUGGRIDGE (BRINE DISPOSAL POLLUTION BY UPPER RIPARIAN OWNER).
W69-04857 06E

CLARK V LINDSAY LIGHT AND CHEMICAL CO (RIPARIAN RIGHTS IN WATERS OF STREAM).
W69-04858 06E

RIPARIAN RIGHTS... ACTION BY STATE TO ENJOIN LANDOWNER FROM FILLING IN LAKE.
W69-04860 06E

BOSTICK V SMOOT SAND AND GRAVEL CORP (DREDGING IN RIVER AS CREATING NUISANCE FOR OTHER RIPARIAN OWNERS).
W69-04869 06E

FENCES ACROSS WATER NEGLECT, REMEDY.
W69-04883 06E

SOUTHLAND V AARON (RIPARIAN OWNER'S ACTION FOR DAMAGES FROM OIL WASTE POLLUTION OF STREAM).
W69-04884 06E

FOREST LAND CO V BLACK (ACTION TO ENJOIN OPERATION OF MOTOR BOAT ON PRIVATE LAKE).
W69-04895 06E

HOLLAND V PT PIERCE FINANCING AND CONSTR CO (ACTION TO SEIZE LANDFILL CONSTRUCTED IN NAVIGABLE STREAM).
W69-04908 06E

MONTGOMERY LIMESTONE CO V BEARDEN (ACTION TO ENJOIN POLLUTION OF A STREAM BY QUARRY OPERATION).
W69-04911 06E

CURRENT TRENDS IN WISCONSIN'S WATER LAW,
W69-05161 06E

MUSGROVE V CICCO (MAINTENANCE OF WHARF OVER OBJECTION OF LITTORAL OWNER).
W69-05176 06E

CRUTCHFIELD V F A SEBRING REALTY CO (INJUNCTION AGAINST REMOVAL OF LAKE WATER).
W69-05180 06E

ROUGHTON V THIELE KAOLIN CO (CHEMICAL POLLUTION BY UPPER RIPARIAN OWNER).
W69-05190 05B

NASS V TOWN OF DUXBURY (DIVERSION OF FLOW BY CHANNEL OBSTRUCTION).
W69-05197 04A

RIPRAP
TENTATIVE DESIGN PROCEDURES FOR RIPRAP-LINED CHANNELS,
W69-04727 08B

RIVER BASIN COMMISSIONS
THE INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN A STUDY OF ITS ROLE AS A PLANNING AGENCY ENGAGED IN THE POLITICAL PROCESS,
W69-04856 06E

RIVER BASIN DEVELOPMENT
HYDROGRAPHICAL INVESTIGATION OF THE BRAHMAPUTRA RIVER IN EAST PAKISTAN,
W69-04752 02E

BASIC DATA COLLECTION FOR WATER DEVELOPMENT IN EAST PAKISTAN,
W69-04755 07A

ACHIEVING PUBLIC ACCEPTANCE OF A RIVER BASIN PLAN,
W69-04861 06B

RIVER BASINS
GEOLOGY OF THE REGOLITH AQUIFERS OF THE NISHNABOTNA BASIN,
W69-04781 02F

SEQUENCE AND TIMING IN RIVER BASIN DEVELOPMENT,
W69-05016 06B

RIVERS
HYDROGRAPHICAL INVESTIGATION OF THE BRAHMAPUTRA RIVER IN EAST PAKISTAN,
W69-04752 02E

SEDIMENT DATA FOR CANADIAN RIVERS, WATER YEAR 1966.
W69-04766 02J

THE UNDERSIDE OF RIVER ICE, ST. CROIX RIVER, WISCONSIN,
W69-04976 02C

RIVER POLLUTION II, CAUSES AND EFFECTS,
W69-05012 02A

REVIEW REPORT ON JAMES RIVER, VIRGINIA.
W69-05045 04A

ROAD USER CHARGES
ROAD PRICING, SOME TECHNICAL ASPECTS,
W69-04837 06C

ROADBED
OWENS V FAYETTE COUNTY (DRAINAGE NUISANCE ABATEMENT).
W69-05167 06E

ROADS
EFFECTS OF SEEDBED TREATMENT ON GRASS ESTABLISHMENT ON LOGGING ROADBEDS IN CENTRAL IDAHO,
W69-05096 04A

CONTROLLING SOIL MOVEMENT FROM STEEP ROAD FILLS,
W69-05105 04A

ROCK EXCAVATION
LABRUZZO V ATLANTIC DREDGING CONSTRUCTION CO (EXCAVATION DIVERTING UNDERGROUND WATERS).
W69-04910 06E

ROCK MECHANICS
AN ENERGY CRITERION FOR THE STRENGTH OF ROCK IN POLYAXIAL COMPRESSION,
W69-04711 08E

ROCKFILL DAMS
SOME ASPECTS OF DESIGN AND CONSTRUCTION OF EARTH AND ROCKFILL DAMS IN INDIA,
W69-04742 08D

ROOT DEVELOPMENT
THE INFLUENCE OF GROWTH MEDIA, TEMPERATURES, AND LIGHT INTENSITIES ON ASPEN ROOT AND TOP GROWTH,
W69-05101 02G

ROOT SYSTEMS
THE INFLUENCE OF GROWTH MEDIA, TEMPERATURES, AND LIGHT INTENSITIES ON ASPEN ROOT AND TOP GROWTH,
W69-05101 02G

ROUGHNESS(HYDRAULIC)
THE UNDERSIDE OF RIVER ICE, ST. CROIX RIVER, WISCONSIN,
W69-04976 02C

ROUGHNESS(SOIL)

TILLAGE INFLUENCES WATER INTAKE,
W69-05089 02G

OUTING
DETERMINING STREAMFLOW ABSTRACTIONS FROM ANTECEDENT CONDITIONS,
W69-04933 02E

A NEW METHOD OF MAPPING THE WATER RESOURCES,
W69-04934 02E

INLET HYDROGRAPH ESTIMATION FOR LINEAR FLOW MODELS ACCORDING TO OUTLET HYDROGRAPH,
W69-04961 02A

UNOFF
TILLAGE INFLUENCES WATER INTAKE,
W69-05089 02G

ROBINSON V BELANGER (SURFACE WATER DRAINAGE RIGHTS).
W69-05177 04A

RAMENTO BASIN
OPTIMUM OPERATIONS FOR PLANNING OF A COMPLEX WATER RESOURCES SYSTEM,
W69-05123 06A

AGEBRUSH
PROPERTIES OF SOIL UNDER ASPEN AND HERB-SHRUB COVER,
W69-05097 02G

ALINE SOILS
POPULATION, GROWTH RATE, AND MATURITY OF VEGETABLE CROPS IN RELATION TO SOIL SALINITY AND TEXTURE UNDER SPRINKLER AND FURROW IRRIGATION,
W69-05074 02I

PROPERTIES OF SALINE RANGE SOILS OF THE RIO GRANDE PLAIN,
W69-05084 02G

ALINE WATER
ESTIMATED USE OF WATER IN THE UNITED STATES, 1960,
W69-05019 06B

A GUIDE TO THE CONSERVATION OF SHORELINES, SUBMERGED BOTTOMS AND SALTWATERS WITH SPECIAL REFERENCE TO BULKHEAD LINES, DREDGING AND FILLING,
W69-05068 04A

POPULATION, GROWTH RATE, AND MATURITY OF VEGETABLE CROPS IN RELATION TO SOIL SALINITY AND TEXTURE UNDER SPRINKLER AND FURROW IRRIGATION,
W69-05074 02I

'ANOMALOUS' THERMAL CONDITIONS IN A HYPERSALINE INLAND POND,
W69-05078 02H

INTERRELATIONSHIP BETWEEN PHYSIOGRAPHY, HYDROLOGY, SEDIMENTATION, AND SALINIZATION OF THE LODDEN RIVER PLAINS, AUSTRALIA,
W69-05079 02A

ALINE WATER INTRUSION
PREDICTION OF THE EXTENT OF SALTWATER INTRUSION INTO ESTUARIES AND SEAS,
W69-04782 02L

ALINITY
ENVIRONMENTAL CHARACTERISTICS OF RARITAN BAY, A POLLUTED ESTUARY,
W69-05008 05C

THE EFFECTS OF TEMPERATURE AND SALINITY ON MARINE AND BRACKISH WATER ANIMALS--I. TEMPERATURE,
W69-05011 05C

ALT CONTROL
HYDROLOGIC MINI-CYCLE FOR SOIL MOISTURE AND SALT CONTROL IN IRRIGATED AGRICULTURE,
W69-05076 03F

ALTBUSH
GERMINATION OF FOURWING SALTBUSH SEEDS AT DIFFERENT LEVELS OF MOISTURE STRESS,
W69-05081 02I

ALTS
HYDROLOGIC MINI-CYCLE FOR SOIL MOISTURE AND SALT CONTROL IN IRRIGATED AGRICULTURE,
W69-05076 03F

MPLING
ORGANIC POLLUTION OF NEW YORK HARBOR APPLICATION,
W69-05026 05B

N JUAN BASIN
SEDIMENTARY HISTORY AND ECONOMIC GEOLOGY OF SAN JUAN BASIN, NEW MEXICO AND COLORADO,
W69-04948 05E

NDS
FACTORS AFFECTING BIOLOGICAL CLOGGING OF SAND ASSOCIATED WITH GROUND WATER RECHARGE,
W69-05075 03C

NDSTONES
MMOBILITY OF CONNATE WATER IN PERMEABLE SANDSTONE,
W69-04977 02F

NITARY WATER BOARD
COMMONWEALTH EX REL SHUMAKER V NEW YORK AND PENNSYLVANIA CO, INC (JURISDICTION OF SANITARY WATER BOARD OVER STREAM POLLUTION).
W69-04887 06E

SAVING QUOTA
CAPITAL ACCUMULATION AND TECHNICAL PROGRESS (GERMAN),
W69-04847 06B

SCALE MODEL
RISING ACTIVE WATER FLOW IN THE OSIRIS REACTOR POOL (FRENCH),
W69-04959 05C

SCARIFICATION
EFFECTS OF SEEDBED TREATMENT ON GRASS ESTABLISHMENT ON LOGGING ROADBEDS IN CENTRAL IDAHO,
W69-05096 04A

SCOUR
LOCALIZED SCOUR IN ERODIBLE-BED CHANNELS,
W69-04788 02J

SEA WATER
DEVELOPMENT OF A LOW-COST IRON-BASE ALLOY TO RESIST CORROSION IN HOT SEA WATER,
W69-04771 03A

COST REDUCTION IN DESALTING SEA WATER,
W69-04826 03A

HETEROGENEOUS EQUILIBRIA INVOLVING OXIDES, HYDROXIDES, CARBONATES, AND HYDROXIDE CARBONATES,
W69-04968 02K

COORDINATION CHEMISTRY OF THE OCEANS,
W69-04971 02K

COOLING WITH SEAWATER,
W69-04999 03C

THE OCCURRENCE, EFFECTS, AND FATE OF OIL POLLUTING THE SEA,
W69-05070 05C

SEAWEED
EFFECT OF SEAWEED ON THE LEVELS OF AVAILABLE PHOSPHORUS AND NITROGEN IN A CALCAREOUS SOIL,
W69-05136 02K

SEDIMENT CONTROL
ENTRY VELOCITY CONTROL LIMITS DRAIN SEDIMENTATION,
W69-04720 08B

SEDIMENT DISCHARGE
A SCALE MODEL STUDY OF SILTING IN THE VILAINE RIVER DUE TO THE ARZAL DAM (FRENCH),
W69-04795 02A

SEDIMENT LOAD
SEDIMENT DATA FOR CANADIAN RIVERS, WATER YEAR 1966.
W69-04766 02J

SEDIMENT TRANSPORT
SEDIMENTATION FROM A HYDRAULIC DREDGE IN A BAY,
W69-05000 04D

SEDIMENTATION
ENTRY VELOCITY CONTROL LIMITS DRAIN SEDIMENTATION,
W69-04720 08B

SUMMARY AND ANALYSIS OF SEDIMENT RECORDS IN RELATION TO ST. LOUIS HARBOR SEDIMENTATION PROBLEM,
W69-04938 02J

THE SEDIMENTS OF CHESAPEAKE BAY,
W69-05052 02L

INTERRELATIONSHIP BETWEEN PHYSIOGRAPHY, HYDROLOGY, SEDIMENTATION, AND SALINIZATION OF THE LODDEN RIVER PLAINS, AUSTRALIA,
W69-05079 02A

SEDIMENTS
A STUDY OF THE PHYSICAL PROPERTIES OF VARIOUS FORMS OF VERY FINE SEDIMENTS AND THEIR BEHAVIOR UNDER HYDRODYNAMIC ACTION (FRENCH),
W69-04796 02J

WINTER LOSS AND SPRING RECOVERY OF DISSOLVED SOLIDS IN TWO PRAIRIE-POTHOLE PONDS IN NORTH DAKOTA,
W69-04983 02J

THE SEDIMENTS OF CHESAPEAKE BAY,
W69-05052 02L

SEEDS
GERMINATION OF FOURWING SALTBUSH SEEDS AT DIFFERENT LEVELS OF MOISTURE STRESS,
W69-05081 02I

EFFECTS OF HERBICIDES, BURNING, AND SEEDING DATE IN RESEEDING AN ARID RANGE.
W69-05082 02A

MEASUREMENT OF THE WATER POTENTIAL OF INTACT PLANT TISSUES III. THE WATER POTENTIALS OF GERMINATING PEAS (PISUM SATIVUM L.),
W69-05095 02I

SEISMIC DESIGN
STRENGTH OF JOINTS AND JOINT ASSEMBLIES OF REINFORCED CONCRETE MULTISTORY FRAMES UNDER LOADS OF THE SEISMIC TYPE,

W69-04735 08P

SEISMIC PROPERTIES
EARTHQUAKE BEHAVIOR OF RESERVOIR-DAM SYSTEMS,
W69-04726 08A

SEMIARID CLIMATES
PERPETUAL SUCCESSION OF STREAM-CHANNEL VEGETATION IN A SEMIARID REGION,
W69-05080 02D

ESTIMATING CONSUMPTIVE USE - MUNSON P. E. INDEX METHOD,
W69-05094 02D

SEMIPERMEABLE MEMBRANES
SYNTHESIS AND EVALUATION OF NEW MEMBRANE CANDIDATES FOR APPLICATION IN REVERSE OSMOSIS,
W69-05157 03A

SEQUENCE
SEQUENCE AND TIMING IN RIVER BASIN DEVELOPMENT,
W69-05016 06B

SEQUENTIAL LINEAR PROGRAMMING
OPERATING POLICIES FOR IRRIGATION SYSTEMS UNDER STOCHASTIC REGIMES,
W69-05131 06A

OPERATING POLICIES FOR IRRIGATION SYSTEMS UNDER STOCHASTIC REGIMES SEQUENTIAL LINEAR PROGRAMMING MODEL,
W69-05133 06A

SEROGROUPS
MICROBIOLOGIC AND ESCHERICHIA COLI SEROLOGIC TRACING OF MICROBIAL POLLUTION,
W69-05155 05B

SETTLEMENT
INSTRUMENT FOR MEASURING SOIL DEFORMATIONS IN DEPTH,
W69-04746 08D

SEVERE STORMS
CLIMATOLOGY OF SEVERE WINTER STORMS IN ILLINOIS,
W69-05159 02B

SEWAGE
DISTRIBUTION, ENVIRONMENTAL REQUIREMENTS AND SIGNIFICANCE OF CLADOPHORA IN THE GREAT LAKES,
W69-04798 02H

SEWAGE DISTRICTS
SEWERS AND DRAINS.
W69-04885 06E

AUTHORITY TO LEVY TAXES FOR STREET IMPROVEMENTS.
W69-05194 06E

SEWAGE TREATMENT
MODERN SEWAGE TREATMENT PLANTS--HOW MUCH DO THEY COST.
W69-05031 05D

ESTIMATING SEWAGE TREATMENT PLANT OPERATION AND MAINTENANCE COSTS,
W69-05051 05D

SEWER EFFLUENTS
SOME EFFECTS OF SEWER EFFLUENT ON MARINE LIFE,
W69-05069 05C

SEWERAGE
FINANCING WATER PROJECTS IN LATIN AMERICA,
W69-04836 06B

SEWERS
POWERS OF COUNCIL.
W69-05195 06E

SHEAR STRAIN
AN ENERGY CRITERION FOR THE STRENGTH OF ROCK IN POLYAXIAL COMPRESSION,
W69-04711 08E

SHELLFISH
TRANSPLANTING OF SHELLS AND OYSTERS.
W69-04879 06E

SOME EFFECTS OF SEWER EFFLUENT ON MARINE LIFE,
W69-05069 05C

SHELLFISH TRANSPLANTING
TRANSPLANTING OF SHELLS AND OYSTERS.
W69-04879 06E

SHORES
SHORELINE RECREATION RESOURCES OF THE UNITED STATES.
W69-05054 02L

A GUIDE TO THE CONSERVATION OF SHORELINES, SUBMERGED BOTTOMS AND SALTWATERS WITH SPECIAL REFERENCE TO BULKHEAD LINES, DREDGING AND FILLING,
W69-05068 04A

SHORE-LINE COVER
SHORELINE FEATURES AS INDICATORS OF HIGH LAKE LEVELS,
W69-04984 02H

SHORING
SHORING FOR THE SEATTLE FIRST NATIONAL BANK BUILDING, SEATTLE, WASHINGTON,
W69-04721 08D

SHRUBS
SPATIAL PATTERN OF SHRUBS ON A DESERT PLAIN IN ETHIOPIA,
W69-05077 02I

SILTING
SUMMARY AND ANALYSIS OF SEDIMENT RECORDS IN RELATION TO ST. LOUIS HARBOR SEDIMENTATION PROBLEM,
W69-04938 02J

SILTS
A SCALE MODEL STUDY OF SILTING IN THE VILAINE RIVER DUE TO THE ARZAL DAM (FRENCH),
W69-04795 02A

A STUDY OF THE PHYSICAL PROPERTIES OF VARIOUS FORMS OF VERY FINE SEDIMENTS AND THEIR BEHAVIOR UNDER HYDRODYNAMIC ACTION (FRENCH),
W69-04796 02J

SEDIMENTATION FROM A HYDRAULIC DREDGE IN A BAY,
W69-05000 04D

SITES
SOIL MOISTURE DEPLETION BY GAMBEL OAK IN CENTRAL UTAH,
W69-05107 02G

SLIDING FRICTION
AN ENERGY CRITERION FOR THE STRENGTH OF ROCK IN POLYAXIAL COMPRESSION,
W69-04711 08E

SLOPE ASPECT
EFFECT OF EXPOSURE AND LOGGING ON RUNOFF AND EROSION,
W69-05104 04D

SLUDGE TREATMENT
MODERN SEWAGE TREATMENT PLANTS--HOW MUCH DO THEY COST.
W69-05031 05D

SNOW
CLIMATOLOGY OF SEVERE WINTER STORMS IN ILLINOIS,
W69-05159 02B

SNOW DEPTH MEASUREMENTS
SNOW LOADS ON ROOFS IN AREAS OF HEAVY SNOWFALL,
W69-05109 02C

SNOW SURVEYS
SNOW LOADS ON ROOFS IN AREAS OF HEAVY SNOWFALL,
W69-05109 02C

SNOWMELT
NET, ALLWAVE RADIATION AS AN INDEX OF NATURAL SNOWMELT AND SNOWMELT ACCELERATED WITH ALBEDO REDUCING MATERIALS,
W69-05103 02C

SNOWPACKS
A LOW INTENSITY RAIN SIMULATOR FOR LONG DURATION RAIN-ON-SNOW EVENTS,
W69-04939 02B

SNOW LOADS ON ROOFS IN AREAS OF HEAVY SNOWFALL,
W69-05109 02C

SOCIAL ASPECTS
ECONOMIC AND SOCIAL ASPECTS OF PLANNING OF WATER RESOURCES IN DEVELOPING COUNTRIES.
W69-04741 06B

SOCIO-ECONOMIC ASPECTS OF WATER QUALITY MANAGEMENT,
W69-05013 05G

SOCIAL COST
CONGESTION, TOLLS, AND THE ECONOMIC CAPACITY OF A WATERWAY,
W69-04838 06C

SOCIAL COSTS
ROAD PRICING, SOME TECHNICAL ASPECTS,
W69-04837 06C

SOCIAL IMPACT
CHESAPEAKE COUNTRY,
W69-05010 06G

SOCIAL PRODUCT
THE PROBLEM OF SOCIAL COST,
W69-04850 06C

SOCIAL VALUES
SOCIO-ECONOMIC ASPECTS OF WATER QUALITY MANAGEMENT,
W69-05013 05G

SOCIAL WELFARE FUNCTION
POSITIVE ECONOMICS, WELFARE ECONOMICS, AND POLITICAL ECONOMY,
W69-04852 06B

SOIL CHEMICAL PROPERTIES
PROPERTIES OF SOIL UNDER ASPEN AND HERB-SHRUB COVER,
W69-05097 02G

SOIL COLUMNS
CAPILLARY CONDUCTIVITY AND SOIL WATER DIFFUSIVITY VALUES FROM VERTICAL COLUMNS,
W69-05093 02G

SOIL CONSERVATION
INSHORE MARINE CONSERVATION,
W69-05044 02L

SOIL DENSITY

SOIL DENSITY MEASUREMENTS WITH GAMMA-RAYS,
W69-04747 08D

INFLUENCE OF THE THICKNESS AND FREE POROSITY OF A DRIED LAYER ON EVAPORATION,
W69-05083 02D

OIL DENSITY PROBES
SOIL DENSITY MEASUREMENTS WITH GAMMA-RAYS,
W69-04747 08D

OIL EROSION
SEDIMENT,
W69-05029 04D

OIL MICROORGANISMS
FACTORS AFFECTING BIOLOGICAL CLOGGING OF SAND ASSOCIATED WITH GROUND WATER RECHARGE,
W69-05075 03C

OIL MOISTURE
HYDROLOGIC MINI-CYCLE FOR SOIL MOISTURE AND SALT CONTROL IN IRRIGATED AGRICULTURE,
W69-05076 03F

CONSUMPTIVE USE OF WATER FOR SOME MAJOR CROPS IN U.A.R. (EGYPT),
W69-05087 02I

INFLUENCE OF SOIL WATER POTENTIAL AND ATMOSPHERIC EVAPORATIVE DEMAND ON TRANSPIRATION AND THE ENERGY STATUS OF WATER IN PLANTS.
W69-05088 02I

SOIL MOISTURE DEPLETION BY ASPEN IN CENTRAL UTAH,
W69-05106 02G

SOIL MOISTURE DEPLETION BY GAMBEL OAK IN NORTHERN UTAH,
W69-05108 02G

IL MOISTURE WITHDRAWAL
SOIL MOISTURE DEPLETION BY GAMBEL OAK IN CENTRAL UTAH,
W69-05107 02G

IL PHYSICAL PROPERTIES
PROPERTIES OF SOIL UNDER ASPEN AND HERB-SHRUB COVER,
W69-05097 02G

IL PROFILE
SOIL MOISTURE DEPLETION BY GAMBEL OAK IN NORTHERN UTAH,
W69-05108 02G

IL PROPERTIES
PROPERTIES OF SALINE RANGE SOILS OF THE RIO GRANDE PLAIN,
W69-05084 02G

THE INFLUENCE OF GROWTH MEDIA, TEMPPRATURES, AND LIGHT INTENSITIES ON ASPEN ROOT AND TOP GROWTH,
W69-05101 02G

IL STABILIZATION
EFFECTS OF SEEDBED TREATMENT ON GRASS ESTABLISHMENT ON LOGGING ROADBEDS IN CENTRAL IDAHO,
W69-05096 04A

CONTROLLING SOIL MOVEMENT FROM STEEP ROAD FILLS,
W69-05105 04A

IL SURFACES
THE DETERMINATION OF THE EVAPORATION FROM THE PLANT COVER AND THE SURFACE OF THE SOIL BY RELATING LYSIMETER AND SOIL MOISTURE MEASUREMENTS TO POTENTIAL EVAPORATION,
W69-05073 02D

INFLUENCE OF THE THICKNESS AND FREE POROSITY OF A DRIED LAYER ON EVAPORATION,
W69-05083 02D

CONSUMPTIVE USE OF WATER FOR SOME MAJOR CROPS IN U.A.R. (EGYPT),
W69-05087 02I

VILLAGE INFLUENCES WATER INTAKE,
W69-05089 02G

IL TEMPERATURE
INFLUENCE OF SOIL TEMPERATURE ON TRANSPIRATION UNDER VARIOUS ENVIRONMENTAL CONDITIONS,
W69-05099 02D

IL TYPES
THE INFLUENCE OF GROWTH MEDIA, TEMPERATURES, AND LIGHT INTENSITIES ON ASPEN ROOT AND TOP GROWTH,
W69-05101 02G

IL WATER MOVEMENT
CAPILLARY CONDUCTIVITY AND SOIL WATER DIFFUSIVITY VALUES FROM VERTICAL COLUMNS,
W69-05093 02G

IL WATER POTENTIAL
INFLUENCE OF SOIL WATER POTENTIAL AND ATMOSPHERIC EVAPORATIVE DEMAND ON TRANSPIRATION AND THE ENERGY STATUS OF WATER IN PLANTS.
W69-05088 02I

ILS
THE FATE OF NITRATE NITROGEN IN SOME TROPICAL SOILS FOLLOWING SUBMERGENCE,
W69-05138 02K

SOIL-WATER-PLANT RELATIONSHIP
PROPERTIES OF SOIL UNDER ASPEN AND HERB-SHRUB COVER,
W69-05097 02G

SOIL MOISTURE DEPLETION BY GAMBEL OAK IN NORTHERN UTAH,
W69-05108 02G

SOLAR DISTILLATION
HYDROLOGIC MINI-CYCLE FOR SOIL MOISTURE AND SALT CONTROL IN IRRIGATED AGRICULTURE,
W69-05076 03F

SOLAR RADIATION
NET, ALLWAVE RADIATION AS AN INDEX OF NATURAL SNOWMELT AND SNOWMELT ACCELERATED WITH ALBEDO REDUCING MATERIALS,
W69-05103 02C

SOLINA PROJECT(POLAND)
THE SOLINA HYDRO PROJECT,
W69-04738 08A

SOLUTES
THE NATURE OF INORGANIC SOLUTE SPECIES IN WATER,
W69-04967 02K

SOURCE OF TITLE TEST
CURRENT TRENDS IN WISCONSIN'S WATER LAW,
W69-05161 06E

SOUTH CAROLINA
FOREST LAND CO V BLACK (ACTION TO ENJOIN OPERATION OF MOTOR BOAT ON PRIVATE LAKE).
W69-04895 06E

SOUTHWEST U S
GERMINATION OF FOURWING SALTBUSH SEEDS AT DIFFERENT LEVELS OF MOISTURE STRESS,
W69-05081 02I

SPATIAL DISTRIBUTION
SPATIAL PATTERN OF SHRUBS ON A DESERT PLAIN IN ETHIOPIA,
W69-05077 02I

SPOIL BANKS
SEDIMENTATION FROM A HYDRAULIC DREDGE IN A BAY,
W69-05000 04D

SPOIL DIRT
FONTENOT V SMITH (CONTRACT AGREEMENTS AND RIGHTS TO NATURAL FLOW).
W69-05170 06E

SPORT FISH
THE FISHERIES--A NEGLECTED ASPECT OF ESTUARINE RESEARCH,
W69-05025 02L

SPORT FISHING
MASSACHUSETTS MARINE SPORT FISHERIES INVENTORY,
W69-04991 06B

SPORT FISHING SURVEY OF THE LOWER POTOMAC ESTUARY,
W69-04992 02L

THE GULF OF MEXICO MENHADEN FISHERY IN RELATION TO THE SPORTS FISHERY,
W69-04996 06B

COMMERCIAL AND SPORT FISHERIES,
W69-05002 03E

A SURVEY OF SALT-WATER SPORT FISHING IN VIRGINIA 1955-1960,
W69-05046 06B

SPRINGS
LABRUZZO V ATLANTIC DREDGING CONSTRUCTION CO (EXCAVATION DIVERTING UNDERGROUND WATERS).
W69-04910 06E

ORIGIN OF THE CHEMICAL COMPOSITIONS OF SOME SPRINGS AND LAKES,
W69-04969 02K

SPRINKLER IRRIGATION
POPULATION, GROWTH RATE, AND MATURITY OF VEGETABLE CROPS IN RELATION TO SOIL SALINITY AND TEXTURE UNDER SPRINKLER AND FURROW IRRIGATION,
W69-05074 02I

STANDARDS
POLICIES, STANDARDS, AND PROCEDURES IN THE FORMULATION, EVALUATION, AND REVIEW OF PLANS FOR USE AND DEVELOPMENT OF WATER AND RELATED LAND RESOURCES.
W69-05039 06B

STARTING
SEMI-SYNCHRONOUS STARTING,
W69-04722 08C

STATE JURISDICTION
WATER LAW AND PRIVATE DECISION MAKING A CRITIQUE,
W69-04839 06B

STATE PROPERTY
MUSGROVE V CICCO (MAINTENANCE OF WHARF OVER OBJECTION OF LITTORAL OWNER).
W69-05176 06E

STATISTICS
AREAL SPREAD OF THE EFFECT OF CLOUD SEEDING AT THE WHITETOP EXPERIMENT,
W69-04775 03B

ESTIMATED USE OF WATER IN THE UNITED STATES, 1960,
W69-05019 06B

A SURVEY OF SALT-WATER SPORT FISHING IN VIRGINIA 1955-1960,
W69-05046 06B

STEM TEMPERATURES
INFLUENCE OF SOIL TEMPERATURE ON TRANSPIRATION UNDER VARIOUS ENVIRONMENTAL CONDITIONS,
W69-05099 02D

STILLING WELL HEATER
A HEATING SYSTEM FOR STREAM GAGING STATIONS,
W69-05110 07B

STOCHASTIC REGIMES
OPERATING POLICIES FOR IRRIGATION SYSTEMS UNDER STOCHASTIC REGIMES DYNAMIC PROGRAMMING MODEL,
W69-05132 06A

OPERATING POLICIES FOR IRRIGATION SYSTEMS UNDER STOCHASTIC REGIMES SEQUENTIAL LINEAR PROGRAMMING MODEL,
W69-05133 06A

STOPPAGE
LABRUZZO V ATLANTIC DREDGING CONSTRUCTION CO (EXCAVATION DIVERTING UNDERGROUND WATERS).
W69-04910 06E

STORAGE
WATER HOLDING CAPACITY OF PONDEROSA PINE FOREST FLOOR LAYERS,
W69-04751 03B

HYDROLOGIC BASES OF WATER RESOURCES UTILIZATION OF LAKES,
W69-04957 02H

STORM DAMAGES
CLIMATOLOGY OF SEVERE WINTER STORMS IN ILLINOIS,
W69-05159 02B

STORM RUNOFF
MASON V LAMB (ACTION TO RECOVER DAMAGES FROM SURFACE WATER RUNOFF ONTO PLAINTIFFS' PROPERTY).
W69-04894 06E

STRAIN ENERGY
AN ENERGY CRITERION FOR THE STRENGTH OF ROCK IN POLYAXIAL COMPRESSION,
W69-04711 08E

STRATIGRAPHY
SEDIMENTARY HISTORY AND ECONOMIC GEOLOGY OF SAN JUAN BASIN, NEW MEXICO AND COLORADO,
W69-04948 05E

STREAM GAGES
A HEATING SYSTEM FOR STREAM GAGING STATIONS,
W69-05110 07B

STREAMBEDS
IN RE CITY OF NEW YORK (STREAM BEDS).
W69-05189 06E

STREAMFLOW
SURFACE WATER DATA, QUEBEC, WATER YEAR 1964.
W69-04768 02E

SURFACE WATER DATA, BRITISH COLUMBIA, WATER YEAR 1966.
W69-04792 02E

BURKHARDT V ROCKY (DEPOSIT OF DEBRIS IN STREAMS - OVERFLOW).
W69-04912 06E

ANNUAL PEAK DISCHARGES FROM SMALL DRAINAGE AREAS IN MONTANA THROUGH SEPTEMBER 1968,
W69-04927 02E

CONTRIBUTION CONCERNING THE FLOW RATES OF RIVERS TRANSPORTING DRAIN WATERS OF OPEN-CAST MINES,
W69-04956 04C

HYDROLOGIC BASES OF WATER RESOURCES UTILIZATION OF LAKES,
W69-04957 02H

THE CONSTRUCTION AND USE OF FLOW-VOLUME CURVES,
W69-04979 02E

STREAMFLOW FORECASTING
STREAMFLOW SYNTHESIS FOR UNGAGED RIVERS,
W69-04932 02E

A NEW METHOD OF MAPPING THE WATER RESOURCES,
W69-04934 02E

SEASONAL DISTRIBUTION AND REGULATION FOR FLOW RIVERS OF MOUNTAIN COUNTRIES,
W69-04935 02E

A METHOD OF DETERMINING THE AVAILABLE SURFACE WATER RESOURCES,
W69-04950 02E

ESTIMATION OF MAXIMUM DISCHARGES AND HYDROGRAPHS OF FLOOD,
W69-04955 02E

STREAMFLOW MEASUREMENT
A HEATING SYSTEM FOR STREAM GAGING STATIONS,
W69-05110 07B

STREAMS
THE EFFECT OF PHOTOSYNTHESIS ON THE OXYGEN BALANCE IN A MIDWESTERN STREAM,
W69-04780 05C

CLARK V LINDSAY LIGHT AND CHEMICAL CO (RIPARIAN RIGHTS IN WATERS OF STREAM).
W69-04858 06E

ANALYTICAL APPROACHES TO COMPUTATION OF DISCHARGE OF AN ICE-COVERED STREAM,
W69-04975 02E

PERPETUAL SUCCESSION OF STREAM-CHANNEL VEGETATION IN A SEMIARID REGION,
W69-05080 02D

STREET IMPROVEMENTS
AUTHORITY TO LEVY TAXES FOR STREET IMPROVEMENTS.
W69-05194 06E

STRIP MINES
CONTRIBUTION CONCERNING THE FLOW RATES OF RIVERS TRANSPORTING DRAIN WATERS OF OPEN-CAST MINES,
W69-04956 04C

STRIPED BASS
EFFECTS OF CIVILIZATION ON STRIPED BASS AND OTHER ESTUARINE BIOTA IN CHESAPEAKE BAY AND TRIBUTARIES,
W69-05021 05C

STRIPED BASS IN MARYLAND TIDEWATER,
W69-05022 06B

STRONTIUM RADIOISOTOPES
FACTORS INFLUENCING RADIOSTRONTIUM ACCUMULATION IN DAPHNIA,
W69-05141 05C

STRUCTURAL DESIGN
A HEATING SYSTEM FOR STREAM GAGING STATIONS,
W69-05110 07B

SUBMERGED LANDS ACT
LEGAL ASPECTS OF OFFSHORE OIL AND GAS OPERATIONS,
W69-04859 06E

SUBMERGED SOILS
THE FATE OF NITRATE NITROGEN IN SOME TROPICAL SOILS FOLLOWING SUBMERGENCE,
W69-05138 02K

SUBMERSED WEEDS
CONTROL OF SUBMERSED AQUATIC WEEDS IN IRRIGATION CANALS BY DAILY APPLICATIONS OF LOW CONCENTRATIONS OF COPPER SULFATE,
W69-04729 04A

SUBSURFACE DRAINS
ENTRY VELOCITY CONTROL LIMITS DRAIN SEDIMENTATION,
W69-04720 08B

SUBSURFACE INVESTIGATIONS
DEVELOPING AN IRRIGATION WATER SUPPLY IN THE COASTAL PLAIN,
W69-04749 02F

SUCCESSION
PERPETUAL SUCCESSION OF STREAM-CHANNEL VEGETATION IN A SEMIARID REGION,
W69-05080 02D

SULFITE LIQUORS
ON OYSTERS AND SULFITE WASTE LIQUOR,
W69-04997 05C

SURFACE DRAINAGE
LIBBY, MCNEIL AND LIBBY V ROBERTS (INTERFERENCE WITH NATURAL DRAINAGE COURSE).
W69-04872 06E

SAWYER V SHADER (OBSTRUCTION TO FLOW).
W69-04888 06E

GIBSON V SHARP (DRAINAGE DITCH RIGHT OF WAY)
W69-04891 06E

BENNETT V COUNTY OF EATON (CONCENTRATED DRAINAGE ONTO LOWER LANDS).
W69-04898 06E

CONGDON V PIONEER CITY COAL CO (RAINWATER RUNOFF).
W69-04913 06E

MCCORMICK COAL CO V B R SCHUBERT (NATURAL FLOW AND DIVERSIO OF STREAM BED).
W69-05171 06E

SURFACE DRAINAGES
RAILWAY COMPANIES, DRAINAGE REPAIRS FAILURE, EXPENSE OF COMPANY.
W69-04905 06E

SURFACE RUNOFF
BARBER PURE MILK CO V YOUNG (OBSTRUCTION OF SURFACE WATER FLOW).
W69-04863 06E

LIABILITY, AS REGARDS SURFACE WATERS, FOR RAISING SURFACE LEVEL OF LAND,
W69-04873 06E

CRAWFORD V SPRINGVIEW CORP (SURFACE DRAINAGE OVER LOWER ADJACENT TRACT).

9-04889 06E

VIS V ATLANTIC COAST LINE RR (DRAINAGE FLOW EASEMENTS).
9-04893 06E

ARK V CITY OF SPRINGFIELD (NUISANCE ABATEMENT SEWAGE AND RFACE WATER).
9-04900 06E

AMP V STATE (ACTION FOR NEGLIGENT HIGHWAY CONSTRUCTION STRUCTING NATURAL SURFACE WATER FLOW).
9-04901 06E

DIMENT,
9-05029 04D

RRENT TRENDS IN WISCONSIN'S WATER LAW,
9-05161 06E

CHOLSON V HOLLOWAY PRINTING CO (ARTIFICIAL INCREASE OF RFACE RUNOFF).
9-05163 06E

CULLOUGH V HARTPENCE (DIVERSION OF DIFFUSED SURFACE TER).
9-05168 06E

TTERS V NATIONAL DRIVE-IN (SURFACE WATER DRAINAGE DAMAGE).
9-05178 06E

THERFORD V LOUISVILLE AND NASHVILLE RR (FLOODING FROM ERFLOWED CULVERT).
9-05179 06E

PES V BARGER (DAMAGES CAUSED BY DAM TO REPEL SURFACE TERS).
9-05181 06E

UMMOND V FRANK (OBSTRUCTION OF SURFACE FLOW).
9-05200 04A

FACE SEALING
HARACTERIZATION OF THE RATE OF WATER INFILTRATION INTO OIL,
9-05143 02G

FACE WATERS
STUDY OF WATER RESOURCES IN THE CANBERRA AREA AND THE EANBEYAN RIVER WATERSHED (GOOGONG DAM CATCHMENT),
9-04757 02E

URFACE WATER DATA, QUEBEC, WATER YEAR 1964.
9-04768 02E

ATER RESOURCES APPRAISAL OF THOUSAND SPRINGS VALLEY, ELKO OUNTY, NEVADA,
9-04791 02E

URFACE WATER DATA, BRITISH COLUMBIA, WATER YEAR 1966.
9-04792 02E

ASON V LAMB (ACTION TO RECOVER DAMAGES FROM SURFACE WATER UNOFF ONTO PLAINTIFFS' PROPERTY).
9-04894 06E

OUNG V MOORE (LANDOWNERS RIGHT TO DRAIN EXCESS SURFACE ATER).
9-04899 06E

NNUAL PEAK DISCHARGES FROM SMALL DRAINAGE AREAS IN MONTANA HROUGH SEPTEMBER 1968,
9-04927 02E

METHOD OF DETERMINING THE AVAILABLE SURFACE WATER ESOURCES,
9-04950 02E

EDDMANN V REDDMANN (OBSTRUCTION TO SURFACE WATER FLOW).
9-05174 06E

FACE-GROUNDWATER RELATIONSHIPS
NFLUENCE OF THE SOUTH SASKATCHEWAN RESERVOIR (CANADA) ON IEZOMETRIC LEVELS IN UNDERLYING BEDROCK AQUIFERS,
9-04774 02F

VEYS
TATE V NICHOLS (MISTAKE - FEDERAL AGENCY JURIS).
9-04896 06E

PORT FISHING SURVEY OF THE LOWER POTOMAC ESTUARY,
9-04992 02L

VIVOR TECHNIQUE
HE ECONOMIES OF SCALE,
9-04840 06C

PENDED LOAD
EDIMENT DATA FOR CANADIAN RIVERS, WATER YEAR 1966.
9-04766 02J

CHRONOUS MACHINES
EMI-SYNCHRONOUS STARTING,
9-04722 08C

OPTIC ANALYSIS
EASONAL DISTRIBUTION AND REGULATION FOR FLOW RIVERS OF OUNTAIN COUNTRIES,
9-04935 02E

THESIS
TREAMFLOW SYNTHESIS FOR UNGAGED RIVERS,
W69-04932 02E

SYSTEMS ANALYSIS
ESTUARINE WATER QUALITY MANAGEMENT AND FORECASTING,
W69-05059 05B

TAX POLICIES
GROUNDWATER UTILIZATION AND TAX POLICY,
W69-05126 06C

TAXES
CONGESTION, TOLLS, AND THE ECONOMIC CAPACITY OF A WATERWAY,
W69-04838 06C

GROUNDWATER UTILIZATION AND TAX POLICY,
W69-05126 06C

AUTHORITY TO LEVY TAXES FOR STREET IMPROVEMENTS.
W69-05194 06E

TECHNICAL PROGRESS
CAPITAL ACCUMULATION AND TECHNICAL PROGRESS (GERMAN),
W69-04847 06B

TECHNOLOGY
CAPITAL ACCUMULATION AND TECHNICAL PROGRESS (GERMAN),
W69-04847 06B

TEHRAN(IRAN)
WATER SUPPLY SCHEME OF GREATER TEHRAN CITY,
W69-04761 06D

TEMPERATURE
CHEMICAL MEASUREMENT OF MEAN TEMPERATURE,
W69-04765 07A

THE EFFECTS OF TEMPERATURE AND SALINITY ON MARINE AND BRACKISH WATER ANIMALS--I. TEMPERATURE,
W69-05011 05C

OBSERVATIONS ON THE RESPONSE OF SOME BENTHONIC ORGANISM TO POWER STATION COOLING,
W69-05023 05C

ESTIMATING CONSUMPTIVE USE - MUNSON P. E. INDEX METHOD,
W69-05094 02D

TENNESSEE VALLEY AUTHORITY PROJECT
THE DYNAMIC CHARACTER OF MULTIPURPOSE RIVER DEVELOPMENT THE TVA EXPERIENCE,
W69-04818 04A

TEXAS
OUTLOOK FOR ECONOMIC USE OF FRESH WATER FROM THE SEA,
W69-05032 03A

TEXTILES
DETERMINATION, EVALUATION AND ABATEMENT OF COLOR IN TEXTILE PLANT EFFLUENTS,
W69-04756 05B

THEORETICAL ANALYSIS
WATER RESEARCH,
W69-05115 06B

THERMAL CONDUCTIVITY
THERMAL CONDUCTIVITY OF TWO-PHASE POROUS MATERIALS DRY SOILS,
W69-04949 07B

THERMAL POLLUTION
THERMAL DISCHARGE BIBLIOGRAPHY,
W69-04937 05B

EFFECTS OF HEATED DISCHARGES IN THE TEMPERATURE OF THE THAMES ESTUARY II,
W69-04994 05C

CULTIVATING FISH FOR FOOD AND SPORT IN POWER-STATION WATER,
W69-05006 05C

OBSERVATIONS ON THE RESPONSE OF SOME BENTHONIC ORGANISM TO POWER STATION COOLING,
W69-05023 05C

PREDICTION OF TEMPERATURE IN RIVERS AND RESERVOIRS,
W69-05042 05B

FORECASTING HEAT LOSS IN PONDS AND STREAMS,
W69-05062 05B

THERMOCLINE
'ANOMALOUS' THERMAL CONDITIONS IN A HYPERSALINE INLAND POND,
W69-05078 02H

THERMODYNAMICS
APPLICATION AND LIMITATIONS OF CHEMICAL THERMODYNAMICS IN NATURAL WATER SYSTEMS,
W69-04770 02K

TIDAL ENERGY
PASSAMAQUODDY-ST. JOHN.
W69-05005 06B

TIDAL POWERPLANTS
PASSAMAQUODDY-ST. JOHN.
W69-05005 06B

INVESTIGATION OF THE INTERNATIONAL PASSAMAQUODDY TIDAL PROJECT.
W69-05007 06B

TIME DISTRIBUTION
ECONOMICS AND THE CONSERVATION QUESTION,
W69-04841 03B

TIMING
SEQUENCE AND TIMING IN RIVER BASIN DEVELOPMENT,
W69-05016 06B

TOTAL YIELD CURVES
HOMOGENEOUS, ESPECIALLY LINEAR HOMOGENEOUS, PRODUCTION FUNCTIONS AND THE LAW OF YIELD (GERMAN),
W69-04846 06B

TRACE ELEMENTS
TRACE INORGANICS IN WATER,
W69-04962 02K

TRACING MICROBIAL POLLUTION
MICROBIOLOGIC AND ESCHERICHIA COLI SEROLOGIC TRACING OF MICROBIAL POLLUTION,
W69-05155 05B

TRANSFERABILITY
WATER LAW AND PRIVATE DECISION MAKING A CRITIQUE,
W69-04839 06B

TRANSFORMATION CURVE
DIRECT VERSUS INDIRECT TAXATION,
W69-04848 06C

TRANSPIRATION
INFLUENCE OF SOIL WATER POTENTIAL AND ATMOSPHERIC EVAPORATIVE DEMAND ON TRANSPIRATION AND THE ENERGY STATUS OF WATER IN PLANTS.
W69-05088 02I

INFLUENCE OF SOIL TEMPERATURE ON TRANSPIRATION UNDER VARIOUS ENVIRONMENTAL CONDITIONS,
W69-05099 02D

TRANSPIRATION CONTROL
EFFECTS OF PHENYLMERCURIC ACETATE ON TRANSPIRATION AND GROWTH OF SMALL PLOTS OF GRASS,
W69-05071 02D

TRANSPORT DEPLETION
DEVELOPMENT OF TRANSPORT DEPLETION PROCESSES,
W69-05156 03A

TRANSPORTATION
THE ROLE OF U S TRANSPORTATION POLICY IN THE DEVELOPMENT OF INLAND WATERWAY NAVIGATION,
W69-04862 06E

REPORT ON THE 1961 TRANSPORTATION RESEARCH AND SERVICE ACTIVITIES OF THE BUREAU OF COMMERCIAL FISHERIES,
W69-05001 03E

TREATIES
LEGAL ASPECTS OF OFFSHORE OIL AND GAS OPERATIONS,
W69-04859 06E

TREATMENT FACILITIES
SCIENTIFIC PARAMETERS OF MARINE WASTE DISCHARGE,
W69-05018 05A

MODERN SEWAGE TREATMENT PLANTS--HOW MUCH DO THEY COST.
W69-05031 05D

ESTIMATING SEWAGE TREATMENT PLANT OPERATION AND MAINTENANCE COSTS,
W69-05051 05D

TREES
PHENOLOGICAL ASPECTS OF A FEW PROMISING EUCALYPTUS IN THE ABID ZONE,
W69-05091 02I

TRESPASS
BURKHARDT V ROCKY (DEPOSIT OF DEBRIS IN STREAMS - OVERFLOW).
W69-04912 06E

W G DUNCAN COAL CO V JONES (PRESCRIPTIVE RIGHTS TO MINEWATER POLLUTION).
W69-04915 06E

TROPICAL REGIONS
THE FATE OF NITRATE NITROGEN IN SOME TROPICAL SOILS FOLLOWING SUBMERGENCE,
W69-05138 02K

TUGBOATS
FOURTH CLASS CITIES - GENERAL POWERS OF CITY CORPORATIONS.
W69-04906 06E

TURBULENCE
HORIZONTAL DIFFUSION FROM AN INSTANTANEOUS POINT SOURCE DUE TO OCEANIC TURBULENCE,
W69-05036 02L

A REVIEW OF THEORETICAL MODELS OF TURBULENT DIFFUSION IN THE SEA,
W69-05037 02L

TURBULENCE INTENSITY
MICROSCOPIC DETERMINATION OF BOUNDARY SHEAR AND SUBLAYER TURBULENCE CHARACTERISTICS IN AN OPEN CHANNEL,
W69-05150 08B

TURBIDITY
INFLUENCE OF SOIL WATER POTENTIAL AND ATMOSPHERIC EVAPORATIVE DEMAND ON TRANSPIRATION AND THE ENERGY STATUS OF WATER IN PLANTS.
W69-05088 02I

UNDERDEVELOPED COUNTRIES
ECONOMIC AND SOCIAL ASPECTS OF PLANNING OF WATER RESOURCES IN DEVELOPING COUNTRIES.
W69-04741 06B

UNDERGROUND STREAMS
LABRUZZO V ATLANTIC DREDGING AND CONST CO (ACTION TO RECOVER DAMAGES FOR DISRUPTION OF UNDERGROUND STREAM).
W69-04909 06E

UNITED ARAB REPUBLIC
CONSUMPTIVE USE OF WATER FOR SOME MAJOR CROPS IN U.A.R. (EGYPT),
W69-05087 02I

UNITED STATES
WATER RESOURCES ACTIVITIES IN THE UNITED STATES WATER SUPPLY AND DEMAND.
W69-05065 06D

UPPER ESTATE
RUTHERFORD V LOUISVILLE AND NASHVILLE RR (FLOODING FROM OVERFLOWED CULVERT).
W69-05179 06E

UPPER LANDOWNER
LARSON V REMEIKIS (ACCELERATION AND DIVERSION OF NATURAL DRAINAGE RELATIVE RIGHTS).
W69-04917 06E

URBANIZATION
SEDIMENT,
W69-05029 04D

USUFRUCTUARY RIGHT
CLARK V LINDSAY LIGHT AND CHEMICAL CO (RIPARIAN RIGHTS IN WATERS OF STREAM).
W69-04858 06E

UTILITIES
BROWARD COUNTY V HURWIT (MUNICIPAL WATER AND SEWER FACILITIES).
W69-05162 06E

WATERWORKS.
W69-05196 06E

VALUE
OUTDOOR RECREATION DEMANDS AND BENEFITS,
W69-05014 06D

VALUES
SOCIO-ECONOMIC ASPECTS OF WATER QUALITY MANAGEMENT,
W69-05013 05G

VALVES
FLOW AND CAVITATION CHARACTERISTICS OF CONTROL VALVES,
W69-04716 08C

VAPOR PRESSURE
EXPERIENCE WITH THREE VAPOUR METHODS FOR MEASURING WATER POTENTIAL IN PLANTS,
W69-05085 02I

VARIABILITY
THE WATER CRISIS,
W69-05113 06B

VARIANCE
A NOTE ON THE VARIANCE OF A MATRIX,
W69-04844 06A

VARNISHES
POLYAMIDE-IMIDE INSULATION VARNISH,
W69-04719 08G

VAULTS
FOURTH CLASS CITIES - GENERAL POWERS OF CITY CORPORATIONS.
W69-04906 06E

VEGETABLE CROPS
POPULATION, GROWTH RATE, AND MATURITY OF VEGETABLE CROPS IN RELATION TO SOIL SALINITY AND TEXTURE UNDER SPRINKLER AND FURROW IRRIGATION,
W69-05074 02I

VEGETATION
PERPETUAL SUCCESSION OF STREAM-CHANNEL VEGETATION IN A SEMIARID REGION,
W69-05080 02D

VEGETATION EFFECTS
AQUATIC PLANT NUISANCES,
W69-05043 04A

SOIL MOISTURE DEPLETION BY ASPEN IN CENTRAL UTAH,
W69-05106 02G

VEGETATION ESTABLISHMENT
GERMINATION OF FOURWING SALTBUSH SEEDS AT DIFFERENT LEVELS OF MOISTURE STRESS,
W69-05081 02I

EFFECTS OF SEEDBED TREATMENT ON GRASS ESTABLISHMENT ON LOGGING ROADBEDS IN CENTRAL IDAHO,
W69-05096 04A

CONTROLLING SOIL MOVEMENT FROM STEEP ROAD FILLS,
W69-05105 04A

GETATION REGROWTH
PROPERTIES OF SALINE RANGE SOILS OF THE RIO GRANDE PLAIN,
W69-05084 02G

LOCITY
ENTRY VELOCITY CONTROL LIMITS DRAIN SEDIMENTATION,
W69-04720 08B

RMONT
RIPARIAN RIGHTS... 'CTION BY STATE TO ENJOIN LANDOWNER FROM FILLING IN LAKE.
W69-04860 06E

RGINIA
BOSTICK V SMOOT SAND AND GRAVEL CORP (DREDGING IN RIVER AS CREATING NUISANCE FOR OTHER RIPARIAN OWNERS).
W69-04869 06E

MASON V LAMB (ACTION TO RECOVER DAMAGES FROM SURFACE WATER RUNOFF ONTO PLAINTIFFS' PROPERTY).
W69-04894 06E

VANCE V DAVIS (ADJUDICATION OF WATER RIGHTS).
W69-04907 06E

COMMERCIAL AND SPORT FISHERIES,
W69-05002 03E

BOAT AND MARINA WASTES,
W69-05009 05G

AQUATIC PLANT NUISANCES,
W69-05043 04A

REVIEW REPORT ON JAMES RIVER, VIRGINIA.
W69-05045 04A

A SURVEY OF SALT-WATER SPORT FISHING IN VIRGINIA 1955-1960,
W69-05046 06B

HODGES MANOR CORP V MAYFLOWER PARK CORP (DAMAGE DUE TO DISCHARGE OF SURFACE WATERS THROUGH ARTIFICIAL CHANNELS).
W69-05173 06E

RUSES
A COMPARISON OF THE INACTIVATION OF ESCHERICHIA COLI AND POLIOVIRUS IN POLLUTED AND UNPOLLUTED WATERS BY CHLORINATION,
W69-04778 05D

LCANOLOGY
GEOPHYSICAL STUDIES FOR VOLCANOLOGICAL GEOHYDROLOGY,
W69-05145 07B

RTICES
ON THE MECHANISM OF LANGMUIR CIRCULATIONS AND THEIR ROLE IN EPILIMNION MIXING,
W69-04929 02H

THERMAL STRUCTURE AND VERTICAL HEAT TRANSPORT IN LANGMUIR CIRCULATIONS,
W69-04931 02H

GES
MANPOWER PROBLEMS IN WATER SUPPLY ORGANIZATION,
W69-04779 06E

SHINGTON
ON OYSTERS AND SULFITE WASTE LIQUOR,
W69-04997 05C

STE ASSIMILATIVE CAPACITY
OXYGENATION OF BALTIMORE HARBOR BY PLANKTONIC ALGAE,
W69-05003 05G

FINAL REPORT ON BALITMORE HARBOR STUDY,
W69-05056 05F

STE DISPOSAL
SOUTHLAND V AARON (RIPARIAN OWNER'S ACTION FOR DAMAGES FROM OIL WASTE POLLUTION OF STREAM).
W69-04884 06E

SUBSURFACE DISPOSAL OF LIQUID INDUSTRIAL WASTES BY DEEP-WELL INJECTION,
W69-04941 05E

POSSIBILITIES FOR DISPOSAL OF INDUSTRIAL WASTES IN SUBSURFACE ROCKS OF NORTH FLANK OF APPALACHIAN BASIN IN NEW YORK,
W69-04943 05E

POSSIBILITIES FOR SUBSURFACE WASTE DISPOSAL IN A STRUCTURAL SYNCLINE IN PENNSYLVANIA,
W69-04944 05E

GEOLOGY OF SUBSURFACE WASTE DISPOSAL IN MICHIGAN BASIN,
W69-04945 05E

SUBSURFACE WASTE-DISPOSAL POTENTIAL IN SALINA BASIN OF KANSAS,
W69-04946 05E

POTENTIAL OF DENVER BASIN FOR DISPOSAL OF LIQUID WASTES,
W69-04947 05E

DISCHARGE OF WASTES INTO THE SEA IN EUROPEAN COASTAL AREAS,
W69-05015 05E

PROCEEDINGS OF THE FIRST INTERNATIONAL CONFERENCE ON WASTE DISPOSAL IN THE MARINE ENVIRONMENT,
W69-05038 05E

WASTE WATER
WASTE WATER CONSERVATION AND RENOVATION RESEARCH,
W69-04748 05D

WASTE WATER RECLAMATION
WASTE WATER CONSERVATION AND RENOVATION RESEARCH,
W69-04748 05D

WASTE WATER TREATMENT
WASTE WATER CONSERVATION AND RENOVATION RESEARCH,
W69-04748 05D

WASTE WATER USE
WASTE WATER CONSERVATION AND RENOVATION RESEARCH,
W69-04748 05D

WASTE WATER(POLLUTION)
CULTIVATING FISH FOR FOOD AND SPORT IN POWER-STATION WATER,
W69-05006 05C

WATER ALLOCATION(POLICY)
THE GENERAL POLICY OF THE IRANIAN MINISTRY OF WATER AND POWER IN DEVELOPMENT OF WATER RESOURCES,
W69-04753 04A

IMPROVEMENT OF WATER RESOURCES UTILIZATION FOR PUBLIC WATER SUPPLY IN TAIWAN,
W69-04760 06B

THE WATER CRISIS,
W69-05113 06B

THE CONJUNCTIVE USE OF SURFACE AND GROUND WATERS,
W69-05135 06A

WATER AND POWER RESOURCES BOARD
BOROUGH OF COLLEGEVILLE V PHILADELPHIA SUBURAN WATER CO (ADMINISTRATIVE REMEDIES FOR WATER DIVERSION).
W69-05198 06E

WATER BALANCE
CALCULATION MODEL FOR THE ACTUAL EVAPOTRANSPIRATION FROM CROPPED AREAS AND OTHER TERMS OF THE WATER BALANCE EQUATION,
W69-05072 02D

WATER CHEMISTRY
TRACE INORGANICS IN WATER,
W69-04962 02K

AQUEOUS SURFACE CHEMISTRY OF OXIDES AND COMPLEX OXIDE MINERALS,
W69-04966 02K

THE NATURE OF INORGANIC SOLUTE SPECIES IN WATER,
W69-04967 02K

HETEROGENEOUS EQUILIBRIA INVOLVING OXIDES, HYDROXIDES, CARBONATES, AND HYDROXIDE CARBONATES,
W69-04968 02K

ORIGIN OF THE CHEMICAL COMPOSITIONS OF SOME SPRINGS AND LAKES,
W69-04969 02K

EQUILIBRIUM MODELS AND COMPOSITION OF THE GREAT LAKES,
W69-04970 02K

COORDINATION CHEMISTRY OF THE OCEANS,
W69-04971 02K

REDOX EQUILIBRIA AND MEASUREMENTS OF POTENTIALS IN THE AQUATIC ENVIRONMENT,
W69-04972 02K

SOME PH-CONTROLLING REDOX REACTIONS IN NATURAL WATERS,
W69-04973 02K

BIOLOGICAL ACTIVITY IN RELATION TO THE CHEMICAL EQUILIBRIUM COMPOSITION OF NATURAL WATERS,
W69-04974 02K

CHEMICAL CHARACTERISTICS OF BULK PRECIPITATION IN THE MOJAVE DESERT REGION, CALIFORNIA,
W69-04982 02K

WINTER LOSS AND SPRING RECOVERY OF DISSOLVED SOLIDS IN TWO PRAIRIE-POTHOLE PONDS IN NORTH DAKOTA,
W69-04983 02J

HYDROGEOLOGIC SIGNIFICANCE OF CALCIUM-MAGNESIUM RATIOS IN GROUND WATER FROM CARBONATE ROCKS IN THE LANCASTER QUADRANGLE, SOUTHEASTERN PENNSYLVANIA,
W69-04985 02F

THE DIFFERENTIATION, ANALYSIS, AND PRESERVATION OF NITROGEN AND PHOSPHORUS FORMS IN NATURAL WATERS,
W69-05137 05A

WATER CIRCULATION
WIND-DRIVEN SUMMER CIRCULATION IN THE GREAT LAKES,
W69-04789 02H

ENVIRONMENTAL CHARACTERISTICS OF RARITAN BAY, A POLLUTED ESTUARY,
W69-05008 05C

WATER CONSERVATION
WASTE WATER CONSERVATION AND RENOVATION RESEARCH,
W69-04748 05D

THE GENERAL POLICY OF THE IRANIAN MINISTRY OF WATER AND POWER IN DEVELOPMENT OF WATER RESOURCES,
W69-04753 04A

INSHORE MARINE CONSERVATION,
W69-05044 02L

WATER COSTS
ANALYSIS OF THE COST OF WATER TRANSMISSION BY PIPELINE,
W69-04827 03A

WATER DEMAND
WATER RESOURCES ACTIVITIES IN THE UNITED STATES WATER SUPPLY AND DEMAND.
W69-05065 06D

TOWARD THE OPTIMIZATION OF INVESTMENT-PRICING DECISIONS A MODEL FOR URBAN WATER SUPPLY TREATMENT FACILITIES,
W69-05128 05F

AN ECONOMIC ANALYSIS OF WATER UTILIZATION IN PENNSYLVANIA,
W69-05154 06D

WATER INVESTMENT
THE IMPACTS OF WATER INVESTMENTS IN DEPRESSED AREAS,
W69-05120 06B

WATER LAW
FOURTH CLASS CITIES - GENERAL POWERS OF CITY CORPORATIONS.
W69-04906 06E

WATER LEVEL FLUCTUATIONS
INFLUENCE OF THE SOUTH SASKATCHEWAN RESERVOIR (CANADA) ON PIEZOMETRIC LEVELS IN UNDERLYING BEDROCK AQUIFERS,
W69-04774 02F

WATER LEVELS
PEOPLE V SYSTEM PROPERTIES (OWNERSHIP OF DAMSITE STATE'S POWER TO CONTROL LAKE LEVEL).
W69-04903 06E

WATER MANAGEMENT
THE INTERMOUNTAIN PRECIPITATION STORAGE GAGE,
W69-05111 07B

WATER RESEARCH,
W69-05115 06B

WATER MEASUREMENT
VELOCITY DISTRIBUTION AND ITS EFFECT ON THE ACCURACY OF THE GIBSON METHOD OF WATER MEASUREMENT,
W69-04744 08C

A HEATING SYSTEM FOR STREAM GAGING STATIONS,
W69-05110 07B

THE INTERMOUNTAIN PRECIPITATION STORAGE GAGE,
W69-05111 07B

WATER POLICY
POLICY PROBLEMS IN THE FIELD OF WATER RESOURCES,
W69-05119 06B

WATER POLLUTION
EFFECTS OF MULTIPLE USES OF WATERSHEDS ON WATER QUALITY,
W69-04702 05B

DETERMINATION, EVALUATION AND ABATEMENT OF COLOR IN TEXTILE PLANT EFFLUENTS,
W69-04756 05B

THE NEW POLLUTION,
W69-04828 05C

SOME NEIGHBORHOOD EFFECTS OF OIL-SHALE DEVELOPMENT,
W69-04854 06C

CAIRO PICKLE CO V MUGGRIDGE (BRINE DISPOSAL POLLUTION BY UPPER RIPARIAN OWNER).
W69-04857 06E

SOUTHLAND V AARON (RIPARIAN OWNER'S ACTION FOR DAMAGES FROM OIL WASTE POLLUTION OF STREAM).
W69-04884 06E

COMMONWEALTH EX REL SHUMAKER V NEW YORK AND PENNSYLVANIA CO, INC (JURISDICTION OF SANITARY WATER BOARD OVER STREAM POLLUTION).
W69-04887 06E

DIVELBISS V PHILLIPS PETROL CO (ACTION FOR DAMAGES TO DAIRY HERD BY STREAM POLLUTION).
W69-04902 06E

MONTGOMERY LIMESTONE CO V BEARDEN (ACTION TO ENJOIN POLLUTION OF A STREAM BY QUARRY OPERATION).
W69-04911 06E

SPARTAN DRILLING CO V BULL (INJUNCTION TO CURE SALT WATER POLLUTION AND INSECT BREEDING).
W69-04914 06E

W G DUNCAN COAL CO V JONES (PRESCRIPTIVE RIGHTS TO MINEWATER POLLUTION).
W69-04915 06E

POLLUTION OF LONDON'S RIVER,
W69-04993 05C

ON OYSTERS AND SULFITE WASTE LIQUOR,
W69-04997 05C

RIVER POLLUTION II, CAUSES AND EFFECTS,
W69-05012 02A

SCIENTIFIC PARAMETERS OF MARINE WASTE DISCHARGE,
W69-05018 05A

ORGANIC POLLUTION OF NEW YORK HARBOR APPLICATION,
W69-05026 05B

ECOLOGICAL EFFECTS OF SEWAGE POLLUTION IN BISCAYNE BAY, FLORIDA SEDIMENTS AND THE DISTRIBUTION OF BENTHIC AND FOULING MACRO-ORGANISMS,
W69-05030 05C

THE CALCULATION OF POLLUTION OF THE THAMES ESTUARY AS A THEORY OF QUANTIZED MIXING,
W69-05041 05B

ESTUARINE WATER QUALITY MANAGEMENT AND FORECASTING,
W69-05059 05B

THE OCCURRENCE, EFFECTS, AND FATE OF OIL POLLUTING THE SEA,
W69-05070 05C

F A BARTLETT TREE EXPERT CO V STAMPER (DAMAGES FROM LOGS A BRUSH ON RIVER BANK).
W69-05169 06E

FAIRES V DUPREE (WATER POLLUTION FROM ANIMAL WASTES).
W69-05182 05B

SOUTHLAND CO V MCDONALD (POLLUTION OF WATERCOURSE BY ESCAP CRUDE OIL).
W69-05186 05B

ROUGHTON V THIELE KAOLIN CO (CHEMICAL POLLUTION BY UPPER RIPARIAN OWNER).
W69-05190 05B

PHILLIPS PETROLEUM CO V HARDEE (LIABILITY FOR DAMAGE BY POLLUTION).
W69-05199 05G

WATER POLLUTION CONTROL
BENEFIT-COST ANALYSIS AND WATER POLLUTION CONTROL,
W69-04998 05G

BOAT AND MARINA WASTES,
W69-05009 05G

WATER QUALITY IN THE POTOMAC ESTUARY,
W69-05027 05G

SHORELINE RECREATION RESOURCES OF THE UNITED STATES.
W69-05054 02L

WATER POLLUTION EFFECTS
NITROGEN AND PHOSPHORUS IN WATER AN ANNOTATED BIBLIOGRAPH OF THEIR BIOLOGICAL EFFECTS.
W69-04805 05C

THE BIOLOGY OF POLLUTED WATERS,
W69-05004 05C

DISCHARGE OF WASTES INTO THE SEA IN EUROPEAN COASTAL AREAS,
W69-05015 05E

PROCEEDINGS OF THE FIRST INTERNATIONAL CONFERENCE ON WASTE DISPOSAL IN THE MARINE ENVIRONMENT,
W69-05038 05E

SOME EFFECTS OF SEWER EFFLUENT ON MARINE LIFE,
W69-05069 05C

THE OCCURRENCE, EFFECTS, AND FATE OF OIL POLLUTING THE SEA,
W69-05070 05C

WATER POLLUTION SOURCES
UNUSUAL PHOSPHORUS SOURCE FOR PLANKTON ALGAE,
W69-04800 05B

WATER POLLUTION BY OUTBOARD MOTORS,
W69-04936 02H

THE OCCURRENCE, EFFECTS, AND FATE OF OIL POLLUTING THE SEA,
W69-05070 05C

WATER POTENTIAL
EXPERIENCE WITH THREE VAPOUR METHODS FOR MEASURING WATER POTENTIAL IN PLANTS,
W69-05085 02I

MEASUREMENT OF THE WATER POTENTIAL OF INTACT PLANT TISSUES III. THE WATER POTENTIALS OF GERMINATING PEAS (PISUM SATIV L.),
W69-05095 02I

WATER PROPERTIES
TRACE INORGANICS IN WATER,
W69-04962 02K

WATER QUALITY
EFFECTS OF MULTIPLE USES OF WATERSHEDS ON WATER QUALITY,
W69-04702 05B

HEMICAL CHARACTERISTICS OF BULK PRECIPITATION IN THE MOJAVE
FSERT REGION, CALIFORNIA,
69-04992 02K

ATER QUALITY CRITERIA, 2ND EDITION,
69-05028 05G

HE CALCULATION OF POLLUTION OF THE THAMES ESTUARY AS A
HEORY OF QUANTIZED MIXING,
69-05041 05B

INAL REPORT ON BALITMORE HARBOR STUDY,
69-05056 05F

ATHEMATICAL MODEL FOR DISSOLVED OXYGEN,
69-05058 05B

HE WATER CRISIS,
69-05113 06B

LANNING A WATER QUALITY MANAGEMENT SYSTEM THE CASE OF THE
OTOMAC ESTUARY,
69-05116 06B

ER QUALITY CONTROL
OAT AND MARINA WASTES,
69-05009 05G

OCIO-ECONOMIC ASPECTS OF WATER QUALITY MANAGEMENT,
69-05013 05G

STUARINE WATER QUALITY MANAGEMENT AND FORECASTING,
69-05059 05B

ER RATES
ECONOMIC ANALYSIS OF WATER UTILIZATION IN PENNSYLVANIA,
69-05154 06D

ER REALLOCATION
ATER RESEARCH,
69-05115 06B

ER REQUIREMENTS
OME NEIGHBORHOOD EFFECTS OF OIL-SHALE DEVELOPMENT,
69-04854 06C

ATER REQUIREMENTS OF ELECTRIC UTILITY STEAM-ELECTRIC-
ENERATING PLANTS IN 1959.
69-05063 08C

ONSUMPTIVE USE COMPUTATIONS FROM EVAPORATION PAN DATA,
69-05092 02D

ER RESOURCE DEVELOPMENT
EGIONAL WATER RESOURCE DEVELOPMENT IN THE FEDERAL SYSTEM,
69-04815 06B

ER RESOURCES
STUDY OF WATER RESOURCES IN THE CANBERRA AREA AND THE
EANBEYAN RIVER WATERSHED (GOOGONG DAM CATCHMENT),
69-04757 02E

ATER RESOURCES APPRAISAL OF THOUSAND SPRINGS VALLEY, ELKO
OUNTY, NEVADA,
69-04791 02E

HE DEVELOPMENT OF NEW WATER RESOURCES IN THE ECONOMICS OF A
OTAL WATER SYSTEM,
69-04813 06B

OLICY PROBLEMS IN THE FIELD OF WATER RESOURCES,
69-05119 06B

ER RESOURCES ACT OF 1964
ATER RESEARCH,
69-05115 06B

ER RESOURCES COUNCIL
HE NATIONAL WATER RESOURCE ASSESSMENT AND REGIONAL
RAMEWORK PLANS,
69-05125 06B

ER RESOURCES DEVELOPMENT
HE SOLINA HYDRO PROJECT,
69-04738 08A

CONOMIC AND SOCIAL ASPECTS OF PLANNING OF WATER RESOURCES
DEVELOPING COUNTRIES.
69-04741 06B

HE GENERAL POLICY OF THE IRANIAN MINISTRY OF WATER AND
WER IN DEVELOPMENT OF WATER RESOURCES,
69-04753 04A

IPROVEMENT OF WATER RESOURCES UTILIZATION FOR PUBLIC WATER
PPLY IN TAIWAN,
69-04760 06B

TER POWER LINKS RIPARIANS - AUSTRIA CONTRIBUTES TO
TERNATIONAL COOPERATION,
69-04777 06E

W THRUSTS IN GROUND WATER,
69-04793 02F

ROUND WATER PERSPECTIVES AND PROSPECTS,
69-04794 02F

ASIC DATA FOR WATER PROGRAMMES SOCIAL AND ECONOMIC
HARACTERISTICS FOR WATER PROGRAMMES.
69-04832 06B

A METHOD OF DETERMINING THE AVAILABLE SURFACE WATER
RESOURCES,
W69-04950 02E

PLANNED UTILIZATION OF WATER RESOURCES,
W69-04952 02E

SEQUENCE AND TIMING IN RIVER BASIN DEVELOPMENT,
W69-05016 06B

EMERGING NATIONAL POLICIES GOVERNING OUTDOOR RECREATION IN
FEDERAL WATER DEVELOPMENT PROJECTS,
W69-05033 06B

POLICIES, STANDARDS, AND PROCEDURES IN THE FORMULATION,
EVALUATION, AND REVIEW OF PLANS FOR USE AND DEVELOPMENT OF
WATER AND RELATED LAND RESOURCES.
W69-05039 06B

THE WATER CRISIS,
W69-05113 06B

AN EFFICIENT PROGRAM OF WATER RESOURCE DEVELOPMENT IN A
FRAMEWORK OF GROWTH AND TRADE,
W69-05127 06B

WATER RESOURCES PLANNING ACT
THE NATIONAL WATER RESOURCE ASSESSMENT AND REGIONAL
FRAMEWORK PLANS,
W69-05125 06B

WATER RETENTION
WATER HOLDING CAPACITY OF PONDEROSA PINE FOREST FLOOR
LAYERS,
W69-04751 03B

WATER REUSE
WASTE WATER CONSERVATION AND RENOVATION RESEARCH,
W69-04748 05D

A COMPARISON OF THE INACTIVATION OF ESCHERICHIA COLI AND
POLIOVIRUS IN POLLUTED AND UNPOLLUTED WATERS BY
CHLORINATION,
W69-04778 05D

WATER RIGHTS
REGIONAL WATER RESOURCE DEVELOPMENT IN THE FEDERAL SYSTEM,
W69-04815 06B

WATER TRANSFER PROBLEMS LAW,
W69-05117 06B

WATER SHORTAGE
THE WATER CRISIS,
W69-05113 06B

WATER SOURCES
WATER SUPPLY SCHEME OF GREATER TEHRAN CITY,
W69-04761 06D

PROSPECTS OF DESALINATION FOR SOLVING WATER PROBLEMS ON THE
MAKRAN COAST,
W69-04776 03A

DESALINIZATION AND FUTURE WATER SUPPLY IN THE UNITED STATES,
W69-04988 03A

WATER STRUCTURE
TRACE INORGANICS IN WATER,
W69-04962 02K

THE STRUCTURE OF WATER AND WATER-SOLUTE INTERACTIONS,
W69-04965 02K

WATER SUPPLY
IMPROVEMENT OF WATER RESOURCES UTILIZATION FOR PUBLIC WATER
SUPPLY IN TAIWAN,
W69-04760 06B

WATER AND ECONOMIC DEVELOPMENT.
W69-04825 06B

BASIC DATA FOR WATER PROGRAMMES SOCIAL AND ECONOMIC
CHARACTERISTICS FOR WATER PROGRAMMES.
W69-04832 06B

ECONOMICS AND FINANCE OF WATER PROGRAMMES ECONOMIC
ANALYSIS, FINANCIAL ANALYSIS, FINANCING.
W69-04833 06D

FINANCING WATER PROJECTS IN LATIN AMERICA,
W69-04836 06B

DESALINIZATION AND FUTURE WATER SUPPLY IN THE UNITED STATES,
W69-04988 03A

WATER RESOURCES ACTIVITIES IN THE UNITED STATES WATER
SUPPLY AND DEMAND.
W69-05065 06D

THE POLITICS OF WATER IN ARIZONA,
W69-05112 06E

TOWARD THE OPTIMIZATION OF INVESTMENT-PRICING DECISIONS A
MODEL FOR URBAN WATER SUPPLY TREATMENT FACILITIES,
W69-05129 05F

W69-05130 05F

BROWARD COUNTY V HURWIT (MUNICIPAL WATER AND SEWER

FACILITIES).
W69-05162 06E

GAGNON V CARRIER (ABANDONMENT OF EASEMENT FOR WATER SUPPLY).
W69-05165 06E

WATER SYSTEMS FINANCING
WATER SYSTEMS FINANCING--FOUR BASIC APPROACHES,
W69-04824 06C

WATER TEMPERATURE
PREDICTION OF TEMPERATURE IN RIVERS AND RESERVOIRS,
W69-05042 05B

FORECASTING HEAT LOSS IN PONDS AND STREAMS,
W69-05062 05B

'ANOMALOUS' THERMAL CONDITIONS IN A HYPERSALINE INLAND POND,
W69-05078 02H

WATER TRANSFER
ANALYSIS OF THE COST OF WATER TRANSMISSION BY PIPELINE,
W69-04827 03A

WATER TRANSFER PROBLEMS LAW,
W69-05117 06B

WATER TRANSMISSION
ANALYSIS OF THE COST OF WATER TRANSMISSION BY PIPELINE,
W69-04827 03A

WATER TRANSMISSION COSTS
ANALYSIS OF THE COST OF WATER TRANSMISSION BY PIPELINE,
W69-04827 03A

WATER TREATMENT
WATER FOR FLUORIDES,
W69-04769 05F

WATER USERS
AN ECONOMIC ANALYSIS OF WATER UTILIZATION IN PENNSYLVANIA,
W69-05154 06D

WATER UTILIZATION
A NEW METHOD OF MAPPING THE WATER RESOURCES,
W69-04934 02E

HYDROLOGIC BASES OF WATER RESOURCES UTILIZATION OF LAKES,
W69-04957 02H

ESTIMATED USE OF WATER IN THE UNITED STATES, 1960,
W69-05019 06B

POLICIES, STANDARDS, AND PROCEDURES IN THE FORMULATION, EVALUATION, AND REVIEW OF PLANS FOR USE AND DEVELOPMENT OF WATER AND RELATED LAND RESOURCES.
W69-05039 06B

WATER USE IN MANUFACTURING, 1963 CENSUS OF MANUFACTURES.
W69-05066 06D

WATER VALUES
AN ECONOMIC ANALYSIS OF WATER UTILIZATION IN PENNSYLVANIA,
W69-05154 06D

WATER WELLS
OPERATION OF A RECHARGE BOREHOLE,
W69-04723 04B

UNITED FUEL GAS CO V SAWYERS (WELL POLLUTION THROUGH PERCOLATING WATERS).
W69-05187 05B

WATER WORKS
VILLAGES - WATER WORKS.
W69-05188 06E

WATER YIELD IMPROVEMENT
EVAPOTRANSPIRATION AND SOIL-MOISTURE DEPLETION,
W69-05102 02G

WATERCOURSES(LEGAL)
GOTT V FRANKLIN (BARRICADE TO NATURAL SURFACE WATER FLOW).
W69-04892 06E

WATERSHED DEVELOPMENT
PREDICTION OF WATERSHED DEVELOPMENT SUCCESS OF LOCAL COMMUNITIES,
W69-04822 04D

WATERSHED MANAGEMENT
EFFECTS OF MULTIPLE USES OF WATERSHEDS ON WATER QUALITY,
W69-04702 05B

THE INTERMOUNTAIN PRECIPITATION STORAGE GAGE,
W69-05111 07B

WATERSHEDS(BASINS)
EFFECTS OF MULTIPLE USES OF WATERSHEDS ON WATER QUALITY,
W69-04702 05B

AN HOURLY WATER BALANCE MODEL AS A BASIS FOR CONTINUOUS WATER RESOURCES ASSESSMENT ON A WATERSHED,
W69-04954 02A

WATERWORKS
WATERWORKS.
W69-05196 06E

WATER-SUPPLY COMPANIES
MANPOWER PROBLEMS IN WATER SUPPLY ORGANIZATION,
W69-04779 06E

WAVES(WATER)
WAVE INTERACTION AND LANGMUIR CIRCULATIONS,
W69-04930 02H

WEATHER
WEATHER MODIFICATION, PRESENT AND FUTURE,
W69-04717 03B

WEATHER DATA
PREDICTION OF TEMPERATURE IN RIVERS AND RESERVOIRS,
W69-05042 05B

SNOW LOADS ON ROOFS IN AREAS OF HEAVY SNOWFALL,
W69-05109 02C

WEATHER MODIFICATION
WEATHER MODIFICATION, PRESENT AND FUTURE,
W69-04717 03B

WEATHER PATTERNS
PROBABLE MAXIMUM PRECIPITATION OVER SOUTH PLATTE RIVER, COLORADO AND MINNESOTA RIVER, MINNESOTA,
W69-05158 04A

WEATHERING
TILLAGE INFLUENCES WATER INTAKE,
W69-05089 02G

WEIGHTED LINEAR LEAST-SQUARES METHOD
LINEAR--A COMPUTER PROGRAM TO FIT DATA EASILY TO MANY MODELS BY THE WEIGHTED LINEAR LEAST-SQUARES METHOD,
W69-04797 07C

WELFARE
THE PROBLEM OF SOCIAL COST,
W69-04850 06C

POSITIVE ECONOMICS, WELFARE ECONOMICS, AND POLITICAL ECONOMY,
W69-04852 06B

THE ANATOMY OF MARKET FAILURE,
W69-04855 06C

WELLS
KOCH V WICK (PRIVATE OWNER MAY ENJOIN COUNTY'S ATTEMPT TO USE GROUNDWATER ON OTHER THAN OVERLYING LAND).
W69-04870 06E

WEST VIRGINIA
RIDDLE V BALTIMORE AND OHIO (FLOOD DAMAGE CAUSED BY INADEQUATE CULVERT).
W69-05191 04A

WHARFBOATS
FOURTH CLASS CITIES - GENERAL POWERS OF CITY CORPORATIONS.
W69-04906 06E

WILDLIFE CONSERVATION
FIRST WORLD CONFERENCE ON NATIONAL PARKS.
W69-04990 06G

WINTER-KENNEDY METHOD
INDEX METHOD FOR PUMPING OPERATION OF REVERSIBLE PUMP-TURBINE,
W69-04743 08C

WISCONSIN
STATE V PUBLIC SERVICE COMM'N (RECREATION FACILITIES).
W69-04867 06B

CURRENT TRENDS IN WISCONSIN'S WATER LAW,
W69-05161 06E

WATTERS V NATIONAL DRIVE-IN (SURFACE WATER DRAINAGE DAMAGE).
W69-05178 06E

WORLD BANK
WATER AND ECONOMIC DEVELOPMENT.
W69-04825 06B

AUTHOR INDEX

BBOTT, WALTER
UNUSUAL PHOSPHORUS SOURCE FOR PLANKTON ALGAE,
W69-04800 05B

DAMS, WILLIAM M.
AN OPTIMIZATION CRITERION FOR MULTI-SPECTRAL PHOTOGRAPHY,
W69-05144 07C

GEOPHYSICAL STUDIES FOR VOLCANOLOGICAL GEOHYDROLOGY,
W69-05145 07B

GIE DE SELSATEN, JOSEPH
SURFACE AND SUBTERRANEAN HYDROLOGY IN ITS APPLICATION TO THE STUDY OF THE MODAVE KARSTIC AQUIFER IN BELGIUM (FRENCH),
W69-04762 02E

LLEN, PAUL B.
ELECTRONIC DATA PROCESSING SYSTEM FOR STREAMFLOW,
W69-04759 07C

NCAJAS, ROSABEL R.
THE FATE OF NITRATE NITROGEN IN SOME TROPICAL SOILS FOLLOWING SUBMERGENCE,
W69-05138 02K

NDERSON, ALVIN G.
TENTATIVE DESIGN PROCEDURES FOR RIPRAP-LINED CHANNELS,
W69-04727 08B

NDERSON, DAVID V.
THEORETICAL FRAMEWORK FOR ASCERTAINING PORE WATER PRESSURE IN CONFINING LAYERS IN THE VICINITY OF A PUMPING WELL,
W69-04767 02F

NTROPOV, V. I.
ELECTRIC-ARC EQUIPMENT FOR BURNING OPENINGS INTO BRICK AND REINFORCED CONTRETE STRUCTURES,
W69-04718 08A

RNBRUSTER, T. F.
SEMI-SYNCHRONOUS STARTING,
W69-04722 08C

SANO, NOBUYUKI
POLYAMIDE-IMIDE INSULATION VARNISH,
W69-04719 08G

SHCROFT, G. L.
INFLUENCE OF SOIL TEMPERATURE ON TRANSPIRATION UNDER VARIOUS ENVIRONMENTAL CONDITIONS,
W69-05099 02D

SH, J. E.
THE EFFECT OF MIX PROPORTIONS AND AGGREGATE DUST UPON THE COMPRESSIVE STRENGTH OF CONCRETE,
W69-04715 08F

TERS, H. D.
AN HOURLY WATER BALANCE MODEL AS A BASIS FOR CONTINUOUS WATER RESOURCES ASSESSMENT ON A WATERSHED,
W69-04954 02A

CKSTROM, T. E.
A STUDY OF DEPASSIVATION OF STEEL IN CONCRETE,
W69-04725 08F

KER, ROBERT A.
TRACE INORGANICS IN WATER,
W69-04962 02K

LEK, J.
AN HOURLY WATER BALANCE MODEL AS A BASIS FOR CONTINUOUS WATER RESOURCES ASSESSMENT ON A WATERSHED,
W69-04954 02A

LLIGAND, P.
HIGH-CAPACITY DUAL-PURPOSE PLANT FOR GENERATING ELECTRICITY AND PRODUCING FRESH WATER FROM SEA WATER,
W69-04754 03A

RRS, H. D.
EXPERIENCE WITH THREE VAPOUR METHODS FOR MEASURING WATER POTENTIAL IN PLANTS,
W69-05085 02I

RTLEY, THOMAS R.
CONTROL OF SUBMERSED AQUATIC WEEDS IN IRRIGATION CANALS BY DAILY APPLICATIONS OF LOW CONCENTRATIONS OF COPPER SULFATE,
W69-04729 04A

SSETT, LOWELL
QUALITATIVE ECONOMICS AND THE SCOPE OF THE CORRESPONDENCE PRINCIPLE,
W69-04806 06B

TOR, FRANCIS M.
THE ANATOMY OF MARKET FAILURE,
W69-04855 06C

YANI, A. G.
THE GENERAL POLICY OF THE IRANIAN MINISTRY OF WATER AND POWER IN DEVELOPMENT OF WATER RESOURCES,
W69-04753 04A

ALS, EDWARD W.
SPATIAL PATTERN OF SHRUBS ON A DESERT PLAIN IN ETHIOPIA,
W69-05077 02I

BEARD, LEO R.
STREAMFLOW SYNTHESIS FOR UNGAGED RIVERS,
W69-04932 02E

BECHER, ALBERT E.
HYDROGEOLOGIC SIGNIFICANCE OF CALCIUM-MAGNESIUM RATIOS IN GROUND WATER FROM CARBONATE ROCKS IN THE LANCASTER QUADRANGLE, SOUTHEASTERN PENNSYLVANIA,
W69-04985 02F

BECK, EARL J.
THE MOSSYROCK DEVELOPMENT,
W69-04737 08A

BENSON, MANUAL A.
NOTE ON THE STANDARD ERROR OF THE COEFFICIENT OF SKEWNESS,
W69-04807 06A

BETHLAHMY, NEDAVIA
EFFECT OF EXPOSURE AND LOGGING ON RUNOFF AND EROSION,
W69-05104 04D

CONTROLLING SOIL MOVEMENT FROM STEEP ROAD FILLS,
W69-05105 04A

BEUSCHER, J. H.
CURRENT TRENDS IN WISCONSIN'S WATER LAW,
W69-05161 06E

BHANDARI, R. C.
THERMAL CONDUCTIVITY OF TWO-PHASE POROUS MATERIALS DRY SOILS,
W69-04949 07B

BOJANOWICZ, MARIA
WATER BALANCE OF LAKE AFFECTED BY SEA (FRENCH),
W69-04960 02H

BORISOV, P. M.
CAN WE CONTROL THE ARCTIC CLIMATE,
W69-04790 04A

BOSTROM, K.
SOME PH-CONTROLLING REDOX REACTIONS IN NATURAL WATERS,
W69-04973 02K

BRIGGS, LOUIS L., JR.
GEOLOGY OF SUBSURFACE WASTE DISPOSAL IN MICHIGAN BASIN,
W69-04945 05E

BROOKS, DAVID B.
DEEP SEA MANGANESE NODULES FROM SCIENTIFIC PHENOMENON TO WORLD RESOURCE,
W69-04810 06B

BROOKS, THOMAS W.
SYNTHESIS AND EVALUATION OF NEW MEMBRANE CANDIDATES FOR APPLICATION IN REVERSE OSMOSIS,
W69-05157 03A

BROWNING, V. DOUGLAS
DEVELOPING AN IRRIGATION WATER SUPPLY IN THE COASTAL PLAIN,
W69-04749 02F

BROWN, KIRK W.
EVAPOTRANSPIRATION-REVIEW OF RESEARCH,
W69-04764 02D

BROWN, NORMAN L.
DEMAND FOR WATER RECREATION,
W69-05121 06D

BUCHANAN, JAMES M.
POSITIVE ECONOMICS, WELFARE ECONOMICS, AND POLITICAL ECONOMY,
W69-04852 06B

BURAS, N.
THE CONJUNCTIVE USE OF SURFACE AND GROUND WATERS,
W69-05135 06A

BURROUGHS, EDWARD R., JR.
EVAPOTRANSPIRATION AND SOIL-MOISTURE DEPLETION,
W69-05102 02G

BURTON, KENNETH T.
FATIGUE TESTS OF REINFORCING BARS--EFFECT OF DEFORMATION PATTERN,
W69-04706 08F

BURWELL, C. C.
ANALYSIS OF THE COST OF WATER TRANSMISSION BY PIPELINE,
W69-04827 03A

BURWELL, R. E.
TILLAGE INFLUENCES WATER INTAKE,
W69-05089 02G

BUSBY, M. W.
TWO METHODS OF ESTIMATING BASE FLOW AT UNGAGED STREAM SITES IN KANSAS AND ADJACENT STATES,
W69-04978 02E

BUTCHER, WILLIAM S.
THE BENEFIT-COST RATIO CONCEPTIONS AND MISCONCEPTIONS,
W69-04812 06B

BUTCHER, W. S.
OPTIMUM OPERATIONS FOR PLANNING OF A COMPLEX WATER RESOURCES SYSTEM,
W69-05123 06A

BYCHENKOV, IU D.
STRENGTH OF JOINTS AND JOINT ASSEMBLIES OF REINFORCED CONCRETE MULTISTORY FRAMES UNDER LOADS OF THE SEISMIC TYPE,
W69-04735 08F

BYKOV, V. D.
SEASONAL DISTRIBUTION AND REGULATION FOR FLOW RIVERS OF MOUNTAIN COUNTRIES,
W69-04935 02E

CAIOZZI, MARIO
EFFECT OF SEAWEED ON THE LEVELS OF AVAILABLE PHOSPHORUS AND NITROGEN IN A CALCAREOUS SOIL,
W69-05136 02K

CALDWELL, LOREN T.
A STUDY OF WATER RESOURCES IN THE CANBERRA AREA AND THE QUEANBEYAN RIVER WATERSHED (GOOGONG DAM CATCHMENT),
W69-04757 02E

CAMPBELL, C. J.
PERPETUAL SUCCESSION OF STREAM-CHANNEL VEGETATION IN A SEMIARID REGION,
W69-05080 02D

CAREY, KEVIN L.
ANALYTICAL APPROACHES TO COMPUTATION OF DISCHARGE OF AN ICE-COVERED STREAM,
W69-04975 02E

THE UNDERSIDE OF RIVER ICE, ST. CROIX RIVER, WISCONSIN,
W69-04976 02C

CARPENTER, J. H.
FINAL REPORT ON BALITMORE HARBOR STUDY,
W69-05056 05F

CARTER, W. A.
FINANCING WATER PROJECTS IN LATIN AMERICA,
W69-04836 06B

CASTLE, EMERY N.
ECONOMICS IN REGIONAL WATER RESEARCH AND POLICY,
W69-05124 06B

CHANGNON, STANLEY A., JR.
A CLIMATOLOGICAL-TECHNOLOGICAL METHOD FOR ESTIMATING IRRIGATION WATER REQUIREMENTS FOR MAXIMUM CROP YIELDS,
W69-04750 03F

CLIMATOLOGY OF SEVERE WINTER STORMS IN ILLINOIS,
W69-05159 02B

CHANG, TSU-SAN
IMPROVEMENT OF WATER RESOURCES UTILIZATION FOR PUBLIC WATER SUPPLY IN TAIWAN,
W69-04760 06B

CHAUDHARY, D. R.
THERMAL CONDUCTIVITY OF TWO-PHASE POROUS MATERIALS DRY SOILS,
W69-04949 07B

CHETTY, V. K.
BAYESIAN ANALYSIS OF HAAVELMO'S MODELS,
W69-04842 06A

CHOPRA, ANIL K.
EARTHQUAKE BEHAVIOR OF RESERVOIR-DAM SYSTEMS,
W69-04726 08A

CHRISTY, FRANCIS T., JR.
MARINE RESOURCES AND THE FREEDOM OF THE SEAS,
W69-04808 06E

CLARY, WARREN P.
WATER HOLDING CAPACITY OF PONDEROSA PINE FOREST FLOOR LAYERS,
W69-04751 03B

COASE, R. H.
THE PROBLEM OF SOCIAL COST,
W69-04850 06C

COLAS, R.
DOCUMENTATION INFORMATION AND INSTRUCTION CONCERNING THE PROBLEMS OF WATER,
W69-04940 10

COLE, GERALD A.
'ANOMALOUS' THERMAL CONDITIONS IN A HYPERSALINE INLAND POND,
W69-05078 02H

COLP, ROBERT
FLUID DYNAMICS,
W69-04701 08B

COOK, N. G. W.
AN ENERGY CRITERION FOR THE STRENGTH OF ROCK IN POLYAXIAL COMPRESSION,
W69-04711 08E

CORTES, CARLOS GUZMAN
DETERMINATION OF THE REGIONAL COEFFICIENT 'K' FOR COMPUTING THE CONSUMPTIVE USE OF NATIVE BLACK KIDNEY BEAN IN THE IRRIGATION DISTRICTS OF VERACRUZ STATE,
W69-05086 02I

COX, P. THOMAS
PREDICTION OF WATERSHED DEVELOPMENT SUCCESS OF LOCAL COMMUNITIES,
W69-04822 04D

CRUTCHFIELD, JAMES A.
AN ECONOMIC EVALUATION OF ALTERNATIVE METHODS OF FISHERY REGULATION,
W69-04849 06B

CSANADY, G. T.
WIND-DRIVEN SUMMER CIRCULATION IN THE GREAT LAKES,
W69-04789 02H

DAFFIN, CARL L.
SYNTHESIS AND EVALUATION OF NEW MEMBRANE CANDIDATES FOR APPLICATION IN REVERSE OSMOSIS,
W69-05157 03A

DARNTON, DONALD C.
DEMAND FOR WATER RECREATION,
W69-05121 06D

DAVENPORT, D. C.
EFFECTS OF PHENYLMERCURIC ACETATE ON TRANSPIRATION AND GROWTH OF SMALL PLOTS OF GRASS,
W69-05071 02D

DAVENPORT, JOHN T.
TENTATIVE DESIGN PROCEDURES FOR RIPRAP-LINED CHANNELS,
W69-04727 08B

DAVIS, ROBERT K.
PLANNING A WATER QUALITY MANAGEMENT SYSTEM THE CASE OF THE POTOMAC ESTUARY,
W69-05116 06B

DE LAGUNA, WALLACE
IMPORTANCE OF DEEP PERMEABLE DISPOSAL FORMATIONS IN LOCATION OF A LARGE NUCLEAR-FUEL REPROCESSING PLANT,
W69-04942 05E

DE LAPP, D. F.
COST REDUCTION IN DESALTING SEA WATER,
W69-04826 03A

DE SALVO, JOSEPH S.
CONGESTION, TOLLS, AND THE ECONOMIC CAPACITY OF A WATERWAY,
W69-04838 06C

DEARLOVE, R. E.
INTRODUCTION TO 'THE CONJUNCTIVE USE OF SURFACE AND GROUNDWATERS',
W69-05134 06A

DEBYLE, NORBERT V.
THE INTERMOUNTAIN PRECIPITATION STORAGE GAGE,
W69-05111 07B

DEITSCHMAN, GLENN H.
SNOW LOADS ON ROOFS IN AREAS OF HEAVY SNOWFALL,
W69-05109 02C

DELUCIA, RUSSELL J.
OPERATING POLICIES FOR IRRIGATION SYSTEMS UNDER STOCHASTIC REGIMES,
W69-05131 06A

OPERATING POLICIES FOR IRRIGATION SYSTEMS UNDER STOCHASTIC REGIMES DYNAMIC PROGRAMMING MODEL,
W69-05132 06A

OPERATING POLICIES FOR IRRIGATION SYSTEMS UNDER STOCHASTIC REGIMES SEQUENTIAL LINEAR PROGRAMMING MODEL,
W69-05133 06A

DILMAGHANI, A.
WATER SUPPLY SCHEME OF GREATER TEHRAN CITY,
W69-04761 06D

DOTY, ROBERT D.
SNOW LOADS ON ROOFS IN AREAS OF HEAVY SNOWFALL,
W69-05109 02C

A HEATING SYSTEM FOR STREAM GAGING STATIONS,
W69-05110 07B

DOUGAL, MERWIN D.
ECONOMICS OF WATER QUALITY MANAGEMENT,
W69-04823 05G

DRNOVSEK, J.
STATIC AND KINEMATIC CONDITIONS OF THE STABILITY OF JOINTED AND FISSURED ROCKY FOUNDATIONS OF ARCH DAMS,
W69-04713 08E

DROST-HANSEN, W.
THE STRUCTURE OF WATER AND WATER-SOLUTE INTERACTIONS,
W69-04965 02K

D'ORIVAL, M.
HIGH-CAPACITY DUAL-PURPOSE PLANT FOR GENERATING ELECTRICITY AND PRODUCING FRESH WATER FROM SEA WATER,
W69-04754 03A

EBEL, R. A.
COST PROJECTIONS FOR LARGE DESALTING SYSTEMS WITH VARIOUS TYPES OF COUPLING,

W69-04814 03A

DENS, CARLTON D.
ELECTRONIC DATA PROCESSING SYSTEM FOR STREAMFLOW,
W69-04759 07C

DMUND, R. W.
SUBSURFACE WASTE-DISPOSAL POTENTIAL IN SALINA BASIN OF KANSAS,
W69-04946 05E

ICHHORN, WOLFGANG
HOMOGENEOUS, ESPECIALLY LINEAR HOMOGENEOUS, PRODUCTION FUNCTIONS AND THE LAW OF YIELD (GERMAN),
W69-04846 06B

LLIS, WILLIS H.
WATER TRANSFER PROBLEMS LAW,
W69-05117 06B

L-RAMBLY, NABIL
THE DEVELOPMENT OF NEW WATER RESOURCES IN THE ECONOMICS OF A TOTAL WATER SYSTEM,
W69-04813 06B

L-SHAL, MOHAMED I.
CONSUMPTIVE USE OF WATER FOR SOME MAJOR CROPS IN U.A.R. (EGYPT),
W69-05087 02I

NGLISH, J. M.
THE DEVELOPMENT OF NEW WATER RESOURCES IN THE ECONOMICS OF A TOTAL WATER SYSTEM,
W69-04813 06B

SOGBUE, A. M.
OPTIMUM OPERATIONS FOR PLANNING OF A COMPLEX WATER RESOURCES SYSTEM,
W69-05123 06A

STEIN, JOSEPH
FLUID DYNAMICS,
W69-04701 08B

VANS, JAMES D.
IMPROVED EVALUATION PROCEDURES IN APPALACHIAN WATER RESOURCE PLANNING,
W69-04817 06B

ANNING, C. D.
PROPERTIES OF SALINE RANGE SOILS OF THE RIO GRANDE PLAIN,
W69-05084 02G

AUST, R. J.
DESALINIZATION AND FUTURE WATER SUPPLY IN THE UNITED STATES,
W69-04988 03A

ELINE, M.
MANPOWER PROBLEMS IN WATER SUPPLY ORGANIZATION,
W69-04779 06E

ENLON, MARK W.
THERMAL DISCHARGE BIBLIOGRAPHY,
W69-04937 05B

ETH, J. H.
CHEMICAL CHARACTERISTICS OF BULK PRECIPITATION IN THE MOJAVE DESERT REGION, CALIFORNIA,
W69-04982 02K

FOLLIOTT, PETER F.
WATER HOLDING CAPACITY OF PONDEROSA PINE FOREST FLOOR LAYERS,
W69-04751 03B

ICKEN, JAMES H.
WINTER LOSS AND SPRING RECOVERY OF DISSOLVED SOLIDS IN TWO PRAIRIE-POTHOLE PONDS IN NORTH DAKOTA,
W69-04983 02J

ITZGIBBON, DONALD S.
REPORT ON THE 1961 TRANSPORTATION RESEARCH AND SERVICE ACTIVITIES OF THE BUREAU OF COMMERCIAL FISHERIES,
W69-05001 03E

ITZPATRICK, W. A.
MASSACHUSETTS MARINE SPORT FISHERIES INVENTORY,
W69-04991 06B

LEGE, R. K.
DETERMINATION, EVALUATION AND ABATEMENT OF COLOR IN TEXTILE PLANT EFFLUENTS,
W69-04756 05B

LOCKER, W. J.
CAPILLARY CONDUCTIVITY AND SOIL WATER DIFFUSIVITY VALUES FROM VERTICAL COLUMNS,
W69-05093 02G

OK, YU-SI
HYDRAULIC GEOMETRY OF ILLINOIS STREAMS,
W69-05153 08B

OLGUERA, HUGO C.
LOCALIZED SCOUR IN ERODIBLE-BED CHANNELS,
W69-04788 02J

OUSS, JAMES L.
ENTRY VELOCITY CONTROL LIMITS DRAIN SEDIMENTATION,
W69-04720 08B

FOX, IRVING K.
POLICY PROBLEMS IN THE FIELD OF WATER RESOURCES,
W69-05119 06B

FRANKEL, M. L.
PLANNED UTILIZATION OF WATER RESOURCES,
W69-04952 02E

FRANKLIN, P. E.
THE ROLE OF U S TRANSPORTATION POLICY IN THE DEVELOPMENT OF INLAND WATERWAY NAVIGATION,
W69-04862 06E

FRISBIE, CHARLES M.
SPORT FISHING SURVEY OF THE LOWER POTOMAC ESTUARY,
W69-04992 02L

FURNESS, L. W.
TWO METHODS OF ESTIMATING BASE FLOW AT UNGAGED STREAM SITES IN KANSAS AND ADJACENT STATES,
W69-04978 02E

GAMESON, A. L. H.
POLLUTION OF LONDON'S RIVER,
W69-04993 05C

EFFECTS OF HEATED DISCHARGES IN THE TEMPERATURE OF THE THAMES ESTUARY II,
W69-04994 05C

GANNON, J. J.
FORECASTING HEAT LOSS IN PONDS AND STREAMS,
W69-05062 05B

GARBARINI, GEORGE S.
POTENTIAL OF DENVER BASIN FOR DISPOSAL OF LIQUID WASTES,
W69-04947 05E

GARDNER, B. DELWORTH
SOME NEIGHBORHOOD EFFECTS OF OIL-SHALE DEVELOPMENT,
W69-04854 06C

GARRELS, ROBERT M.
ORIGIN OF THE CHEMICAL COMPOSITIONS OF SOME SPRINGS AND LAKES,
W69-04969 02K

GATES, DILLARD H.
EFFECTS OF HERBICIDES, BURNING, AND SEEDING DATE IN RESEEDING AN ARID RANGE.
W69-05082 02A

GAVANDE, S. A.
INFLUENCE OF SOIL WATER POTENTIAL AND ATMOSPHERIC EVAPORATIVE DEMAND ON TRANSPIRATION AND THE ENERGY STATUS OF WATER IN PLANTS.
W69-05088 02I

GERBER, ABRAHAM
THE SOCIAL-ECONOMIC EVALUATION OF WATER RESOURCE PROJECTS,
W69-04816 06B

GIFFORD, GERALD F.
THE INFLUENCE OF GROWTH MEDIA, TEMPERATURES, AND LIGHT INTENSITIES ON ASPEN ROOT AND TOP GROWTH,
W69-05101 02G

GILL, WILLIAM N.
FLUID DYNAMICS,
W69-04701 08B

GLANTZ, PAUL J.
MICROBIOLOGIC AND ESCHERICHIA COLI SEROLOGIC TRACING OF MICROBIAL POLLUTION,
W69-05155 05B

GOEBEL, EDWIN D.
SUBSURFACE WASTE-DISPOSAL POTENTIAL IN SALINA BASIN OF KANSAS,
W69-04946 05E

GOLDBERGER, ARTHUR S.
THE INTERPRETATION AND ESTIMATION OF COBB-DOUGLAS FUNCTIONS,
W69-04853 06A

GOLF, WALTER
CONTRIBUTION CONCERNING THE FLOW RATES OF RIVERS TRANSPORTING DRAIN WATERS OF OPEN-CAST MINES,
W69-04956 04C

GOODELL, BERTRAM C.
NET, ALLWAVE RADIATION AS AN INDEX OF NATURAL SNOWMELT AND SNOWMELT ACCELERATED WITH ALBEDO REDUCING MATERIALS,
W69-05103 02C

GORHAM, EVILLE
OBSERVATIONS ON THE FORMATION AND BREAKDOWN OF THE OXIDIZED MICROZONE AT THE MUD SURFACE IN LAKES,
W69-05139 02H

GORIANINOV, K. E.
ELECTRIC-ARC EQUIPMENT FOR BURNING OPENINGS INTO BRICK AND REINFORCED CONTRETE STRUCTURES,
W69-04718 08A

GRADOWCZYK, MARIO H.
LOCALIZED SCOUR IN ERODIBLE-BED CHANNELS,
W69-04788 02J

GREEN, WIN
PERPETUAL SUCCESSION OF STREAM-CHANNEL VEGETATION IN A

SEMIARID REGION,
W69-05080 02D

GRUBB, HERBERT W.
GROUNDWATER UTILIZATION AND TAX POLICY,
W69-05126 06C

GUNTER, GORDON
THE GULF OF MEXICO MENHADEN FISHERY IN RELATION TO THE SPORTS FISHERY,
W69-04996 06B

ON OYSTERS AND SULFITE WASTE LIQUOR,
W69-04997 05C

HALL, L.
EFFECTS OF HEATED DISCHARGES IN THE TEMPERATURE OF THE THAMES ESTUARY II,
W69-04994 05C

HALL, W. A.
OPTIMUM OPERATIONS FOR PLANNING OF A COMPLEX WATER RESOURCES SYSTEM,
W69-05123 06A

HAMMOND, R. J.
BENEFIT-COST ANALYSIS AND WATER POLLUTION CONTROL,
W69-04998 05G

HANNA, G. P., JR.
ANNUAL REPORT, FISCAL YEAR 1968,
W69-05160 09D

HANSON, JOHN M.
FATIGUE TESTS OF REINFORCING BARS--EFFECT OF DEFORMATION PATTERN,
W69-04706 08F

HANSON, RONALD L.
CHARACTERISTICS OF SUMMER BASE FLOW OF THE POTOMAC RIVER,
W69-04981 02E

HARDAWAY, JOHN E.
POSSIBILITIES FOR SUBSURFACE WASTE DISPOSAL IN A STRUCTURAL SYNCLINE IN PENNSYLVANIA,
W69-04944 05E

HARGREAVES, GEORGE H.
CONSUMPTIVE USE COMPUTATIONS FROM EVAPORATION PAN DATA,
W69-05092 02D

HARRISON, ROBERT W.
IMPROVED EVALUATION PROCEDURES IN APPALACHIAN WATER RESOURCE PLANNING,
W69-04817 06B

HARTMAN, MONROE A.
DETERMINING STREAMFLOW ABSTRACTIONS FROM ANTECEDENT CONDITIONS,
W69-04933 02E

HART, HOYT E.
EVAPOTRANSPIRATION-REVIEW OF RESEARCH,
W69-04764 02D

HASLER, ARTHUR D.
CALORIFIC VALUES OF SOME INVERTEBRATES IN LAKE MENDOTA, WISCONSIN,
W69-04799 02H

HAUPT, HAROLD F.
EFFECTS OF SEEDBED TREATMENT ON GRASS ESTABLISHMENT ON LOGGING ROADBEDS IN CENTRAL IDAHO,
W69-05096 04A

THE INTERMOUNTAIN PRECIPITATION STORAGE GAGE,
W69-05111 07B

HEINEMANN, G.
COOLING WITH SEAWATER,
W69-04999 03C

HELLIER, THOMAS R., JR.
SEDIMENTATION FROM A HYDRAULIC DREDGE IN A BAY,
W69-05000 04D

HENDRICK, JAMES G.
DEVELOPING AN IRRIGATION WATER SUPPLY IN THE COASTAL PLAIN,
W69-04749 02F

HENKEL, DONALD E.
GEOLOGY OF THE REGOLITH AQUIFERS OF THE NISHNABOTNA BASIN,
W69-04781 02F

HOADLEY, ALFRED W.
BIOLOGICAL ACTIVITY IN RELATION TO THE CHEMICAL EQUILIBRIUM COMPOSITION OF NATURAL WATERS,
W69-04774 02K

HOCH, IRVING
AN EFFICIENT PROGRAM OF WATER RESOURCE DEVELOPMENT IN A FRAMEWORK OF GROWTH AND TRADE,
W69-05127 06B

HOFFMAN, CARL P., JR.
REPORT ON THE 1968 TRANSPORTATION RESEARCH AND SERVICE ACTIVITIES OF THE BUREAU OF COMMERCIAL FISHERIES,
W69-05001 09B

HOFFMAN, E. J.
A COMPARISON OF THE INACTIVATION OF ESCHERICHIA COLI AND POLIOVIRUS IN POLLUTED AND UNPOLLUTED WATERS BY CHLORINATION,
W69-04778 05D

HOGNESTAD, EIVIND
FATIGUE TESTS OF REINFORCING BARS--EFFECT OF DEFORMATION PATTERN,
W69-04706 08F

HOLLIS, EDGAR H.
COMMERCIAL AND SPORT FISHERIES,
W69-05002 03E

HOLLIS, E. H.
STRIPED BASS IN MARYLAND TIDEWATER,
W69-05022 06B

HOLLIS, MARK D.
RURAL COMMUNITY WATER SUPPLIES, A DISCUSSION IN FINANCING,
W69-04820 06C

HOPKINS, S. H.
STUDIES ON OYSTER MORTALITY IN RELATION TO NATURAL ENVIRONMENTS AND TO OIL FIELDS IN LOUISIANA,
W69-05020 05C

HOWARD, H. H.
WATER POLLUTION BY OUTBOARD MOTORS,
W69-04936 02H

HOWELLS, D. H.
ESTIMATING SEWAGE TREATMENT PLANT OPERATION AND MAINTENANCE COSTS,
W69-05051 05D

HUBNER, J.
A METHOD OF DETERMINING THE AVAILABLE SURFACE WATER RESOURCES,
W69-04950 02E

HUFFENUS, J. P.
RISING ACTIVE WATER FLOW IN THE OSIRIS REACTOR POOL (FRENCH),
W69-04959 05C

HUFFMAN, EVERETT L.
DEVELOPMENT OF TRANSPORT DEPLETION PROCESSES,
W69-05156 03A

HUFSCHMIDT, MAYNARD M.
THE INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN A STUDY OF ITS ROLE AS A PLANNING AGENCY ENGAGED IN THE POLITICAL PROCESS,
W69-04856 06E

HUGHES, B. P.
THE EFFECT OF MIX PROPORTIONS AND AGGREGATE DUST UPON THE COMPRESSIVE STRENGTH OF CONCRETE,
W69-04715 08F

HUGHES, PAUL W.
WATER SYSTEMS FINANCING--FOUR BASIC APPROACHES,
W69-04824 06C

HULL, C. H. J.
OXYGENATION OF BALTIMORE HARBOR BY PLANKTONIC ALGAE,
W69-05003 05G

HULL, F. C.
DEVELOPMENT OF A LOW-COST IRON-BASE ALLOY TO RESIST CORROSION IN HOT SEA WATER,
W69-04771 03A

HUNT, CHARLES G.
DETERMINING STREAMFLOW ABSTRACTIONS FROM ANTECEDENT CONDITIONS,
W69-04933 02E

HUSSEY, KEITH M.
GEOLOGY OF THE REGOLITH AQUIFERS OF THE NISHNABOTNA BASIN,
W69-04781 02F

HUTCHINSON, ANNE
THERMAL DISCHARGE BIBLIOGRAPHY,
W69-04937 05B

HUYGHE, J.
HIGH-CAPACITY DUAL-PURPOSE PLANT FOR GENERATING ELECTRICITY AND PRODUCING FRESH WATER FROM SEA WATER,
W69-04754 03A

HYLAND, WILLIAM F.
THE ROLE OF INVESTOR-OWNED WATER UTILITIES IN NATIONAL DEVELOPMENT,
W69-04830 06B

HYNES, H. B. N.
THE BIOLOGY OF POLLUTED WATERS,
W69-05004 05C

ILES, R. B.
CULTIVATING FISH FOR FOOD AND SPORT IN POWER-STATION WATER,
W69-05006 05C

INGRAM, WILLIAM MARCUS
ALGAL GROWTH AQUEOUS FACTORS OTHER THAN NITROGEN AND PHOSPHORUS,
W69-04801 05C

ISSACS, DEAN
PROPERTIES OF SALINE RANGE SOILS OF THE RIO GRANDE PLAIN,

69-05084 02G

MI, MASAHIRO
OLYAMIDE-IMIDE INSULATION VARNISH,
69-04719 08G

SMA, J. DEAN
N ECONOMIC ANALYSIS OF WATER UTILIZATION IN PENNSYLVANIA,
69-05154 06D

FRIES, H. P.
NVIRONMENTAL CHARACTERISTICS OF RARITAN BAY, A POLLUTED
STUARY,
69-05008 05C

KINS, DAVID
HE DIFFERENTIATION, ANALYSIS, AND PRESERVATION OF NITROGEN
ND PHOSPHORUS FORMS IN NATURAL WATERS,
69-05137 05A

KINS, K. C.
STIMATING SEWAGE TREATMENT PLANT OPERATION AND MAINTENANCE
OSTS,
69-05051 05D

NSON, G. DUGAN
ELOCITY DISTRIBUTION AND ITS EFFECT ON THE ACCURACY OF THE
IBSON METHOD OF WATER MEASUREMENT,
69-04744 08C

NSON, M. V.
NNUAL PEAK DISCHARGES FROM SMALL DRAINAGE AREAS IN MONTANA
HROUGH SEPTEMBER 1968,
69-04927 02E

NSTON, ROBERT S.
HEATING SYSTEM FOR STREAM GAGING STATIONS,
69-05110 07B

ES, E. B.
HEMICAL MEASUREMENT OF MEAN TEMPERATURE,
69-04765 07A

DAN, P. R.
UMMARY AND ANALYSIS OF SEDIMENT RECORDS IN RELATION TO ST.
OUIS HARBOR SEDIMENTATION PROBLEM,
69-04938 02J

WANI, N. C.
OTE ON THE UNBIASEDNESS OF A MIXED REGRESSION ESTIMATOR,
69-04845 06A

AL, ISHAT
ROSPECTS OF DESALINATION FOR SOLVING WATER PROBLEMS ON THE
AKRAN COAST,
69-04776 03A

HERER, J. C.
STIMATED USE OF WATER IN THE UNITED STATES, 1960,
69-05019 06B

., R. N.
HENOLOGICAL ASPECTS OF A FEW PROMISING EUCALYPTUS IN THE
RID ZONE,
69-05091 02I

LEHER, THOMAS F.
OAT AND MARINA WASTES,
69-05009 05G

NEY, NATHANIEL T.
HESAPEAKE COUNTRY,
69-05010 06G

NS, WALDON R.
ECONOMIC ANALYSIS OF WATER UTILIZATION IN PENNSYLVANIA,
69-05154 06D

L, HAROLD D.
FFECTS OF HERBICIDES, BURNING, AND SEEDING DATE IN
SEEDING AN ARID RANGE.
69-05082 02A

S, W. SCOTT
AGNETIC TAPE RECORDING OF GEOPHYSICAL LOGS,
69-04986 07B

, WALTER J., JR.
FFECTS OF SEEDBED TREATMENT ON GRASS ESTABLISHMENT ON
OGGING ROADBEDS IN CENTRAL IDAHO,
69-05096 04A

ONTROLLING SOIL MOVEMENT FROM STEEP ROAD FILLS,
69-05105 04A

CHEL, WALTER, JR.
EGIONAL WATER RESOURCE DEVELOPMENT IN THE FEDERAL SYSTEM,
69-04815 06B

IER, A.
967 AN EXCEPTIONAL YEAR IN THE LIFE OF THE DE BERRE POND
FRENCH),
69-04958 05C

NE, O.
HE EFFECTS OF TEMPERATURE AND SALINITY ON MARINE AND
ACKISH WATER ANIMALS--I. TEMPERATURE,
69-05011 05C

NSING, O.
HE DETERMINATION OF THE EVAPORATION FROM THE PLANT COVER
AND THE SURFACE OF THE SOIL BY RELATING LYSIMETER AND SOIL
MOISTURE MEASUREMENTS TO POTENTIAL EVAPORATION,
W69-05073 02D

KLEIN, LOUIS
RIVER POLLUTION II, CAUSES AND EFFECTS,
W69-05012 02A

KNEESE, ALLEN V.
SOCIO-ECONOMIC ASPECTS OF WATER QUALITY MANAGEMENT,
W69-05013 05G

WATER RESEARCH,
W69-05115 06B

KNETSCH, JACK L.
OUTDOOR RECREATION DEMANDS AND BENEFITS,
W69-05014 06D

KNOCHENMUS, DARWIN D.
SHORELINE FEATURES AS INDICATORS OF HIGH LAKE LEVELS,
W69-04984 02H

KOCH, PIERRE
DISCHARGE OF WASTES INTO THE SEA IN EUROPEAN COASTAL AREAS,
W69-05015 05E

KORNICKER, LOUIS S.
SEDIMENTATION FROM A HYDRAULIC DREDGE IN A BAY,
W69-05000 04D

KRAMER, DIETRICH
ON INVESTIGATIONS CONCERNING THE INFLUENCE OF AGRICULTURAL
UTILIZATION ON THE RUNOFF FORMATION BY MEANS OF GROUNDWATER-
LYSIMETERS,
W69-04951 02G

KRAMER, JAMES R.
EQUILIBRIUM MODELS AND COMPOSITION OF THE GREAT LAKES,
W69-04970 02K

KRIEBEL, CHARLES H.
QUADRATIC TEAMS, INFORMATION ECONOMICS, AND AGGREGATE
PLANNING DECISIONS,
W69-04843 06B

KRUTILLA, JOHN V.
SEQUENCE AND TIMING IN RIVER BASIN DEVELOPMENT,
W69-05016 06B

KUCHMENT, L. S.
INLET HYDROGRAPH ESTIMATION FOR LINEAR FLOW MODELS ACCORDING
TO OUTLET HYDROGRAPH,
W69-04961 02A

KUL'GAVII, YA K
ANALYSIS OF THE FAILURE OF BRITTLE MODELS OF ARCH DAMS,
W69-04710 08A

KURHANOWICZ, A.
THE SOLINA HYDRO PROJECT,
W69-04738 08A

LAMBERT, P.
RISING ACTIVE WATER FLOW IN THE OSIRIS REACTOR POOL
(FRENCH),
W69-04959 05C

LAMB, JAMES C., III.
ECONOMIC ASPECTS OF SALINE-WATER CONVERSION,
W69-05017 03A

LATIF, A.
HYDROGRAPHICAL INVESTIGATION OF THE BRAHMAPUTRA RIVER IN
EAST PAKISTAN,
W69-04752 02E

LAVE, LESTER B.
CONGESTION, TOLLS, AND THE ECONOMIC CAPACITY OF A WATERWAY,
W69-04838 06C

LEBARON, ALLEN D.
SOME NEIGHBORHOOD EFFECTS OF OIL-SHALE DEVELOPMENT,
W69-04854 06C

LEE, FRED G.
BIOLOGICAL ACTIVITY IN RELATION TO THE CHEMICAL EQUILIBRIUM
COMPOSITION OF NATURAL WATERS,
W69-04974 02K

LEE, RICHARD
CHEMICAL MEASUREMENT OF MEAN TEMPERATURE,
W69-04765 07A

LEROUGE, B.
RISING ACTIVE WATER FLOW IN THE OSIRIS REACTOR POOL
(FRENCH),
W69-04959 05C

LEVIN, GILBERT V.
THE NEW POLLUTION,
W69-04828 05C

LIN, K.
SOIL DENSITY MEASUREMENTS WITH GAMMA-RAYS,
W69-04747 08D

LITTLE, I. M. D.
DIRECT VERSUS INDIRECT TAXATION,
W69-04848 06C

LIU, C.
DEVELOPMENT OF A LOW-COST IRON-BASE ALLOY TO RESIST CORROSION IN HOT SEA WATER,
W69-04771 03A

LOLEIT, ALLAN J.
SEDIMENTARY HISTORY AND ECONOMIC GEOLOGY OF SAN JUAN BASIN, NEW MEXICO AND COLORADO,
W69-04948 05E

LONGUEMARE, R.
1967 AN EXCEPTIONAL YEAR IN THE LIFE OF THE DE BERRE POND (FRENCH),
W69-04958 05C

LUDWIG, HARVEY F.
SCIENTIFIC PARAMETERS OF MARINE WASTE DISCHARGE,
W69-05018 05A

MAC KICHON, K. A.
ESTIMATED USE OF WATER IN THE UNITED STATES, 1960,
W69-05019 06B

MACKENTHUN, KENNETH M.
ALGAL GROWTH AQUEOUS FACTORS OTHER THAN NITROGEN AND PHOSPHORUS,
W69-04801 05C

MACKENZIE, FRED T.
ORIGIN OF THE CHEMICAL COMPOSITIONS OF SOME SPRINGS AND LAKES,
W69-04969 02K

MACKIN, J. G.
STUDIES ON OYSTER MORTALITY IN RELATION TO NATURAL ENVIRONMENTS AND TO OIL FIELDS IN LOUISIANA,
W69-05020 05C

MACRAE, I. C.
THE FATE OF NITRATE NITROGEN IN SOME TROPICAL SOILS FOLLOWING SUBMERGENCE,
W69-05138 02K

MACUMBER, P. G.
INTERRELATIONSHIP BETWEEN PHYSIOGRAPHY, HYDROLOGY, SEDIMENTATION, AND SALINIZATION OF THE LODDEN RIVER PLAINS, AUSTRALIA,
W69-05079 02A

MAGGIOLO, OSCAR J.
LOCALIZED SCOUR IN ERODIBLE-BED CHANNELS,
W69-04788 02J

MAIER, FRANZ J.
WATER FOR FLUORIDES,
W69-04769 05F

MAKKINK, G. F.
CALCULATION MODEL FOR THE ACTUAL EVAPOTRANSPIRATION FROM CROPPED AREAS AND OTHER TERMS OF THE WATER BALANCE EQUATION,
W69-05072 02D

MALONE, THOMAS F.
WEATHER MODIFICATION, PRESENT AND FUTURE,
W69-04717 03B

MANGER, G. EDWARD
IMMOBILITY OF CONNATE WATER IN PERMEABLE SANDSTONE,
W69-04977 02F

MANN, DEAN E.
THE POLITICS OF WATER IN ARIZONA,
W69-05112 06E

MANN, JOHN F., JR.
CONCEPTS IN GROUND WATER MANAGEMENT,
W69-04704 04B

MANOHAR, MAN SINGH
MEASUREMENT OF THE WATER POTENTIAL OF INTACT PLANT TISSUES III. THE WATER POTENTIALS OF GERMINATING PEAS (PISUM SATIVUM L.),
W69-05095 02I

MANSUETI, R. J.
EFFECTS OF CIVILIZATION ON STRIPED BASS AND OTHER ESTUARINE BIOTA IN CHESAPEAKE BAY AND TRIBUTARIES,
W69-05021 05C

STRIPED BASS IN MARYLAND TIDEWATER,
W69-05022 06B

MARAIS, A. F.
A COMPARISON OF THE INACTIVATION OF ESCHERICHIA COLI AND [illegible] IN POLLUTED AND UNPOLLUTED WATERS BY CHLORINATION,
W69-04778 05D

MARKOWSKI, S.
OBSERVATIONS ON THE RESPONSE OF SOME BENTHONIC ORGANISM TO [illegible] STATION COOLING,
W69-05023 05C

MARSHALL, J. K.
OPERATION OF A [illegible] BOREHOLE,
W69-04723 04B

MARTIN, DEAN S.
[illegible] CHEMISTRY OF THE OCEAN,
W69-04771 02K

MARTS, M. E.
THE CONFLICT BETWEEN FISH AND POWER RESOURCES IN THE PACIFIC NORTHWEST,
W69-05024 06B

MASSMANN, WILLIAM H.
THE FISHERIES--A NEGLECTED ASPECT OF ESTUARINE RESEARCH,
W69-05025 02L

MATALAS, NICHOLAS C.
NOTE ON THE STANDARD ERROR OF THE COEFFICIENT OF SKEWNESS,
W69-04807 06A

MATHEWS, MICHAEL J.
MICROSCOPIC DETERMINATION OF BOUNDARY SHEAR AND SUBLAYER TURBULENCE CHARACTERISTICS IN AN OPEN CHANNEL,
W69-05150 08B

MATIN, A.
BASIC DATA COLLECTION FOR WATER DEVELOPMENT IN EAST PAKISTAN,
W69-04755 07A

MATSUMURA, SHIGERU
POLYAMIDE-IMIDE INSULATION VARNISH,
W69-04719 08G

MAYBEE, JOHN
QUALITATIVE ECONOMICS AND THE SCOPE OF THE CORRESPONDENCE PRINCIPLE,
W69-04806 06B

MCCABE, J. S.
ORGANIC POLLUTION OF NEW YORK HARBOR APPLICATION,
W69-05026 05B

MCCALLUM, GORDON E.
WATER QUALITY IN THE POTOMAC ESTUARY,
W69-05027 05G

MCCANN, THOMAS P.
POSSIBILITIES FOR DISPOSAL OF INDUSTRIAL WASTES IN SUBSURFACE ROCKS OF NORTH FLANK OF APPALACHIAN BASIN IN NEW YORK,
W69-04943 05E

MCCARTHY, DANIEL V.
THE ROLE OF ECONOMICS IN PLAN FORMULATION,
W69-04835 06B

MCCOY, ORVAL D.
POPULATION, GROWTH RATE, AND MATURITY OF VEGETABLE CROPS IN RELATION TO SOIL SALINITY AND TEXTURE UNDER SPRINKLER AND FURROW IRRIGATION,
W69-05074 02I

MCDONALD, D. B.
THE EFFECT OF PHOTOSYNTHESIS ON THE OXYGEN BALANCE IN A MIDWESTERN STREAM,
W69-04780 05C

MCGUINNESS, C. L.
NEW THRUSTS IN GROUND WATER,
W69-04793 02F

MCKEE, JACK
ON OYSTERS AND SULFITE WASTE LIQUOR,
W69-04997 05C

MCKEE, JACK EDWARD,
WATER QUALITY CRITERIA, 2ND EDITION,
W69-05028 05G

MCKEE, PAUL W.
SEDIMENT,
W69-05029 04D

MCNULTY, J. K.
ECOLOGICAL EFFECTS OF SEWAGE POLLUTION IN BISCAYNE BAY, FLORIDA SEDIMENTS AND THE DISTRIBUTION OF BENTHIC AND FOULING MACRO-ORGANISMS,
W69-05030 05C

MEGHAN, WALTER F.
NET, ALLWAVE RADIATION AS AN INDEX OF NATURAL SNOWMELT AND SNOWMELT ACCELERATED WITH ALBEDO REDUCING MATERIALS,
W69-05103 02C

MEIMAN, JAMES R.
NET, ALLWAVE RADIATION AS AN INDEX OF NATURAL SNOWMELT AND SNOWMELT ACCELERATED WITH ALBEDO REDUCING MATERIALS,
W69-05103 02C

MEISLER, HAROLD
HYDROGEOLOGIC SIGNIFICANCE OF CALCIUM-MAGNESIUM RATIOS IN GROUND WATER FROM CARBONATE ROCKS IN THE LANCASTER QUADRANGLE, SOUTHEASTERN PENNSYLVANIA,
W69-04985 02F

MEL'NIKOV, B. N.
INSTRUMENT FOR MEASURING SOIL DEFORMATIONS IN DEPTH,
W69-04746 08D

MERRITT, C. A.
THE EFFECT OF PHOTOSYNTHESIS ON THE OXYGEN BALANCE IN A MIDWESTERN STREAM,
W69-04780 05C

MEYERS, J. F.
SEMI-SYNCHRONOUS STARTING,
W69-04722 08C

HAEL, N.
EVELOPMENT OF A LOW-COST IRON-BASE ALLOY TO RESIST
ORROSION IN HOT SEA WATER,
59-04771 03A

NIOT, C.
STUDY OF THE PHYSICAL PROPERTIES OF VARIOUS FORMS OF VERY
NE SEDIMENTS AND THEIR BEHAVIOR UNDER HYDRODYNAMIC ACTION
FRENCH),
59-04796 02J

ILSKI, ZDZISLAW
TER BALANCE OF LAKE AFFECTED BY SEA (FRENCH),
59-04960 02H

ER, E.
OW AND CAVITATION CHARACTERISTICS OF CONTROL VALVES,
59-04716 08C

ER, E. G.
E CONSTRUCTION AND USE OF FLOW-VOLUME CURVES,
59-04979 02E

ER, ROBERT J.
DROLOGIC MINI-CYCLE FOR SOIL MOISTURE AND SALT CONTROL IN
RIGATED AGRICULTURE,
59-05076 03F

IMAN, J. W.
TER LAW AND PRIVATE DECISION MAKING A CRITIQUE,
59-04839 06B

KLEY, W. L.
NOMALOUS' THERMAL CONDITIONS IN A HYPERSALINE INLAND POND,
59-05078 02H

HELL, R.
CTORS AFFECTING BIOLOGICAL CLOGGING OF SAND ASSOCIATED
TH GROUND WATER RECHARGE,
59-05075 03C

ORE, G. E.
REVIEW OF FIBER REINFORCEMENT OF PORTLAND CEMENT PASTE,
RTAR, AND CONCRETE,
59-04708 08F

AN, JAMES J.
PLICATION AND LIMITATIONS OF CHEMICAL THERMODYNAMICS IN
TURAL WATER SYSTEMS,
59-04770 02K

IS, J. CARREL
DOX EQUILIBRIA AND MEASUREMENTS OF POTENTIALS IN THE
UATIC ENVIRONMENT,
59-04972 02K

IS, S. B.
TLOOK FOR ECONOMIC USE OF FRESH WATER FROM THE SEA,
59-05032 03A

, FRANK E.
E WATER CRISIS,
59-05113 06B

ER, UDO
MOGENEOUS, ESPECIALLY LINEAR HOMOGENEOUS, PRODUCTION
NCTIONS AND THE LAW OF YIELD (GERMAN),
59-04846 06B

ON, WENDELL C.
TIMATING CONSUMPTIVE USE - MUNSON P. E. INDEX METHOD,
59-05094 02D

S, EARL A.
STE WATER CONSERVATION AND RENOVATION RESEARCH,
59-04748 05D

, GLENN E.
THE MECHANISM OF LANGMUIR CIRCULATIONS AND THEIR ROLE IN
ILIMNION MIXING,
59-04929 02H

ERMAL STRUCTURE AND VERTICAL HEAT TRANSPORT IN LANGMUIR
RCULATIONS,
59-04931 02H

, RAYMOND L.
OUND WATER PERSPECTIVES AND PROSPECTS,
59-04794 02F

SIMHAN, T. N.
TIO METHOD FOR DETERMINING CHARACTERISTICS OF IDEAL,
AKY, AND BOUNDED AQUIFERS,
59-04763 02F

E, S.
E DISCHARGE RECESSION AS CRITERION ON THE RETENTION
PACITY OF BASINS,
59-04953 02E

S, JOHN C.
VELOPMENT AND STATUS OF POND FERTILIZATION IN CENTRAL
ROPE,
59-04804 05G

, JOHN H.
STRIBUTION, ENVIRONMENTAL REQUIREMENTS AND SIGNIFICANCE OF
ADOPHORA IN THE GREAT LAKES,
59-04798 02H

NELSON, W. W.
TILLAGE INFLUENCES WATER INTAKE,
W69-05089 02G

NEVO, Z.
FACTORS AFFECTING BIOLOGICAL CLOGGING OF SAND ASSOCIATED
WITH GROUND WATER RECHARGE,
W69-05075 03C

NEYMAN, JERZY
AREAL SPREAD OF THE EFFECT OF CLOUD SEEDING AT THE WHITETOP
EXPERIMENT,
W69-04775 03B

NICKS, ARLIN D.
ELECTRONIC DATA PROCESSING SYSTEM FOR STREAMFLOW,
W69-04759 07C

NIELSEN, D. R.
CAPILLARY CONDUCTIVITY AND SOIL WATER DIFFUSIVITY VALUES
FROM VERTICAL COLUMNS,
W69-05093 02G

NISSEN, DAVID H.
A NOTE ON THE VARIANCE OF A MATRIX,
W69-04844 06A

NOBE, KENNETH C.
EMERGING NATIONAL POLICIES GOVERNING OUTDOOR RECREATION IN
FEDERAL WATER DEVELOPMENT PROJECTS,
W69-05033 06B

NUPEN, E. M.
A COMPARISON OF THE INACTIVATION OF ESCHERICHIA COLI AND
POLIOVIRUS IN POLLUTED AND UNPOLLUTED WATERS BY
CHLORINATION,
W69-04778 05D

OKUBO, A.
HORIZONTAL DIFFUSION FROM AN INSTANTANEOUS POINT SOURCE DUE
TO OCEANIC TURBULENCE,
W69-05036 02L

A REVIEW OF THEORETICAL MODELS OF TURBULENT DIFFUSION IN THE
SEA,
W69-05037 02L

OMANG, R. J.
ANNUAL PEAK DISCHARGES FROM SMALL DRAINAGE AREAS IN MONTANA
THROUGH SEPTEMBER 1968,
W69-04927 02E

ONEDERA, BEN
SCIENTIFIC PARAMETERS OF MARINE WASTE DISCHARGE,
W69-05018 05A

ORGERON, C.
A SCALE MODEL STUDY OF SILTING IN THE VILAINE RIVER DUE TO
THE ARZAL DAM (FRENCH),
W69-04795 02A

OWEN, GLENN E.
DISTRIBUTION, ENVIRONMENTAL REQUIREMENTS AND SIGNIFICANCE OF
CLADOPHORA IN THE GREAT LAKES,
W69-04798 02H

O'CONNOR, D. J.
ORGANIC POLLUTION OF NEW YORK HARBOR - THEORETICAL
CONSIDERATIONS,
W69-05034 05B

OXYGEN BALANCE OF AN ESTUARY,
W69-05035 05B

PAINTAL, AMREEK S.
TENTATIVE DESIGN PROCEDURES FOR RIPRAP-LINED CHANNELS,
W69-04727 08B

PARIKH, S. C.
OPTIMUM OPERATIONS FOR PLANNING OF A COMPLEX WATER RESOURCES
SYSTEM,
W69-05123 06A

PARKS, GEORGE A.
AQUEOUS SURFACE CHEMISTRY OF OXIDES AND COMPLEX OXIDE
MINERALS,
W69-04966 02K

PARTH, RUDOLF
WATER POWER LINKS RIPARIANS - AUSTRIA CONTRIBUTES TO
INTERNATIONAL COOPERATION,
W69-04777 06E

PAULSON, W. L.
THE EFFECT OF PHOTOSYNTHESIS ON THE OXYGEN BALANCE IN A
MIDWESTERN STREAM,
W69-04780 05C

PEARSON, E. A.
PROCEEDINGS OF THE FIRST INTERNATIONAL CONFERENCE ON WASTE
DISPOSAL IN THE MARINE ENVIRONMENT,
W69-05038 05E

PECK, EUGENE L.
EVAPORATION RATES IN MOUNTAINOUS TERRAIN,
W69-05098 02D

PEIRANO, PEDRO
EFFECT OF SEAWEED ON THE LEVELS OF AVAILABLE PHOSPHORUS AND
NITROGEN IN A CALCAREOUS SOIL,
W69-05136 02K

PENNER, E.
PARTICLE SIZE AS A BASIS FOR PREDICTING FROST ACTION IN SOILS,
W69-04739 02C

PFSSAIL, N.
DEVELOPMENT OF A LOW-COST IRON-BASE ALLOY TO RESIST CORROSION IN HOT SEA WATER,
W69-04771 03A

PETERSON, JAMES A.
SEDIMENTARY HISTORY AND ECONOMIC GEOLOGY OF SAN JUAN BASIN, NEW MEXICO AND COLORADO,
W69-04948 05E

PETROVA, R. S.
A NFW METHOD OF MAPPING THE WATER RESOURCES,
W69-04934 02E

PETROV, G. N.
A NEW METHOD OF MAPPING THE WATER RESOURCES,
W69-04934 02E

PFANKUCH, DALE J.
EVAPORATION RATES IN MOUNTAINOUS TERRAIN,
W69-05098 02D

PHINNEY, HARRY K.
MINERAL REQUIREMENTS FOR THE GROWTH OF ANABAENA SPIROIDES IN VITRO,
W69-04802 05C

PIRIE, E.
SOIL DENSITY MEASUREMENTS WITH GAMMA-RAYS,
W69-04747 08D

PORCELLA, DONALD B.
FACTORS INFLUENCING RADIOSTRONTIUM ACCUMULATION IN DAPHNIA,
W69-05141 05C

PREDDY, W. S.
EFFECTS OF HEATED DISCHARGES IN THE TEMPFRATURE OF THE THAMES ESTUARY II,
W69-04994 05C

THE CALCULATION OF POLLUTION OF THE THAMES ESTUARY AS A THEORY OF QUANTIZED MIXING,
W69-05041 05B

PRITCHARD, D. W.
FINAL REPORT ON BALITMORE HARBOR STUDY,
W69-05056 05F

PRIVRASKY, NORMAN C.
POSSIBILITIES FOR DISPOSAL OF INDUSTRIAL WASTES IN SUBSURFACE ROCKS OF NORTH FLANK OF APPALACHIAN BASIN IN NEW YORK,
W69-04943 05E

PURNELL, G. R.
ECONOMICS AND FINANCE OF WATER DEVELOPMENT IN ALBERTA, CANADA,
W69-05122 06B

QUIRT, JAMES
QUALITATIVE ECONOMICS AND THE SCOPE OF THE CORRESPONDENCE PRINCIPLE,
W69-04806 06B

RADEMACHER, JOHN M.
EFFECTS OF MULTIPLE USES OF WATERSHEDS ON WATER QUALITY,
W69-04702 05B

RAPHAEL, JEROME M.
PREDICTION OF TEMPERATURE IN RIVERS AND RESERVOIRS,
W69-05042 05B

RAUCH, EDUARDO
EFFECT OF SEAWEED ON THE LEVELS OF AVAILABLE PHOSPHORUS AND NITROGEN IN A CALCAREOUS SOIL,
W69-05136 02K

RAVEN, J. A.
THE MECHANISM OF PHOTOSYNTHETIC USE OF BICARBONATE BY HYDRODICTYON AFRICANUM,
W69-04803 02K

RAWLS, CHARLES K.
AQUATIC PLANT NUISANCES,
W69-05044 04A

RAY, CARLETON
INSHORE MARINE CONSERVATION,
W69-05044 02L

REEVE, RONALD C.
ENTRY VELOCITY CONTROL LIMITS DRAIN SEDIMENTATION,
W69-04729 08B

REITZEL, JOHN E.
PROPOSED MAXIMUM USE IRRIGATION SYSTEM, SOUTH PLATTE RIVER, COLORADO AND MINNESOTA RIVER, MINNESOTA,
W69-05150 04A

RICHARDS, T. E.
A SURVEY OF SALT-WATER SPORT FISHING IN VIRGINIA 1955-1960,
W69-05044 06B

RICHMAN, BARNEY
TOWARD THE OPTIMIZATION OF INVESTMENT POLICING DECISIONS A MODEL FOR URBAN WATER SUPPLY TREATMENT FACILITIES,
W69-05128 05F

W69-05129 05F

W69-05130 05F

RITCHIE, DOUGLAS E., JR.
SPORT FISHING SURVEY OF THE LOWER POTOMAC ESTUARY,
W69-04992 02L

RITTER, JOHN R.
BED-MATERIAL MOVEMENT, MIDDLE FORK EEL RIVER, CALIFORNIA,
W69-04980 02J

RIXFORD, CHARLES E.
FACTORS INFLUENCING RADIOSTRONTIUM ACCUMULATION IN DAPHNIA,
W69-05141 05C

ROBINSON, FRANK E.
POPULATION, GROWTH RATE, AND MATURITY OF VEGETABLE CROPS IN RELATION TO SOIL SALINITY AND TEXTURE UNDER SPRINKLER AND FURROW IRRIGATION,
W69-05074 02I

ROBOCKER, W. C.
EFFECTS OF HERBICIDES, BURNING, AND SEEDING DATE IN RESEEDING AN ARID RANGE.
W69-05082 02A

ROGERS, GEORGE W.
THE FUTURE OF ALASKA,
W69-05047 06B

RORHOLM, NIELS
ECONOMIC IMPACT OF NARRAGANSETT BAY,
W69-05048 06B

ROSENBERG, NORMAN J.
EVAPOTRANSPIRATION-REVIEW OF RESEARCH,
W69-04764 02D

ROSE, WALTER
FURTHER STUDY OF AQUIFER PERFORMANCE,
W69-05149 02A

ROUNSEFELL, G. A.
PRECONSTRUCTION STUDY OF THE FISHERIES OF THE ESTUARINE AREAS TRAVERSED BY THE MISSISSIPPI RIVER-GULF OUTLET PROJECT,
W69-05049 02L

REALISM IN THE MANAGEMENT OF ESTUARIES,
W69-05050 02L

ROWAN, P. P.
ESTIMATING SEWAGE TREATMENT PLANT OPERATION AND MAINTENANCE COSTS,
W69-05051 05D

RUIZ-DELGADO, DOMINGO A.
FINANCIAL ASPECTS OF POTABLE WATER AND SEWERAGE SYSTEMS,
W69-04821 05D

RUSH, EUGENE F.
WATER RESOURCES APPRAISAL OF THOUSAND SPRINGS VALLEY, ELKO COUNTY, NEVADA,
W69-04791 02E

RUSSELL, S.
MASSACHUSETTS MARINE SPORT FISHERIES INVENTORY,
W69-04991 06B

RYAN, J. DONALD
THE SEDIMENTS OF CHESAPEAKE BAY,
W69-05052 02L

SABACK, DAVID K.
PRODUCERS' MARGINS FOR FOOD FISH AND SHELLFISH,
W69-05053 06C

SABINGS, FLOYD F., JR.
THERMAL INFRARED IMAGERY FOR GEOLOGISTS,
W69-04745 07B

SALANDANAN, S.
THE FATE OF NITRATE NITROGEN IN SOME TROPICAL SOILS FOLLOWING SUBMERGENCE,
W69-05138 02K

SALAZAR, E.
FINANCING WATER PROJECTS IN LATIN AMERICA,
W69-04836 06B

SANCHEZ-MORA, J. A.
FINANCIAL ASPECTS OF POTABLE WATER AND SEWERAGE SYSTEMS,
W69-04821 05D

SARAVANAPAVAN, A.
OPERATION OF A RECHARGE BOREHOLE,
W69-04723 04B

SCHERF, HAROLD
INFLATION AND INCOME DISTRIBUTION (GERMAN),
W69-04851 06C

SCHINDLER, PAUL W.
HETEROGENEOUS EQUILIBRIA INVOLVING OXIDES, HYDROXIDES, CARBONATES, AND HYDROXIDE CARBONATES,
W69-04968 02K

MITT, RICHARD K.
AVE INTERACTION AND LANGMUIR CIRCULATIONS,
69-04930 02H

ONFELD, E.
INEAR--A COMPUTER PROGRAM TO FIT DATA EASILY TO MANY MODELS
Y THE WEIGHTED LINEAR LEAST-SQUARES METHOD,
69-04797 07C

OOF, RUSSELL R.
LECTRONIC DATA PROCESSING SYSTEM FOR STREAMFLOW,
69-04759 07C

ETERMINING STREAMFLOW ABSTRACTIONS FROM ANTECEDENT
ONDITIONS,
69-04933 02E

ULTHESS, H.
INANCING WATER PROJECTS IN LATIN AMERICA,
69-04836 06B

ULTZ, JOHN D.
IELD CORRELATION OF TWO NEUTRON-SCATTERING SOIL MOISTURE
ETERS,
69-05100 07B

VAPOTRANSPIRATION AND SOIL-MOISTURE DEPLETION,
69-05102 02G

WARZ, FRANCIS K.
ROBABLE MAXIMUM PRECIPITATION OVER SOUTH PLATTE RIVER,
OLORADO AND MINNESOTA RIVER, MINNESOTA,
69-05158 04A

T, ELIZABETH
REAL SPREAD OF THE EFFECT OF CLOUD SEEDING AT THE WHITETOP
IPERIMENT,
69-04775 03B

T, GORDON
CONOMICS AND THE CONSERVATION QUESTION,
69-04841 03B

T, JON T.
THE MECHANISM OF LANGMUIR CIRCULATIONS AND THEIR ROLE IN
PILIMNION MIXING,
69-04929 02H

Y, EDWARD H.
LECTRONIC DATA PROCESSING SYSTEM FOR STREAMFLOW,
69-04759 07C

LEIN, LYLE V. A.
OLOGY OF THE REGOLITH AQUIFERS OF THE NISHNABOTNA BASIN,
69-04781 02F

LL, W. R. D.
E CONFLICT BETWEEN FISH AND POWER RESOURCES IN THE PACIFIC
RTHWEST,
69-05024 06B

IN, MAMDOUH
NSUMPTIVE USE OF WATER FOR SOME MAJOR CROPS IN U.A.R.
GYPT),
69-05087 02I

NON, WILLIAM L.
ORING FOR THE SEATTLE FIRST NATIONAL BANK BUILDING,
ATTLE, WASHINGTON,
69-04721 08D

HERD, R. W.
TIMUM OPERATIONS FOR PLANNING OF A COMPLEX WATER RESOURCES
STEM,
69-05123 06A

LEY, W. E.
ABILITY, AS REGARDS SURFACE WATERS, FOR RAISING SURFACE
VEL OF LAND,
69-04873 06E

MAN, HAROLD R.
NSIDERATIONS INVOLVED IN THE PLANNING, ORGANIZATION,
NAGEMENT, AND DESIGN OF PUBLIC WATER SUPPLIES,
69-04834 06B

TSOV, V. B.
STRUMENT FOR MEASURING SOIL DEFORMATIONS IN DEPTH,
69-04746 08D

EN, LARS GUNNAR
STER VARIABLES AND ACTIVITY SCALES,
69-04963 02K

BBS PHASE RULE AND MARINE SEDIMENTS,
69-04964 02K

GS, R. W.
ARACTERIZATION OF THE RATE OF WATER INFILTRATION INTO
IL,
69-05143 02G

, C. M.
LOW INTENSITY RAIN SIMULATOR FOR LONG DURATION RAIN-ON-
OW EVENTS,
69-04939 02B

LOMANOV, I. A.
TIMATION OF MAXIMUM DISCHARGES AND HYDROGRAPHS OF FLOOD,
69-04955 02E

SLATER, JOHN V.
FACTORS INFLUENCING RADIOSTRONTIUM ACCUMULATION IN DAPHNIA,
W69-05141 05C

SLATYER, R. O.
EXPERIENCE WITH THREE VAPOUR METHODS FOR MEASURING WATER
POTENTIAL IN PLANTS,
W69-05085 02I

SLONEKER, L. L.
TILLAGE INFLUENCES WATER INTAKE,
W69-05089 02G

SMITH, FRANKLAND
THE MOSSYROCK DEVELOPMENT,
W69-04737 08A

SMITH, JEROME A.
AREAL SPREAD OF THE EFFECT OF CLOUD SEEDING AT THE WHITETOP
EXPERIMENT,
W69-04775 03B

SMITH, STEPHEN C.
WATER RESEARCH,
W69-05115 06B

SOBEL, MATTHEW J.
ESTUARINE WATER QUALITY MANAGEMENT AND FORECASTING,
W69-05059 05B

SOKOLOVSKY, D. L.
ESTIMATION OF MAXIMUM DISCHARGES AND HYDROGRAPHS OF FLOOD,
W69-04955 02E

SPENCER, CHARLES W.
SEDIMENTARY HISTORY AND ECONOMIC GEOLOGY OF SAN JUAN BASIN,
NEW MEXICO AND COLORADO,
W69-04948 05E

SPIEGEL, Z.
OPERATION OF A RECHARGE BOREHOLE,
W69-04723 04B

SPIEWAK, I.
COST PROJECTIONS FOR LARGE DESALTING SYSTEMS WITH VARIOUS
TYPES OF COUPLING,
W69-04814 03A

SPORN, PHILIP
THE SOCIAL-ECONOMIC EVALUATION OF WATER RESOURCE PROJECTS,
W69-04816 06B

SPRINGFIELD, H. W.
GERMINATION OF FOURWING SALTBUSH SPEDS AT DIFFERENT LEVELS
OF MOISTURE STRESS,
W69-05081 02I

STALL, JOHN B.
HYDRAULIC GEOMETRY OF ILLINOIS STREAMS,
W69-05153 08B

STANDER, G. J.
A COMPARISON OF THE INACTIVATION OF ESCHERICHIA COLI AND
POLIOVIRUS IN POLLUTED AND UNPOLLUTED WATERS BY
CHLORINATION,
W69-04778 05D

STANSBY, MAURICE E.
INDUSTRIAL FISHERY TECHNOLOGY,
W69-05055 06B

STARR, JOHN T.
ACHIEVING PUBLIC ACCEPTANCE OF A RIVER BASIN PLAN,
W69-04861 06B

STEAD, FREDERICK L.
POSSIBILITIES FOR DISPOSAL OF INDUSTRIAL WASTES IN
SUBSURFACE ROCKS OF NORTH FLANK OF APPALACHIAN BASIN IN NEW
YORK,
W69-04943 05E

STEELE, HARRY A.
THE NATIONAL WATER RESOURCE ASSESSMENT AND REGIONAL
FRAMEWORK PLANS,
W69-05125 06B

STEWART, RONALD
ON THE MECHANISM OF LANGMUIR CIRCULATIONS AND THEIR ROLE IN
EPILIMNION MIXING,
W69-04929 02H

WAVE INTERACTION AND LANGMUIR CIRCULATIONS,
W69-04930 02H

WATER POLLUTION BY OUTBOARD MOTORS,
W69-04936 02H

THERMAL DISCHARGE BIBLIOGRAPHY,
W69-04937 05B

STIGLER, GEORGE J.
THE ECONOMIES OF SCALE,
W69-04840 06C

STONE, OLIVER L.
LEGAL ASPECTS OF OFFSHORE OIL AND GAS OPERATIONS,
W69-04859 06E

STRAZER, ROBERT J.
SHORING FOR THE SEATTLE FIRST NATIONAL BANK BUILDING,
SEATTLE, WASHINGTON,

W69-04721 08D

STROUP, E. D.
FINAL REPORT ON BALITMORE HARBOR STUDY,
W69-05056 05F

STUMM, WERNER
REDOX EQUILIBRIA AND MEASUREMENTS OF POTENTIALS IN THE AQUATIC ENVIRONMENT,
W69-04972 02K

SUAREZ, GUZMAN R.
FINANCING WATER PROJECTS IN LATIN AMERICA,
W69-04836 06B

SWARTZENDRUBER, D.
CHARACTERIZATION OF THE RATE OF WATER INFILTRATION INTO SOIL,
W69-05143 02G

SYKES, J. F.
MULTIPLE UTILIZATION OF GULF COAST ESTUARIES,
W69-05057 02L

SZESZTAY, K.
HYDROLOGIC BASES OF WATER RESOURCES UTILIZATION OF LAKES,
W69-04957 02H

TAEGER, HERMANN
ON INVESTIGATIONS CONCERNING THE INFLUENCE OF AGRICULTURAL UTILIZATION ON THE RUNOFF FORMATION BY MEANS OF GROUNDWATER-LYSIMETERS,
W69-04951 02G

TAYLOR, D.
SOIL DENSITY MEASUREMENTS WITH GAMMA-RAYS,
W69-04747 08D

TAYLOR, FLOYD B.
WATER SYSTEMS FINANCING--FOUR BASIC APPROACHES,
W69-04824 06C

TAYLOR, S. A.
INFLUENCE OF SOIL WATER POTENTIAL AND ATMOSPHERIC EVAPORATIVE DEMAND ON TRANSPIRATION AND THE ENERGY STATUS OF WATER IN PLANTS.
W69-05088 02I

INFLUENCE OF SOIL TEMPERATURE ON TRANSPIRATION UNDER VARIOUS ENVIRONMENTAL CONDITIONS,
W69-05099 02D

TEW, RONALD K.
PROPERTIES OF SOIL UNDER ASPEN AND HERB-SHRUB COVER,
W69-05097 02G

SOIL MOISTURE DEPLETION BY ASPEN IN CENTRAL UTAH,
W69-05106 02G

SOIL MOISTURE DEPLETION BY GAMBEL OAK IN CENTRAL UTAH,
W69-05107 02G

SOIL MOISTURE DEPLETION BY GAMBEL OAK IN NORTHERN UTAH,
W69-05108 02G

TEW, R. K.
INFLUENCE OF SOIL TEMPERATURE ON TRANSPIRATION UNDER VARIOUS ENVIRONMENTAL CONDITIONS,
W69-05099 02D

THOMANN, ROBERT V.
ESTUARINE WATER QUALITY MANAGEMENT AND FORECASTING,
W69-05059 05B

THOMANN, R. V.
MATHEMATICAL MODEL FOR DISSOLVED OXYGEN,
W69-05058 05B

THOMPSON, C. M.
PROPERTIES OF SALINE RANGE SOILS OF THE RIO GRANDE PLAIN,
W69-05084 02G

THOMPSON, SETON H.
WHAT IS HAPPENING TO OUR ESTUARIES,
W69-05060 06B

TIABLIKOV, IU. R.
STRENGTH OF JOINTS AND JOINT ASSEMBLIES OF REINFORCED CONCRETE MULTISTORY FRAMES UNDER LOADS OF THE SEISMIC TYPE,
W69-04735 08F

TIMBLIN, L. O.
A STUDY OF DEPASSIVATION OF STEEL IN CONCRETE,
W69-047[illegible] 08F

TIMKO, [illegible] T.
A LOW INTENSITY RAIN SIMULATOR FOR LONG DURATION RAIN-ON-SNOW EVENTS,
W69-[illegible] 02B

TIMMONS, JOHN F.
[illegible] OF WATER QUALITY MANAGEMENT,
W69-[illegible] 05[illegible]

TOLLEY, [illegible]
THE IMPACTS OF WATER INVESTMENTS IN DEPRESSED AREAS,
W69-[illegible] 06B

TRAIN[illegible], [illegible]
[illegible] OF THE ABUNDANCE OF [illegible] TRACKS ON AERIAL [illegible],

W69-04987 02F

TSELISHCHEVA, L. K.
INFLUENCE OF THE THICKNESS AND FREE POROSITY OF A DRIED LAYER ON EVAPORATION,
W69-05083 02D

TYREE, S. Y., JR.
THE NATURE OF INORGANIC SOLUTE SPECIES IN WATER,
W69-04967 02K

ULLRICH, RICHARD A.
SEDIMENTARY HISTORY AND ECONOMIC GEOLOGY OF SAN JUAN BASIN, NEW MEXICO AND COLORADO,
W69-04948 05E

UY, M. C.
COST REDUCTION IN DESALTING SEA WATER,
W69-04826 03A

VAN DER BURGH, P.
PREDICTION OF THE EXTENT OF SALTWATER INTRUSION INTO ESTUARIES AND SEAS,
W69-04782 02L

VAN EVERDINGEN, A. F.
FLUID MECHANICS OF DEEP-WELL DISPOSALS,
W69-04928 05E

VAN EVERDINGEN, R. O.
INFLUENCE OF THE SOUTH SASKATCHEWAN RESERVOIR (CANADA) ON PIEZOMETRIC LEVELS IN UNDERLYING BEDROCK AQUIFERS,
W69-04774 02F

VAN HEEMST, H. D. J.
CALCULATION MODEL FOR THE ACTUAL EVAPOTRANSPIRATION FROM CROPPED AREAS AND OTHER TERMS OF THE WATER BALANCE EQUATION
W69-05072 02D

VARGIN, M. N.
EFFECT OF CONTINUOUS SURCHARGE ON A RETAINING WALL,
W69-04740 08D

VASIL'EV, S. P.
STRENGTH OF JOINTS AND JOINT ASSEMBLIES OF REINFORCED CONCRETE MULTISTORY FRAMES UNDER LOADS OF THE SEISMIC TYPE,
W69-04735 08F

VEAL, HARRY K.
POTENTIAL OF DENVER BASIN FOR DISPOSAL OF LIQUID WASTES,
W69-04947 05E

VELZ, C. J.
FORECASTING HEAT LOSS IN PONDS AND STREAMS,
W69-05062 05B

VIGNET, P.
HIGH-CAPACITY DUAL-PURPOSE PLANT FOR GENERATING ELECTRICITY AND PRODUCING FRESH WATER FROM SEA WATER,
W69-04754 03A

VOGT, WINFRIED
CAPITAL ACCUMULATION AND TECHNICAL PROGRESS (GERMAN),
W69-04847 06B

VOLK, SHERRY L.
MINERAL REQUIREMENTS FOR THE GROWTH OF ANABAENA SPIROIDES IN VITRO,
W69-04802 05C

WAGNER, AUBREY J.
THE DYNAMIC CHARACTER OF MULTIPURPOSE RIVER DEVELOPMENT THE TVA EXPERIENCE,
W69-04818 04A

WALTHER, ERIC G.
ON THE MECHANISM OF LANGMUIR CIRCULATIONS AND THEIR ROLE IN EPILIMNION MIXING,
W69-04929 02H

WARNER, DON L.
SUBSURFACE DISPOSAL OF LIQUID INDUSTRIAL WASTES BY DEEP-WELL INJECTION,
W69-04941 05E

WATERS, A. A.
ROAD PRICING, SOME TECHNICAL ASPECTS,
W69-04837 06C

WATERS, O. B., JR.
COST REDUCTION IN DESALTING SEA WATER,
W69-04826 03A

WEAVER, ROBERT L.
PROBABLE MAXIMUM PRECIPITATION OVER SOUTH PLATTE RIVER, COLORADO AND MINNESOTA RIVER, MINNESOTA,
W69-05158 04A

WEBBER, B.
THE CALCULATION OF POLLUTION OF THE THAMES ESTUARY AS A THEORY OF QUANTIZED MIXING,
W69-05041 05B

WEBER, CORNELIUS I.
A BIBLIOGRAPHY ON PERIPHYTON,
W69-05140 10

WEBER, EUGENE W.
RECREATION--A PURPOSE OF WATER RESOURCES DEVELOPMENT,
W69-05067 06B

WEDEL, JORGE C.
IMPORTANCE OF THE ECONOMIC FEASIBILITY OF THE WATER SUPPLY AND SEWER SYSTEM PROJECTS,
W69-04811 06B

WEINBERGER, A. J.
COST REDUCTION IN DESALTING SEA WATER,
W69-04826 03A

WENZEL, HARRY G.
MICROSCOPIC DETERMINATION OF BOUNDARY SHEAR AND SUBLAYER TURBULENCE CHARACTERISTICS IN AN OPEN CHANNEL,
W69-05150 08B

WERTMAN, W. T.
IMMOBILITY OF CONNATE WATER IN PERMEABLE SANDSTONE,
W69-04977 02F

WHITE, GILBERT F.
OPTIMAL FLOOD DAMAGE MANAGEMENT RETROSPECT AND PROSPECT,
W69-05118 06B

WIEBOLS, G. A.
AN ENERGY CRITERION FOR THE STRENGTH OF ROCK IN POLYAXIAL COMPRESSION,
W69-04711 08E

WIERSMA, D.
CHARACTERIZATION OF THE RATE OF WATER INFILTRATION INTO SOIL,
W69-05143 02G

WILDER, HUGH B.
ESTUARIES AND SOUNDS OF NORTH CAROLINA,
W69-04758 02L

WILLARDSON, LYMAN S.
ENTRY VELOCITY CONTROL LIMITS DRAIN SEDIMENTATION,
W69-04720 08B

WILSON, JAMES E.
POSSIBILITIES FOR DISPOSAL OF INDUSTRIAL WASTES IN SUBSURFACE ROCKS OF NORTH FLANK OF APPALACHIAN BASIN IN NEW YORK,
W69-04943 05E

WISSING, THOMAS E.
CALORIFIC VALUES OF SOME INVERTEBRATES IN LAKE MENDOTA, WISCONSIN,
W69-04799 02H

WOLF, HAROLD W.
WATER QUALITY CRITERIA, 2ND EDITION,
W69-05028 05G

WOODBURN, KENNETH D.
A GUIDE TO THE CONSERVATION OF SHORELINES, SUBMERGED BOTTOMS AND SALTWATERS WITH SPECIAL REFERENCE TO BULKHEAD LINES, DREDGING AND FILLING,
W69-05068 04A

YAKOVLEV, N. N.
SOME ASPECTS OF DESIGN AND CONSTRUCTION OF EARTH AND ROCKFILL DAMS IN INDIA,
W69-04742 08D

YAMABE, M.
INDEX METHOD FOR PUMPING OPERATION OF REVERSIBLE PUMP-TURBINE,
W69-04743 08C

YAMAGUCHI, M.
CAPILLARY CONDUCTIVITY AND SOIL WATER DIFFUSIVITY VALUES FROM VERTICAL COLUMNS,
W69-05093 02G

YAMAGUCHI, Y.
INDEX METHOD FOR PUMPING OPERATION OF REVERSIBLE PUMP-TURBINE,
W69-04743 08C

YOSHIMURA, S.
SEASONAL VARIATION IN CONTENT OF NITROGENOUS COMPOUNDS AND PHOSPHATE IN THE WATER OF TAKASUKA POND, SAITAMA, JAPAN,
W69-05142 02H

YOUMANS, RUSSELL C.
ECONOMICS IN REGIONAL WATER RESEARCH AND POLICY,
W69-05124 06B

YOUNG, P. H.
SOME EFFECTS OF SEWER EFFLUENT ON MARINE LIFE,
W69-05069 05C

ZEIZEL, ARTHUR J.
THE HYDROGEOLOGIST'S RESPONSIBILITY -- METROPOLITAN WATER RESOURCE PLANNING,
W69-05114 06B

ZINOVYEVA, E. M.
A NEW METHOD OF MAPPING THE WATER RESOURCES,
W69-04934 02E

ZOBELL, CLAUDE E.
THE OCCURRENCE, EFFECTS, AND FATE OF OIL POLLUTING THE SEA,
W69-05070 05C

ZUNINO, HUGO
EFFECT OF SEAWEED ON THE LEVELS OF AVAILABLE PHOSPHORUS AND NITROGEN IN A CALCAREOUS SOIL,
W69-05136 02K

ZUSMAN, PINHAS
AN EFFICIENT PROGRAM OF WATER RESOURCE DEVELOPMENT IN A FRAMEWORK OF GROWTH AND TRADE,
W69-05127 06B

ORGANIZATIONAL INDEX

AGRICULTURAL RESEARCH SERVICE, BRAWLEY, CALIF. AND AGRICULTURAL RESEARCH SERVICE, COLUMBUS, OHIO.
ENTRY VELOCITY CONTROL LIMITS DRAIN SEDIMENTATION,
W69-04720 08B

AGRICULTURAL RESEARCH SERVICE, CHICKASHA, OKLA. SOUTHERN PLAINS BRANCH.
DETERMINING STREAMFLOW ABSTRACTIONS FROM ANTECEDENT CONDITIONS,
W69-04933 02E

AGRICULTURAL RESEARCH SERVICE, MORRIS, MINN. NORTH CENTRAL SOIL CONSERVATION RESEARCH CENTER SOUTHWEST MINNESOTA AGRICULTURAL EXPERIMENT STATION, LAMBERTON.
TILLAGE INFLUENCES WATER INTAKE,
W69-05089 02G

AGRICULTURAL RESEARCH SERVICE, PULLMAN, WASH. CROPS RESEARCH DIV. AGRICULTURAL RESEARCH SERVICE, BELTSVILLE, MD. CROPS RESEARCH DIV. OREGON STATE UNIV., CORVALLIS.
EFFECTS OF HERBICIDES, BURNING, AND SEEDING DATE IN RESEEDING AN ARID RANGE.
W69-05082 02A

AGRICULTURAL RESEARCH SERVICE, WESLACO, TEX. SOIL AND WATER CONSERVATION RESEARCH DIV. SOIL CONSERVATION SERVICE, HARLINGEN, TEX. SOIL CONSERVATION SERVICE, ALICE, TEX.
PROPERTIES OF SALINE RANGE SOILS OF THE RIO GRANDE PLAIN,
W69-05084 02G

AKADEMIYA NAUK SSSR, MOSCOW. INSTITUT GEOGRAFII.
INFLUENCE OF THE THICKNESS AND FREE POROSITY OF A DRIED LAYER ON EVAPORATION,
W69-05083 02D

ALABAMA MARINE RESOURCES LAB., DAUPHIN ISLAND.
REALISM IN THE MANAGEMENT OF ESTUARIES,
W69-05050 02L

ALBANY LAW SCHOOL, N. Y.
RIPARIAN RIGHTS... ACTION BY STATE TO ENJOIN LANDOWNER FROM FILLING IN LAKE.
W69-04860 06E

ALLIS-CHALMERS MFG. CO., MILWAUKEE, WIS.
SEMI-SYNCHRONOUS STARTING,
W69-04722 08C

ALLIS-CHALMERS MFG. CO., YORK, PA.
VELOCITY DISTRIBUTION AND ITS EFFECT ON THE ACCURACY OF THE GIBSON METHOD OF WATER MEASUREMENT,
W69-04744 08C

ARIZONA STATE UNIV., TEMPE.
'ANOMALOUS' THERMAL CONDITIONS IN A HYPERSALINE INLAND POND,
W69-05078 02H

ARIZONA UNIV., TUCSON.
THE POLITICS OF WATER IN ARIZONA,
W69-05112 06E

AUBURN UNIV, ALA. DEPT. OF AGRICULTURAL ENGINEERING.
DEVELOPING AN IRRIGATION WATER SUPPLY IN THE COASTAL PLAIN,
W69-04749 02F

AUGUSTANA COLL., ROCK ISLAND, ILL. KANSAS STATE GEOLOGICAL SURVEY, LAWRENCE.
SUBSURFACE WASTE-DISPOSAL POTENTIAL IN SALINA BASIN OF KANSAS,
W69-04946 05E

BEREA COLL., KY.
DEEP SEA MANGANESE NODULES FROM SCIENTIFIC PHENOMENON TO WORLD RESOURCE,
W69-04810 06B

BIRMINGHAM UNIV. (ENGLAND)
ROAD PRICING, SOME TECHNICAL ASPECTS,
W69-04837 06C

BIRMINGHAM UNIV. (ENGLAND).
THE EFFECT OF MIX PROPORTIONS AND AGGREGATE DUST UPON THE COMPRESSIVE STRENGTH OF CONCRETE,
W69-04715 08F

BORDEAUX UNIV., (FRANCE).
SURFACE AND SUBTERRANEAN HYDROLOGY IN ITS APPLICATION TO THE STUDY OF THE MODAVE KARSTIC AQUIFER IN BELGIUM (FRENCH),
W69-04762 02E

BUREAU OF RECLAMATION, DENVER, COLO.
A STUDY OF DEPASSIVATION OF STEEL IN CONCRETE,
W69-04725 08F

CONTROL OF SUBMERSED AQUATIC WEEDS IN IRRIGATION CANALS BY DAILY APPLICATIONS OF LOW CONCENTRATIONS OF COPPER SULFATE,
W69-04729 04A

BUREAU OF RECLAMATION, WASHINGTON, D. C.
ESTIMATING CONSUMPTIVE USE - MUNSON P. E. INDEX METHOD,
W69-05094 02D

CAIRO UNIV., GIZA (EGYPT). DEPT. OF IRRIGATION AND HYDRAULICS, MINISTRY OF AGRICULTURE, CAIRO (EGYPT).
CONSUMPTIVE USE OF WATER FOR SOME MAJOR CROPS IN U.A.R. (EGYPT),
W69-05087 02I

CALIFORNIA INST. OF TECH., PASADENA. W. M. KECK LAB. OF ENVIRONMENTAL HEALTH ENGINEERING.
APPLICATION AND LIMITATIONS OF CHEMICAL THERMODYNAMICS IN NATURAL WATER SYSTEMS,
W69-04770 02K

CALIFORNIA UNIV., BERKELEY.
EARTHQUAKE BEHAVIOR OF RESERVOIR-DAM SYSTEMS,
W69-04726 08A

CALIFORNIA UNIV., BERKELEY. DEPT. OF STATISTICS.
AREAL SPREAD OF THE EFFECT OF CLOUD SEEDING AT THE WHITETOP EXPERIMENT,
W69-04775 03B

CALIFORNIA UNIV., BERKELEY. SANITARY ENGINEERING RESEARCH LAB.
THE DIFFERENTIATION, ANALYSIS, AND PRESERVATION OF NITROGEN AND PHOSPHORUS FORMS IN NATURAL WATERS,
W69-05137 05A

CALIFORNIA UNIV., BERKELEY. SANITARY ENGINEERING RESEARCH LAB. CALIFORNIA UNIV., BERKELEY. SCHOOL OF PUBLIC HEALTH.
FACTORS INFLUENCING RADIOSTRONTIUM ACCUMULATION IN DAPHNIA,
W69-05141 05C

CALIFORNIA UNIV., DAVIS.
CAPILLARY CONDUCTIVITY AND SOIL WATER DIFFUSIVITY VALUES FROM VERTICAL COLUMNS,
W69-05093 02G

CALIFORNIA UNIV., DAVIS. DEPT. OF WATER SCIENCE AND ENGINEERING CALIFORNIA UNIV., RIVERSIDE.
POPULATION, GROWTH RATE, AND MATURITY OF VEGETABLE CROPS IN RELATION TO SOIL SALINITY AND TEXTURE UNDER SPRINKLER AND FURROW IRRIGATION,
W69-05074 02I

CALIFORNIA UNIV., DAVIS. DEPT. OF WATER SCIENCE AND ENGINEERING.
HYDROLOGIC MINI-CYCLE FOR SOIL MOISTURE AND SALT CONTROL IN IRRIGATED AGRICULTURE,
W69-05076 03F

CALIFORNIA UNIV., LOS ANGELES. WATER RESOURCES CENTER.
OPTIMUM OPERATIONS FOR PLANNING OF A COMPLEX WATER RESOURCES SYSTEM,
W69-05123 06A

CAMBRIDGE UNIV. (ENGLAND) BOTANY SCHOOL.
THE MECHANISM OF PHOTOSYNTHETIC USE OF BICARBONATE BY HYDRODICTYON AFRICANUM,
W69-04803 02K

CARLETON UNIV., OTTAWA (ONTARIO).
ECONOMICS AND THE CONSERVATION QUESTION,
W69-04841 03B

CARNEGIE-MELLON UNIV, PITTSBURGH, PA., RAND CORP., SANTA MONICA, CALIF.
CONGESTION, TOLLS, AND THE ECONOMIC CAPACITY OF A WATERWAY,
W69-04838 06C

CARNEGIE-MELLON UNIV., PITTSBURGH, PA.
QUADRATIC TEAMS, INFORMATION ECONOMICS, AND AGGREGATE PLANNING DECISIONS,
W69-04843 06B

CENTRAL ARID ZONE RESEARCH INST., JODHPUR (INDIA). DIV. OF RESOURCE UTILIZATION STUDIES.
PHENOLOGICAL ASPECTS OF A FEW PROMISING EUCALYPTUS IN THE ARID ZONE,
W69-05091 02I

CENTRE FRANCAIS D'INFORMATION DE L'EAU.
DOCUMENTATION INFORMATION AND INSTRUCTION CONCERNING THE PROBLEMS OF WATER,
W69-04940 10

CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE, MARSEILLE (FRANCE). GENERAL BIOLOGY AND ECOLOGY LAB. EDF HYDRAULIC GROUP OF SOUTH-ALPS REGION.
1967 AN EXCEPTIONAL YEAR IN THE LIFE OF THE DE BERRE POND (FRENCH),
W69-04958 05C

CHAMBER OF MINES, JOHANNESBURG (SOUTH AFRICA).
AN ENERGY CRITERION FOR THE STRENGTH OF ROCK IN POLYAXIAL COMPRESSION,
W69-04711 08E

CHEVRON RESEARCH CO., LA HABRA, CALIF.
THERMAL INFRARED IMAGERY FOR GEOLOGISTS,
W69-04745 07B

CHICAGO UNIV., ILL.
THE ECONOMIES OF SCALE,
W69-04840 06C

CHILE UNIV., SANTIAGO. FACULTY OF CHEMISTRY AND PHARMACY.
EFFECT OF SEAWEED ON THE LEVELS OF AVAILABLE PHOSPHORUS AND NITROGEN IN A CALCAREOUS SOIL,
W69-05136 02K

CLARKSON COLL. OF TECHNOLOGY, POTSDAM, N. Y. RENSSELAER POLYTECHNIC INST., TROY, N. Y.

FLUID DYNAMICS,
W69-04701 08B

COLUMBIA UNIV., NEW YORK.
BAYESIAN ANALYSIS OF HAAVELMO'S MODELS,
W69-04842 06A

COMMISSARIAT A L'ENERGIE ATOMIQUE, GRENOBLE (FRANCE). CENTRE D'ETUDES NUCLEAIRES' SOCIETE GRENOBLOISE D'ETUDE ET D'APPLICATIONS HYDRAULIQUES (FRANCE).
RISING ACTIVE WATER FLOW IN THE OSIRIS REACTOR POOL (FRENCH),
W69-04959 05C

COMMISSARIAT A L'ENERGIE ATOMIQUE, PARIS (FRANCE).
HIGH-CAPACITY DUAL-PURPOSE PLANT FOR GENERATING ELECTRICITY AND PRODUCING FRESH WATER FROM SEA WATER,
W69-04754 03A

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, CANBERRA (AUSTRALIA). DIV. OF LAND RESEARCH AND REGIONAL SURVEY.
EXPERIENCE WITH THREE VAPOUR METHODS FOR MEASURING WATER POTENTIAL IN PLANTS,
W69-05085 02I

CORNELL UNIV., ITHACA, N. Y.
TOWARD THE OPTIMIZATION OF INVESTMENT-PRICING DECISIONS A MODEL FOR URBAN WATER SUPPLY TREATMENT FACILITIES,
W69-05128 05F

W69-05129 05F

W69-05130 05F

CORPS OF ENGINEERS, ALBUQUERQUE, N. MEX.
FLOOD PLAIN INFORMATION, SANTA FE RIVER, SANTA FE, NEW MEXICO.
W69-04783 04A

CORPS OF ENGINEERS, ANCHORAGE, ALASKA.
FLOOD PLAIN INFORMATION, CAMPBELL CREEK, ANCHORAGE, ALASKA.
W69-04919 04A

FLOOD PLAIN INFORMATION, CHESTER CREEK, ANCHORAGE, ALASKA.
W69-04922 04A

CORPS OF ENGINEERS, BUFFALO, N. Y.
FLOOD PLAIN INFORMATION, CHAGRIN RIVER, LAKE AND CUYAHOGA COUNTIES, OHIO.
W69-04923 04A

FLOOD PLAIN INFORMATION, CUYAHOGA RIVER, BIG CREEK AND TINKERS CREEK, CUYAHOGA COUNTY, OHIO.
W69-04925 04A

CORPS OF ENGINEERS, HONOLULU, HAWAII.
FLOOD PLAIN INFORMATION, PUPUKEA, OAHU, HAWAII.
W69-04920 04A

CORPS OF ENGINEERS, JACKSONVILLE, FLA.
FLOOD PLAIN INFORMATION, CHARLOTTE AND NORTH LEE COUNTIES, FLORIDA.
W69-04918 04A

CORPS OF ENGINEERS, LOS ANGELES, CALIF.
FLOOD PLAIN INFORMATION, LOWER LAS VEGAS WASH, CLARK COUNTY, NEVADA.
W69-04785 04A

FLOOD PLAIN INFORMATION, AGUA FRIA RIVER, MARICOPA COUNTY, ARIZONA.
W69-04921 04A

CORPS OF ENGINEERS, MOBILE, ALA.
FLOOD PLAIN INFORMATION OF PURPLE CREEK IN VICINITY OF JACKSON, MISSISSIPPI.
W69-04924 04A

CORPS OF ENGINEERS, ROCK ISLAND, ILL.
FLOOD PLAIN INFORMATION, BLACK HAWK CREEK, BLACK HAWK COUNTY, IOWA.
W69-04926 04A

CORPS OF ENGINEERS, SACRAMENTO, CALIF. HYDROLOGIC ENGINEERING CENTER.
STREAMFLOW SYNTHESIS FOR UNGAGED RIVERS,
W69-04932 02E

CORPS OF ENGINEERS, ST. PAUL, MINN.
FLOOD PLAIN INFORMATION, CROW RIVER, ROCKFORD, MINNESOTA.
W69-04784 04A

FLOOD PLAIN INFORMATION, SOUTH FORK OF THE CROW RIVER, DELANO, MINNESOTA.
W69-04787 04A

CORPS OF ENGINEERS, VICKSBURG, MISS.
FLOOD PLAIN INFORMATION, MISSISSIPPI AND YAZOO RIVERS, VICKSBURG, MISSISSIPPI.
W69-04786 04A

COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH, PRETORIA, (SOUTH AFRICA).
A COMPARISON OF THE INACTIVATION OF ESCHERICHIA COLI AND POLIOVIRUS IN POLLUTED AND UNPOLLUTED WATERS BY CHLORINATION,
W69-04778 05D

DRESSLYER AND MACNAUGHTON, DALLAS, TEX.
FLUID MECHANICS OF DEEP-WELL DISPOSAL,
W69-04928 05E

DEPARTMENT OF ENERGY, MINES AND RESOURCES, CALGARY (ALBERTA). INLAND WATERS BRANCH.
INFLUENCE OF THE SOUTH SASKATCHEWAN RESERVOIR (CANADA) ON PIEZOMETRIC LEVELS IN UNDERLYING BEDROCK AQUIFERS,
W69-04774 02F

DEPARTMENT OF ENERGY, MINES AND RESOURCES, OTTAWA (ONTARIO). INLAND WATERS BRANCH.
SEDIMENT DATA FOR CANADIAN RIVERS, WATER YEAR 1966.
W69-04766 02J

SURFACE WATER DATA, QUEBEC, WATER YEAR 1966.
W69-04768 02E

SURFACE WATER DATA, BRITISH COLUMBIA, WATER YEAR 1966.
W69-04792 02E

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT, WASHINGTON, D. C.
THE HYDROGEOLOGIST'S RESPONSIBILITY -- METROPOLITAN WATER RESOURCE PLANNING,
W69-05114 06B

EAST PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY, DACCA. WATER INVESTIGATION.
HYDROGRAPHICAL INVESTIGATION OF THE BRAHMAPUTRA RIVER IN EAST PAKISTAN,
W69-04752 02E

BASIC DATA COLLECTION FOR WATER DEVELOPMENT IN EAST PAKISTAN,
W69-04755 07A

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, CINCINNATI, OHIO. DIV. OF POLLUTION SURVEILLANCE.
A BIBLIOGRAPHY ON PERIPHYTON,
W69-05140 10

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, WASHINGTON, D. C.
EFFECTS OF MULTIPLE USES OF WATERSHEDS ON WATER QUALITY,
W69-04702 05B

FLORIDA STATE BOARD OF CONSERVATION, ST. PETERSBURG. MARINE LAB.
A GUIDE TO THE CONSERVATION OF SHORELINES, SUBMERGED BOTTOMS AND SALTWATERS WITH SPECIAL REFERENCE TO BULKHEAD LINES, DREDGING AND FILLING,
W69-05068 04A

FOREST SERVICE (USDA), ALBUQUERQUE, N. MEX. ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION.
GERMINATION OF FOURWING SALTBUSH SEEDS AT DIFFERENT LEVELS OF MOISTURE STRESS,
W69-05081 02I

FOREST SERVICE (USDA), BOISE, IDAHO. INTERMOUNTAIN FOREST AND RANGE EXPERIMENT STATION.
EFFECTS OF SEEDBED TREATMENT ON GRASS ESTABLISHMENT ON LOGGING ROADBEDS IN CENTRAL IDAHO,
W69-05096 04A

NET, ALLWAVE RADIATION AS AN INDEX OF NATURAL SNOWMELT AND SNOWMELT ACCELERATED WITH ALBEDO REDUCING MATERIALS,
W69-05103 02C

CONTROLLING SOIL MOVEMENT FROM STEEP ROAD FILLS,
W69-05105 04A

FOREST SERVICE (USDA), FLAGSTAFF, ARIZ. ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION.
WATER HOLDING CAPACITY OF PONDEROSA PINE FOREST FLOOR LAYERS,
W69-04751 03B

FOREST SERVICE (USDA), FORT COLLINS, COLO. ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION.
PERPETUAL SUCCESSION OF STREAM-CHANNEL VEGETATION IN A SEMIARID REGION,
W69-05080 02D

FOREST SERVICE (USDA), LOGAN UTAH. INTERMOUNTAIN FOREST AND RANGE EXPERIMENT STATION.
PROPERTIES OF SOIL UNDER ASPEN AND HERB-SHRUB COVER,
W69-05097 02G

A HEATING SYSTEM FOR STREAM GAGING STATIONS,
W69-05110 07B

THE INTERMOUNTAIN PRECIPITATION STORAGE GAGE,
W69-05111 07B

FOREST SERVICE (USDA), LOGAN, UTAH. INTERMOUNTAIN FOREST AND RANGE EXPERIMENT STATION.
EVAPORATION RATES IN MOUNTAINOUS TERRAIN,
W69-05098 02D

INFLUENCE OF SOIL TEMPERATURE ON TRANSPIRATION UNDER VARIOUS ENVIRONMENTAL CONDITIONS,
W69-05099 02D

FIELD CORRELATION OF TWO NEUTRON-SCATTERING SOIL MOISTURE METERS,
W69-05100 07B

SOIL MOISTURE DEPLETION BY ASPEN IN CENTRAL UTAH,
W69-05106 02G

SOIL MOISTURE DEPLETION BY GAMBEL OAK IN CENTRAL UTAH,

W69-05107 02G

SNOW LOADS ON ROOFS IN AREAS OF HEAVY SNOWFALL,
W69-05109 02C

FOREST SERVICE (USDA), MOSCOW, IDAHO. INTERMOUNTAIN FOREST AND RANGE EXPERIMENT STATION.
EVAPOTRANSPIRATION AND SOIL-MOISTURE DEPLETION,
W69-05102 02G

FOREST SERVICE(USDA), BOISE, IDAHO. INTERMOUNTAIN FOREST AND RANGE EXPERIMENT STATION.
EFFECT OF EXPOSURE AND LOGGING ON RUNOFF AND EROSION,
W69-05104 04D

FOREST SERVICE, (USDA), LOGAN, UTAH. INTERMOUNTAIN FOREST AND RANGE EXPERIMENT STATION.
THE INFLUENCE OF GROWTH MEDIA, TEMPERATURES, AND LIGHT INTENSITIES ON ASPEN ROOT AND TOP GROWTH,
W69-05101 02G

SOIL MOISTURE DEPLETION BY GAMBEL OAK IN NORTHERN UTAH,
W69-05108 02G

FRENCH CENTRAL HYDRAULIC LAB, FRANCE.
A SCALE MODEL STUDY OF SILTING IN THE VILAINE RIVER DUE TO THE ARZAL DAM (FRENCH),
W69-04795 02A

FRENCH CENTRAL HYDRAULIC LAB.
A STUDY OF THE PHYSICAL PROPERTIES OF VARIOUS FORMS OF VERY FINE SEDIMENTS AND THEIR BEHAVIOR UNDER HYDRODYNAMIC ACTION (FRENCH),
W69-04796 02J

FRESHWATER BIOLOGICAL ASSOCIATION, AMBLESIDE (ENGLAND).
OBSERVATIONS ON THE FORMATION AND BREAKDOWN OF THE OXIDIZED MICROZONE AT THE MUD SURFACE IN LAKES,
W69-05139 02H

GEOLOGICAL SURVEY OF AUSTRALIA, MELBOURNE.
INTERRELATIONSHIP BETWEEN PHYSIOGRAPHY, HYDROLOGY, SEDIMENTATION, AND SALINIZATION OF THE LODDEN RIVER PLAINS, AUSTRALIA,
W69-05079 02A

GEOLOGICAL SURVEY, CARSON CITY, NEV.
WATER RESOURCES APPRAISAL OF THOUSAND SPRINGS VALLEY, ELKO COUNTY, NEVADA,
W69-04791 02E

GEOLOGICAL SURVEY, DENVER, COLO.
MAGNETIC TAPE RECORDING OF GEOPHYSICAL LOGS,
W69-04986 07B

GEOLOGICAL SURVEY, HARRISBURG, PA.
HYDROGEOLOGIC SIGNIFICANCE OF CALCIUM-MAGNESIUM RATIOS IN GROUND WATER FROM CARBONATE ROCKS IN THE LANCASTER QUADRANGLE, SOUTHEASTERN PENNSYLVANIA,
W69-04985 02F

GEOLOGICAL SURVEY, HELENA, MONT.
ANNUAL PEAK DISCHARGES FROM SMALL DRAINAGE AREAS IN MONTANA THROUGH SEPTEMBER 1968,
W69-04927 02E

GEOLOGICAL SURVEY, LAWRENCE, KAN. GEOLOGICAL SURVEY, ALBANY, N. Y.
TWO METHODS OF ESTIMATING BASE FLOW AT UNGAGED STREAM SITES IN KANSAS AND ADJACENT STATES,
W69-04978 02E

GEOLOGICAL SURVEY, LINCOLN, NEBR.
WINTER LOSS AND SPRING RECOVERY OF DISSOLVED SOLIDS IN TWO PRAIRIE-POTHOLE PONDS IN NORTH DAKOTA,
W69-04983 02J

GEOLOGICAL SURVEY, MADISON, WIS.
ANALYTICAL APPROACHES TO COMPUTATION OF DISCHARGE OF AN ICE-COVERED STREAM,
W69-04975 02E

THE UNDERSIDE OF RIVER ICE, ST. CROIX RIVER, WISCONSIN,
W69-04976 02C

GEOLOGICAL SURVEY, MENLO PARK, CALIF.
CHEMICAL CHARACTERISTICS OF BULK PRECIPITATION IN THE MOJAVE DESERT REGION, CALIFORNIA,
W69-04982 02K

GEOLOGICAL SURVEY, OCALA, FLA.
SHORELINE FEATURES AS INDICATORS OF HIGH LAKE LEVELS,
W69-04984 02H

GEOLOGICAL SURVEY, RALEIGH, N. C.
ESTUARIES AND SOUNDS OF NORTH CAROLINA,
W69-04758 02L

GEOLOGICAL SURVEY, SACRAMENTO, CALIF.
BED-MATERIAL MOVEMENT, MIDDLE FORK EEL RIVER, CALIFORNIA,
W69-04980 02J

GEOLOGICAL SURVEY, TRENTON, N.J.
THE CONSTRUCTION AND USE OF FLOW-VOLUME CURVES,
W69-04979 02E

GEOLOGICAL SURVEY, WASHINGTON, DC.
GROUND WATER PERSPECTIVES AND PROSPECTS,
W69-04794 02F

GEOLOGICAL SURVEY, WASHINGTON, D. C.
NEW THRUSTS IN GROUND WATER,
W69-04793 02F

NOTE ON THE STANDARD ERROR OF THE COEFFICIENT OF SKEWNESS,
W69-04807 06A

SUMMARY AND ANALYSIS OF SEDIMENT RECORDS IN RELATION TO ST. LOUIS HARBOR SEDIMENTATION PROBLEM,
W69-04938 02J

CHARACTERISTICS OF SUMMER BASE FLOW OF THE POTOMAC RIVER,
W69-04981 02E

MEASUREMENT OF THE ABUNDANCE OF FRACTURE TRACES ON AERIAL PHOTOGRAPHS,
W69-04987 02F

GEOLOGICAL SURVEY, WASHINGTON, D. C. BUREAU OF MINES, MORGANTOWN, W. VA., PETROLEUM RESEARCH LAB.
IMMOBILITY OF CONNATE WATER IN PERMEABLE SANDSTONE,
W69-04977 02F

GEORGIA INST. OF TECH., ATLANTA. FRENCH TEXTILE SCHOOL.
DETERMINATION, EVALUATION AND ABATEMENT OF COLOR IN TEXTILE PLANT EFFLUENTS,
W69-04756 05B

GIDROMETEOROLOGICHESKII INSTITUT, LENINGRAD (USSR).
ESTIMATION OF MAXIMUM DISCHARGES AND HYDROGRAPHS OF FLOOD,
W69-04955 02E

GLENFIELD AND KENNEDY LTD., KILMARNOCK (SCOTLAND).
FLOW AND CAVITATION CHARACTERISTICS OF CONTROL VALVES,
W69-04716 08C

HAILE SELLASSIE I UNIV., ADDIS ABABA (ETHIOPIA).
SPATIAL PATTERN OF SHRUBS ON A DESERT PLAIN IN ETHIOPIA,
W69-05077 02I

HAMBURG UNIV. (WEST GERMANY).
INFLATION AND INCOME DISTRIBUTION (GERMAN),
W69-04851 06C

HARVARD UNIV., CAMBRIDGE, MASS.
OPERATING POLICIES FOR IRRIGATION SYSTEMS UNDER STOCHASTIC REGIMES,
W69-05131 06A

OPERATING POLICIES FOR IRRIGATION SYSTEMS UNDER STOCHASTIC REGIMES DYNAMIC PROGRAMMING MODEL,
W69-05132 06A

OPERATING POLICIES FOR IRRIGATION SYSTEMS UNDER STOCHASTIC REGIMES SEQUENTIAL LINEAR PROGRAMMING MODEL,
W69-05133 06A

HARVARD UNIV., CAMBRIDGE, MASS. DIV. OF ENGINEERING AND APPLIED PHYSICS.
REDOX EQUILIBRIA AND MEASUREMENTS OF POTENTIALS IN THE AQUATIC ENVIRONMENT,
W69-04972 02K

HARZA ENGINEERING CO., CHICAGO, ILL. TACOMA DEPT. OF PUBLIC UTILITIES, WASH.
THE MOSSYROCK DEVELOPMENT,
W69-04737 08A

HAWAII INST. OF GEOPHYSICS, HONOLULU.
AN OPTIMIZATION CRITERION FOR MULTI-SPECTRAL PHOTOGRAPHY,
W69-05144 07C

GEOPHYSICAL STUDIES FOR VOLCANOLOGICAL GEOHYDROLOGY,
W69-05145 07B

HEBREW UNIV., JERUSALEM (ISRAEL) RESOURCES FOR THE FUTURE, INC., WASHINGTON, D. C.
AN EFFICIENT PROGRAM OF WATER RESOURCE DEVELOPMENT IN A FRAMEWORK OF GROWTH AND TRADE,
W69-05127 06B

HITACHI LTD., HITACHI CITY (JAPAN).
INDEX METHOD FOR PUMPING OPERATION OF REVERSIBLE PUMP-TURBINE,
W69-04743 08C

HYDERGUDA, HYDERABAD (INDIA).
RATIO METHOD FOR DETERMINING CHARACTERISTICS OF IDEAL, LEAKY, AND BOUNDED AQUIFERS,
W69-04763 02F

HYDROMETEOROLOGICAL CENTRE (USSR).
INLET HYDROGRAPH ESTIMATION FOR LINEAR FLOW MODELS ACCORDING TO OUTLET HYDROGRAPH,
W69-04961 02A

ILLINOIS STATE WATER SURVEY, URBANA ILLINOIS UNIV., URBANA.
HYDRAULIC GEOMETRY OF ILLINOIS STREAMS,
W69-05153 08B

ILLINOIS STATE WATER SURVEY, URBANA.
A CLIMATOLOGICAL-TECHNOLOGICAL METHOD FOR ESTIMATING IRRIGATION WATER REQUIREMENTS FOR MAXIMUM CROP YIELDS,
W69-04750 03F

ILLINOIS UNIV., URBANA.
FURTHER STUDY OF AQUIFER PERFORMANCE,
W69-05149 02A

MICROSCOPIC DETERMINATION OF BOUNDARY SHEAR AND SUBLAYER TURBULENCE CHARACTERISTICS IN AN OPEN CHANNEL,
W69-05150 08B

INDIANA UNIV., BLOOMINGTON.
WATER LAW AND PRIVATE DECISION MAKING A CRITIQUE,
W69-04839 06B

INSTITUT FUER WASSERWIRTSCHAFT, BERLIN (EAST GERMANY).
A METHOD OF DETERMINING THE AVAILABLE SURFACE WATER RESOURCES,
W69-04950 02E

ON INVESTIGATIONS CONCERNING THE INFLUENCE OF AGRICULTURAL UTILIZATION ON THE RUNOFF FORMATION BY MEANS OF GROUNDWATER-LYSIMETERS,
W69-04951 02G

THE DISCHARGE RECESSION AS CRITERION ON THE RETENTION CAPACITY OF BASINS,
W69-04953 02E

INTERNATIONAL RICE RESEARCH INST., LOS BANOS, LAGUNA (PHILIPPINES).
THE FATE OF NITRATE NITROGEN IN SOME TROPICAL SOILS FOLLOWING SUBMERGENCE,
W69-05138 02K

INTERSTATE COMMISSION ON THE POTOMAC RIVER BASIN, WASHINGTON, D. C.
COMMERCIAL AND SPORT FISHERIES,
W69-05002 03E

BOAT AND MARINA WASTES,
W69-05009 05G

WATER QUALITY IN THE POTOMAC ESTUARY,
W69-05027 05G

SEDIMENT,
W69-05029 04D

AQUATIC PLANT NUISANCES,
W69-05043 04A

IOWA STATE UNIV., AMES.
GEOLOGY OF THE REGOLITH AQUIFERS OF THE NISHNABOTNA BASIN,
W69-04781 02F

IOWA UNIV, IOWA CITY. DEPT. OF CIVIL ENGINEERING.
THE EFFECT OF PHOTOSYNTHESIS ON THE OXYGEN BALANCE IN A MIDWESTERN STREAM,
W69-04780 05C

IRRIGATION AND DRAINAGE ENGINEERING OFFICE, VERACRUZ (MEXICO).
DETERMINATION OF THE REGIONAL COEFFICIENT 'K' FOR COMPUTING THE CONSUMPTIVE USE OF NATIVE BLACK KIDNEY BEAN IN THE IRRIGATION DISTRICTS OF VERACRUZ STATE,
W69-05086 02I

JOHNS HOPKINS UNIV., BALTIMORE, MD. CHESAPEAKE BAY INST.
FINAL REPORT ON BALITMORE HARBOR STUDY,
W69-05056 05F

LJUBLJANA UNIV. (YUGOSLAVIA).
STATIC AND KINEMATIC CONDITIONS OF THE STABILITY OF JOINTED AND FISSURED ROCKY FOUNDATIONS OF ARCH DAMS,
W69-04713 08E

MARSEILLES WATER CO. (FRANCE).
MANPOWER PROBLEMS IN WATER SUPPLY ORGANIZATION,
W69-04779 06E

MASSACHUSETTS INST. OF TECH., CAMBRIDGE.
THE ANATOMY OF MARKET FAILURE,
W69-04855 06C

MIAMI UNIV., FLA. INST. OF MARINE SCIENCE.
THE STRUCTURE OF WATER AND WATER-SOLUTE INTERACTIONS,
W69-04965 02K

MICHIGAN UNIV, ANN ARBOR.
GEOLOGY OF SUBSURFACE WASTE DISPOSAL IN MICHIGAN BASIN,
W69-04945 05E

MINISTRY OF WATER AND POWER, TEHRAN (IRAN).
THE GENERAL POLICY OF THE IRANIAN MINISTRY OF WATER AND POWER IN DEVELOPMENT OF WATER RESOURCES,
W69-04753 04A

MINNESOTA UNIV., MINNEAPOLIS.
TENTATIVE DESIGN PROCEDURES FOR RIPRAP-LINED CHANNELS,
W69-04727 08B

MONTANA STATE UNIV., MISSOULA EL PASO NATURAL GAS CO., TEX. TEXACO, INC., FARMINGTON, N. MEX.
SEDIMENTARY HISTORY AND ECONOMIC GEOLOGY OF SAN JUAN BASIN, NEW MEXICO AND COLORADO,
W69-04948 05E

MOSCOW STATE UNIV.(USSR). DEPT. OF LAND HYDROLOGY.
SEASONAL DISTRIBUTION AND REGULATION FOR FLOW RIVERS OF MOUNTAIN COUNTRIES,
W69-04935 02E

NATIONAL BUREAU OF STANDARDS, WASHINGTON, D. C.
HETEROGENEOUS EQUILIBRIA INVOLVING OXIDES, HYDROXIDES, CARBONATES, AND HYDROXIDE CARBONATES,
W69-04963 02K

NATIONAL RESEARCH COUNCIL OF CANADA, OTTAWA (ONTARIO).
PARTICLE SIZE AS A BASIS FOR PREDICTING FROST ACTION IN SOILS,
W69-04739 02C

NEBRASKA UNIV., LINCOLN. DEPT. OF HORTICULTURE AND FORESTRY.
EVAPOTRANSPIRATION-REVIEW OF RESEARCH,
W69-04764 02D

NEVADA UNIV., RENO. DESERT RESEARCH INST.
THEORETICAL FRAMEWORK FOR ASCERTAINING PORE WATER PRESSURE IN CONFINING LAYERS IN THE VICINITY OF A PUMPING WELL,
W69-04767 02F

A LOW INTENSITY RAIN SIMULATOR FOR LONG DURATION RAIN-ON-SNOW EVENTS,
W69-04939 02B

NEW MEXICO UNIV., ALBUQUERQUE.
WATER TRANSFER PROBLEMS LAW,
W69-05117 06B

NEW SOUTH WALES UNIV., KENSINGTON (AUSTRALIA).
NOTE ON THE UNBIASEDNESS OF A MIXED REGRESSION ESTIMATOR,
W69-04845 06A

NORTH CAROLINA UNIV., CHAPEL HILL.
THE NATURE OF INORGANIC SOLUTE SPECIES IN WATER,
W69-04967 02K

NORTHERN ILLINOIS UNIV., DEKALB. DEPT. OF EARTH SCIENCES.
A STUDY OF WATER RESOURCES IN THE CANBERRA AREA AND THE QUEANBEYAN RIVER WATERSHED (GOOGONG DAM CATCHMENT),
W69-04757 02E

NORTHERN RESEARCH INST. OF HYDRAULIC ENGINEERING AND RECLAMATION, KAZAN(USSR). DEPT. OF HYDROLOGY AND WATER RESOURCES.
A NEW METHOD OF MAPPING THE WATER RESOURCES,
W69-04934 02E

NORTHWESTERN UNIV., EVANSTON, ILL. BERMUDA BIOLOGICAL STATIONS, ST. GEORGE'S WEST.
ORIGIN OF THE CHEMICAL COMPOSITIONS OF SOME SPRINGS AND LAKES,
W69-04969 02K

NOTTINGHAM UNIV. (ENGLAND). DEPT OF HORTICULTURE.
EFFECTS OF PHENYLMERCURIC ACETATE ON TRANSPIRATION AND GROWTH OF SMALL PLOTS OF GRASS,
W69-05071 02D

NOTTINGHAM UNIV. (ENGLAND). DEPT. OF HORTICULTURE.
MEASUREMENT OF THE WATER POTENTIAL OF INTACT PLANT TISSUES III. THE WATER POTENTIALS OF GERMINATING PEAS (PISUM SATIVUM L.),
W69-05095 02I

OAK RIDGE NATIONAL LAB., OAK RIDGE, TENN. HEALTH PHYSICS DIV.
IMPORTANCE OF DEEP PERMEABLE DISPOSAL FORMATIONS IN LOCATIC OF A LARGE NUCLEAR-FUEL REPROCESSING PLANT,
W69-04942 05E

OAK RIDGE NATIONAL LAB., TENN.
LINEAR--A COMPUTER PROGRAM TO FIT DATA EASILY TO MANY MODEL BY THE WEIGHTED LINEAR LEAST-SQUARES METHOD,
W69-04797 07C

OESTERREICHISCHE ELEKTRIZITAETSWIRTSCHAFTS A.G., VIENNA.
WATER POWER LINKS RIPARIANS - AUSTRIA CONTRIBUTES TO INTERNATIONAL COOPERATION,
W69-04777 06E

OHIO STATE UNIV., COLUMBUS. WATER RESOURCES CENTER.
ANNUAL REPORT, FISCAL YEAR 1968,
W69-05160 09D

ONTARIO AGRICULTURAL COLL., GUELPH. SCHOOL OF AGRICULTURAL ENGINEERING CESKOSLOVENSKA AKADEMIE VED, PRAGUE. INST. OF HYDRODYNAMICS.
AN HOURLY WATER BALANCE MODEL AS A BASIS FOR CONTINUOUS WATER RESOURCES ASSESSMENT ON A WATERSHED,
W69-04954 02A

ONTARIO WATER RESOURCES COMMISSION, TORONTO, BIOLOGY BRANCH.
DISTRIBUTION, ENVIRONMENTAL REQUIREMENTS AND SIGNIFICANCE O CLADOPHORA IN THE GREAT LAKES,
W69-04798 02H

OREGON STATE UNIV., CORVALLIS. DEPT. OF AGRICULTURAL ECONOMICS.
ECONOMICS IN REGIONAL WATER RESEARCH AND POLICY,
W69-05124 06B

OREGON STATE UNIV., CORVALLIS. DEPT. OF BOTANY.
MINERAL REQUIREMENTS FOR THE GROWTH OF ANABAENA SPIROIDES I VITRO,
W69-04802 05C

PAKISTAN ATOMIC ENERGY COMMISSION, KARACHI.
PROSPECTS OF DESALINATION FOR SOLVING WATER PROBLEMS ON THE MAKRAN COAST,
W69-04776 03A

PAN AMERICAN HEALTH ORGANIZATION, WASHINGTON, D. C. WORLD HEALTH ORGANIZATION, GENEVA (SWITZERLAND).
WATER FOR FLUORIDES,
W69-04769 05F

PENINSULAR CHEM RESEARCH, GAINESVILLE, FLA.
SYNTHESIS AND EVALUATION OF NEW MEMBRANE CANDIDATES FOR APPLICATION IN REVERSE OSMOSIS,

W69-05157 03A

PENNSYLVANIA STATE UNIV., UNIVERSITY PARK.
WASTE WATER CONSERVATION AND RENOVATION RESEARCH,
W69-04748 05D

CHEMICAL MEASUREMENT OF MEAN TEMPERATURE,
W69-04765 07A

PENNSYLVANIA STATE UNIV., UNIVERSITY PARK. INST. FOR RESEARCH ON LAND AND WATER RESOURCES.
AN ECONOMIC ANALYSIS OF WATER UTILIZATION IN PENNSYLVANIA,
W69-05154 06D

MICROBIOLOGIC AND ESCHERICHIA COLI SEROLOGIC TRACING OF MICROBIAL POLLUTION,
W69-05155 05B

PORTLAND CEMENT ASSOCIATION, SKOKIE, ILL.
FATIGUE TESTS OF REINFORCING BARS--EFFECT OF DEFORMATION PATTERN,
W69-04706 08F

A REVIEW OF FIBER REINFORCEMENT OF PORTLAND CEMENT PASTE, MORTAR, AND CONCRETE,
W69-04708 08F

PRINCETON UNIV., N. J. DEPT. OF GEOLOGICAL ENGINEERING
ATOMIC ENERGY COMMISSION, WASHINGTON, D. C.
POSSIBILITIES FOR SUBSURFACE WASTE DISPOSAL IN A STRUCTURAL SYNCLINE IN PENNSYLVANIA,
W69-04944 05E

PUBLIC HEALTH SERVICE, WASHINGTON, D. C.
NITROGEN AND PHOSPHORUS IN WATER AN ANNOTATED BIBLIOGRAPHY OF THEIR BIOLOGICAL EFFECTS.
W69-04805 05C

PURDUE UNIV., LAFAYETTE, IND.
CHARACTERIZATION OF THE RATE OF WATER INFILTRATION INTO SOIL,
W69-05143 02G

RAJASTHAN UNIV., JAIPUR (INDIA). DEPT. OF PHYSICS.
THERMAL CONDUCTIVITY OF TWO-PHASE POROUS MATERIALS DRY SOILS,
W69-04949 07B

REGENSBURG UNIV. (WEST GERMANY).
CAPITAL ACCUMULATION AND TECHNICAL PROGRESS (GERMAN),
W69-04847 06B

RESEARCH AND ADVISORY INST. FOR FIELD CROP AND GRASSLAND HUSBANDRY, WAGENINGEN (NETHERLANDS).
CALCULATION MODEL FOR THE ACTUAL EVAPOTRANSPIRATION FROM CROPPED AREAS AND OTHER TERMS OF THE WATER BALANCE EQUATION,
W69-05072 02D

RESEARCH INST. FOR WATER RESOURCES DEVELOPMENT, BUDAPEST (HUNGARY).
HYDROLOGIC BASES OF WATER RESOURCES UTILIZATION OF LAKES,
W69-04957 02H

RESOURCES FOR THE FUTURE, INC, WASHINGTON, D. C.
PLANNING A WATER QUALITY MANAGEMENT SYSTEM THE CASE OF THE POTOMAC ESTUARY,
W69-05116 06B

RESOURCES FOR THE FUTURE, INC., WASHINGTON, D. C.
MARINE RESOURCES AND THE FREEDOM OF THE SEAS,
W69-04808 06E

WATER RESEARCH,
W69-05115 06B

POLICY PROBLEMS IN THE FIELD OF WATER RESOURCES,
W69-05119 06B

RESOURCES FOR THE FUTURE, INC., WASHINGTON, D. C. CHICAGO UNIV., ILL.
OPTIMAL FLOOD DAMAGE MANAGEMENT RETROSPECT AND PROSPECT,
W69-05118 06B

RESOURCES FOR THE FUTURE, INC., WASHINGTON, D. C. NORTH CAROLINA STATE UNIV., RALEIGH.
THE IMPACTS OF WATER INVESTMENTS IN DEPRESSED AREAS,
W69-05120 06B

RICE UNIV., HOUSTON, TEX.
A NOTE ON THE VARIANCE OF A MATRIX,
W69-04844 06A

RIJKSWATERSTAAT-SERVICE FOR THE DELTA WORKS, THE HAGUE (NETHERLANDS).
PREDICTION OF THE EXTENT OF SALTWATER INTRUSION INTO ESTUARIES AND SEAS,
W69-04782 02L

ROBERT A. TAFT SANITARY ENGINEERING CENTER, CINCINNATI, OHIO.
ALGAL GROWTH AQUEOUS FACTORS OTHER THAN NITROGEN AND PHOSPHORUS,
W69-04801 05C

ROBERT A. TAFT SANITARY ENGINEERING CENTER, CINCINNATI, OHIO. CINCINNATI WATER RESEARCH LAB.
SUBSURFACE DISPOSAL OF LIQUID INDUSTRIAL WASTES BY DEEP-WELL INJECTION,
W69-04941 05E

ROYAL INST. OF TECH., STOCKHOLM (SWEDEN).
MASTER VARIABLES AND ACTIVITY SCALES,
W69-04963 02K

GIBBS PHASE RULE AND MARINE SEDIMENTS,
W69-04964 02K

SCRIPPS INSTITUTION OF OCEANOGRAPHY, LAJOLLA, CALIF.
SOME PH-CONTROLLING REDOX REACTIONS IN NATURAL WATERS,
W69-04973 02K

SHANNON AND WILSON, SEATTLE, WASH.
SHORING FOR THE SEATTLE FIRST NATIONAL BANK BUILDING, SEATTLE, WASHINGTON,
W69-04721 08D

SHELL CANADIAN EXPLORATION CO., HOUSTON, TEX. TIDEWATER OIL CO., PITTSBURGH, PA. CONSOLIDATED GAS SUPPLY CORP., CLARKSBURG, W. VA.
POSSIBILITIES FOR DISPOSAL OF INDUSTRIAL WASTES IN SUBSURFACE ROCKS OF NORTH FLANK OF APPALACHIAN BASIN IN NEW YORK,
W69-04943 05E

SOUTHERN GREAT PLAINS WATERSHED RESEARCH CENTER, CHICKASHA, OKLA.
ELECTRONIC DATA PROCESSING SYSTEM FOR STREAMFLOW,
W69-04759 07C

SOUTHERN RESEARCH INST., BIRMINGHAM, ALA.
DEVELOPMENT OF TRANSPORT DEPLETION PROCESSES,
W69-05156 03A

STANFORD UNIV., CALIF.
AQUEOUS SURFACE CHEMISTRY OF OXIDES AND COMPLEX OXIDE MINERALS,
W69-04966 02K

STATE INST. OF HYDROLOGY AND METEOROLOGY, WARSAW (POLAND).
WATER BALANCE OF LAKE AFFECTED BY SEA (FRENCH),
W69-04960 02H

STATE UNIV. OF NEW YORK, ALBANY. ATMOSPHERIC SCIENCES RESEARCH CENTER.
ON THE MECHANISM OF LANGMUIR CIRCULATIONS AND THEIR ROLE IN EPILIMNION MIXING,
W69-04929 02H

WAVE INTERACTION AND LANGMUIR CIRCULATIONS,
W69-04930 02H

THERMAL STRUCTURE AND VERTICAL HEAT TRANSPORT IN LANGMUIR CIRCULATIONS,
W69-04931 02H

WATER POLLUTION BY OUTBOARD MOTORS,
W69-04936 02H

THERMAL DISCHARGE BIBLIOGRAPHY,
W69-04937 05B

SUMITOMO ELECTRIC INDUSTRIES LTD., OSAKA, (JAPAN).
POLYAMIDE-IMIDE INSULATION VARNISH,
W69-04719 08G

SUN OIL CO., DENVER, COLO. WOLF EXPLORATION CO., DALLAS, TEX.
POTENTIAL OF DENVER BASIN FOR DISPOSAL OF LIQUID WASTES,
W69-04947 05E

SYRACUSE UNIV., N. Y. DEPT. OF GEOLOGY.
EQUILIBRIUM MODELS AND COMPOSITION OF THE GREAT LAKES,
W69-04970 02K

TAIWAN PROVINCIAL GOVERNMENT. PUBLIC WORKS BUREAU.
IMPROVEMENT OF WATER RESOURCES UTILIZATION FOR PUBLIC WATER SUPPLY IN TAIWAN,
W69-04760 06B

TECHNION - ISRAEL INST. OF TECH., HAIFA CALIFORNIA UNIV., BERKELEY.
THE CONJUNCTIVE USE OF SURFACE AND GROUND WATERS,
W69-05135 06A

TEHRAN REGIONAL WATER AUTHORITY, (IRAN).
WATER SUPPLY SCHEME OF GREATER TEHRAN CITY,
W69-04761 06D

TEXAS A AND M UNIV., COLLEGE STATION. DEPT. OF BIOLOGY.
UNUSUAL PHOSPHORUS SOURCE FOR PLANKTON ALGAE,
W69-04800 05B

TEXAS TECHNOLOGICAL COLL., LUBBOCK. DEPT. OF AGRICULTURAL ECONOMICS.
GROUNDWATER UTILIZATION AND TAX POLICY,
W69-05126 06C

TOKYO IMPERIAL UNIV. (JAPAN). GEOGRAPHICAL INST.
SEASONAL VARIATION IN CONTENT OF NITROGENOUS COMPOUNDS AND PHOSPHATE IN THE WATER OF TAKASUKA POND, SAITAMA, JAPAN,
W69-05142 02H

TRAVELERS INSURANCE CO, HARTFORD, CONN.
WEATHER MODIFICATION, PRESENT AND FUTURE,
W69-04717 03B

TRINITY COLL., OXFORD (ENGLAND).
DIRECT VERSUS INDIRECT TAXATION,
W69-04848 06C

TRW SYSTEMS, REDONDO BEACH, CALIF.
PLANNED UTILIZATION OF WATER RESOURCES,

W69-04952 02E

UNIVERSIDAD DE LA REPUBLICA, MONTEVIDEO (URUGUAY). FACULTAD DE INGENIERIA AGRIMENSURA NEW YORK UNIV., N. Y. COURANT INST. OF MATHEMATICAL SCIENCES.
LOCALIZED SCOUR IN ERODIBLE-BED CHANNELS,
W69-04788 02J

UNIVERSITY OF SOUTH FLORIDA, TAMPA.
COORDINATION CHEMISTRY OF THE OCEANS,
W69-04971 02K

UNIVERSITY OF STRATHCLYDE, GLASGOW (SCOTLAND).
SOIL DENSITY MEASUREMENTS WITH GAMMA-RAYS,
W69-04747 08D

UTAH STATE UNIV., LOGAN.
SOME NEIGHBORHOOD EFFECTS OF OIL-SHALE DEVELOPMENT,
W69-04854 06C

INFLUENCE OF SOIL WATER POTENTIAL AND ATMOSPHERIC EVAPORATIVE DEMAND ON TRANSPIRATION AND THE ENERGY STATUS OF WATER IN PLANTS.
W69-05088 02I

VIRGINIA POLYTECHNIC INST., BLACKSBURG.
DEMAND FOR WATER RECREATION,
W69-05121 06D

VIRGINIA UNIV., CHARLOTTESVILLE.
THE PROBLEM OF SOCIAL COST,
W69-04850 06C

POSITIVE ECONOMICS, WELFARE ECONOMICS, AND POLITICAL ECONOMY,
W69-04852 06B

WASHINGTON UNIV., SEATTLE COLORADO UNIV., BOULDER KANSAS UNIV., LAWRENCE.
QUALITATIVE ECONOMICS AND THE SCOPE OF THE CORRESPONDENCE PRINCIPLE,
W69-04806 06B

WASHINGTON UNIV., SEATTLE.
AN ECONOMIC EVALUATION OF ALTERNATIVE METHODS OF FISHERY REGULATION,
W69-04849 06B

WASSERWIRTSCHAFTSDIREKTION, COTTBUS (EAST GERMANY).
CONTRIBUTION CONCERNING THE FLOW RATES OF RIVERS TRANSPORTING DRAIN WATERS OF OPEN-CAST MINES,
W69-04956 04C

WATER RESOURCES COUNCIL, WASHINGTON, D. C.
THE NATIONAL WATER RESOURCE ASSESSMENT AND REGIONAL FRAMEWORK PLANS,
W69-05125 06B

WATERLOO UNIV. (ONTARIO).
WIND-DRIVEN SUMMER CIRCULATION IN THE GREAT LAKES,
W69-04789 02H

WEATHER BUREAU, SILVER SPRING, MD.
PROBABLE MAXIMUM PRECIPITATION OVER SOUTH PLATTE RIVER, COLORADO AND MINNESOTA RIVER, MINNESOTA,
W69-05158 04A

WEIZMANN INST. OF SCIENCE, REHOVOTH (ISRAEL).
FACTORS AFFECTING BIOLOGICAL CLOGGING OF SAND ASSOCIATED WITH GROUND WATER RECHARGE,
W69-05075 03C

WESTINGHOUSE ELECTRIC CORP., PITTSBURGH, PA.
DEVELOPMENT OF A LOW-COST IRON-BASE ALLOY TO RESIST CORROSION IN HOT SEA WATER,
W69-04771 03A

WILLCOX, RAIKES AND MARSHALL, CONSULTING ENGINEERS (GT. BRIT.).
OPERATION OF A RECHARGE BOREHOLE,
W69-04723 04B

WISCONSIN STATE BAR, MADISON.
CURRENT TRENDS IN WISCONSIN'S WATER LAW,
W69-05161 06E

WISCONSIN UNIV., MADISON.
THE INTERPRETATION AND ESTIMATION OF COBB-DOUGLAS FUNCTIONS,
W69-04853 06A

WISCONSIN UNIV., MADISON. DEPT. OF ZOOLOGY.
DEVELOPMENT AND STATUS OF POND FERTILIZATION IN CENTRAL EUROPE,
W69-04804 05G

WISCONSIN UNIV., MADISON. LAB. OF LIMNOLOGY.
CALORIFIC VALUES OF SOME INVERTEBRATES IN LAKE MENDOTA, WISCONSIN,
W69-04799 02H

WISCONSIN UNIV., MADISON. WATER CHEMISTRY LAB.
BIOLOGICAL ACTIVITY IN RELATION TO THE CHEMICAL EQUILIBRIUM COMPOSITION OF NATURAL WATERS,
W69-04974 02K

WORLD BANK, WASHINGTON, D. C.
WATER AND ECONOMIC DEVELOPMENT.
W69-04825 06B

W69-04829 06B

WORLD HEALTH ORGANIZATION, GENEVA (SWITZERLAND).
BASIC DATA FOR WATER PROGRAMMES SOCIAL AND ECONOMIC CHARACTERISTICS FOR WATER PROGRAMMES.
W69-04832 06B

ECONOMICS AND FINANCE OF WATER PROGRAMMES ECONOMIC ANALYSIS, FINANCIAL ANALYSIS, FINANCING.
W69-04833 06D

WUERZBURG UNIV. (WEST GERMANY).
HOMOGENEOUS, ESPECIALLY LINEAR HOMOGENEOUS, PRODUCTION FUNCTIONS AND THE LAW OF YIELD (GERMAN),
W69-04846 06B

ACCESSION NUMBER INDEX

8B	W69-04701
5B	W69-04702
4B	W69-04704
8F	W69-04706
8F	W69-04708
0A	W69-04710
8E	W69-04711
8E	W69-04713
8F	W69-04715
8C	W69-04716
3B	W69-04717
8A	W69-04718
8G	W69-04719
8B	W69-04720
8D	W69-04721
8C	W69-04722
4B	W69-04723
8F	W69-04725
8A	W69-04726
8B	W69-04727
9A	W69-04729
8F	W69-04735
8A	W69-04737
8A	W69-04738
2C	W69-04739
9D	W69-04740
5B	W69-04741
8D	W69-04742
8C	W69-04743
8C	W69-04744
7B	W69-04745
9D	W69-04746
9D	W69-04747
5D	W69-04748
8F	W69-04749
9F	W69-04750
9B	W69-04751
2E	W69-04752
0A	W69-04753
0A	W69-04754
7A	W69-04755
5B	W69-04756
2E	W69-04757
2L	W69-04758
7C	W69-04759
4B	W69-04760
0D	W69-04761
2E	W69-04762
9F	W69-04763
2D	W69-04764
7A	W69-04765
2J	W69-04766
2F	W69-04767
2E	W69-04768
9F	W69-04769
2K	W69-04770
7A	W69-04771
2F	W69-04774
9B	W69-04775
0A	W69-04776
2E	W69-04777
0D	W69-04778
2E	W69-04779
0C	W69-04780
2F	W69-04781
2L	W69-04782
0A	W69-04783
0A	W69-04784
0A	W69-04785
0A	W69-04786
0A	W69-04787
2J	W69-04788
0H	W69-04789
0A	W69-04790
2E	W69-04791
2E	W69-04792
2F	W69-04793
2F	W69-04794
0A	W69-04795
2J	W69-04796
0C	W69-04797
0H	W69-04798
0H	W69-04799
9B	W69-04800
0C	W69-04801
0C	W69-04802
9K	W69-04803
9G	W69-04804
0C	W69-04805
9B	W69-04806
0A	W69-04807
2E	W69-04808
9B	W69-04810
9B	W69-04811
9B	W69-04812
06B	W69-04813
03A	W69-04814
06B	W69-04815
06B	W69-04816
06B	W69-04817
04A	W69-04818
06C	W69-04820
05D	W69-04821
04D	W69-04822
05G	W69-04823
06C	W69-04824
06B	W69-04825
03A	W69-04826
03A	W69-04827
05C	W69-04828
06B	W69-04829
06B	W69-04830
06B	W69-04832
06D	W69-04833
06B	W69-04834
06B	W69-04835
06B	W69-04836
06C	W69-04837
06C	W69-04838
06B	W69-04839
06C	W69-04840
03B	W69-04841
06A	W69-04842
06B	W69-04843
06A	W69-04844
06A	W69-04845
06B	W69-04846
06B	W69-04847
06C	W69-04848
06B	W69-04849
06C	W69-04850
06C	W69-04851
06B	W69-04852
06A	W69-04853
06C	W69-04854
06C	W69-04855
06E	W69-04856
06E	W69-04857
06E	W69-04858
06E	W69-04859
06E	W69-04860
06B	W69-04861
06E	W69-04862
06E	W69-04863
06E	W69-04864
06E	W69-04865
06E	W69-04866
06B	W69-04867
06E	W69-04868
06E	W69-04869
06E	W69-04870
06E	W69-04871
06E	W69-04872
06E	W69-04873
06E	W69-04874
06E	W69-04875
06E	W69-04876
06E	W69-04877
06E	W69-04878
06E	W69-04879
06E	W69-04880
06E	W69-04881
06E	W69-04882
06E	W69-04883
06E	W69-04884
06E	W69-04885
06E	W69-04886
06E	W69-04887
06E	W69-04888
06E	W69-04889
06E	W69-04890
06E	W69-04891
06E	W69-04892
06E	W69-04893
06E	W69-04894
06E	W69-04895
06E	W69-04896
06E	W69-04897
06E	W69-04898
06E	W69-04899
06E	W69-04900
06E	W69-04901
06E	W69-04902
06E	W69-04903
06E	W69-04904
06E	W69-04905
06E	W69-04906
06E	W69-04907
06E	W69-04908
06E	W69-04909
06E	W69-04910
06E	W69-04911
06E	W69-04912
06E	W69-04913
06E	W69-04914
06E	W69-04915
06E	W69-04916
06E	W69-04917
04A	W69-04918
04A	W69-04919
04A	W69-04920
04A	W69-04921
04A	W69-04922
04A	W69-04923
04A	W69-04924
04A	W69-04925
04A	W69-04926
02E	W69-04927
05E	W69-04928
02H	W69-04929
02H	W69-04930
02H	W69-04931
02E	W69-04932
02E	W69-04933
02E	W69-04934
02E	W69-04935
02H	W69-04936
05B	W69-04937
02J	W69-04938
02B	W69-04939
10	W69-04940
05E	W69-04941
05E	W69-04942
05E	W69-04943
05E	W69-04944
05E	W69-04945
05E	W69-04946
05E	W69-04947
05E	W69-04948
07B	W69-04949
02E	W69-04950
02G	W69-04951
02E	W69-04952
02E	W69-04953
02A	W69-04954
02E	W69-04955
04C	W69-04956
02H	W69-04957
05C	W69-04958
05C	W69-04959
02H	W69-04960
02A	W69-04961
02K	W69-04962
02K	W69-04963
02K	W69-04964
02K	W69-04965
02K	W69-04966
02K	W69-04967
02K	W69-04968
02K	W69-04969
02K	W69-04970
02K	W69-04971
02K	W69-04972
02K	W69-04973
02K	W69-04974
02E	W69-04975
02C	W69-04976
02F	W69-04977
02E	W69-04978
02E	W69-04979
02J	W69-04980
02E	W69-04981
02K	W69-04982
02J	W69-04983
02H	W69-04984
02F	W69-04985
07B	W69-04986
02F	W69-04987
03A	W69-04988
09D	W69-04989
06G	W69-04990
06B	W69-04991
02L	W69-04992
05C	W69-04993
05C	W69-04994
06B	W69-04995
06B	W69-04996
05C	W69-04997
05G	W69-04998
03C	W69-04999
04D	W69-05000
03E	W69-05001
03E	W69-05002
05G	W69-05003
05C	W69-05004
06B	W69-05005
05C	W69-05006
06B	W69-05007
05C	W69-05008
05G	W69-05009
06G	W69-05010
05C	W69-05011
02A	W69-05012
05G	W69-05013
06D	W69-05014
05E	W69-05015
06B	W69-05016
03A	W69-05017
05A	W69-05018
06B	W69-05019
05C	W69-05020
05C	W69-05021
06B	W69-05022
05C	W69-05023
06B	W69-05024
02L	W69-05025
05B	W69-05026
05G	W69-05027
05G	W69-05028
04D	W69-05029
05C	W69-05030
05D	W69-05031
03A	W69-05032
06B	W69-05033
05B	W69-05034
05B	W69-05035
02L	W69-05036
02L	W69-05037
05E	W69-05038
06B	W69-05039
05B	W69-05041
05B	W69-05042
04A	W69-05043
02L	W69-05044
04A	W69-05045
06B	W69-05046
06B	W69-05047
06B	W69-05048
02L	W69-05049
02L	W69-05050
05D	W69-05051
02L	W69-05052
06C	W69-05053
02L	W69-05054
06B	W69-05055
05F	W69-05056
02L	W69-05057
05B	W69-05058
05B	W69-05059
06B	W69-05060
06C	W69-05061
05B	W69-05062
08C	W69-05063
08C	W69-05064
06D	W69-05065
06D	W69-05066
06B	W69-05067
04A	W69-05068
05C	W69-05069
05C	W69-05070
02D	W69-05071
02D	W69-05072
02D	W69-05073
02I	W69-05074
03C	W69-05075
03F	W69-05076
02I	W69-05077
02H	W69-05078
02A	W69-05079
02D	W69-05080
02I	W69-05081
02A	W69-05082
02D	W69-05083
02G	W69-05084
02I	W69-05085
02I	W69-05086
02I	W69-05087
02I	W69-05088
02G	W69-05089
02I	W69-05091
02D	W69-05092
02G	W69-05093
02D	W69-05094
02I	W69-05095
04A	W69-05096
02G	W69-05097
02D	W69-05098
02D	W69-05099
07B	W69-05100
02G	W69-05101
02G	W69-05102
02C	W69-05103
04D	W69-05104
04A	W69-05105
02G	W69-05106
02G	W69-05107
02G	W69-05108
02C	W69-05109
07B	W69-05110
07B	W69-05111
06E	W69-05112
06B	W69-05113
06B	W69-05114
06B	W69-05115
06B	W69-05116
06B	W69-05117
06B	W69-05118
06B	W69-05119
06B	W69-05120
06D	W69-05121
06B	W69-05122
06A	W69-05123
06B	W69-05124
06B	W69-05125
06C	W69-05126
06B	W69-05127
05F	*W69-05128
05F	W69-05129
05F	W69-05130
06A	W69-05131
06A	W69-05132
06A	W69-05133
06A	W69-05134
06A	W69-05135
02K	W69-05136
05A	W69-05137
02K	W69-05138
02H	W69-05139
10	W69-05140
05C	W69-05141
02H	W69-05142
02G	W69-05143
07C	W69-05144
07B	W69-05145
02A	W69-05149
08B	W69-05150
08B	W69-05153
06D	W69-05154
05B	W69-05155
03A	W69-05156
03A	W69-05157
04A	W69-05158
02B	W69-05159
09D	W69-05160
06E	W69-05161
06E	W69-05162
06E	W69-05163
06E	W69-05164
06E	W69-05165
06E	W69-05166
06E	W69-05167
06E	W69-05168
06E	W69-05169
06E	W69-05170
06E	W69-05171
06E	W69-05172
06E	W69-05173
06E	W69-05174
06E	W69-05175
06E	W69-05176
04A	W69-05177
06E	W69-05178
06E	W69-05179
06E	W69-05180
06E	W69-05181
05B	W69-05182
04A	W69-05183
06E	W69-05184
06E	W69-05185
05B	W69-05186
05B	W69-05187
06E	W69-05188
06E	W69-05189
05B	W69-05190
04A	W69-05191
06E	W69-05192
06E	W69-05193
06E	W69-05194
06E	W69-05195
06E	W69-05196
04A	W69-05197
06E	W69-05198
05G	W69-05199
04A	W69-05200

ABSTRACT SOURCES

A. Centers of Competence:	Accession Numbers	To
(1) Bureau of Reclamation - Engineering Works	W69-04701--W69-04748	
(2) U.S. Geological Survey - Hydrology	W69-04749--W69-04796 W69-04918--W69-04987	1
(3) Rutgers University - Water Resources Economics	W69-04806--W69-04855 W69-05115--W69-05127	
(4) University of Wisconsin - Eutrophication	W69-04797--W69-04805 W69-05136--W69-05142	
(5) University of Arizona - Arid Land Water Resources	W69-05071--W69-05095	
(6) Cornell University - Policy Models of Water Resources Systems	W69-05128--W69-05135	
(7) University of Chicago - Metropolitan Water Resources Management	W69-05112--W69-05114	
(8) University of Florida - Eastern U.S. Water Law	W69-04856--W69-04917 W69-05161--W69-05200	1
B. Others		
(1) Federal Water Pollution Control Administration - Estuarine and Oceanographic Programs Branch	W69-04988--W69-05070	
(2) Forest Service, U.S.D.A.	W69-05096--W69-05111	
(3) Office of Saline Water	W69-05156--W69-05157	
(4) Environmental Sciences Service Administration - Weather Bureau	W69-05158	
(5) Penn State University - Institute for Research on Land and Water Resources	W69-05154--W69-05155	
(6) University of Nevada - Water Resources Research Center		
(7) University of Hawaii - Water Resources Research Center	W69-05144--W69-05145	
(8) University of Illinois - Water Resources Center	W69-05149--W69-05153	
(9) Illinois State Water Survey	W69-05159	
(10) Ohio State University - Water Resources Center	W69-05160	
(11) Purdue University - Water Resources Research Center	W69-05143	
	Grand Total	4

Subject Fields

1 NATURE OF WATER

2 WATER CYCLE

3 WATER SUPPLY AUGMENTATION AND CONSERVATION

4 WATER QUANTITY MANAGEMENT AND CONTROL

5 WATER QUALITY MANAGEMENT AND PROTECTION

6 WATER RESOURCES PLANNING

7 RESOURCES DATA

8 ENGINEERING WORKS

9 MANPOWER, GRANTS, AND FACILITIES

10 SCIENTIFIC AND TECHNICAL INFORMATION

INDEXES

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

ABSTRACT SOURCES

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF COMMERCE

LIBRARY RATE
PRINTED MATTER

U.S. DEPARTMENT OF COMMERCE
CLEARINGHOUSE FOR FEDERAL
SCIENTIFIC AND TECHNICAL INFORMATION
SPRINGFIELD, VA. 22151

OFFICIAL BUSINESS

616.33391
Se 48

UNIVERSITY OF ILLINOIS
AUG 29 1969
LIBRARY

SELECTED WATER RESOURCES ABSTRACTS

VOLUME 2, NUMBER 13
JULY 1, 1969

W69-05201 -- W69-05600

Selected Water Resources Abstracts is published semimonthly for the Water Resources Scientific Information Center (WRSIC) by the Clearinghouse for Federal Scientific and Technical Information (CFSTI) of the Bureau of Standards, U. S. Department of Commerce. It is available to Federal agencies, contractors, or grantees in water resources upon request to: Manager, Water Resources Scientific Information Center, Office of Water Resources Research, U. S. Department of the Interior, Washington, D. C. 20240. Annual subscription is $22.00 (domestic), $27.50 (foreign), single copy price is $3.00. Certain documents abstracted in this journal can be purchased from the Clearinghouse at the prices indicated in the entry. Prepayment is required.

CLEARINGHOUSE
FOR FEDERAL SCIENTIFIC AND TECHNICAL INFORMATION
U.S. Department of Commerce, Springfield, Va., 22151

SELECTED
WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

VOLUME 2, NUMBER 13
JULY 1, 1969

W69-05201 -- W69-05600

Use of funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources. WRSIC is not presently prepared to furnish loan or retention copies of the publications announced.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas. Centers, and their subject coverage, now in operation are:

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

CONTENTS

FOREWORD iii

SUBJECT FIELDS AND GROUPS

(Use Edge Index on back cover to Locate Subject Fields and Indexes in the journal.)

01 NATURE OF WATER
Includes the following Groups: Properties; Aqueous Solutions and Suspensions

02 WATER CYCLE
Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION
Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL
Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Non-Water Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION
Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING
Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA
Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS
Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS, AND FACILITIES
Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.

10 SCIENTIFIC AND TECHNICAL INFORMATION
Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

01. NATURE OF WATER

1B. Aqueous Solutions and Suspensions

HYDRODYNAMIC DISPERSION IN A SATURATED HOMOGENEOUS POROUS MEDIUM AT LOW PECLET NUMBERS AND NONHOMOGENEOUS SOLUTION,
Guelph Univ. (Ontario).
Yehuda Bachmat.
Water Resources Res, Vol 5, No 1, pp 139-143, Feb 1969. 5 p, 7 ref.

Descriptors: *Dispersion, *Diffusion, *Porous media, Flow, Groundwater movement, Density, Circulation, Fluid mechanics, Mass transfer, Mixing.
Identifiers: Binary solutions, Density gradient.

The coefficient of mechanical dispersion of a solute in a homogeneous porous medium saturated by a binary diluted solution is derived, taking into account nonuniform density and viscosity fields. It is shown that in the neighborhood of a vanishing macroscopic velocity, a nonuniform density field induces a macroscopic dispersion resulting from the variation of microscopic density gradients and from horizontal variations of the macroscopic density. Both together yield the macroscopic effect of density instability on solute redistribution phenomena in porous materials. (Knapp-USGS)
W69-05434

02. WATER CYCLE

2A. General

AN EXPERIMENTAL INVESTIGATION OF PARTIAL AREA CONTRIBUTIONS,
Maryland Univ., College Park.
Robert M. Ragan.
Int Ass Sci Hydrol Pub No 76, Symp on Hydrol Aspects of Util of Water, Bern, Sept 25-Oct 7, 1967, pp 241-251, 1968. 11 p, 5 fig, 8 ref.

Descriptors: *Routing, *Runoff, *Rainfall-runoff relationships, Subsurface runoff, Flood routing, Surface-groundwater relationships, Hydrographs, Discharge (Water), Infiltration, Rainfall intensity, Storm runoff, Interception, Vermont.
Identifiers: Partial area runoff contribution.

The paper describes a detailed experimental-numerical investigation of the concept of partial area contributions to storm hydrographs. A computer solution of a numerical flood routing technique was used to isolate the time-spatial distribution of local runoff entering the main channel of a small watershed. Extensive experimental information collected in the vicinity of the 619 ft length of second order stream provided a means of interpreting these land-phase hydrographs. Analysis of a series of storms showed that only a small portion of the watershed ever contributed flow to the storm hydrograph. The contributing area was found to be a function of the storm duration and intensity and, rather than being uniformly distributed along the length of the channel, it existed in the form of localized zones of intense contribution. In a given storm the contributng area was found to fluctuate with changes in the rainfall intensity. During periods of low intensity, most of the flow came from channel precipitation and rain falling on the wet areas surrounding a series of seeps. If a period of high intensity occurred, flow developed through the forest litter on the hillsides and thereby created a larger contributing area. No interflow in the soil mass above the water table was encountered. A rapid response of the groundwater at some points along the channel, however might have been interpreted as interflow if extensive measurements had not been taken. The behavior of the watershed was quite logical when the fundamentals of the individual processes were considered. The results of the study illustrate that there is a need for a reevaluation of some of the traditional methods used for runoff computations. Furthur, any parametric model developed for the synthesis of hydrologic events should be able to reflect partial area contributions. (Knapp-USGS)
W69-05227

STUDIES OF RUNOFF FORMATION UNDER CONDITION OF HIGH-ANGLE ATTITUDE OF THE IMPERVIOUS BED,
Hydrometeorological Centre (USSR).
For primary bibliographic entry see Field 02E.
W69-05229

MOUNTAIN RIVER FLOOD RUNOFF THEORY, MEANS OF ITS INVESTIGATION AND CALCULATION,
Gidrometeorologicheskii Institut, Odessa (USSR).
A. N. Befani.
Int Ass Sci Hydrol Pub No 76, Symp on Hydrol Aspects of Util of Water, Bern, Sept 25-Oct 7, 1967, pp 323-333, 1968. 11 p, 6 ref.

Descriptors: *Rainfall-runoff relationships, *Flood routing, *Mountains, *Slopes, Topography, Infiltration, Subsurface runoff, Hydrographs, Hydrograph analysis, Rainfall intensity, Rainfall disposition.
Identifiers: USSR.

Results of extensive experimental studies of mountain slope runoff formation carried out by a number of institutes in the USSR are treated and a theory of mountain runoff and a verification of regional design methods are presented. A great variety of mountain runoff genetic types, the basic being the surface and contact ones, are indicated. The latter takes place in friable surface sediments on an underlying relative confining layer, a slightly fissured rock or loam-skeleton layer. The theories of contact and surface runoff are developed on the basis of integration of partial differential runoff equations using subsequent approximation methods to solve complex mathematical formulae. As a result simple theoretical expressions determining a slope flood runoff component, a maximum runoff module, and a surface and contact flow discharge hydrograph equation are obtained. Parameters of different types of slope flow time and parameters of losses including surface infiltration, infiltration into the underlying rock, and soil storage are the main components of theoretical equations. Performance investigations made it possible to verify the regional formula calculation method for layer and slope inflow discharge hydrograph computation. (Knapp-USGS)
W69-05230

NUMERICAL FORECASTING OF MOUNTAIN RIVER FLOOD RUNOFF ON THE BASIS OF ESTABLISHING TERRITORIALLY - GENERALIZED RELATIONSHIPS,
Gidrometeorologicheskii Institut, Odessa (USSR).
N. F. Benfani.
Int Ass Sci Hydrol Pub No 76, Symp on Hydrol Aspects of Util of Water, Bern, Sept 25-Oct 7, 1967, pp 334-342, 1968. 9 p, 1 fig, 2 ref.

Descriptors: *Rainfall-runoff relationships, *Routing, *Mountains, *Slopes, Topography, Infiltration, Subsurface runoff, Hydrograph analysis, Rainfall intensity, Rainfall disposition.
Identifiers: Carpathian Mountains (USSR), Sikhote-Alin Mountains (USSR), Flood runoff.

Results of analysis and generalization of experimental data and observations of mountain rivers of the Carpathian and Sikhote-Alin mountain slopes are reported. The work is based on a genetic theory of mountain slope runoff. A theoretical balance formula including surface and contact components of a total runoff layer is presented. Components of a theoretical equation are determined for experimental plots and natural drainage basins. Storage in a friable sediment layer is expressed as a function of an antecedent moistening index and runoff-forming rainfall. Infiltration losses are presented as a function of time and antecedent moistening index. In this case infiltration contact runoff losses are estimated in terms of inter-rain intervals and duration of fall. A surface flood runoff component as a function of friable rock saturation and other factors is also introduced. Generalization of local relationships enabled the establishment of parameters of losses for territories of homogeneous structures and soils. Specific examples show that the utilization of theoretical and experimental parameters give territorially-generalized relationships, approaching the forecast of the runoff of small ungaged rivers.
W69-05231

THE ASSESSMENT OF SURFACE RUNOFF FROM RAINFALL DATA FOR AN ARID REGION OF WEST PAKISTAN,
MacDonald (Murdoch) and Partners, London (England).
For primary bibliographic entry see Field 02E.
W69-05232

THE ASSESSMENT OF RUNOFF FROM A MOUNTAINOUS AND SEMI-ARID AREA IN WESTERN IRAN,
Hydrological Research Unit, Wallingford (England); Gibb (Alexander) and Partners, London (England).
For primary bibliographic entry see Field 02E.
W69-05233

DESIGN CRITERIA FOR LABORATORY CATCHMENT EXPERIMENTS, WITH PARTICULAR REFERENCE TO RAINFALL SIMULATION,
Imperial Coll. of Science and Technology, London (England).
M. J. Hall, and P. O. Wolf.
Int Ass Sci Hydrol Pub No 76, Symp on Hydrol Aspects of Util of Water, Bern, Sept 25-Oct 7, 1967, pp 395-406, 1968. 12 p, 1 tab, 19 ref.

Descriptors: *Rainfall-runoff relationships, *Laboratory tests, *Model studies, *Hydraulic models, *Rainfall simulators, Runoff, Rainfall intensity, Erosion, Streamflow forecasting.
Identifiers: *Laboratory catchment experiments.

Study of the hydrological cycle of an artificial catchment area under laboratory conditions is reviewed and discussed. If 'laboratory catchment' is defined as a physical system of limited areal extent on to which on 'input' of rainfall, either real or simulated, is applied to produce in 'output' in the form of surface and/or subsurface runoff, it is seen that the concept is not recent. The pioneer work on soil erosion problems in the United States during the 1930's was largely based upon the study under controlled conditions of small plots, each of which was effectively a simplified model of the hydrological cycle. In studies of the hydraulics of overland flow during the 1940's, an even simpler conceptual model was investigated. The first attempt to construct a scale model of a natural catchment was made during the 1950's, and in the 1960's there is a return to the use of the plane, two-dimensional impervious surface, not as a small hydraulic prototype, but as a 'system' for generating data against which non-linear rainfall/runoff theories can be tested. Existing work is reviewed and a new approach to the problem of determining the influence of catchment characteristics on the shape of flood hydrographs using artificial catchment areas in the laboratory is suggested. A major difficulty in any laboratory catchment experiment is the design of the associated equipment for the production of storms of artificial rainfall. The selection of design criteria for the rainfall simulator to be used in the proposed experiments is discussed in detail, and a working solution outlined. (Knapp-USGS)
W69-05234

PREPARATION OF CO-ORDINATED PRECIPITATION, RUNOFF AND EVAPORATION MAPS,
World Meteorological Organization, Geneva (Switzerland).
Tor J. Nordenson.
Report No. 6 of Reports on WMO/IHD Projects, 1968. 20 p, 3 tab, 13 fig, 32 ref.

Descriptors: *Precipitation, *Evaporation, Water balance, *Runoff, Design data.
Identifiers: Water control structures.

In the design of water control structures for water supply, hydro-electric power, irrigation, navigation and flood control, it is necessary to have knowledge of the volume of water available. Estimates of actual evapotranspiration loss are required for determining irrigation needs and increased losses from construction of reservoirs in arid and semi-arid areas. This report attempts to describe methods for the preparation of maps of average annual precipitation, runoff and evaporation. Major emphasis is devoted to the co-ordinated development of these maps in order to attain a consistency between them which will provide a nearly true water balance.
W69-05337

IN DEFENSE OF EXPERIMENTAL WATERSHEDS,
Georgia Univ., Athens. School of Forestry; and Northeastern Forest Experiment Station, Upper Darby, Pa.
John D. Hewlett, Howard W. Lull, and Kenneth G. Reinhart.
Water Resources Res, Vol 5, No 1, pp 306-316, Feb 1969. 11 p, 1 tab, 40 ref.

Descriptors: *Demonstration watersheds, Model studies, Watersheds (Basins), Synthetic hydrology, Stream gages, Hydrologic budget.
Identifiers: Experimental watersheds.

Recent criticisms discount the contribution of experimental watersheds to the science of hydrology and to watershed management. The critics cite as disadvantages the cost of experimental watersheds, their unrepresentativeness, leakiness, difficulty in applying results to other areas, and the lack of progress in basic knowledge about hydrologic processes. Some critics propose mathematical synthesis, statistical analysis, plot studies, soil moisture studies, meteorological methods, and the study of individual hydrologic processes as alternatives to experimental watersheds. The criticisms lack weight, because published results of catchment experiments were not carefully reviewed. The alternatives are obviously aids rather than substitutes for experiments on watersheds. By reference to recent and older results, the authors argue that the experimental watershed method has produced much of our present knowledge about the land phase of the hydrologic cycle and man's influence on it, that method is sound, and that its future in any comprehensive research program is secure. (Knapp-USGS)
W69-05405

TREATED WATERSHED YIELDS IMPROVED WATER HARVEST,
Geological Survey, Albuquerque, N. Mex.
For primary bibliographic entry see Field 03B.
W69-05410

HYDROLOGIC EFFECTS OF THE 1962-66 DROUGHT ON LONG ISLAND, N. Y.,
Geological Survey, Washington, D. C.
Philip Cohen, O. L. Franke, and N. E. McClymonds.
Geol Surv Water-Supply Pap 1879-F, pp F1-F18, 1969. 18 p, 10 fig, 7 ref.

Descriptors: *Droughts, *Hydrologic aspects, *Water level fluctuations, Groundwater, Streamflow, Precipitation (Atmospheric), Runoff, Water storage, Discharge (Water), Crop response, Soil moisture.
Identifiers: Long Island (N.Y.).

The hydrologic system of Long Island, N. Y., showed a marked response to deficient precipitation in the years 1962-66. By 1966, streamflow was the lowest of record in many Long Island streams, and groundwater levels had declined a maximum of about 10 feet in the central part of the island. Although the drought apparently ended in the early months of 1967 and groundwater levels and streamflow recovered somewhat since then, groundwater levels and streamflow were still considerably below long-term average values in September 1968. (Knapp-USGS)
W69-05411

RAINFALL-RUNOFF MODEL FOR SMALL BASIN FLOOD HYDROGRAPH SIMULATION,
Geological Survey, Menlo Park, Calif.
R. W. Lichty, D. R. Dawdy, and J. M. Bergmann.
Int Ass Sci Hydrol Pub No 81, Symp of Tucson-1968, pp 356-367, 1968. 12 p, 6 fig, 2 tab, 10 ref.

Descriptors: *Mathematical models, *Computer models, *Rainfall-runoff relationships, Optimization, Streamflow forecasting, Runoff forecasting, Simulation analysis, Floods, Flood forecasting, Antecedent precipitation, Precipitation excess.
Identifiers: Peak stages, Philips equation.

A simplified, mathematical model of the surface-runoff component of streamflow response to storm rainfall was developed and programmed for digital-computer solution. The model uses an infiltration component based on an equation by Philip to determine rainfall excess, which is transformed by a linear basin-response function to simulate the flood hydrograph. An objective-fitting procedure that emphasizes the simulation of peak-discharge rate was used to identify optimum model parameters in a pilot study of a 5-sq mi drainage basin in North Carolina. Split-sample fitting and testing showed that predictive capability varied for 3 samples of flood events. Results of simulation for 2 test samples of pre-1948 flood events showed reasonable correspondence between simulated and observed flood peaks. The post-1948 test sample showed wide scatter between simulated and observed flood peaks. Sensitivity analysis of objective-function response to parameter incrementation showed that antecedent moisture accounting grossly controlled the results of optimization. (Knapp-USGS)
W69-05420

A PROPOSED MECHANICS FOR THE INVESTIGATION OF SURFACE RUNOFF FROM SMALL WATERSHEDS. 1, DEVELOPMENT,
Ohio Agricultural Research and Development Center, Wooster.
George E. Merva, Ross D. Brazee, Glenn O. Schwab, and R. Bruce Curry.
Water Resources Res, Vol 5, No 1, pp 76-83, Feb 1969. 8 p, 2 fig, 6 ref. Grant ITI-WP-39-01A1-PHS. OWRR Project B-005-OHIO.

Descriptors: *Rainfall-runoff relationships, *Small watersheds, *Stochastic processes, Statistical models, Markov processes, Probability, Equations, Isotropy.
Identifiers: Brownian motion analogy.

A probabilistic method is proposed for predicting runoff from small watersheds. An analogy with Brownian motion is used to find the relationship between a stochastically impressed force acting upon fluid particles on a planar surface with a statistically homogeneous and isotropic distribution of random roughness. Fluid motion is studied as a function of energy degradation for a particle collection in random motion induced by surface forces. (Knapp-USGS)
W69-05425

RUNOFF VOLUME PREDICTION FR DAILY CLIMATIC DATA,
Agricultural Research Service, Riesel, Tex.; Agricultural Research Service, Chickasha, Okla.
Walter G. Knisel, Jr., Ralph W. Baird, and Monr A. Hartman.
Water Resources Res, Vol 5, No 2, pp 84-94, 1969. 11 p, 8 fig, 9 ref.

Descriptors: *Rainfall-runoff relationships, *S moisture, *Runoff forecasting, Model studi Mathematical models, Digital comput Hydrologic budget, Discharge (Water), Infilt tion, Inflow, Streamflow, Water balance, Evapo tion, Precipitation intensity, Duration curv Hydrograph analysis, Hydrographs.
Identifiers: Soil moisture reservoir, Runoff pred tion.

A two-soil-moisture-reservoir model is develop to improve the estimate accuracy of a runo volume-prediction model. Soil moisture account in the two reservoirs is an intermediate step to noff prediction. A decay-type function descri the moisture depletion between days of rainf The moisture depletion constant in the function ries by season with soil moisture, pan evaporati and mean daily temperature. The runoff-predicti equation relates runoff to rainfall and soil moistu at the beginning of the storm. Computed run volumes are compared with values observed on a acre native grass-meadow watershed for an 11-ye period. Accumulated computed amounts for t period agree within 1% of the accumulated o served amounts. (Knapp-USGS)
W69-05426

USING ANALYTICAL METHODS T DEVELOP A SURFACE-RUNOFF MODEL,
Tennessee Valley Authority, Knoxville.
Roger P. Betson, Russell L. Tucker, and Faye M. Haller.
Water Resources Res, Vol 5, No 1, pp 103-11 Feb 1969. 9 p, 5 fig, 2 tab, 5 ref.

Descriptors: *Rainfall-runoff relationships, *R noff forecasting, *Analytical techniques, Rainfa intensity, Antecedent precipitation, Meteorolog Mathematical models, Computer models, Digit computers.
Identifiers: Graphical methods, Analytical models

By using analytical methods, successive restrictio were imposed on a mathematical version of the U S. Weather Bureau's graphical surface-runo model to develop an analytical model that e presses the API (Antecedent precipitation index runoff relations with 2 equations and 5 coefficient The analytical model is similar in concept to th graphical model in that both relate rainfall, wee number, and the API measure to surface runof The concise relations of the analytical model, hov ever, can be rapidly derived from a historical storm list by computer. When tested, runoff relation derived with the analytical model over selecte watersheds, predicted surface runoff from thos watersheds somewhat better than the regiona graphical relations developed for the Valley. (K napp-USGS)
W69-05431

SYNTHETIC HYDROGRAPHS; EFFECTS O NETWORK GEOMETRY,
Thomas J. Watson Research Center, Yorktow Heights, N. Y.
A. J. Surkan.
Water Resources Res, Vol 5, No 1, pp 112-12 Feb 1969. 17 p, 20 fig, 8 ref.

Descriptors: *Synthetic hydrology, *Hydrograph Routing, Mathematical models, Computer model Digital computers, Simulation analysis, Rive systems, Stochastic processes, Streamflow, Rainfal disposition, Storage.
Identifiers: *Synthetic hydrographs, Algorithmi methods, Synthetic drainage basins.

mathematical model for channel networks resented by directed graphs on a rectangular i is used to generate synthetic hydrographs. This ces possible simulation of the effects of changes geometric factors specified by shape and con- tivity, while keeping fixed a prescribed tem- al and spatial precipitation pattern. Alternative- his model may be used with fixed networks of rest to study effects of different types and mo- s of storms. The model provides for a discrete roximation of a distributed network, a transfor- ion relating the runoff hydrograph and input cipitation. No combinations of generating ameters had to be determined, since only a sin- parameter associated with the collection and ase of water to the channel was used. Although parameter, which was the collection area age constant, and the speed of travel for ipitation could be given different values at point on the network, and might be varied as a tion of time, both were assumed to be fixed in and spatially uniform. The formation of rographs is determined by interlocking relation- s between the network's geometry, its storage tions, and temporal and spatial variations of ipitation reaching and traversing a graphically ified network. (Knapp-USGS)
-05432

OFF HYDROGRAPH AS A FUNCTION OF NFALL EXCESS,
bridge Univ. (England).
Hill.
er Resources Res, Vol 5, No 1, pp 95-102, Feb . 8 p, 5 fig, 6 ref.

criptors: *Rainfall-runoff relationships, thematical models, *Runoff forecasting, eamflow forecasting, *Hydrographs, Duration es, Rainfall intensity, Hyetographs, Precipita- excess, Surface runoff, Overland flow, Storm ff.
tifiers: Kinematic wave theory.

t of differential equations has been obtained the overland runoff from an arbitrary nment when the rainfall excess over the nment is known as a function of space and An analytical solution is given for a steady of finite duration. The differential equations ned are also solved analytically for a moving at storm over a plane catchment, and the mum depth is obtained explicitly as a function e storm duration and catchment length. The ts for all plane catchments with a given re- ce formula are reduced to a single curve. It is d that the depth is increased if the storm moves stream and decreased if the storm moves up- m the slower the storm the greater being the ge. Finally, it is shown that all the results apply tatively to open channel flow where the kine- wave approach is suitable. If the lateral in- replaces the rainfall excess, it is found that the of the curve describing the variation of depth time is a function of the cross-section etry but is qualitatively similar to the overland curve described above. (Knapp-USGS)
-05438

URRENCE INTERVALS BETWEEN EX- DANCES OF SELECTED RIVER LEVELS. TERNATIVES TO A MARKOV MODEL,
South Wales Univ. Kensington (Australia); Commonwealth Scientific and Industrial rch Organization, Canberra (Australia). Div. nd Research.
rimary bibliographic entry see Field 02E.
05454

Precipitation

ROMETEOROLOGICAL STUDIES IN SUP- T OF THE INTERNATIONAL FIELD YEAR THE GREAT LAKES,
orological Service of Canada, Toronto (On- . Hydrometeorology Section.
Richards.
Int Ass Sci Hydrol Pub No 76, Symp on Hydrol Aspects of Util of Water, Bern, Sept 25-Oct 7, 1967, pp 171-180, 1968. 10 p, 21 ref.

Descriptors: *Great Lakes, *International Hydrological Decade, International Joint Commission, Conferences, Data collections, Networks, Hydrology, Meteorology, Synoptic analysis, Governments, Water resources development, International commissions.
Identifiers: Canada, Hydrometeorological studies.

The Canadian and United States Com for the Int Hydrol Decade agreed to sponsor an International Field Year on the Great Lakes. Concentrated scientific studies are planned for Lake Ontario for an 18-mo period beginning Apr 1, 1970. First, there will be feasibility studies, project planning, and instrument development. Preliminary proposals have been designed to evaluate atmospheric and terrestrial water budgets and the energy balance of a lake as well as the circulation, wave climatology and diffusion characteristics. The program will be based on a limited number of primary projects to be sponsored by agencies in Canada and the United States responsible for major observational programs. Universities, research institutes and individual scientists from all countries will be welcome to conduct studies and investigations in support of, or auxiliary to, the primary projects, and data from the major observing programs will be made available to assist such studies. Many studies will be of a hydrometeorological nature, including an investigation of lake level variations as related to precipitation, evaporation and the inflow and outflow of surface and groundwater. Evaporation will be assessed by all means including atmospheric water budget, energy balance, water budget, mass transfer and micrometeorological flux techniques. The difference between over-lake and overland precipitation amounts will also receive special attention through improved rain gauge networks and weather radar film analyses by an optical scanning device. (Knapp-USGS)
W69-05222

SNOW ACCUMULATION AS RELATED TO METEOROLOGICAL, TOPOGRAPHIC, AND FOREST VARIABLES IN CENTRAL SIERRA NEVADA, CALIFORNIA,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 02C.
W69-05226

THE WEATHER BUREAU AND WATER MANAGEMENT.
Weather Bureau, Silver Spring, Md.
For primary bibliographic entry see Field 07C.
W69-05336

AN ACCURATE SMALL ORIFICE RAIN GAGE,
Volcani Inst. of Agricultural Research, Bet Dagan (Israel); and Israel Meteorological Service, Bet Dagan.
For primary bibliographic entry see Field 07B.
W69-05404

HYDROLOGIC EFFECTS OF THE 1962-66 DROUGHT ON LONG ISLAND, N. Y.,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02A.
W69-05411

2C. Snow, Ice, and Frost

SNOW ACCUMULATION AS RELATED TO METEOROLOGICAL, TOPOGRAPHIC, AND FOREST VARIABLES IN CENTRAL SIERRA NEVADA, CALIFORNIA,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
Henry W. Anderson.
Int Ass Sci Hydrol Pub No 76, Symp on Hydrol Aspects of Util of Water, Bern, Sept 25-Oct 7, 1967, pp 215-224, 1968. 10 p, 4 tab, 22 ref.

Descriptors: *Snowfall, *Snow cover, *Energy budget, *Topography, Melting, Radiation, Winds, Trees, Forests, Terrain analysis, Regression analysis, Microenvironment, California.
Identifiers: Multivariate analysis, Terrain, Snow accumulation, Sierra Nevada.

Snow accumulation at individual points in forest and openings in forests was studied by selecting 16 periods in the winter of 1957-58 under different meteorological conditions. Wide differences in topography and forest conditions were obtained by selection of 250 points from 1,300 available. Snow accumulation was the difference in water equivalent of the snow pack between measurements. Meteorological variables included functions of clouds, wind, humidity, temperature, and precipitation. Forest variables included indexes of shade, back radiation, interception, cold air drainage, and shelter from the wind. Topography was expressed in terms of solar energy received and exposure to prevailing winds. The factors related to snow accumulations were studied by reduced rank procedure of principal components, principal axis, canonical, and alpha factoring with varimax rotation of the factors. The best regressions relating the variables to snow accumulations arose from principal components analysis when highly correlated variables were included. Snow accumulation depended strongly on combinations of meteorological and forest variables, and on forest-meteorological interactions. Interception of snow, as indexed by the canopy over the point, averaged 10% of the precipitation. Snow accumulation in forest openings, forest margins, and in large areas of uniform forest had different relations to meteorological and topographic variables. Forest shade and back radiation from trees were most important on high energy south slopes. (Knapp-USGS)
W69-05226

PATTERNS OF BACKWATER AND DISCHARGE ON SMALL ICE-AFFECTED STREAMS,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 07B.
W69-05256

2D. Evaporation and Transpiration

EVAPORATION FROM BOGS IN THE EUROPEAN TERRITORY OF THE USSR,
State Hydrological Inst., Leningrad (USSR).
V. V. Romanov.
Trans. of mono. Isparenie s Bolot Evropeiskoi Territorii SSR, 1962, 227 p. Available from CFSTI as TT-67-51293 HC$3.00 MF$0.65. Dep Agr and Nat Sci Found Rep, 1968. 183 p, 52 fig, 39 tab, 87 ref, 2 append.

Descriptors: *Bogs, *Evaporation, Evapotranspiration, Heat budget, Hydrologic budget, Temperature, Precipitation (Atmospheric), Runoff, Discharge (Water), Groundwater, Soil water, Drainage, Infiltration, Streamflow.
Identifiers: USSR, Bog evaporation studies.

Bogs occupy a little less than 10% of the USSR. Bog evaporation is 10.8% of the total evaporation below latitude 60 deg N and 17.3% of the total north of 60 deg. Total European USSR bog evaporation is about 94 cu km per yr. Bog evaporation is studied by heat and water budget methods in a nationwide program of large-scale bog reclamation and peat production. The budget methods used are described in detail. Results of calculations are presented and discussed for undrained highmoor bogs, undrained lowmoor bogs, and drained bogs. (Knapp-USGS)
W69-05214

A METHOD OF DETERMINING EVAPOTRANSPIRATION IN SOIL MONOLITHS,
Institute for Land and Water Management Research, Wageningen (Netherlands).
W. C. Visser.

UNESCO Arid Zone Research, Vol 25, pp 453-460, 1965. 9 fig, disc, 7 ref.

Descriptors: *Soil moisture, *Evapotranspiration, *Transmissivity, *Model studies, *Soil profiles, Evaporation, Permeability, Root systems, Aeration, Moisture content, Instrumentation, Measurement, Data collections, Density, Depth, Sampling, Equations, Hydrologic properties, Flow.
Identifiers: *Monoliths, Desorption.

A model of the evaporation process with respect to the influence of soil is developed. Described here is the installation constructed to measure the required data. The model shows that influences will be exerted on evapotranspiration by transmissibility of the plant, permeability of the soil, the desorption curve and root density. Since the determinations nearly all require taking samples, one has to work with a container of such dimensions that soil in the monolith is not damaged too much by sampling. The formula developed does not account for variations in root density and suction pressure with depth, nor is impeded aeration considered. The formula may be valuable as a starting point for further improvements of the description of the processes of evaporation and depletion of soil moisture. (Blecker-Ariz)
W69-05270

THE INTERCEPTION-TRANSPIRATION RELATIONSHIP OF WHITE SPRUCE AND WHITE PINE,
Minnesota Univ., St. Paul, School of Forestry; Arizona Univ., Tucson, Dept. of Watershed Management.
J. A. Nicolson, D. B. Thorud, and E. I. Sucoff.
J Soil and Water Conservation, Vol 23, No 5, pp 181-184, Sept-Oct 1968. 1 fig, 3 tab, 10 ref.

Descriptors: *Interception, *Transpiration, *Soil moisture, *White pine trees, *Coniferous trees, Evaporation, Humidity, Radiation, Moisture stress, Calibrations, Diurnal, Water balance, Wetting, Wind velocity, Bouyoucos blocks, Water conservation.
Identifiers: *White spruce trees.

A study was conducted on the interception-transpiration relationship of two widely distributed northern conifers--white spruce and eastern white pine. Intercepted water reduced transpiration and conserved soil moisture. Mean saving in relation to the amount of intercepted water applied was 13% for white spruce and 12% for white pine. Grouping periods according to the number of wettings required during a 3 1/2 hour period showed that the percentage of water saved in white pine decreased as the number of wettings increased. White spruce failed to show any trend. Percentage of water saved in white spruce tended to decrease as wind speed increased. Water savings in white pine appeared to be greatest during calm, humid and low radiation periods. Savings in white spruce tended to be higher in environments favoring moderate transpiration. Principles and procedures outlined in the study could possibly be used to determine ways of reducing transpiration and conserving soil moisture in arid climates. (Blecker-Ariz)
W69-05274

2E. Streamflow and Runoff

FLOOD PLAIN INFORMATION, SOUTHWEST BRANCH, PRINCE GEORGES COUNTY, MARYLAND.
Corps of Engineers, Baltimore, Md.
For primary bibliographic entry see Field 04A.
W69-05203

FLOOD PLAIN INFORMATION (ANACOSTIA RIVER), PRINCE GEORGES COUNTY, MARYLAND.
Corps of Engineers, Baltimore, Md.
For primary bibliographic entry see Field 04A.
W69-05204

FLOOD PLAIN INFORMATION, INTRENCHMENT, SUGAR, DOOLITTLE AND DOLESS CREEKS.
Corps of Engineers, Savannah, Ga.
For primary bibliographic entry see Field 04A.
W69-05205

FLOOD PLAIN INFORMATION OF PROCTOR CREEK, METROPOLITAN ATLANTA, GEORGIA.
Corps of Engineers, Mobile, Ala.
For primary bibliographic entry see Field 04A.
W69-05206

FLOOD PLAIN INFORMATION ON HEADWATERS SOUTH RIVER, METROPOLITAN ATLANTA, GEORGIA.
Corps of Engineers, Savannah, Ga.
For primary bibliographic entry see Field 04A.
W69-05207

COMPARATIVE STUDY OF SNOW TYPE HYDROLOGY OF NORTHEASTERN CANADA AND OF PLAINS OF RUSSIA AND SIBERIA,
Catholic Univ. of America, Washington, D. C.
Boris S. Browzin.
Int Ass Sci Hydrol Pub No 76, Symp on Hydrol Aspects of Util of Water, Bern, Sept 25-Oct 7, 1967, pp 204-214, 1968. 11 p, 5 fig, 2 tab, 9 ref, 1 append.

Descriptors: *Hydrographs, *Hydrograph analysis, *Climatology, *Synoptic analysis, *Cold regions, Subarctic, Meteorology, Climatic zones, Snow, Weather, Runoff, Streamflow.
Identifiers: North America, Siberia, Climatic-hydrologic relations.

River hydrology is defined by a dimensionless monthly hydrograph of twelve coefficients, which are ratios of the mean monthly flow to the mean annual flow. The hydrograph is a function of climatic factors determined by climatic indices. The type of precipitation and the temperatures are factors determining the hydrologic character. The study of snow hydrology of northeastern Canada and that of European Russia and Siberia indicates that in similar climatic conditions the hydrology is similar. However, because of differences in climate the snow hydrology is considerably different in deeply continental locations of Eurasia as compared with northeastern Canada. Eastern Canada is wetter than European Russia and much more than Siberia, but European Russian and Siberian climate is generally cooler than that of eastern Canada. The magnitude of climatic indices determined for those countries made it possible to explain causes of the different character of snow hydrology in the studied parts of Northern America, Europe and Asia. (Knapp-USGS)
W69-05225

AN EXPERIMENTAL INVESTIGATION OF PARTIAL AREA CONTRIBUTIONS,
Maryland Univ., College Park.
For primary bibliographic entry see Field 02A.
W69-05227

TIME-OF-TRAVEL MEASUREMENTS AND OTHER APPLICATIONS OF DYE TRACING,
Geological Survey, Cheyenne, Wyo. Water Resources Division.
For primary bibliographic entry see Field 07B.
W69-05228

STUDIES OF RUNOFF FORMATION UNDER CONDITION OF HIGH-ANGLE ATTITUDE OF THE IMPERVIOUS BED,
Hydrometeorological Centre (USSR).
A. G. Levin, and A. S. Kouznetzov.
Int Ass Sci Hydrol Pub No 76, Symp on Hydrol Aspects of Util of Water, Bern, Sept 25-Oct 7, 1967, pp 300-305, 1968. 6 p, 4 fig, 4 ref.

Descriptors: *Rainfall-runoff relationships, *F mafrost, *Floods, Frozen ground, Flash flo Cold regions, Evaporation, Runoff, Infiltrati Melting, Hydrograph analysis, Precipitation (mospheric), Rainfall intensity.
Identifiers: USSR, Kolyma River (USSR).

During the summer and the fall, rain floods most characteristic of the water conditions mountaineous streams in the areas where groun frozen. Sometimes the floods are quite danger and exceed considerably the spring flood. If take the mountain Upper Kolyma basin, for ex ple, in the area of perennial frozen ground, consider the conditions of flood formation the we may come to the following conclusions: floods are formed on account of the precipitat flowing on the surface and mainly within the la of seasonal melting. The underlying ground is in fact involved in the water circulation process serves only as a water-resisting bed. The flood pends on the amount of the precipitation, on its tribution on the basin conditions. The inflow due snow melting in the mountains and ice body tha ing has no important effect on the flood format accounting for about 5 to 10% of the summ period drainage. Some calculations are given as example, showing that during rains evaporat water losses make 20% and more of the total. losses on surface drainage and in the active la depend on the nature of the underlying surface the depth of melting of the active frozen grou layer. (Knapp-USGS)
W69-05229

MOUNTAIN RIVER FLOOD RUNO THEORY, MEANS OF ITS INVESTIGATIO AND CALCULATION,
Gidrometeorologicheskii Institut, Odessa (USSR
For primary bibliographic entry see Field 02A.
W69-05230

THE ASSESSMENT OF SURFACE RUNO FROM RAINFALL DATA FOR AN ARID R GION OF WEST PAKISTAN,
MacDonald (Murdoch) and Partners, London (E gland).
J. H. Fleming.
Int Ass Sci Hydrol Pub No 76, Symp on Hyd Aspects of Util of Water, Bern, Sept 25-Oct 1967, pp 369-382, 1968. 14 p, 3 fig, 4 tab, 1 ref, pend.

Descriptors: *Rainfall-runoff relationships, *A lands, *Streamflow forecasting, *Flood foreca ing, *Routing, Water resources, Rainfall intensi Rainfall disposition, Infiltration, Runoff, Subs face runoff, Stream gages.
Identifiers: Pakistan, Kachhi Plain (Pakistan).

In assessing the water resources of the Kachhi Pla in West Pakistan the annual flood runoff fr 15,000 sq mi of arid mountainous catchment had be estimated. There were no reliable flo discharge measurements for any extended peri of time on any of the rivers, but the rainfall recor were good, and extended back in some cases for yr. Average annual rainfall varied between 4 a 14 in. The problem was to make an initial asse ment of 50 yr of surface runoff after 18 mo correl tion of measured discharges and rainfall, and refine the approximation as data accumulated. was assumed that the runoff coefficient was depe dent on the quantity of rain, the intensity of ra fall, ground configuration, and rate of infiltratio The intensity of rainfall in the monsoon is mu higher than in winter, so that the 2 seasons we considered separately. Ground configuration w assessed from air photographs. For each of 4 top graphically defined sub-areas, further subdivid into 7.5 min quadrangles, the areas in ea catchment and land class were known, and t seasonal rainfall was assigned by interpolation fro isohyets. Runoff coefficients were evolved fro measured rainfall and runoff over 4 gag catchments for 2 monsoon seasons. Basically a r noff coefficient of 0.25 was found to apply for ste

cky catchments and more than 3 in. of mon-
onal rainfall. Correlation of the rainfall and ru-
ff for the non-monsoon period was less satisfac-
y, because the runoff coefficients was much
wer. Actual overall runoff coefficients for a 3-yr
riod varied between 0.232 and 0.039 for dif-
ent catchments, but it was possible to reconcile
se widely divergent figures in a reasonably
isfactory way. (Knapp-USGS)
69-05232

IE ASSESSMENT OF RUNOFF FROM A OUNTAINOUS AND SEMI-ARID AREA IN ESTERN IRAN,
drological Research Unit, Wallingford (En-
nd); Gibb (Alexander) and Partners, London
ngland).
. Sutcliffe, and T. G. Carpenter.
Ass Sci Hydrol Pub No 76, Symp on Hydrol
pects of Util of Water, Bern, Sept 25-Oct 7,
57, pp 383-394, 1968. 12 p, 4 fig, 3 tab, 8 ref.

scriptors: *Rainfall-runoff relationships,
lountains, *Routing, Slopes, Topography,
aporation, Infiltration, Estimating, Synoptic
lysis.
ntifiers: Iran, Rainfall-altitude relations, Kark-
River (Iran).

e assessment of river flows over an area requires
vider investigation of the hydrology than the
dy of measured flows at single sites; such studies
mountainous and semi-arid areas present
oblems which do not arise in flatter humid areas.
investigation of the surface water resources of a
r basin in a mountainous regions of Iran is used
llustrate the problems involved. Because of the
ography the precipitation is extremely variable,
the use of a rainfall-elevation relationship ena-
s the residual effect of position to be deduced.
many hydrological purposes for such terrain it
referable to map equivalent precipitation at a
stant altitude rather than produce a complex
yetal map. The effect of altitude on potential
actual evaporation is discussed and a relation-
between rainfall and runoff is derived from the
ords. (Knapp-USGS)
9-05233

MOGRAPHS FOR DETERMINING AMOUNT RHODAMINE B DYE FOR TIME-OF-AVEL STUDIES,
ological Survey, Washington, D. C.
primary bibliographic entry see Field 07B.
9-05236

NSTANT-RATE-INJECTION EQUIPMENT R DYE-DILUTION DISCHARGE MEASURE-NTS,
Geological Survey, Washington, D. C.
primary bibliographic entry see Field 07B.
9-05237

LECTION OF DYE-INJECTION AND MEA-RING SITES FOR TIME-OF-TRAVEL STU-ES,
ological Survey, Washington, D. C.
primary bibliographic entry see Field 07B.
9-05238

MPARISON OF RESULTS USING THREE MPLING TECHNIQUES FOR A FLUOMET-C DYE STUDY IN A STREAM,
ological Survey, Washington, D. C.
primary bibliographic entry see Field 07B.
9-05239

MPARISON OF FLOOD-WAVE AND TER-PARTICLE TRAVELTIMES,
ological Survey, Washington, D. C.
mas J. Buchanan.
l Surv Water-Supply Pap 1892, Selec Tech in
ter Resources Invest, 1966-67, pp 34-36, 1968.
1 tab, 1 ref.

Descriptors: *Floods, *Unsteady flow, *Flood forecasting, Flood routing, Tracers, Dye releases, Hydrographs, Channel morphology, Mannings equation, Chezy equation.
Identifiers: Flood-wave traveltime, Water velocity.

By applying the Manning and Chezy formulas, the ratio of the velocity of a flood wave to the mean velocity of water particles is shown to be between 1.3 and 1.7. The results of an actual study with a fluorescent dye in an open channel to determine the ratio show good agreement with the expected ratios in channel reaches without dams, but reaches with dams give ratios greater than 2.0. (USGS)
W69-05240

DYE-CLOUD PHOTOGRAPHY,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 07B.
W69-05241

POLAR COORDINATE CHART READER FOR STAGE-RAINFALL RECORDER,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 07B.
W69-05254

INTERPRETATION OF FLOOD-FREQUENCY DATA,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 07B.
W69-05260

COMPUTERIZED SYSTEM FOR WYOMING SURFACE WATER RECORDS,
Wyoming Univ., Laramie. Water Resources Research Inst.
Paul A. Rechard, William N. Embree, and Lee W. Larson.
Wyoming State Water Plan Report No 1, Cheyenne: State Engineer's Office; and Wyoming WRRI - Water Resources Series No 13, September 1968. 66 p, 2 fig, 3 append.

Descriptors: Annual discharge, Automation, *Computer programs, *Data processing, *Data storage and retrieval, Duration curves, Frequency analysis, Hydrologic data, Information retrieval, Maximum flow, Mean daily flow, Minimum flow, *Streamflow, *Surface waters, Water resources, Water year.

A general description of a computerized system for Wyoming Surface Water Records is given. This system, developed by the University of Wyoming's Water Resources Research Institute, in conjunction with the Computer Center, is designed to store and utilize streamflow data. All available programs and types of out-put are described and procedures for operation of the system are given.
W69-05326

IN DEFENSE OF EXPERIMENTAL WATERSHEDS,
Georgia Univ., Athens. School of Forestry; and Northeastern Forest Experiment Station, Upper Darby, Pa.
For primary bibliographic entry see Field 02A.
W69-05405

UNSTEADY FLOW PARAMETERS IN HYDRAULIC DESIGN,
Kansas Univ., Lawrence.
For primary bibliographic entry see Field 08B.
W69-05408

WATER RESOURCES OF THE SALMON FALLS CREEK BASIN, IDAHO-NEVADA,
Geological Survey, Washington, D. C.
E. G. Crosthwaite.
Geol Surv Water-Supply Pap 1879-D, pp D1-D33, 1969. 33 p, 7 fig, 5 tab, 39 ref.

Descriptors: *Water resources, Groundwater, Surface waters, Aquifers, Idaho, Nevada, Irrigation water, Water yield, Water utilization, Data collections, Hydrologic data, Water levels, Streamflow, Water table.
Identifiers: Volcanic rocks, Salmon Falls Creek (Idaho).

The Salmon Falls Creek basin, Idaho-Nevada, has insufficient surface water to irrigate its good agricultural land. Specific capacities of the existing irrigation and test wells range from 0.5 to 70 gpm per ft. The area's most important aquifer is the Idavada volcanic rocks, and only 5 local areas have been discovered where irrigation water may be pumped economically. About 8,000 acre-ft were withdrawn for all uses in 1960. Natural discharge is estimated to be 115,000 acre-ft per yr. The groundwater has a medium to high salinity hazard and low sodium hazard. The surface water supply averages 107,000 acre-ft per yr, of which 76,000 are used for irrigation. (Knapp-USGS)
W69-05409

WATER-RESOURCES APPRAISAL OF THE SNAKE RIVER BASIN IN NEVADA,
Geological Survey, Carson City, Nev.
Donald O. Moore, and Thomas E. Eakin.
Nev Div Water Resources-Reconnaissance Ser Rep 48,July 1968. 103 p, 13 fig, 1 plate, 29 tab, 25 ref.

Descriptors: *Water resources, *Surface waters, *Groundwater, *Nevada, Water sources, Water utilization, Water yield, Precipitation (Atmospheric), Runoff, Streamflow, Water wells, Aquifers, Induced infiltration, Evapotranspiration, Transmissivity, Data collections.
Identifiers: Snake River Basin (Nev).

The Snake River basin in Nevada includes about 5,000 sq mi in Elko and Humboldt Counties, nearly all above 5,000 ft. The basin has high runoff, high evapotranspiration, and the streams are groundwater drains. Precipitation is estimated to average about 3.9 million acre-ft per yr of which 83% is lost to evapotranspiration where it falls. Potential recharge is estimated to be about 150,000 acre-ft per yr. Groundwater is largely undeveloped. Irrigation wells in volcanic rock yield as much as 2,500 gpm and suggest the possibility of good irrigation development potential. Development to perennial yield might salvage as much as 45,000 acre-ft per year now lost to evapotranspiration, and induce recharge from streamflow. Both surface water and groundwater are of good quality with medium salinity and low alkali hazards, hard, and of low total dissolved solids content. (Knapp-USGS)
W69-05414

FLOODS IN VIRGINIA - MAGNITUDE AND FREQUENCY,
Geological Survey, Richmond, Va.
E. M. Miller.
Geol Surv open-file rep, 1969. 371 p, 12 fig, 2 plate, 4 tab, 19 ref, 1 append.

Descriptors: *Floods, *Stage-discharge relations, *Streamflow, *Data collections, Hydrologic data, Duration curves, Hydrographs, Equations.
Identifiers: Flood peak, Peak stages, Flood frequencies.

Flood magnitude-frequency equations applicable to streams in Virginia are presented. The equations are based on flood data collected at 200 gaging stations having 10 or more years of record not materially affected by regulation, and relate flood magnitude and frequency to drainage area and stream slope. A compilation of flood records at all sites at which 5 or more consecutive years of record have been collected is included. An appendix presents the results of flood-frequency analyses as pertains to Virginia from U. S. Geological Survey Water-Supply Papers 1672, 1673, 1675, and 1676. (Knapp-USGS)
W69-05415

RAINFALL-RUNOFF MODEL FOR SMALL BASIN FLOOD HYDROGRAPH SIMULATION,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 02A.
W69-05420

WATER RESOURCES OF THE BURNETT REGION,
F. B. Haigh, J. A. O'Shea, J. E. Ladewig, R. G. H. Prince, and L. de Henry.
Water Resources Found of Australia Rep No 26, Symp Pap, 1968. 56 p, 9 fig, 6 tab, 10 ref.

Descriptors: *Water resources, *Surface waters, *Groundwater, *Irrigation, *Optimum development plans, River basin development, Recharge, Water yield, Safe yield, Streamflow, Runoff, Reservoirs, Water wells, Storage, Water pollution, Irrigation water, Municipal water, Domestic water.
Identifiers: Australia, Queensland, Burnett region, Bundaberg.

The water resources of the Burnett region, Queensland, eastern Australia, are discussed in a seminar of 5 papers which include the topics of recharge, land and water use, corrosion of well equipment, and stream pollution. The region has an area of about 14,000 sq mi and a population of about 80,000. Sugar cane production accounts for 22% of primary industrial and agricultural output. Rainfall averages 44 inches per year. Average streamflow is 1,663,000 acre-ft per yr. In irrigated areas the surface and groundwater supplies are fully developed and near Bundaberg they are overdeveloped. Full development of the region's water resources would provide an estimated safe supply of 500,000-600,000 acre-ft per yr, while present and near-future commitments amount to about 500,000 acre-ft. Conservation measures including underground storage, evaporation control, runoff improvement, optimum use plans, dry farming, pollution control, and others are being studied. (Knapp-USGS)
W69-05423

A PROPOSED MECHANICS FOR THE INVESTIGATION OF SURFACE RUNOFF FROM SMALL WATERSHEDS. 1, DEVELOPMENT,
Ohio Agricultural Research and Development Center, Wooster.
For primary bibliographic entry see Field 02A.
W69-05425

RUNOFF VOLUME PREDICTION FROM DAILY CLIMATIC DATA,
Agricultural Research Service, Riesel, Tex.; and Agricultural Research Service, Chickasha, Okla.
For primary bibliographic entry see Field 02A.
W69-05426

PREDICTING TEMPERATURES OF SMALL STREAMS,
Oregon State Univ., Corvallis. Forest Research Lab.
George W. Brown.
Water Resources Res, Vol 5, No 1, pp 68-75, Feb 1969. 8 p, 6 fig, 15 ref. Grant WP-423.

Descriptors: *Water temperature, *Water quality, *Streamflow, *Small watersheds, *Heat budget, Energy budget, Heat balance, Heat flow, Heat transfer, Vegetation effects, Conduction, Convection, Evaporation, Meteorology.
Identifiers: Water temperature control, Radiometers.

Hourly temperatures of small streams can be accurately predicted using an energy balance. Micrometeorological measurements are required to assess the environment of the small stream accurately. The temperature-prediction technique was tested on 3 streams in Oregon. On unshaded stretches, net all-wave radiation is the predominant energy source during the day; evaporation and convection account for less than 10% of the total energy exchange. Conduction of heat into the stream bottom is an important energy balance component on shallow streams having a bedrock bottom. Up to 25% of the energy absorbed by such a stream may be transferred into the bed. Hourly temperature changes of 0-16 deg F were predicted to within 1 deg F more than 90% of the time. This technique permits foresters to control water temperature through manipulation of stream-side vegetation. (Knapp-USGS)
W69-05427

USING ANALYTICAL METHODS TO DEVELOP A SURFACE-RUNOFF MODEL,
Tennessee Valley Authority, Knoxville.
For primary bibliographic entry see Field 02A.
W69-05431

SYNTHETIC HYDROGRAPHS; EFFECTS OF NETWORK GEOMETRY,
Thomas J. Watson Research Center, Yorktown Heights, N. Y.
For primary bibliographic entry see Field 02A.
W69-05432

RUNOFF HYDROGRAPH AS A FUNCTION OF RAINFALL EXCESS,
Cambridge Univ. (England).
For primary bibliographic entry see Field 02A.
W69-05438

RECURRENCE INTERVALS BETWEEN EXCEEDANCES OF SELECTED RIVER LEVELS. 2. ALTERNATIVES TO A MARKOV MODEL,
New South Wales Univ. Kensington (Australia); and Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Land Research.
C. A. McGilchrist, K. D. Woodyer, and T. G. Chapman.
Water Resources Res, Vol 5, No 1, pp 268-275, Feb 1969. 8 p, 3 fig, 7 tab, 4 ref.

Descriptors: *Mathematical models, *Statistical models, *Probability, *Markov processes, Streamflow forecasting, Hydrograph analysis, Runoff forecasting, Rainfall-runoff relationships, Duration curves.
Identifiers: Exponential models, Gamma models.

In a study of the probability of exceedance of a selected stage for daily maximum water levels, exponential and gamma models can be shown to be more realistic than a Markov model. The important differences are in the tails of the distributions, and the estimate of the expected recurrence interval is affected little by the choice of model. Confidence limits for the mean recurrence interval are, in fact, somewhat wider for the exponential model than for the Markov model. It is shown that the general relationship between the expected recurrence interval and the return period for the annual maximum series depends on the choice of model (Knapp-USGS)
W69-05454

FREQUENCY CURVES FOR ANNUAL FLOOD SERIES WITH SOME ZERO EVENTS OR INCOMPLETE DATA,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 07C.
W69-05455

FLOOD PLAIN INFORMATION OF ELLICOTT CREEK IN CITY OF TONAWANDA AND VICINITY, ERIE COUNTY, NEW YORK.
Corps of Engineers, Buffalo, N. Y.

Corps Eng Flood Plain Rep, Jan 1968. 60 p, 58 fig, 10 plate, 12 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, New York, Maximum probable flood, Historic flood.
Identifiers: Tonawanda (NY), Erie County, Ellicott Creek (NY), Standard project flood, Intermediate regional flood.

Flooding of Ellicott Creek, vicinity of Tonawanda, Erie County, New York is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-05458

FLOOD PLAIN INFORMATION OF DUCK CREEK, GARLAND, TEXAS.
Corps of Engineers, Fort Worth, Tex.

Corps Eng Flood Plain Rep, Mar 1968. 33 p, 10 fig, 19 plate, 12 tab.

Descriptors: *Floods, *Flood damage, Flood control, Non-structural alternatives, Texas, Maximum probable flood, Historic flood.
Identifiers: Garland (Tex), Duck Creek, Standard project flood, Intermediate regional flood.

Flooding of Duck Creek, Garland, Texas is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-05459

FLOOD PLAIN INFORMATION, SOUTH MESQUITE CREEK, MESQUITE, TEXAS.
Corps of Engineers, Fort Worth, Tex.

Corps Eng Flood Plain Rep, June 1968. 40 p, 6 fig, 21 plates, 11 tab. Prepared for city and county of Dallas Flood Control Committee.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, Texas, Maximum probable flood.
Identifiers: Mesquite (Tex), South Mesquite Creek, Standard project flood, Intermediate regional flood.

Flooding os South Mesquite Creek, Mesquite, Texas is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-05460

FLOOD PLAIN INFORMATION, TENMILE CREEK, DALLAS COUNTY, TEXAS.
Corps of Engineers, Fort Worth, Tex.

Corps Eng Flood Plain Rep, May 1968. 45 p, 10 fig, 36 plate, 12 tab. Prepared for the city and county of Dallas Flood Control Committee.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, Texas, Maximum probable flood.

ntifiers: Dallas County (Tex), Tenmile Creek, ndard project flood, Intermediate regional od.

oding of Tenmile Creek, Dallas County, Texas described in a report of flood plain problems ed on records of rainfall, runoff, and historical l present flood heights. Maps, photographs, files, and cross sections indicate the extent of oding that has occurred and which may be ex- ted to occur in the future. The information is use in study and planning ways to minimize vul- ability to flood damages by control of flood n use by zoning and subdivision regulations, the struction of flood protection works, or by com- ations of these approaches. (Knapp-USGS) 9-05461

OOD PLAIN INFORMATION OF CAT- RAUGUS CREEK, ARCADE, WYOMING UNTY, NEW YORK.
ps of Engineers, Buffalo, N. Y.

ps Eng Flood Plain Rep, July 1968. 50 p, 28 fig, ate, 2 exhibit, 10 tab.

criptors: *Floods, *Flood damage, Flood ns, Flood control, Non-structural alternatives, v York, Maximum probable flood, Historic d.
ntifiers: Arcade (NY), Wyoming County, Cat- ugus Creek, Standard project flood, Inter- liate regional flood.

oding of Cattaraugus Creek, Arcade, Wyoming nty, New York is described in a report of flood n problems based on records of rainfall, runoff, historical and present flood heights. Maps, tographs, profiles, and cross sections indicate extent of flooding that has occurred and which be expected to occur in the future. The infor- ion is for use in study and planning ways to imize vulnerability to flood damages by control ood plain use by zoning and subdivision regula- s, the construction of flood protection works, y combinations of these approaches. (Knapp- GS) 9-05462

. Groundwater

IE-OF-TRAVEL MEASUREMENTS AND HER APPLICATIONS OF DYE TRACING,
logical Survey, Cheyenne, Wyo. Water ources Division.
primary bibliographic entry see Field 07B. 9-05228

NTIFICATION OF NONLINEAR PARAME- RS OF GROUND WATER BASINS BY RID COMPUTATION,
fornia Univ., Los Angeles.
kateswararao Vemuri, and Walter J. Karplus.
er Resources Research, Vol 5, No 1, pp 172- Feb 1969. 8 fig, 13 ref.

criptors: *Groundwater basins, *Aquifers, mputer models, *Parametric hydrology, ter table, Analog computers, Digital compu- Data processing, Equations, Hydrologic data, nsmissivity, Input-output analysis, Systems ysis, Boundaries (Surfaces), California, Con- s, Storage coefficient, Mathematical models. tifiers: *Parameters, *Hybrid computers, Al- thms, San Fernando Valley, California.

tification of parameters of an unconfined fer in which the dynamics of the water table e describable by a partial differential equation be looked upon as a control system problem in ributed parameters systems. A maximum prin- e was used in conjunction with a steepest ent algorithm and the transmissibility of an fer was identified starting from observed values put-output as data. This algorithmic procedure blended with a heuristic method to identify the storage coefficient and the boundary of an aquifer in the San Fernando Valley basin in the city of Los Angeles. Some typical results of computations carried out on the hybrid computer were presented. This work demonstrates the computational advantages in combining analog and digital hardware, not only in terms of the gain in computational time but also in terms of the flexibility offered by the system. (Affleck-Ariz)
W69-05271

VARIATION IN THE COMPOSITION OF BRINE FROM THE SYLVANIA FORMATION NEAR MIDLAND, MICHIGAN,
Dow Chemical Co., Midland, Mich.
G. C. Egleson, and C. W. Querio.
Environ Sci and Technol, Vol 3, No 4, pp 367-371, Apr 1969. 5 p, 3 fig, 4 tab, 5 ref.

Descriptors: *Brines, *Water chemistry, *Groundwater, Saline water systems, Geochemistry, Michigan, Calcium, Magnesium, Sulfates, Potassium, Boron, Ammonium compounds, Trace elements, Salinity, Sea water, Aqueous solutions.
Identifiers: Sylvania Formation (Mich), Bromine, Strontium, Rubidium, Lithium, Iodine.

Brines from 51 wells in The Dow Chemical Co.'s brine field near Midland, Mich., were analyzed for major and minor components. The Ca, Mg, Na, Sr, Cl, and Br ions, which make up the bulk of the total dissolved solids in the brine, are fairly constant throughout the field, varying less than 10% above or below the mean. Another suite of ions-K, B, Ammonium, Rb, Li, and I-varies from 25 to 50% above and below the mean. Analyses of trends and relationships among the ions indicate that dolomitization probably is the mechanism most important in determining the Ca, Mg, and Sr content of the brine; that the relative amounts of Li, I, and ammonium are too high for them to have been derived directly from sea water evaporation; and that many interrelationships among the minor ions as yet are not well defined. (Knapp-USGS)
W69-05401

WATER RESOURCES OF THE SALMON FALLS CREEK BASIN, IDAHO-NEVADA,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02E.
W69-05409

TRANSIENT FLOW OF GROUND WATER TO WELLS IN MULTIPLE-AQUIFER SYSTEMS,
California Univ., Berkeley.
Shlomo P. Neuman, and Paul A. Witherspoon.
Dep Civil Eng, Inst Transp and Traffic Eng Publication No 69-1, Jan 1969. 182 p, 40 fig, 52 ref, 3 append.

Descriptors: *Groundwater movement, *Mathematical studies, *Mathematical models, *Unsteady flow, Water wells, Numerical analysis, Aquifers, Aquitards, Permeability, Drawdown, Theis equation, Thiems equation, Water level fluctuations, Withdrawal.
Identifiers: Multiple-aquifer systems, Finite-difference methods, Leaky aquifers.

The transient flow of fluid to wells in multiple-aquifer systems was analyzed for 2-aquifer and 3-aquifer systems by finite-difference methods. Asymptotic solutions for small time values were obtained to give the drawdown distribution in an aquifer enclosed by 2 aquitards. Solutions for 2-aquifer systems were evaluated by a numerical method and the results are presented graphically. The finite element method was used to study 2-aquifer systems and to check analytical solutions. The assumption that flow is essentially horizontal in aquifers and vertical in aquitards was found to hold approximately in most field situations. Presently used test methods for leaky aquifers are limited in application, and new methods are outlined. (Knapp-USGS)
W69-05413

WATER-RESOURCES APPRAISAL OF THE SNAKE RIVER BASIN IN NEVADA,
Geological Survey, Carson City, Nev.
For primary bibliographic entry see Field 02E.
W69-05414

EVALUATION OF SOME GEOPHYSICAL TECHNIQUES APPLIED TO THE ENVIRONMENT OF A MAUI WELL,
Hawaii Inst. of Geophysics, Honolulu.
W. M. Adams, and A. Malahoff.
Hawaii Inst Geophys Rep No HIG-68-23, Nov 1968. 29 p, 10 fig, 7 tab, 9 ref, 3 append. OWRR Project B-005-HI.

Descriptors: *Borehole geophysics, *Electrical resistance, *Seismic studies, *Groundwater, *Hawaii, Saline water-freshwater interfaces, Resistivity, Exploration, Geothermal studies, Logging (Recording), Subsurface investigations, Water quality, Water yield, Water temperature, Water table, Aquifers.
Identifiers: Groundwater exploration, Maui (Hawaii).

A review of the various geophysical techniques applicable to groundwater exploration in Hawaii was made to determine which were suitable for further development. Improvements on some aspects of sugar production and agriculture indicated the need for improving the production of water on the island without loss of quality. The environment of a Maui well was studied with five types of geophysical techniques. These were lateral and vertical temperature surveying, seismic refraction, seismic reflection, and electrical resistivity sounding. Results of the lateral temperature surveying were not informative but those of the vertical temperature surveying indicated inflowing water and additional development possibilities. The seismic techniques were not useful at the attempted small effort. The electrical resistivity sounding located the fresh-salt interface and indicated a shallow, unexpected discontinuity in the electrical resistivity. The water table was not located directly. No resistivity profiling was attempted. On the basis of this limited work, it is suggested that one of the borings from the surface could be extended to a deeper aquifer at minimal cost. Comparison of the effectiveness of the various methods suggests that the vertical temperature surveys and the electrical resistivity sounding were most informative for the amount of effort involved. (Knapp-USGS)
W69-05418

WATER RESOURCES OF THE BURNETT REGION,
For primary bibliographic entry see Field 02E.
W69-05423

MEASUREMENT OF SMALL SURFACE DISPLACEMENTS INDUCED BY FLUID FLOW,
Missouri Univ., Columbia; Hawaii Univ., Honolulu, Water Resources Research Center; and Arizona Univ., Tucson. Agricultural Extension Service.
Stanley N. Davis, Frank L. Peterson, and Allan D. Halderman.
Water Resources Res, Vol 5, No 1, pp 129-138, Feb 1969. 10 p, 7 fig, 1 tab, 18 ref. Grant GP-985 (NSF).

Descriptors: *Groundwater movement, *Aquifers, *Strain, Withdrawal, Strain measurement, Stress analysis, Strain gages, Elasticity (Mechanical), Subsidence.
Identifiers: Fluid movement-aquifer strain relationships, Aquifer dynamics.

Fluid flow to wells produces strain that has been measured as horizontal, vertical, and rotational displacements of reference points fixed on the ground surface. Most linear displacements measured were between 1 and 100 microns, and angular displacements were a few microradians. Of the various devices used to make measurements, a horizontal extensometer proved to be the most accurate and versatile. Most measurements were made of effects

produced by pumping wells for 5 to 30 minutes. Such effects are almost entirely elastic except in some geologically recent materials. Deflections of the land surface resembled the theoretical deflections caused by a point load on a plate of infinite extent resting on an elastic foundation. Significant horizontal strain was measured in all materials tested, suggesting that accepted equations for fluid discharge from wells might be modified for special conditions near the wells. (Knapp-USGS)
W69-05433

HYDRODYNAMIC DISPERSION IN A SATURATED HOMOGENEOUS POROUS MEDIUM AT LOW PECLET NUMBERS AND NON-HOMOGENEOUS SOLUTION,
Guelph Univ. (Ontario).
For primary bibliographic entry see Field 01B.
W69-05434

COMPUTER METHODS FOR TRANSIENT ANALYSIS OF WATER-TABLE AQUIFERS,
California Univ., Davis; and Ohio State Univ., Columbus.
For primary bibliographic entry see Field 07C.
W69-05435

THE MECHANISM OF NATURAL GROUNDWATER RECHARGE AND DISCHARGE-1. ONE-DIMENSIONAL, VERTICAL, UNSTEADY, UNSATURATED FLOW ABOVE A RECHARGING OR DISCHARGING GROUND-WATER FLOW SYSTEM,
Dept. of Energy, Mines and Resources, Calgary (Alberta). Inland Waters Branch.
R. Allan Freeze.
Water Resources Res, Vol 5, No 1, pp 153-171, Feb 1969. 18 p, 9 fig, 2 tab, 33 ref.

Descriptors: *Unsteady flow, *Saturated flow, *Unsaturated flow, *Infiltration, Mathematical models, Evaporation, Water-level fluctuations, Percolation, Recharge, Discharge (Water), Darcy's law, Soil water movement, Groundwater movement, Rainfall intensity.
Identifiers: Transient flow.

The unsaturated flow processes of infiltration and evaporation are in physical and mathematical continuity with the parallel saturated processes of recharge and discharge. Water table fluctuations result when the rate of groundwater recharge or discharge is not matched by the unsaturated flow rate created by infiltration or evaporation. A water-table rise provides the source of replenishment to the groundwater zone that allows the prevailing rate of recharge to continue. This dynamic water-table behavior can be simulated by a one-dimensional, numerical mathematical model involving transient flow through an integrated saturated-unsaturated system. The solutions are applicable to homogeneous, isotropic soils in which the functional relationships show hysteresis properties. The model allows upper boundary conditions of constant rate rainfall, ponded water, evaporation, and redistribution. It can be used to determine the water-table fluctuation that will arise from a given set of initial conditions, boundary conditions, and soil type. The effects of variations in the parameters that control the flow are examined to arrive at a better understanding of the mechanism of natural groundwater recharge and discharge. (Knapp-USGS)
W69-05436

FLUID FLOW IN THE WESTERN CANADA SEDIMENTARY BASIN - 1. EFFECT OF TOPOGRAPHY,
Research Council of Alberta, Edmonton.
Brian Hitchon.
Water Resources Res, Vol 5, No 1, pp 186-195, Feb 1969. 10 p, 8 fig, 16 ref.

Descriptors: *Groundwater movement, *Flow nets, *Topography, Groundwater basins, Water levels, Water level fluctuations, Streamflow, Drawdown, Potential flow, Potentiometric level.
Identifiers: *Western Canada basin.

In the western Canada sedimentary basin, the main variables affecting the groundwater potential distribution are topography and geology. The effect of topography is studied by use of fluid potential slice maps and cross sections taken from the 3-dimentional flow net. The dominant fluid potential in any part of the basin corresponds closely to the fluid potential at the topographic surface in that part of the basin. Major recharge areas correspond to major upland areas, and major lowland regions are major discharge regions. Large river valleys commonly exert a drawdown effect on the fluid potential distribution, which may be observed to depths of up to 5000 ft. The presence of a thick sequence of highly permeable Upper Devonian and Carboniferous carbonate rocks in the medium-depth portion of the Alberta basin has resulted in the development of a low fluid-potential drain, which essentially channels flow from most of the Alberta basin towards the Athabasca oil sands and has modified the theoretical relation between local and regional flow systems. (Knapp-USGS)
W69-05451

DETERMINING THE RATIO OF HORIZONTAL TO VERTICAL PERMEABILITY BY AQUIFER-TEST ANALYSIS,
Geological Survey, Madison, Wis.
Edwin P. Weeks.
Water Resources Res, Vol 5, No 1, pp 196-214, Feb 1969. 19 p, 6 fig, 1 tab, 22 ref.

Descriptors: *Groundwater movement, *Permeability, Anisotropy, Aquifers, Beds, Unsteady flow, Porosity, Interstices, Piezometers, Piezometry, Theis equation, Drawdown, Water level fluctuations.
Identifiers: Aquifer anisotropy, Vertical permeability, Horizontal permeability, Aquifer testing, Pumping tests, Partially penetrating wells.

The ratio of horizontal to vertical permeability may be determined by analysis of drawdown data from piezometers or partially penetrating observation wells near a partially penetrating production well. The analyses are made by comparing measured drawdowns in the piezometers to those predicted if the production well fully penetrated the aquifer. The differences between the measured and predicted drawdowns are determined, and the distances from the pumped well at which these differences would occur in an isotropic aquifer are determined from an equation. The permeability ratio is computed as the square of the ratio of actual distances to computed distances. The ratio of horizontal to vertical permeability in glacial outwash in central Wisconsin was determined from 5 aquifer tests to range from about 2 to about 20. (Knapp-USGS)
W69-05452

SALT WATER ENCROACHMENT IN KARST AQUIFERS, ISLAND OF KEPHALLINIA, (IONIAN),
Society of Hydrogeological Scientists Graz, (Austria).
For primary bibliographic entry see Field 02L.
W69-05472

SALT-WATER ENCROACHMENT OF TERTIARY LIMESTONE ALONG COASTAL SOUTH CAROLINA,
Geological Survey, Columbia, S. C.
For primary bibliographic entry see Field 02L.
W69-05473

DETERMINATION OF FRESH WATERS IN THE CALCAREOUS MASSIF OF 'COSTA BRAVA', SPAIN (FRENCH),
Federico Macau Vilar.
Hydrol of fractured rocks Vol 2, Proc Dubro Symp (Oct 1965), Int Ass Sci Hydrol, Pub 7 455-462, 1967. 8 p, 2 fig.

Descriptors: *Aquifers, *Fresh w *Limestones, *Hydrologic properties, Hydrog gy, Springs, Saline water-fresh water interf Groundwater movement, Water sources, W storage, Geochemistry, Discharge, Water che try, Water wells.
Identifiers: *Spain, Montgri calcareous ma Costa Brava.

This article describes the methods used and re of an investigation of groundwater resources i calcareous massif in Spain, and the prelimi results of mapping the fresh water aquifers and saline water occurrence along the coast. hydrological survey used in the area consiste several trial boreholes along profiles selected the basis of submarine fresh-water springs pointed by special frogman teams. The study sh that the marine environments, such as temperat plant and animal life, etc., deviate from nor marine patterns at the places of emergence of f water springs. A detailed geological map ar cross section showing fresh water and the sa water-fresh water interface are presen (Gabriel-USGS)
W69-05474

STATISTICAL ANALYSIS OF GROU WATER USE AND REPLENISHMENT,
Purdue Univ., Lafayette, Ind.
J. D. Rockaway, and R. B. Johnson.
Water Resources Res Center Tech Rep No 2, due Univ, Sept 1967. 142 p, 28 fig, 28 ref, 4 pend. OWRR Project A-002-IND.

Descriptors: *Statistical methods, *Statist models, *Water resources development, Forec ing, Groundwater, Water table, Flow n Aquifers, Recharge, Water yield, Water utilizati Water level fluctuations, Observation we Precipitation (Atmospheric), Digital computers
Identifiers: *Trend-surface analysis, Aqu evaluation.

A trend-surface analysis of hydrogeologic data carried out in an attempt to derive techniq which could give additional guidance in the sel tion of areas suitable for the development of fut groundwater resources. South Bend, Indiana is area of municipal and industrial groundwa requirements and Bartholomew County, Indian an area of essentially rural or small-scale deman Both areas obtain water from glacial sand a gravel aquifers in which water levels have be monitored for several years. Trend-surface ma and maps of the residuals from the trend surfac were prepared from the water-level data at regu intervals and evaluated to establish their relatio ships with the hydrogeologic regimen. The ma were compared with conventional piezomet maps drawn from the same data, with known su surface conditions and aquifer parameters, and t fluctuations of these maps with time were co pared with variations in the recharge and discha characteristics of the groundwater reservoir. field-testing program was carried out Bartholomew County to evaluate an area det mined by the trend-surface analysis to be favorab for the development of groundwater. A mathema cally computed surface is used to approximate t piezometric surface. The addition of orthogon flow lines to the contours of the trend-surface ma can provide additional information on the directio and relative amounts of groundwater flow. Th trend-surface approach to the analysis of groun water levels cannot be completely successful unle the requirements for suitable data are satisfied. (K napp-USGS)
W69-05475

WATER RESOURCES LAWS IN VIRGINI (PERCOLATING GROUNDWATER - DIFFUSE SURFACE WATER).
For primary bibliographic entry see Field 06E.

59-05535

G. Water in Soils

IARACTERISTICS OF LOGARITHMIC RAT-G CURVES,
ological Survey, Washington, D. C.
r primary bibliographic entry see Field 07B.
59-05259

CASUREMENT OF DROUGHT RESISTANCE CROP PLANTS,
ian Agricultural Research Inst., New Delhi. Div. Botany.
D. Asana.
ESCO Arid Zone Research, Vol 25, pp 413-9, 1965. 1 fig, 2 tab, 18 ref, disc.

scriptors: *Dry farming, *Monsoons, *Moisture ss, *Drought resistance, *Crop response, eat, Plant growth, Wet seasons, Dry seasons, nperature, Precipitation (Atmospheric), Soil isture, Droughts.
ntifiers: *India.

arif (summer) and rabi (winter) crops grown in ia were discussed in this report. Annual rabi ps grow under unirrigated cultivation on soil sture accumulated during the preceding mon-n, and therefore on soil moisture that gradually reases with time, increasing moisture stress. ieties with early to early-medium maturity ld be better suited to such conditions than late uring varieties which would be exposed to more nse soil and atmospheric drought. The kharif ps, which are raised during monsoon rains in mer, do not grow under a gradually increasing moisture stress up to maturity. The kharif crops be injured or their growth may be suppressed porarily during a long break in the rains. The wth aspect must not be overlooked while evolv-criteria for adaptability of varieties to unir-ted cultivation and to low rainfall areas where ribution of rainfall is very erratic. (Blecker-z)
59-05265

L MOISTURE CONDITIONS UNDER STURES OF COOL-SEASON AND WARM-ASON GRASSES,
raska Univ., Lincoln; Washington State Univ., man.
. Conard, and Vern E. Youngman.
ange Management, Vol 18, No 2, pp 74-78, ch 1965. 2 fig, 4 tab, 2 ref.

criptors: *Moisture content, *Soil moisture, stures, *Grazing, *Grasses, Drought tolerance, sture availability, Nebraska, Precipitation (At-pheric), Sampling, Clay loam, Soil-water-plant tionships, Depth, Autumn, Field capacity, Crop onse, Spring, Plant growth, Variability.

iations in the soil moisture content of a silty loam under two kinds of pasture, cool-season warm-season grasses, were studied in conjunc-with a grazing experiment at Lincoln, raska. Warm-season pastures consisted of big stem, side-oats grama, Nebraska 28 chgrass and Nebraska 27 sand lovegrass. Cool-on grasses were Lincoln bromegrass, tall atgrass, and intermediate wheatgrass. There less available water in soil under the cool-on than under warm-season grasses in the mid-ng of each year. Amounts under warm-season ses ranged from 25% to 240% more than under -season grasses. Cool-season pastures suffered midsummer drought more often than did n-season pastures. Since the grasses used in the y are grown in arid areas, results of the experi-t would give an indication performance of e grasses under drought conditions. (Blecker-)
59-05266

MOISTURE-RETENTION CAPACITY OF LITTER UNDER TWO ARIZONA CHAPARRAL COMMUNITIES,
R. M. Garcia, and C. P. Pase.
U. S. Forest Service, Research Note RM-85, 2 pp, 1967. 1 fig, 1 tab, 3 ref.

Descriptors: *Soil moisture, *Moisture content, *Chaparral, *Retention, *Field capacity, Plant growth, Percolation, Arizona, Canopy, Biological communities, Water yield, Weight, Soil-water-plant relationships.
Identifiers: *Litter layer, Manzanita.

Retention of moisture in the litter layer affects soil-moisture supply and therefore plant growth and percolation water yield. Moisture-retention capacity of chaparral litter was studied at three sites in the Tonto National Forest, Arizona. Arrangement of litter appeared to have little effect on water-holding capacity, and therefore disturbed and undisturbed litter samples would be expected to yield reasonably similar results. Within each community, litter weight varied substantially more than did water retained per gram of litter. Pringle manzanita litter held more water per gram of litter than did shrub live oak but total litter produced was less. Increasing the litter layer under plants may be a possible way of increasing vegetative production on arid lands by increasing the moisture content of soil near the plants. (Blecker-Ariz)
W69-05267

SOIL PROBLEMS IN RESEEDING A GREASEWOOD-RABBITBRUSH RANGE SITE,
Agricultural Research Service, Washington, D. C. Soil and Water Research Div., Agricultural Research Service, Washington, D. C. Crops Research Div.
M. B. Rollins, A. S. Dylla, and R. E. Eckert, Jr.
J of Soil and Water Conservation, Vol 23, No 4, pp 138-140, July-August, 1968. 2 fig, 1 tab, 13 ref.

Descriptors: *Wheatgrasses, *Range management, *Soil surfaces, *Infiltration, *Grasses, *Dunes, Seeds, Semiarid climates, Shrubs, Soil physical properties, Soil chemical properties, Sodium compounds, Boron, Salts, Ranges, Nevada, Desert plants, Revegetation, Sampling.
Identifiers: *Rabbitbush, *Greasewood, Reseeding.

A study was conducted on relationship of tall wheatgrass seedling survival to physical and chemical properties of surface soils at a greasewood-rabbitbrush range site. The study site was located in the semiarid northern desert of Nevada. Small dunes, which comprised about one-third of the study site, were more textured than the barren soils. Native vegetation consisted of greasewood, rabbitbrush, Great Basin wildrye and saltgrass. Exchangeable sodium percentage levels in the 3 inches of surface soil were closely related to infiltration rates. Grasses were successfully established only on dune soils. Excessive exchangeable sodium, total salts or boron in barren surface soils accounted for death of tall wheatgrass seedlings. Total salts and exchangeable sodium (0-6-inch depth) were lower beneath greasewood and rabbitbrush plants than in adjacent barren soil. (Blecker-Ariz)
W69-05269

EFFECT OF FATTY ALCOHOL ON CHANGE IN SOIL WATER DURING THE SUMMER FALLOW PERIOD,
Colorado State Univ., Springfield. Southeastern Colorado Branch Station.
K. G. Brengle, and H. O. Mann.
J Soil and Water Conserv, Vol 24, No 1, pp 25, 26, Jan-Feb, 1969. 1 tab, 6 ref.

Descriptors: *Octadecanol, Fallowing, *Soil water, *Summer, *Evaporation control, Alcohols, Colorado, Semiarid climates, Retardants, Rates of application, Precipitation (Atmospheric), Water loss, Water storage, Soil surfaces, Evaporation pans, Cultivation.
Identifiers: *Powder.

A study was conducted to determine whether fatty alcohols would improve efficiency of soil water storage during the fallow period under semiarid conditions in southeastern Colorado. Octadecanol in powder form was applied at rates of 0, 300, 600, and 900 pounds per acre in a randomized block experiment with 5 replications. No significant differences in soil water changes were noted in any of the 3 years during which the test was conducted, but there was a trend for less water loss with 900 pounds of fatty alcohol per acre. Surface application of fatty alcohol at the rates used in this study did not retard soil water loss enough to warrant its use in a fallow system. (Affleck-Ariz)
W69-05284

STUDIES ON METHODS OF SOIL WATER DETERMINATION,
Idaho Univ., Moscow. Water Resources Research Inst.
Howard E. Hite, Jr.
Idaho Univ Engineering Experiment Station, M. A. Thesis, April 1968. 133 p, 7 tab, 37 fig, 64 ref. OWRR Project A-019-IDA.

Descriptors: *Soil water, *Moisture content, *Lustrumentation, Thermal conductivity, Infrared, Zeta potential, Nuclear magnetic resonance.
Identifiers: Soil water measurement.

Various methods for determining the water content of soils are examined. Development work on probe type instruments utilizing the principles of thermal conductivity and infrared reflectance is reported. Aside from the necessity of calibrating for each soil type, relatively fast determinations can be made with simple apparatus utilizing these principles. Difficulties encountered in providing laboratory simulation of varying said conditions are discussed. The use of the streaming potential or the principle of Nuclear Magnetic Resonance hold virtually no promise for a workable instrument.
W69-05304

STUDIES OF METHODS OF SOIL WATER DETERMINATION,
Idaho Univ., Moscow. Water Resources Research Inst.
J. I. Hagen.
Research Technical Completion Report, June 1968. 45 p, 2 tab, 19 fig, 76 ref. OWRR Project A-019-IDA.

Descriptors: *Soil moisture, moisture content, soil moisture meters, *Soil water, Instrumentation, Specific heat, Thermal capacity.

The work reported was undertaken with the intent to develop for soil water determination a more reliable instrument for remote site operation. A survey of the literature led to the selection of four fields of study: streaming potential, thermal conductivity and specific heat, absorption of infrared radiation by moist soil, and some adaption of the principle of nuclear magnetic resonance. Experimentation revealed that the factors controlling streaming potential were so diverse that isolation of soil moisture or moisture flow variables was not feasible in field applications. Extensive laboratory testing of an original thermal measuring device showed that this principle could be successfully and reliably used in certain ambient temperature ranges. The data also revealed that, when soil is partially frozen at 32 deg F, information could be derived on the percentage of the soil water in the frozen state, provided the soil moisture content was known. Nuclear magnetic resonance may be discounted as a means of measuring soil moisture content because of fundamental difficulties.
W69-05305

SOIL OR FOLIAR FERTILIZATION OF WELL-DRAINED AND FLOODED SLASH PINE,
Forest Service (USDA), Olustee, Fla. Naval Stores and Timber Production Lab.
Robert P. Schultz.
Forest Service, USDA, Research Paper SE-32, pp 1-8, Apr 1968. 8 p, 3 tab, 13 ref.

Descriptors: *Soil water, Soil moisture, Nitrogen, Fertilizers, Fertilization, Phosphorus, *Application methods, *Crop production, Forest management, Flooding, Wetlands, Plant growth, *Drainage effects, *Foliar application.
Identifiers: *Slash pine trees.

One-year-old slash pine seedlings were grown for 9 months under 2 soil-moisture and 4 N+P fertilization treatments. Flooding increased seedling mortality and decreased growth. Foliar fertilized seedlings did not grow better than unfertilized seedlings either under well-drained or flooded conditions. Under well-drained conditions, seedlings receiving soil fertilization or foliar plus soil fertilization had more than double the dry-weight increment and one-quarter more height growth than unfertilized seedlings. Under flooded conditions, soil fertilization or foliar plus soil fertilization did not increase height growth but increased dry-weight increment by 40% to 50% over unfertilized seedlings.
W69-05332

HYDROLOGY OF A SLIDE-PRONE GLACIAL TILL SOIL IN SOUTHEAST ALASKA,
Forest Service (USDA) Juneau, Alaska. Pacific Northwest Forest and Range Experiment Station.
J. H. Patric, and D. N. Swanston.
J Forest, Vol 66, No 1, pp 62-66, Jan 1968. 5 p, 7 fig, 6 ref.

Descriptors: *Landslides, *Glacial soils, *Soil water, *Soil water movement, *Hydrologic aspects, Land subsidence, Drainage, Permeability, Mass wasting, Irrigation, Soil mechanics, Saturated soils, Saturation, Soaking, Alaska.
Identifiers: Glacial till, Slide-prone soils.

Heavy irrigation caused no surface runoff, erosion, or debris avalanches on well-drained Karta soil, a tentative series producing much of the commercial timber in southeast Alaska. Interpreting measured rainfall, streamflow, and piezometric head in terms of Darcy's equation showed how this slide-prone soil accommodates large amounts of water. About 2/3 of the water applied drained laterally through permeable surface layers to a stream adjacent to the study area. The remaining 1/3 presumably drained deeply into highly fractured bedrock. Less permeable soil, less fractured bedrock, or longer irrigated slopes probably would have caused saturated soil under heavy watering. It appears that Karta soil must be saturated to cause debris avalanches, a condition which may occur naturally when much larger areas are wetted by much smaller rainfall. (Knapp-USGS)
W69-05406

PORE SIZE DISTRIBUTIONS AS MEASURED BY THE MERCURY INTRUSION METHOD AND THEIR USE IN PREDICTING PERMEABILITY,
Oregon Agricultural Experiment Station, Corvallis; Pacific Northwest Forest and Range Experiment Station, Corvallis, Ore.; and Louvain Univ. (Belgium).
G. O. Klock, L. Boersma, and L. W. DeBacker.
Supported in part by grant from OWRR, Dept of Interior. Soil Sci Soc Amer Proc, Vol 33, No 1, pp 12-15, Jan-Feb 1969 4 p, 5 fig, 2 tab, 8 ref.

Descriptors: *Permeability, *Porous media, *Porosity, Equations, Regression analysis, Soil water movement, Permeameters, Capillary action, Saturated flow, nsaturated flow.
Identifiers: Mercury intrusion porosimeter, Pore size distribution, Millington and Quirk equation.

Equations for predicting the permeability of porous media using pore size distribution are reviewed and a mercury intrusion method for obtaining pore size distribution information from samples is described. Calculated and measured permeability values of 35 glass bead and 28 sand samples were compared and agree closely. Permeabilities and pore size distributions of 54 systematically selected particle size classes of glass beads and sand were measured. Limits of the particle size classes ranged from 44-53 to 208-246 microns for the particle diameters. Millington and Quirk's equation was used to calculate the permeabilities. The calculated permeabilities agree with the measured values only when a correction factor is used. (Knapp-USGS)
W69-05439

ANALYZING STEADY-STATE FLOW IN AN INCLINED SOIL SLAB WITH AN ELECTRIC ANALOG,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
F. D. Whisler.
Soil Sci Soc Amer Proc, Vol 33, No 1, pp 19-25, Jan-Feb 1969. 7 p, 12 fig, 17 ref.

Descriptors: *Steady flow, *Soil water movement, *Analog models, Saturated flow, Unsaturated flow, Surface-groundwater relationships, Hydraulic conductivity, Isotropy, Anisotropy, Rainfall-runoff relationships, Infiltration, Flow nets.
Identifiers: Homogeneous isotropic soil, Soil water flow models.

An electrical resistance network analog was used to analyze the steady-state flow in sloping land modeled as an inclined soil slab for both saturated and unsaturated conditions. At saturation the equipotentials and surface fluxes are symmetrical about the vertical midplane of the slab and agree with an analytic solution. For 'rainfall' rates lower than that necessary to saturate the slab, this symmetry is lost. For unsaturated flow a step function representation of the pressure head-conductivity relationship gives comparable results to a more complicated function. As the angle of slope is increased, even though part of the slab may be unsaturated, the internal flow rate increases, especially at the lower outflow end of the slab. Although the results are presented for homogenous-isotropic soils, they can be used for anisotropic soils by using a transformation process. (Knapp-USGS)
W69-05440

MOVEMENT OF WATER AND SALT THROUGH A CLAY-WATER SYSTEM: EXPERIMENTAL VERIFICATION OF ONSAGER RECIPROCAL RELATION,
California Univ., Riverside; Colorado State Univ., Fort Collins; and Agricultural Research Service, Washington, D. C.
J. Letey, and W. D. Kemper.
Soil Sci Soc Amer Proc, Vol 33, No 1, pp 25-29, Jan-Feb 1969. 5 p, 2 fig, 2 tab, 12 ref.

Descriptors: *Soil water movement, *Osmotic pressure, Osmosis, Expansive clays, Clays, Salinity, Diffusion, Fluid mechanics, Porous media, Flow measurement, Permeability, Porosity, Thermodynamics.
Identifiers: Onsager relationship, Clay-water-salt systems, Concentration gradients.

Linear equations are derived to describe the movement of water and salt through soil systems with both hydrostatic and osmotic pressure gradients. The theory of nonequilibrium thermodynamics is used to describe the flows and to test the validity of Onsager reciprocal relations for clay-water-salt systems. Calculated values were compared with data from flow cell experiments using the 2-micron fraction of sodium-saturated Wyoming bentonite. The Onsager reciprocal relation was found to hold; that is, the osmotic flow coefficient is equal to the solute diffusion coefficient in clay-water-salt systems. (Knapp-USGS)
W69-05441

THE EFFECT OF OSMOTIC PRESSURE GRADIENTS ON WATER MOVEMENT IN UNSATURATED SOIL,
California Univ., Riverside. Dept. of Soil Physics, and Colorado State Univ., Fort Collins.
J. Letey, W. D. Kemper, and L. Noonan.
Soil Sci Soc Amer Proc, Vol 33, No 1, pp 15-
Jan-Feb 1969. 4 p, 2 fig, 5 tab, 6 ref.

Descriptors: *Soil water movement, *Unsatura
flow, *Osmotic pressure, Osmosis, Clays, Salin
Evaporation, Percolation, Diffusion, Flow m
surement, Fluid mechanics, Permeability.
Identifiers: Concentration gradients.

Water movement, in response to osmotic press
gradients, was measured in clay loam and sa
loam soils at soil water suctions from 0.08 to
bars. Movement in response to osmotic press
gradients were compared to movement in respo
to hydraulic pressure gradients in the soil wa
suction range from 0.08 to 0.65 bars. At suct
less than 0.5 bars, the amount of water moved
osmotic pressure gradients was generally less th
4% of the water moved by hydraulic gradients
equal magnitude. (Knapp-USGS)
W69-05442

**HYDRAULIC CONDUCTIVITY RELATED
POROSITY AND SWELLING OF SOIL,**
Agricultural Research Service, Beltsville, Md. Sc
Lab.; and Agricultural Research Service, Phoen
Ariz. Water Conservation Lab.
J. V. Lagerwerff, F. S. Nakayama, and M. H. Fre

Soil Sci Soc Amer Proc, Vol 33, No 1, pp 3-11, J
- Feb 1969. 9 p, 6 tab, 29 ref.

Descriptors: *Hydraulic conductivity, *Soil wa
movement, *Porosity, *Expansive soils, Perme
bility, Percolation, Infiltration, Diffusion, Unsat
rated flow, Darcy's law, Soil physical properti
Soil physics, Soil properties.
Identifiers: Kozeny-Carman equation, Swelli
soils.

The hydraulic conductivity factor in Darcy's equ
tion for viscous flow is analyzed in terms of
modified Kozeny equation. The modifications i
clude a correction for swelling, and the replac
ment of the cubic exponent of the porosity term
an exponent varying between 0 and 3. The choi
depends on the interplay between surface a
volume of soil pores, as determined by floccul
tion-dispersion conditions. Swelling is calculat
from the theory of the diffuse double layer.
theoretical analysis of experimental results on t
hydraulic conductivity of 2 soils for percolants
variable concentration and composition showe
that a single value for the electrical potenti
parameter sufficed to match theoretical with e
perimental data when the concentration of the pe
colant ranged from 10 to 100 meq/liter. Takir
into account effects of pore size, pore density, e
fective porosity, and flow matrix on the hydraul
conductivity, the above has been explained
terms of expansive swelling of smaller pores at th
expense of larger ones. A number of published st
dies have been analyzed in the light of the theor
proposed. The relevance of the theory with regar
to the alleged contrast between grain and por
models of soil has been considered. (Knapp-USGS
W69-05443

2H. Lakes

**HYDROMETEOROLOGICAL STUDIES IN SUP
PORT OF THE INTERNATIONAL FIELD YEA
FOR THE GREAT LAKES,**
Meteorological Service of Canada, Toronto (On
tario). Hydrometeorology Section.
For primary bibliographic entry see Field 02B.
W69-05222

**TECHNIQUES OF WATER MANAGEMENT O
LAKE OKEECHOBEE AND THE FLORIDA
EVERGLADES,**
Corps of Engineers, Jacksonville, Fla. South Atlan
tic Div.
For primary bibliographic entry see Field 04A.
W69-05223

LIMNOLOGICAL STUDIES OF LENTIC WATERS,
Idaho Univ., Moscow. Water Resources Research Inst.
Fred W. Rabe, and Robert C. Wissmar.
Research Technical Completion Report, September 1968. 23 p, 8 tab, 4 fig, 10 ref. OWRR Project A-018-IDA.

Descriptors: *Microcrustaceans, Standing crop, *Mountain lakes, Sampling, Dispersion, Plankton, Limnology.
Identifiers: Ecology, *Oligotrophy, *Zooplankton, Limnology.

Standing crop of micro-crustaceans was compared in four mountain lakes in northeast Idaho. Results over two summers indicated that the lower meadow lakes had higher densities of crustaceans than the headwall lakes. These findings were based on vertical plankton hauls. Four different field methods of collection together with various sample sizes were also compared. Reliability of data was possibly affected by small sample sizes and avoidance behavior of the crustaceans to the samplers. The four lakes had a similar species composition and low density of crustaceans. Fisher's coefficient of dispersion Sz/x was computed for all samples and used as a measure of horizontal dispersion. Mean total crustacean density and dispersion approximated taxa density and dispersions. Tables and graphs are included.
W69-05302

BIOLOGICAL ASPECTS OF EUTROPHICATION IN LAKES MENDOTA, CRYSTAL, TROUT AND GREEN,
Wisconsin Univ., Madison. Lab. of Limnology,
A. D. Hasler, M. Terraguchi, and J. P. Wall.
Water Resources Center, Technical Completion Report, April 1969. 34 p, 6 tab, 3 fig, 21 ref, 2 append. OWRR Project A-002-WIS.

Descriptors: *Phytoplankton, Indicators, Trophic level, Cultures, *Eutrophication, Assay, Zooplankton, Ecology, *Productivity.
Identifiers: Indicator organisms, Trophic potential.

This report is composed of two separate studies, the first concerning itself with an evaluation of the use of plankton organisms as bio-indicators of the trophic potential of a variety of Wisconsin lake types ranging from eutrophic to oligotrophic. Water samples and sediment extracts were innoculated with plankton species collected in the field and those cultured in the lab. A list of organisms used and relative success in culturing in various media is shown. Results of assay of extracts with euglena gracilis and Aphanezomenon are presented. The second study is concerned with some physical, chemical and biological aspects of Green Lake, Wisconsin. Present data are described and then compared to past data on these aspects. Earlier and recent data on temperature and zooplankton are generally similar, whereas earlier and recent data on oxygen and phytoplankton show striking dissimilarities. Recent values of org.N and NH4-N are comparable to earlier values, whereas previous values of N03-N are higher than past ones by one order of magnitude. Several aspects of the ecology of Mysis relicta are described. (Bruinsma)
W69-05324

ARTIFICIAL MIXING OF DENSITY-STRATIFIED FLUIDS: A LABORATORY INVESTIGATION,
Princeton Univ., N. J. Lewis F. Moody Hydrodynamics Lab., and Princeton Univ., N. J. Dept. of Civil and Geological Engineering.
Lucien M. Brush, Francis C. McMichael, and Y. Huo Chin.
NJ Water Resources Res Inst Final Rep, No MH-2, Dec 1968. 80 p, 18 fig, 11 tab, 10 ref. OWRR Project: B-005-NJ.

Descriptors: *Reaeration, *Mixing, *Thermal stratification, *Reservoirs, Hypolimnion, Stagnant water, Water quality, Water quality control, Water pollution treatment, Diffusion, Turbulence, Pumping.
Identifiers: Destratification, Reservoir mixing, Air jet mixing.

Methods of artificially mixing a thermally or density-stratified reservoir are studied in models and the results extrapolated to reservoir scale. In small laboratory tanks propeller agitation is the best method and pumping the next best, but field studies showed no great differences in energy requirements between these methods and air jetting. Air jetting not only mixes water but also reaerates it, an important advantage if the hypolimnion is depleted in oxygen. Large scale convection and interfacial diffusion occur in mixing, and maximization of both is desirable. Jet discharges that disturb the density interface are preferable to those that do not. (Knapp-USGS)
W69-05412

SHOALING OF SOLITARY WAVES ON SMALL SLOPES,
Oregon State Univ., Corvallis. Dept. of Civil Engineering; and Stanford Univ., Calif. Dept. of Civil Engineering.
Frederick E. Camfield, and Robert L. Street.
ASCE Proc, J Waterways and Harbors Div, Vol 95, No WWI, Pap 6380, pp 1-22, Feb 1969. 22 p, 9 fig, append.

Descriptors: *Waves (Water), *Hydraulic models, Surf, Heights, Celerity, Seiches, Wave pile-up, Model studies, Mathematical models, Shoals.
Identifiers: Breaking waves, Shoaling waves, Solitary waves.

Solitary waves were used as initial wave shapes in model experiments to determine the criteria for shoaling wave growth, celerity, and breaking height. Theoretical methods of predicting wave breaking were reviewed and tested. None were found to be completely satisfactory. The commonly used criteria underestimate wave height. Empirical relations between wave dimensions, bottom geometry, wave growth, and form of breaking are derived, listed, and analyzed graphically. (Knapp-USGS)
W69-05450

RESERVOIR FISHERY RESOURCES,
American Fisheries Society, New York.
Charles, E. Lane, Jr.
Symp of Reservoir Fish Resources, Amer Fish Soc, Georgia Univ, Apr 5-7, 1967. 569 p, 142 fig, 3 map, 118 tab, 627 ref.

Descriptors: *Reservoir fisheries, *Fish management, Sport Fishing, Commercial fishing, Ecology, Environmental effects, Nutrient requirements, Water policy, Productivity, Reservoir operation, Water quality, Thermal stratification, Reaeration, Dissolved oxygen, Water pollution effects.
Identifiers: *Reservoir fishery management.

Reservoir fisheries are discussed in a symposium of 39 papers falling into the general themes of sport fish ecology, reservoir and fishery management, water quality effects, and reservoir design. Cooperation is needed between fishery biologists and project planning engineers to achieve better fishery conditions both in reservoirs and downstream waters. Prediction of water quality is possible with mathematical modeling of limnological and biological parameters used with careful dam design study. Principles of predator-prey relationships and other ecological relationships studied in other waters such as lakes and experimental ponds also apply to reservoirs. Management of fish populations is already practicable and with further research and development will be useful in meeting demand for reservoir fishing. Destratification is a relatively new field of research that shows promise for improving oxygen levels both in reservoirs and in water releases. (Knapp-USGS)
W69-05463

THE MECHANICS OF STRATIFIED FLOW IN RESERVOIRS,
Tennessee Valley Authority, Norris. Engineering Lab.
W. O. Wunderlich, and R. A. Elder.
Reservoir Fish Resources Symp, Georgia Univ, Apr 5-7, 1967, pp 56-68, 1967. 13 p, 6 fig, 12 ref.

Descriptors: *Reservoirs, *Stratification, Thermal stratification, Density stratification, Dissolved oxygen, Dye releases, Model studies.
Identifiers: Fontana Reservoir (TVA), Big Ridge Reservoir (TVA).

The phenomena leading to temperature stratification in reservoirs are discussed. A model is described for the approximate prediction of stratification and outflow water temperatures, based on theoretical principles and observed behavior of stratified flow in reservoirs. A similar model is proposed for predicting other water quality parameters, such as dissolved oxygen, if they are strongly influenced by stratification. An application of the method is shown in an example. The accuracy of the method is analyzed. (Knapp-USGS)
W69-05464

A LIMNOLOGICAL RECONNAISSANCE OF AN IMPOUNDMENT RECEIVING HEAVY METALS WITH EMPHASIS OF DIATOMS AND FISH,
Kansas Univ, Lawrence; and Academy of Natural Sciences of Philadelphia, Pa.
Richard Benoit, John Cairns, Jr., and Charles W. Reimer.
Reservoir Fish Resources Symp, Georgia Univ, Apr 5-7, 1967, pp 69-99, 1967. 31 p, 12 fig, 12 tab.

Descriptors: *Fishkill, *Water pollution effects, *Diatoms, *Acid mine water, Toxicity, Iron, Copper, California, Impounded waters, Tributaries.
Identifiers: Sacramento River (Cal), Keswick Lake (Cal), Lake Redding (Cal), Zinc.

Sporadic fishkills in the upper Sacramento River, California, below Keswick Reservoir were studied by attempting to locate and identify materials in the water that might be causing the problem. The upper tributaries of Keswick Lake had typical flora and fauna but Spring Creek, one of the lower tributaries, was severely degraded by acid mine drainage. A pulse of increased damage to diatoms in lower Keswick Lake and upper Lake Redding occurred during a freshet. Waters of Spring Creek Lake had very low pH and high concentrations of Fe, Cu, and Zn. The delta muds of Spring Creek in Keswick Lake had high concentrations of these metals. Both the Spring Creek water and the delta muds were toxic. At some times toxic conditions could develop in lower Keswick Lake and upper Lake Redding because of the acid water and heavy metals discharged from Spring Creek. (Knapp-USGS)
W69-05465

DYNAMICS OF PHYSICOCHEMISTRY IN A LARGE RESERVOIR,
Auburn Univ., Ala. Agricultural Experiment Station.
J. M. Lawrence.
Reservoir Fish Resources Symp, Georgia Univ, Apr 5-7, 1967, pp 100-113, 1967. 14 p, 6 fig.

Descriptors: *Reservoirs, *Density currents, *Stratification, *Chemistry, *Water quality, Tracers, Dye releases, Georgia, Impoundments, Sampling.
Identifiers: *Physicochemistry, Lake Eufaula (Ga), Walter F. George Reservoir (Ga).

Thermal and chemical stratification occurred in all inundated areas of Walter F. George Reservoir, Georgia, during summer months of 1965 and 1966, but was broken at least four times each year by cool-rainy weather. Dye studies indicated existence of main channel density currents during stratified conditions. Iron concentrations in water varied

with stratification and often appeared to be in particle form. Calcium plus magnesium contents of these waters averaged 5.5 ppm, which places this lake in the very soft water category. Total carbon content averaged 13 ppm in 1965 and 11 ppm in 1966. (Knapp-USGS)
W69-05466

WATER QUALITY IN IMPOUNDMENTS AND MODIFICATIONS FROM DESTRATIFICATION,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio. Cincinnati Water Research Lab.
William H. Irwin, James M. Symons, and Gordon G. Robeck.
Reservoir Fish Resources Symp, Georgia Univ, Apr 5-7, 1967, pp 130-152, 1967. 23 p, 18 fig, 2 tab.

Descriptors: *Stratification, *Impoundments, *Water quality, *Reservoirs, *Dissolved oxygen, *Anaerobic conditions, *Reaeration, Mixing, Kentucky, Thermal stratification.
Identifiers: Artificial destratification.

The success of projects to regulate streamflow for improving water quality depends on a source of good quality impounded water that can be used for downstream flow control. Engineering methods to overcome or prevent water quality deterioration that occurs during storage are being investigated. Some of the reactions that take place in reservoirs and lakes are described and are presented to demonstrate the effectiveness of artificial destratification as a means of maintaining good quality water. In thermally stratified impounded water, the lower waters in the impoundment are effectively sealed from the atmosphere by the warm water floating on the surface. Because atmospheric reaeration is prevented, the naturally occurring oxygen-demanding reactions reduce the dissolved oxygen concentration to zero, and reducing reactions such as sulfide production with iron and managanese dissolution can degrade water quality. Because very little energy is required per unit volume to lift the cooler water to the surface of a stratified impoundment, an attempt was made to artificially destratify 2 small lakes in northern Kentucky, one 2,000 acre-ft and the other 4,600 acre-ft. In 1965, a raft-mounted pump was used, while in 1966, a diffused air system was used. Considerable improvement in water quality resulted from the mixing. Nearly uniform water temperatures, better vertical distribution of the DO, decreases in the concentration of reduced materials, and prevention of reduction reactions from continuing all resulted from the destratification operation. These improvements in the quality of the water made it a better source of streamflow regulation and improved its recreational potential. (Knapp-USGS)
W69-05467

EVALUATION OF PRE-IMPOUNDMENT CONDITIONS FOR PREDICTION OF STORED WATER QUALITY,
Federal Water Pollution Control Administration, Corvallis, Oreg. Pacific Northwest Water Lab.
Lyman H. Nielson.
Reservoir Fish Resources Symp, Georgia Univ, Apr 5-7, 1967, pp 153-168, 1967. 16 p, 5 fig, 2 tab, 41 ref.

Descriptors: *Reservoirs, *Water quality, *Forecasting, Nutrients, Dissolved oxygen, Water temperature, Mathematical models, Impounded waters, Photosynthesis.
Identifiers: Water quality prediction.

Methods for forecasting water temperature and dissolved oxygen in new reservoirs are outlined. Use of a mathematical model is suggested to predict photosynthesis as a function of water temperature, available light energy, light transmissibility through the water mass, and nutrient concentration. Thermal budget methods are proposed for temperature prediction. Aerial photographs may be used to calculate vegetation to be submerged. Total nutrient input to new reservoirs is used to estimate algal growth. (Knapp-USGS)
W69-05468

EFFECT OF IMPOUNDMENTS ON PRODUCTIVITY, WATER CHEMISTRY, AND HEAT BUDGETS OF RIVERS,
Montana State Univ., Bozeman. Dept. of Botany and Microbiology.
John C. Wright.
Reservoir Fish Resources Symp, Georgia Univ, Apr 5-7, 1967, pp 188-199, 1967. 12 p, 2 fig, 3 tab, 32 ref.

Descriptors: *Reservoirs, *Water quality, *Hypolimnion, Stratification, Reservoir operation, Fish management, Productivity, Heat budget, Eutrophication, Zooplankton.
Identifiers: Hypolimnial water releases.

The practice of designing large deep multiple-purpose dams with deep-water penstocks appears to have many deleterious effects. Water is released during the irrigation season with a higher salinity than would be obtained from surface water withdrawal. Essential nutrients are lost from such reservoirs, thus tending to deplete the productive capacity of the reservoir and at the same time cause eutrophication downstream. Evaporative loss is increased as a result of storing warm incoming water and releasing cold hypolimnial water. Water too cold for satisfactory fish growth may also be released under certain conditions. Water with dissolved oxygen concentrations too low to handle downstream BOD may be released. In extreme cases hydrogen sulfide-laden water has been discharged resulting in downstream fish-kills. The interrelationships between fish populations and zooplankton production in reservoirs should be more carefully investigated. Since bottom fauna production is usually negligible in such reservoirs, excessive predation pressure on large zooplankton forms by fish may be responsible, in part, for decreased fish production. (Knapp-USGS)
W69-05469

RESERVOIR MANAGEMENT PROBLEMS CREATED BY INCREASED PHOSPHORUS LEVELS OF SURFACE WATERS,
Southern Illinois Univ., Carbondale. Dept. of Botany.
Jacob Verduin.
Reservoir Fish Resources Symp, Georgia Univ, Apr 5-7, 1967, pp 200-206, 1967. 7 p, 1 fig, 3 tab, 15 ref.

Descriptors: *Reservoir operation, *Eutrophication, *Phosphorus, Lake Erie, Algae, Sewage treatment, Tertiary treatment, Nutrients, Nitrogen, Lagoons.
Identifiers: Reservoir management, Phosphorus removal.

Phosphorus levels have increased in fresh waters of the U.S.A. about four-fold during the past 20 years. Present levels are in the vicinity of 100-200 micrograms/liter, and are about 10 times higher than the levels considered sufficient to produce nuisance concentrations of algae. Nitrogen to phosphorus ratios have dropped from values of 35 to about 9, in Lake Erie, indicating a more nearly balanced N:P supply. High nutrient levels are likely to create such increased problems for reservoir management as foul odors and tastes in drinking water, large deposits of algae on beaches, and fish and benthos mortality. It is suggested that lagoons be constructed as an adjunct to sewage treatment plants to reduce nutrient levels by natural cropping before releasing sewage effluents to our streams and lakes. (Knapp-USGS)
W69-05470

RESERVOIR EUTROPHICATION AND DYSTROPHICATION FOLLOWING IMPOUNDMENT,
North Dakota Univ., Grand Forks. Dept. of Biology.
Joe Kendall Neal.
Reservoir Fish Resources Symp, Georgia Univ, Apr 5-7, 1967, pp 322-332, 1967. 11 p, 1 fig, 2 tab.

Descriptors: *Reservoirs, *Eutrophication, *Dystrophy, Water quality, Productivity, Nutrients, Missouri River, Plankton, Phosphorus, Nitrogen.
Identifiers: Missouri River Reservoirs.

Commonly accepted concepts of productivity controls in inland waters are reviewed and their modifications by reservoirs discussed. Various factors contributing to early reservoir enrichment and productivity decline are related to reservoir characters and peculiarities. Type and size of reservoir, initial operation, pretreatment of basin, nature of inundated soils, withdrawal of bottom waters, and isolation of flow segments are included. Factors associated with early autotrophic maxima and minima in Missouri River main stem reservoirs indicate that phosphorus and nitrogen build-up was a prerequisite to maximum growth, but that exhaustion of other nutrients led to decline after nitrogen and phosphorus ceased to be limiting factors. Phosphorus and nitrogen concentration increased with plankton declines and decreased with plankton growth. During early impoundment plankton often reached greater densities below reservoirs than in them. (Knapp-USGS)
W69-05471

WATER RESOURCES LAW IN VIRGINIA (ARTIFICALLY CONFINED WATER).
William R. Walker, and William E. Cox.
Water Resources Law in Virginia, Bulletin 9, Au 1968, 181 p, 412 ref, 1 fig.

Descriptors: *Virginia, *Water sources, *Water rights, *Confined water, Riparian rights, Publications, Water law, Legal aspects, Ponds, Lakes, Channels, Drains, Drainage, Soil conservation, Water works, Sewage systems, Local governments, Regulation.

The law applicable to artificially confined water differs from that applicable to water in its natural state. The extent of this difference is dependent upon the nature of the artificial confinement. Legal rights associated with ponds and artificial lakes are determined by the source of the impounded water. When the source is a natural watercourse, the law applicable to the rights in the watercourse governs; if the source is diffused surface water, then the law applicable to that type of water controls. No riparian rights attach to water in a canal, and the only rights which have been recognized are those based on contracts and franchises. Supervision and control of all waterworks in the state and all waters therein is exercised by the State Board of Health. All sewerage systems are under the joint supervision of the State Department of Health and the State Water Control Board. Two basic remedies for the infringement of water rights are actions at law for damages and actions in equity for injunctions. The statute of limitations in Virginia is five years. It begins to run at the time the cause of action accrues, which is the time the injury actually occurs. There is a duty to mitigate damages by the exercise of ordinary care. (Childs-Fla)
W69-05537

2I. Water in Plants

EFFECTS OF MOISTURE AND FERTILIZER ON YIELDS OF SPRING WHEAT AND BARLEY,
Nevada Univ., Reno; Cornell Univ., Ithaca, N. Y.
A. Bauer, R. A. Young, and J. L. Ozbun.
Agronomy J, Vol 57, No 4, pp 354-356, July-Aug, 1965. 4 tab, 10 ref.

Descriptors: *Rainfall, *Wheat, *Barley, *Crop response, *Nitrogen, Soil moisture, Planting management, Crop production, Fertilizers, Seasonal, Spring, North Dakota, Rates of application, Moisture availability, Correlation analysis.
Identifiers: Parameters.

Investigations were conducted in North Dakota to evaluate effects of seasonal rainfall and stored available soil moisture at seeding on yield responses of spring-sown wheat and barley with varying

ates of applied nitrogen. Average grain yields increased as rainfall increased, both with and without fertilizers. The magnitude of response as well as the rate of nitrogen fertilizer needed for maximum yield also increased as rainfall increased. With more stored available soil moisture at seeding, less seasonal rainfall was required to produce profitable responses to nitrogen. Highly significant correlation coefficients were obtained between selected yield parameters and moisture categories under the arid growing conditions. (Blecker-Ariz)
W69-05263

DROUGHT AND PHOSPHORUS AFFECT GROWTH OF ANNUAL FORAGE LEGUMES,
Agricultural Research Service, Pullman, Wash. Research Div.; California Univ., Riverside; California Univ., Davis.
A. M. Wilson, C. M. McKell, and W. A. Williams.

of Range Management, Vol 21, No 5, pp 305-308, September 1968. 2 fig, 6 tab, 8 ref.

Descriptors: *Legumes, *Drought resistance, Phosphorus, *Moisture stress, *Water utilization, Clovers, Root systems, Photosynthesis, Transpiration, Annual, Forage legumes, Growth stages, Fertilizers, Plant growth, Crop response, California, Semiarid climates, Soil moisture, Absorption.

A study was conducted to understand drought resistance in 3 annual legumes and to determine the role that phosphorus might play in their response to soil moisture stress. The legumes were Mt Barker subterranean clover, rose clover and Spanish clover. Spanish clover was lowest and subterranean clover was highest in top growth production in the 1 atm regime. In the 3 and 15 atm regimes, top growth of the 3 annual legumes did not differ significantly. Growth of Spanish clover was inhibited less by moderate stress than growth of rose and subterranean clover. The pattern of root growth response to moisture stress for all legumes was essentially similar. Efficient water use by fertilized annual legumes suggested that phosphorus increased photosynthesis per unit leaf area more than transpiration per unit leaf area. Stimulation of growth by phosphorus fertilization in drier regimes did not necessarily mean that phosphorus enhanced drought resistance of annual legumes. Top growth and phosphorus uptake, on a relative basis, suggest that Spanish clover possessed greater drought resistance than rose and subterranean clover. (Blecker-Ariz)
W69-05264

EFFECT OF MOISTURE REGIMES AND HARVESTS ON EFFICIENCY OF WATER USE BY GREEN FORAGE CROPS,
Pennsylvania State Univ., University Park.
J. D. Powell, and L. T. Kardos.
Soil Sci Soc Amer Proc, Vol 32, No 6, pp 871-874, Nov-Dec, 1968. 6 tab, 10 ref.

Descriptors: *Soil water, *Moisture deficit, *Forage grasses, *Forage legumes, *Harvesting, *Water utilization, Consumptive use, Irrigation efficiency, Hay, Soil-water-plant relationships, Water requirements, Rates of application, Crop production, Pastures, Meteorological data, Bouyoucos blocks.
Identifiers: *Blaney-Criddle formula, Dry matter.

Total amounts and rates of depletion of soil water required to produce dry matter by 10 crops were studied. Water use efficiency of forages managed as either hay or simulated pasture under three levels of irrigation was also studied. On the basis of total harvest for all species, most efficient use of water occurred at the control irrigation level. Most efficient use of water occurred prior to the first harvest and least efficient use usually occurred after the first harvest but prior to the second harvest. Alfalfa swards managed for hay were more efficient than other swards and legume-grass combinations differed only slightly from legumes alone. Measured values for rates of moisture depletion per day of all unirrigated forages were generally smaller than values computed by using the Blaney-Criddle formula. Measured values of irrigated forages approached the Blaney-Criddle values more closely. By using correct forage crops and irrigation levels, efficiency of water use by plants could probably be increased in arid climates. (Blecker-Ariz)
W69-05268

STOMATAL OPENING IN ISOLATED EPIDERMAL STRIPS OF VICIA FABA. I. RESPONSE TO LIGHT AND TO CO2-FREE AIR,
California Univ., Davis. Lab. of Plant-Water Relations.
R. A. Fischer.
Plant Physiol, Vol 43, No 12, pp 1947-1952, 1968. 1 fig 4 tab, 22 ref.

Descriptors: *Stomata, *Epidermis, *Air, *Carbon dioxide, *Light, Leaves, Cytological studies, Plant physiology, Crop response, Absorption, Beans, Osomotic pressure, Turgidity.
Identifiers: Mesophyll, Starch.

This paper reports a consistent and large opening response to light and CO sub 2-free air in living stomata of isolated epidermal strips of Vicia faba. The response was compared to that of non-isolated stomata in leaf discs floating on water; stomatal apertures, guard cell solute potentials and starch contents were similar in the 2 situations. It was necessary to float epidermal strips on dilute KCL solutions to obtain such stomatal behavior. This suggested that solute uptake was necessary for stomatal opening. This technique provides a very useful system in which to investigate the mechanism of stomatal opening. It was possible to show independent responses in stomatal aperture to light and to CO sub 2-free air. (Affleck-Ariz)
W69-05278

EFFECT OF EARLY-SUMMER SEEDING OF WINTER WHEAT ON YIELD, SOIL MOISTURE, AND SOIL NITRATE,
Utah State Univ., Logan. Dept. of Plant Science.
For primary bibliographic entry see Field 03F.
W69-05280

TISSUE WATER RELATIONS FOR BRIGALOW AND MULGA,
Queensland Univ., Brisbane (Australia). Dept. of Botany.
D. J. Connor, and B. R. Tunstall.
Aust J Bot, Vol 16, pp 487-490, 1968. 1 fig, 15 ref.

Descriptors: *Plant tissues, *Moisture content, *Drought resistance, *Leaves, Drought tolerance, Arid climates, Plant physiology, Resistance, Turgidity.
Identifiers: *Mulga, *Brigalow, *Australia, *Phyllodes, Water potential, Microdesiccators, Desiccation.

The relationship between relative water content and water potential of leaves measures the amount of water held by leaf tissues at various levels of water potential. This is more commonly termed the resistance of leaf tissue to desiccation and is taken to indicate one aspect of drought resistance of the species involved. The species with the smaller change in relative water content for each interval of water potential is considered to be the more drought resistant. In this study the relationship between relative water content and water potential of the phyllodes in brigalow and mulga were compared. Brigalow phyllode tissue was found to be more resistant to desiccation than that of mulga. This was of interest because mulga has previously been considered to represent an extreme in drought tolerance of Australian arid zone plants. (Affleck-Ariz)
W69-05281

RELATIONSHIP OF PALMER DROUGHT VARIABLES TO YIELD OF WINTER WHEAT,
Kansas State Univ., Manhattan; Weather Bureau, Silver Spring, Md.
For primary bibliographic entry see Field 03F.
W69-05283

ISOPIESTIC TECHNIQUE FOR MEASURING LEAF WATER POTENTIALS WITH A THERMOCOUPLE PSYCHROMETER,
Duke Univ., Durham, N. C. Dept. of Botany.
John S. Boyer, and Edward B. Knipling.
Proc National Academy Science, Vol 54, No 4, pp 1044-1051, October 1965. 3 fig, 2 tab.

Descriptors: *Plant tissues, *Hygrometry, *Water vapor, *Leaves, *Measurement, Equations, Moisture stress, Instrumentation, Evaporation, Cooling, Diffusion, Resistance.
Identifiers: *Water potential, *Thermocouple, *Isopiestic, Error.

A new technique of measuring water potential of plant tissue was developed. This technique, which was free of error usually attributable to leaf resistance, was used to evaluate error in various types of psychrometers. The new technique involved use of a modified Richards thermocouple to determine rate of vapor movement between the thermocouple and leaf when solutions of various potentials were present on the thermocouple. No vapor movement occured when solution on the thermocouple had a potential equal to that of the tissue and therefore leaf resistance did not affect measurement. The theoretical basis for this conclusion was developed using equations. It was possible to determine the influence of leaf resistance on various thermocouple measurements for leaf tissue from several plant species at various water potential levels. The thermocouple psychrometer can be used to measure water potential levels of leaves in order to determine moisture stress that plants undergo when they are grown in an arid climate. (Blecker-Ariz)
W69-05286

SEASONAL AND DIURNAL VARIATION IN POCOSIN SHRUB MOISTURE CONTENT,
Forest Service (USDA), Asheville, N. C. Southeastern Forest Experiment Station; Forest Service (USDA), Macon, Ga. Southern Forest Fire Lab.; North Carolina Div. of Forestry.
W. H. Blackmarr, and William B. Flanner.
Forest Service, USDA, Research Paper SE-33, pp 1-11, Apr 1968. 11 p, 1 fig, 12 chart.

Descriptors: *Moisture content, Plant physiology, *Diurnal, *Seasonal, Spring, Summer, Autumn, *Leaves, *Stemflow, Shrubs.
Identifiers: *Pocosin.

Seasonal variation in the moisture content of six species of pocosin shrubs was observed over a 10-month period during 1965. The variation in the moisture content of the foliage and stems is compared with the average moisture content of the whole plant. Moisture contents of both stems and foliage reached their lowest levels during the fall and early spring. The moisture content of most species increased rapidly through May, reaching a maximum during the first 2 weeks of June. The initiation of new foliage occurred at about the same time that the average moisture content of the whole plant began its rapid spring buildup. Diurnal variation in the moisture content of the foliage of four shrub species was observed over a 36-hour period during June 21 and 22, 1965. The moisture content of newly developed foliage exhibited noticeable diurnal fluctuation. Maximum moisture contents occurred between 2 and 6 a.m. Minimum moisture contents occurred between 2 and 6 p.m.
W69-05331

COMMON AQUATIC WEEDS,
Agricultural Research Service, Gainesville, Fla. Crops Research Div.; and Florida Univ., Gainesville. Agricultural Extension Service.

L. W. Weldon, R. D. Blackburn, and D. S. Harrison.
Dep Agr Res Serv Handbook No. 352, Jan 1969. 43 p, 49 fig, 20 ref.

Descriptors: *Aquatic plants, Aquatic algae, Aquatic weeds, Floating plants, Pondweeds, Rooted aquatic plants, Submerged plants.
Identifiers: Aquatic plant identification handbook, Plant redognition.

A handbook for field identification of common aquatic weeds is presented. Photographs of the plants are used to aid in identification, and where necessary, the important characteristics of the plants are emphasized by drawings. Plant descriptions, habitats, distribution, and importance are listed. The plants are classified in 5 groups: Free-floating plants; aquatic grasses; emersed plants; submersed plants; and algae. Plants which closely resemble each other are described together for easier differentiation. (Knapp-USGS)
W69-05446

2J. Erosion and Sedimentation

GRANITES, GRUSSES, AND THE SHERMAN EROSION SURFACE, SOUTHERN LARAMIE RANGE, COLORADO-WYOMING,
Pennsylvania State Univ., University Park; Colorado Univ., Boulder.
D. H. Eggler, E. E. Larson, and W. C. Bradley.
Amer J of Sci, Vol 267, pp 510-522, Apr 1969. 13 p, 3 fig, 2 tab, 1 plate, 26 ref.

Descriptors: *Topography, *Erosion, *Weathering, *Granites, Geomorphology, Land forming, Petrography, Mapping, Colorado, Wyoming, Oxidation, Clay minerals.
Identifiers: *Grusses, Southern Laramie Range.

Recent detailed mapping of the southern Laramie Range in Wyoming-Colorado reveals that the smooth Sherman erosion surface is closely related to bedrock lithology of the Precambrian Trail Creek part of the Sherman Granite. Other crystalline rocks form a rugged, parkland-tor topography. A distinctive petrographic characteristic of the Trail Creek is extensive oxidation with principally opaque and biotite minerals. Weathering has exploited the oxidized biotites to produce vermiculite, montmorillonite, kaolinite, and gibbsite, all contributing to additional biotite expansion and shattering the near-surface rock. Gruss is formed so rapidly that rugged outcrops are few and a smooth gently rolling topography results. (Lang-USGS)
W69-05211

VARIABLE-SPEED POWER EQUIPMENT FOR DEPTH-INTEGRATION SEDIMENT SAMPLING,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 07B.
W69-05257

ELECTRIC CONTROL SYSTEM FOR DUAL OPERATION OF CURRENT METER AND SUSPENDED-SEDIMENT SAMPLER,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 07B.
W69-05258

FLAT CHANNEL TERRACES,
Soil Conservation Service, McCook, Nebr.
H. G. Buchta, D. E. Broberg, and F. E. Liggett.
Trans American Soc Ag Engineers, Vol 9, No 4, pp 571-573, 1966. 4 fig, 2 tab, 5 ref.

Descriptors: *Terracing, *Erosion control, *Flood control, *Runoff, *Channels, Surface runoff, Storms, Storage capacity, Sediments, Storm runoff, Slopes, Water storage, Water conservation, Floodwater, Kansas, Nebraska.

Level terraces with blocked ends have been used for erosion control. They are designed to hold runoff from storms in the 10-year frequency class in Nebraska and Kansas. Flat-channel terraces have held the runoff from high intensity storms of 4 to 6 inches with little or no damage. The cost of providing cropland flood storage compares favorably, on slopes to 4%. Storage capacity for both floodwater and sediment may be substantially reduced for mechanical structures located below areas treated with flat channel terraces. The terraces could possibly be used in arid climates to control sediment and runoff water. (Blecker-Ariz)
W69-05282

PREDICTION OF SEDIMENT PROFILES IN OPEN CHANNEL FLOW BY TURBULENT DIFFUSION THEORY,
Kentucky Univ., Lexington; and Texas A and M Univ., College Station. Water Resources Inst.
Billy J. Barfield, Ernest T. Smerdon, and Edward A. Hiler.
Water Resources Res, Vol 5, No 1, pp 291-299, Feb 1969. 10 p, 6 fig, 10 ref. WP-00757-03 (FWP-CA).

Descriptors: *Sediment transport, *Suspended load, Open channel flow, *Mathematical models, *Hydraulic models, Probability, Model studies, Sedimentation, Roughness (Hydraulic), Turbulence, Dispersion, Velocity, Settling velocity.
Identifiers: *Sediment profiles, Particle fall velocity.

Using turbulent diffusion theory, a non-steady-state model of sediment transportation is developed in the form of a partial differential equation relating the change of sediment concentration with time to the change of concentration in space. The required input to the model is the root-mean-square fluid velocity, the time scale of turbulence, and the mean particle fall velocity. Preliminary experimental investigations are reported using turbulence measurements made over a smooth channel. When smooth channel turbulent intensities were used, predicted sediment concentrations were low when compared with actual measurements. When turbulent intensities were used from an artificially roughened channel, the predicted concentrations were of the same order as the measured concentrations. Since data were not available for turbulent intensities in alluvial channels, no conclusion could be made about the validity of the model. (Knapp-USGS)
W69-05403

RELATION OF SOIL PROPERTIES TO ITS ERODIBILITY,
Agricultural Research Service, Lafayette, Ind.; and Purdue Univ., Lafayette, Ind. Dept. of Agronomy.
W. H. Wischmeier, and J. V. Mannering.
Soil Sci Soc Amer Proc, Vol 33, No 1, pp 131-137, Jan-Feb 1969. 7 p, 1 fig, 4 tab, 17 ref.

Descriptors: *Soil erosion, *Runoff, *Soil physical properties, Soil conservation, Erosion control, Soil stability, Soil strength, Bulk density, Particle size, Soil structure, Soil aggregates, Permeability, Porosity, Soil texture, Saturation, Sands, Silts, Clays, Organic matter, Hydrogen ion concentration, Crops, Grasses, Slopes.
Identifiers: Soil-loss prediction, Soil erodibility, Soil detachment.

A soil's inherent erodibility, which is a major factor in erosion prediction and land-use planning, is a complex property dependent both on its infiltration capacity and on its capacity to resist detachment and transport by rainfall and runoff. The relations of these capacities to soil physical and chemical properties were investigated in a 5-year field, laboratory, and statistical study including 55 selected Corn Belt soils. Properties that contributed significantly to soil-loss variance included percentages of sand, silt, clay, and organic matter; pH, structure and bulk density of plow layer and subsoil; steepness and concavity or convexity of slope; pore space filled by air; residual effects sod crops; aggregation; parent material; and v ous interactions of these variables. An empiri equation was derived for calculating the univer soil-loss equation's erobility factor K for spec soils. Tests of the equation against soils of the ol erosion-research stations, for which the erodibi factor is known, substantiated its general appli bility over a broad range of medium-textured so (Knapp-USGS)
W69-05444

SHOALING OF SOLITARY WAVES ON SMA SLOPES,
Oregon State Univ., Corvallis. Dept. of Civil E gineering; and Stanford Univ., Calif. Dept. of C Engineering.
For primary bibliographic entry see Field 02H.
W69-05450

2K. Chemical Processes

VARIATION IN THE COMPOSITION BRINE FROM THE SYLVANIA FORMATIO NEAR MIDLAND, MICHIGAN,
Dow Chemical Co., Midland, Mich.
For primary bibliographic entry see Field 02F.
W69-05401

DYNAMICS OF PHYSICOCHEMISTRY IN LARGE RESERVOIR,
Auburn Univ., Ala. Agricultural Experiment St tion.
For primary bibliographic entry see Field 02H.
W69-05466

2L. Estuaries

ON THE REPRESENTATION OF TH REYNOLDS STRESS IN A TIDAL ESTUARY,
Reading Univ. (England). Dept. of Geophysics.
B. Johns.
Geophys J Roy Astron Soc, Vol 17, No 1, pp 39-4 Jan 1969. 6 p, 1 fig, 4 ref.

Descriptors: *Estuaries, *Tides, *Turbulence, Cu rents (Water), Reynolds number, Viscosity, Tid effects.
Identifiers: Eddy viscosity, Reynolds stress.

The parametric representation of turbulence by coefficient of eddy viscosity is discussed for th tidal flow in a river estuary. If the eddy viscosity a tains a specified maximum value in the mid-depth it is shown that the amplitude of the tidal curre has a logarithmic profile throughout the depth. (K napp-USGS)
W69-05213

THE LONGITUDINAL DIFFUSION COEFFI CIENT IN THE DELAWARE RIVER ESTUAR AS DETERMINED FROM A STEADY-STAT MODEL,
Geological Survey, Philadelphia, Pa.
Richard W. Paulson.
Water Resources Res, Vol 5, No 1, pp 59-67, Fe 1969. 9 p, 7 fig, 3 tab, 6 ref.

Descriptors: *Diffusion, *Estuaries, *Path of pollu tants, Model studies, Dispersion, Diffusivity, Wate quality, Saline water-freshwater interfaces, Salini ty, Mathematical models, Computer models Digital computers.
Identifiers: *Delaware estuary.

An analytical solution to 1-dimensional steady state diffusion of a conservative substance in a estuary of constant depth and exponentially vary ing width is derived using a turbulent diffusio coefficient which varies exponentially with estuar width. Because the form of the diffusion coefficien allows 2 deg of freedom in fitting the solution of th diffusion equation to data from a real estuary, it i

ossible to determine the magnitude of the diffu-ion coefficient as well as the effect on the distribu-ion of the conservative substance of assuming a onstant coefficient. Data from the reach of the Delaware estuary from Torresdale, Pa. to Reddy sland, Del. were used to test the solution, because resh-water inflow data are available for the reach, nd its channel geometry satisfies the above equirement. This reach also contains 5 U.S. Geological Survey water-quality monitors that pro-ide salinity data to test the solution. Analysis of hese data indicates that, for low freshwater inflow nto the estuary, the diffusion constant is of the rder of 100 m squared per second and that for nost operational purposes the diffusion constant nay be assumed to be a constant. (Knapp-USGS) W69-05428

QUILIBRIUM FLOW AREAS OF INLETS ON ANDY COASTS,
California Univ., Berkeley. Coll. of Engineering.
Morrough P. O'Brien.
ASCE Proc, J Waterways and Harbors Div, Vol 95, No WWI, Pap 6405, pp 43-52, Feb 1969. 10 p, 3 g, 1 tab, 2 ref, append.

Descriptors: *Harbors, *Currents (Water), Estua-ies, Tides, Waves (Water), Beaches, Sands, Sand ars, Sedimentation, Breakwaters, Coasts, Jetties, Coastal engineering, Tidal effects.
Identifiers: Tidal currents (Inlets), Tidal prism.

The minimum flow area below mean sea level in he entrance channel of a tidal inlet on a sandy oast is a unique function of the tidal prism. Bot-om material size, presence or absence of jetties, nd magnitude of the littoral drift appear not to af-ect this relationship, within the accuracy of availa-le data. The magnitude of the currents through he inlet channel are determined by the range of de. The tendency for wave-induced littoral cur-ents to transport sand towards an inlet and to educe its flow area should vary with the intensity f wave action, but the data available do not show ide deviations from the equilibrium area, possibly ecause hydrographic surveys are made during alm weather. Reduction in the tidal prism of an let will reduce the equilibrium flow area at the inimum cross section of the inlet channel. (K-app-USGS) W69-05447

WATER WAVES OVER A RECTANGULAR HANNEL THROUGH A REEF,
Suez Canal Authority Research Center, Ismailia (Egypt).
Sabil Hilaly.
ASCE Proc, J Waterways and Harbors Div, Vol 95, No WWI, Pap 6409, pp 77-94, Feb 1969. 18 p, 20 g, 9 ref, append. Corps of Eng DA-49-055-CIVENG-63-5.

Descriptors: *Waves (Water), *Channels, *Refrac-ion (Water waves), Reefs, Hydraulic models, Model studies, Mathematical models, Ripple arks.
Identifiers: Ripple tank studies, Diffraction (Water aves), Reef channels.

A practical method for predicting characteristics of aves propagating over a submarine channel, of ectangular cross section is presented, based on ex-erimental results and theoretical models. The rip-e tank was a useful tool in wave refraction stu-es. In the case when waves propagate over an rupt bottom discontinuity normal to their crests, e adjacent wave fronts in both sides of the discon-inuity were connected by smooth transitions, 2 raight lines could be drawn, inclined to the iscontinuity, to define the transition zones, and e angles between the discontinuity and the 2 raight lines defining the transition zones in the ep and shallow sides were not constant. They ry with the ratio (height/length--shallow)/ eight/length--deep). (Knapp-USGS) 69-05448

WATER SUPPLY IN THE BRACKISH-WATER REGIONS OF SOUTH VIETNAM.
Ministry of Public Works (South Vietnam).

For the 8 Volume Proceedings, see Vol 2, No 9, Field 06B and W69-03305. Int Conf on Water for Peace, Wash, D C, Vol 2, pp 876-880, 1968. 5 p, 2 fig, 1 tab.

Descriptors: *Water resources development, *Brackish water, *Groundwater, *Saline water intrusion, Water supply, Water wells, Desalination, Alluvium, Deltas, Water utilization, Water yield.
Identifiers: Viet-Nam, Mekong delta.

The South Viet-Nam delta is a very low and flat region averaging 1 to 2 meters above sea level. Sea water intrudes inland 70 km. The water in the rivers and canals and in the phreatic water table is brackish everywhere. A total of 3 million people (30% of the delta population) suffer greatly from the shortage of potable water during the dry season (November to May). Rain water stored in cisterns, water brought in by boat from neighboring regions, small fresh-water pockets located at a depth of 1 to 3 m are not a true solution to this serious problem. The region contaminated by sea water has an unconsolidated aquifer, the Recent alluviums, made up of sand, silt, clay, and very little gravel. A fresh-water stratum, whose thickness may range from a few meters to 10 m, is 200 to 300 m deep. Except in the provinces located between the 2 branches of the Mekong, where wells drilled as deep as 300 m have not yet yielded any satisfactory results, the chances of success in the search for fresh-water-bearing strata vary from 80 to 100%. A well with a capacity of 100 cu m per hr, drilled 200 m deep, costs $18,000 (a surface-water treatment plant with the same capacity costs $80,000). As the operation is very simple (the well water being directly consumable, without treatment) the cost is only 3 cents per cu m (6 cents per cu m in a treatment plant). A well can be completed in 4 months; the construction of a plant takes 18 months. If the electrodialysis process is contemplated, although it is the best method for the desalination of brackish water, the construction cost will be 40 times higher and the operating cost 8 times higher. (Knapp-USGS) W69-05457

SALT WATER ENCROACHMENT IN KARST AQUIFERS, ISLAND OF KEPHALLINIA, (IONIAN),
Society of Hydrogeological Scientists Graz, (Austria).
V. Mourin, and J. Zoetl.
Hydrol of fractured rocks Vol 2, Proc Dubrovnik Symp (Oct 1965), Int Ass Sci Hydrol, Pub 74, pp 423-438, 1967. 16 p, 8 fig, 3 tab, 10 ref.

Descriptors: *Saline water intrusion, *Karst, *Saline water-fresh water interfaces, Groundwater movement, Sea level, Water levels, Infiltration, Hydrogeology, Precipitation (Atmospheric), Aquifers, Water circulation, Carbonate rocks, Structural geology, Water temperature, Springs, Water chemistry.
Identifiers: *Greece, Kephallinia Island, Ionian Sea.

The reappearance of salt water that disappears into the rocks of Kephallinia Island was investigated using hydrogeological methods. One method used was the dissolving of 160 kg of fluorescein in the groundwater at an observation station and its identification as a coloring substance, in the brackish water springs of the eastern coast, which is 15 km distant. Surveys included appraisals and mapping of 243 springs and wells. The study shows that during the Pleistocene age an aquifer, existing in the present Gulf of Livadi, was drained subterraneously towards the lower level of the eastern coast. In general, the fresh waters issuing from the main massif to the east and the old, lower-levelled karstic holes that allow inflow of sea water into the rock fissures of the northern part of the peninsula, are the most important factors of the hydrological processes taking place in the Kephallinia Island. (Gabriel-USGS) W69-05472

SALT-WATER ENCROACHMENT OF TERTIARY LIMESTONE ALONG COASTAL SOUTH CAROLINA,
Geological Survey, Columbia, S. C.
George E. Siple.
Hydrol of fractured rocks Vol 2, Proc Dubrovnik Symp (Oct 1965), Int Ass Sci Hydrol, Pub 74, pp 439-453, 1967. 15 p, 6 fig, 16 ref.

Descriptors: *Saline water intrusion, *Limestones, *Geology, *Saline water-fresh water interface, *South Carolina, Aquifers, Stratigraphy, Structural geology, Water circulation, Hydraulic gradient, Infiltration, Tertiary, Permeability, Sediment distribution, Sea water, Geochemistry, Sea level, Artesian wells.
Identifiers: Salt-water encroachment.

Limestones and clastic sediments of coastal South Carolina, characterized by their high-grade aquifers, have been invaded during Recent and past geologic epochs by sea water. To understand the magnitude of this encroachment, the author conducted a detailed investigation by means of geological, hydrological and geochemical methods. The study shows that the upper zones of Eocene limestones, incised by estuaries during Pleistocene and Recent time, and the sub-sea contact of Eocene and Oligocene deposits are now subject to considerable salt-water encroachment. The most extensive encroachment occurs in the limestones of Tertiary age and clastic beds of Cretaceous age. The aquifers located in these beds have fresh-water heads ranging from altitudes of -3m to +49m and maximum chloride concentration of about 8,500 ppm. (Gabriel-USGS) W69-05473

A CONTINUOUS SIZE SPECTRUM FOR PARTICULATE MATTER IN THE SEA,
Fisheries Research Board, Nanaimo (British Columbia). Pacific Oceanographic Group.
For primary bibliographic entry see Field 07C.
W69-05529

WATER RESOURCES LAW IN VIRGINIA (OTHER WATER SOURCES).
For primary bibliographic entry see Field 06E.
W69-05536

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

NUCLEAR POWER AND WATER DESALTING PLANTS FOR SOUTHWEST UNITED STATES AND NORTHWEST MEXICO.
Joint United States-Mexico International Atomic Energy Agency Study Team.

Joint US-Mex-Int At Energy Agency Rep, Sept 1968. 154 p, 69 fig, 83 tab, 5 append.

Descriptors: *Desalination, *Nuclear powerplants, *Colorado River basin, *United States, *Mexico, Pilot plants, International commissions, International Joint Commission, International waters, Water shortage, Water demand, Economics, Irrigation water, Water distribution (Applied), Arizona, California.
Identifiers: International Atomic Energy Agency.

The feasibility and economics of combined desalination and nuclear powerplants for southwest US and northwest Mexico, studied by a joint US-Mexico International Atomic Energy Agency Team are summarized. Large, dual-purpose desalting and powerplants are technically feasible and economically attractive for satisfying the long-term water and power requirements of the lower Colorado

River basin. An experimental farm is suggested as the next study project. The most promising locations for an experimental desalting and farm facility with capacities of 1 bgd and 2,000 MWE are on the border east of San Luis Rio Colorado or near El Golfo de Santa Clara. The regional water deficit is projected to increase from about 1,300 mgd in 1980 to 2,500 mgd in 1995 even if no new agriculture is developed. The cost of the first study stage, including the cost of water and power distribution system, is estimated to be from $850,000 million to about $1,000 million. Water costs would vary from about 15 1/2 to 33 cents per 1,000 gal for the least-cost location, and from 17-40 cents for the most-cost location. Electricity costs would range from 1.8 to 3.1 mills per KWH. (Knapp-USGS)
W69-05208

BASIC STUDIES OF SCALE CONTROL,
Office of Saline Water, Washington, D. C.
Chin H. Lu, B. M. Fabuss, Alex Korosi, T. R. Middleton, and J. P. DeMonico.
Monsanto Resezrch Corporation, Boston, Mass., March 15, 1969, 52 p. OSW 14-01-0001-1269.

Descriptors: *Desalination, *Scaling, *Calcium sulfate, *Scale versus process variables, *Roswell water, *Fluidized bed seeding, *Synthetic carbonate free seawater, *Natural seawater, Chemical precipitation, Solubility, Brackish water, Sea water, Dissolution rate constants, Concentration, Temperatures, Structure, Kinetic factors.
Identifiers: *Roswell water, *Fluidized bed seeding, *Synthetic carbonate free seawater.

The use of seeding techniques for scale control in saline water distillation is practiced but little is known of the fundamental aspects of the process. The objective of this work was two-fold: (1) evaluate the investigations on calcium sulfate scaling performed by contractors as requested by the Office of Saline Water; (2) conduct laboratory investigations to obtain basic information on calcium sulfate scale control. A laboratory unit was built to investigate the effects on calcium sulfate precipitation of such factors as temperature, composition, fluid dynamics, heat flux, size and weight of seeds. It was found that; (a) crystal growth was extremely slow and appeared to be the limiting process in scale formation; (b) the operating conditions were far from equilibrium; (c) the total precipitation, scale plus suspension, increased with wall temperature of the heater and the amount of seawater circulated through the heater; (d) presence of seeds in the fluidized bed heater improved the heat transfer coefficient and, hence, reduced the temperature difference between the solution and the heater wall accordingly; (e) presence of fluidized seeds did not affect the total precipitation, but did reduce the amount of scale formed. With proper size and amount of seeds, scale-free operation could be achieved; (f) dissolved organic compounds in natural sea water had no significant effect on scale formation and total precipitation. (Pruett-OSW)
W69-05334

A PILOT PLANT STUDY FOR REMOVAL OF SOLUBLE SILICA FROM ROSWELL, NEW MEXICO WATER. PHASE 1. INITIAL CONSTRUCTION AND OPERATION,
Johns-Manville Products Corp., Manville, N. J.
D. W. Davis, and T. S. Brown.
Research and Engineering Center, Final Report, April 1969. 41 p, 11 fig, 6 ref. OSW 14-01-0001-1710.

Descriptors: *Silica, *Scaling, *Brackish water, *Pilot plants, Adsorption, Distillation.
Identifiers: *Activated alumina, Feedwater treatment, *Roswell plant.

Silica removal from the Roswell, New Mexico plant feedwater by adsorption on activated alumina has been demonstrated using a 7-gpm pilot plant, thus confirming laboratory work reported in OSW R and D Report 286. The pilot plant consisted of a carboxylic softener, 4 silica removal colums, each containing 550 lb. of 8-28 mesh activated alumina, and associated regeneration equipment. The silica content of the water was reduced from 10-16 mg/l to less than 1.0 mg/l in the two trial runs. The treated feedwater was fed to the A.T.U. pilot evaporator system for two 100-hour runs. No scaling was noted in either run at a concentration ratio of 7 and a temperature of 216F.
W69-05335

3B. Water Yield Improvement

TREATED WATERSHED YIELDS IMPROVED WATER HARVEST,
Geological Survey, Albuquerque, N. Mex.
W. C. Ballance, and J. A. Basler.
Environ Sci and Tech, Vol 3, No 2, pp 110-112, Feb 1969. 3 p, 1 fig, 2 photo.

Descriptors: *Water management (Applied), *Water yield improvement, Watersheds (Basins), Paving, Water yield, Demonstration watersheds, New Mexico, Runoff, Infiltration, Evaporation.
Identifiers: Runoff improvement, Impervious watersheds, Experimental watersheds, White Sands (N.M.).

An asphalt-coated watershed was constructed and studied in White Sands Missile Range, New Mexico, to determine the increase in surface-water runoff that may be obtained for water supply in an arid land. The 9.1 acre watershed was cleared and covered with 1/8 inch of asphalt, and a recording rain gage and V-notch weir were installed. Infiltration was measured downstream from the treated area and from a similar but untreated control area. Average rainfall is 10 inches per year. Evaporation may be as much as 100 inches per yr. The untreated watershed collected only 3% of precipitation while the treated area collected from 40% in small rainfalls to over 75% in larger events. The total cost was $4,700 or $516.40 per acre, with an estimated total 10-yr initial and operating cost of $7,774. The cost of the water recovered would be about 50.75 cents per 1,000 gal, and the average supply from the area would be 4.7 acre-ft per yr. (Knapp-USGS)
W69-05410

3C. Use of Water of Impaired Quality

ASSESSING IMPACTS OF DECLINING WATER QUALITY ON GROSS VALUE OUTPUT OF AGRICULTURE, A CASE STUDY,
Economic Research Service, Salt Lake City, Utah.
M. Glade Pincock.
Water Resources Research, Vol 5, No 1, pp 1-12, Feb 1969. 1 fig, 6 tab, 12 ref.

Descriptors: *Water quality, *Salinity, *Arizona, *Economic impact, *Crop production, Irrigation water, Salt tolerance, Damages, Withdrawal, Budgeting, Consumptive use, Water pollution, Leaching, Electrical conductance, Costs, Return (Monetary).
Identifiers: *Wellton-Mohawk Irrigation District, Arizona, Crop losses.

Continued economic development in a river basin lowers water quality in the main stream over time, since some of the water withdrawn at each diversion is consumptively used, and return flows carry pollutants to the stream. The objective of this study was to analyze impacts of irrigation water quality on projected gross value output for agriculture in the Wellton-Mohawk Irrigation District, Yuma County, Arizona. A procedure for estimating physical crop losses due to salinity was summarized from the literature. Published enterprise and farm budgets were adjusted to show damages that might be expected for a specific irrigation project. A change in water quality of the magnitude studied did not indicate an adjusted cropping pattern in response to deteriorated water quality. The method and procedures summarized here may be used assessing the impacts of declining water quality gross value output of agriculture for any area whe sufficient basic data are available. (Affleck-Ariz)
W69-05273

QUALITY OF WATERS FROM PLAYAS O THE SOUTHERN HIGH PLAINS,
Agricultural Research Service, Bushland, Tex.
Frederick B. Lotspeich, Victor L. Hauser, and Oliver R. Lehman.
Water Resources Research, Vol 5, No 1, pp 48-5 Feb 1969. 8 fig, 5 tab, 16 ref.

Descriptors: *Water quality, *Water chemistr *Playas, *Surface runoff, *Texas, Runoff, Wat storage, Groundwater, Aquifers, Salts, Nitrate Hydrogen ion concentration, Electrical co ductance, Watersheds (Basins), Dissolved solic Sodium.

It is estimated that 2.5 to 3.0 million acre-feet surface runoff accumulate annually in th thousands of playas that dot the southern Hig Plains. Most of this water is wasted by evaporatio but much of it could be conserved by storage in th aquifer. However, past lack of knowledge about i quality has impeded progress. A study was co ducted to determine the quality of water from 1 playas in an area extending about 100 miles fro northeast to southwest and covering two major so types. The change in water quality with time wa also determined. Playa water contained less sal than ground water and was of excellent quality fo irrigation. Nitrate contents were less than 1. mg/liter in nearly all playas. Almost no nitrogen ap plied as fertilizer was washed into playas by runo water. High and variable amounts of suspende solids contained in playa waters were substantiall reduced by settling in deep reservoirs protecte from wind and wave action. (Affleck-Ariz)
W69-05276

3D. Conservation in Domestic and Municipal Use

PROCEEDINGS-SYMPOSIUM ON BETTEI WATER AND SEWER SERVICES FOR SMALI COMMUNITIES IN NORTH CAROLINA.
North Carolina Univ., Chapel Hill. Wate Resources Research Inst.

North Carolina Water Resources Research In stitute, Report No 15, December 1968. 113 p.

Descriptors: *Municipal water, *Municipal wastes *Water resources planning, City planning grants.
Identifiers: Community water supply, Communit sewer systems, *North Carolina.

Proceedings of a Symposium held at the Institute o Government in Chapel Hill on December 4, 1968 to examine current water and sewer problems i the context of a multitude of applicable Federa and State programs, North Carolina law and alter native governmental arrangements for the planning, financing, construction and managemen of water and sewer systems. Some of the principa findings were: (1) The numerous deficiencies i community water and sewer systems due to poo planning, lack of cooperation between communi ties and inefficient operation of systems; (2) The economic and other advantages of area wide wate and sewer systems; (3) The need to attune loca water development plans to regional needs and water availability; (4) The need for a sound and politically acceptable statewide program within which local government could construct and operate area wide water and sewer systems; (5) The lack of an established procedure to assure that actions taken at the local level are coordinated or that alternative arrangements for the provision of services are considered in advance; and (6) The absence of clearly established responsibility for comprehensive planning of water and sewerage services throughout the State. (Howells-N C)
W69-05312

VATER SUPPLY PROBLEMS IN DEVELOPING COUNTRIES,
nternational Bank for Reconstruction and Development, Washington, D. C.
Harold R. Shipman.
our American Water Works Association, Vol 59, No 7, pp 767-772, July 1967. 6 p, 1 ref.

Descriptors: *Water supply, *Sewerage, Urbanization, Municipal water, Loans, Feasibility studies, Management, Project planning.
Identifiers: *Unaccounted-for water, *World Bank, Local funds, Investment priorities, Technical resources.

f approximately 50 percent of the urban populations of the 86 developing countries (of the World Bank's total membership of 106) is now reasonably supplied by some sort of municipal water system, his still leaves 210 million unserved people living n urban centers. This total will probably increase o 483 million by 1980. The sewerage situation is ar worse and far more costly when measured on a er capita basis. It becomes apparent that there will e need for large investment by countries to meet he needs of their people for both water and ewerage. The policy of the World Bank is that ater projects for which funds will be made availale should be of high priority in the country's evelopment program, technically designed to proide maximum benefits at least cost, and capable of eing supported, operated, and maintained by local ersonnel. The organization should have maximum pportunity to operate without undue political inerference. It should be able to function as a wellun public utility, and should meet all expenses and osts out of its operating revenues. (Sokoloff-Ruters)
/69-05513

OMPLETION OF THE FAIRFAX COUNTY VATER AUTHORITY ACQUISITION PRORAM.
airfax County Water Authority, Annandale, Va.
ames J. Corbalis, Jr.
ournal Am Water Wks Assn, Vol 61, No 3, pp 39-144, Mar 1969. 6 p, 2 ref, 3 tab.

escriptors: *Virginia, *Water districts, *Legislaon, *Administrative agencies, Local governents, Government finance, public utility districts, ater resources development, Eminent domain, ondemnation, Gravity dams, Streams, Hydraulic ructures, Pumping, Water supply, Storage tanks, umped storage, Judicial decisions, Legal aspects, peration and maintenance, Equipment, Facilities, eservoir operation, Water Yield.

he Fairfax County Water Authority was created nder the Virginia Water and Sewer Authorities ct (Chapter 28, Title 15.1, Code of Virginia 950) pursuant to a vote of the Board of County upervisors. The creation of the authority for the urpose of acquisition, construction, operation and aintenance of an integrated county wide water stem was in response to the population growth of e county and the general inadequacy of private oncerns serving the area. The Authority is empowered to acquire water systems by purchase, gift, ase, or through the exercise of the power of minent domain. In acquiring twenty systems for an ggregate expenditure of $55,700,000.00, the uthority has come to serve 43,933 customers rough 438 miles of pipe delivering 46.4 mgd. The imary water source is Occoquan Creek, which s a safe yield of 65 mgd which can be increased 75 mgd by means of reservoir level control. nancing of the Authority has been through public nd sale. The Authority acquired the largest of e incorporated water systems, the Alexandria ater Company by condemnation. The litigation ondemning the water company took seven years, e company finally accepting a fair value deterination of $45,231,182. This condemnation oceeding represents one of the few instances of acquisition by condemnation of a water supply mpany. (Katz-Fla)
/69-05539

COHASSET WATER CO V TOWN OF COHASSET (CONVEYANCE OF WATER WORKS TO TOWN).
For primary bibliographic entry see Field 06E.
W69-05583

PEOPLE V VILLAGE OF BERKELEY (STATUTORY DUTIES UNDER WATER SUPPLY CONTRACTS).
For primary bibliographic entry see Field 06E.
W69-05584

3E. Conservation in Industry

ECONOMIC ANALYSIS OF PUBLIC WATER SUPPLY IN THE PISCATAQUA RIVER WATERSHED,
New Hampshire Univ., Durham.
Donald V. Bourcier, and Robert H. Forste.
Water Resources Research Center, Bulletin 1, March, 1967. 56 p, 25 fig, 7 photo, 7 tab, 16 ref. OWRR Project A-008-NH.

Descriptors: *Water supply, *Water utilization, *Costs, *Pricing, *Water rates, Administration, Economics, Utilities, Rivers, Watersheds (Basins), Returns to scale, Cost trends, New Hampshire, Maine.
Identifiers: *Piscataqua River, Proportionality adjustments, Plant size.

The economics of public water supply for ten firms in the Piscataqua River Watershed were analyzed in terms of the cost of production and distribution, plant size adjustments of water works systems, and variation in water use. Pricing policies were derived from analysis of the costs of production and distribution of water as reported by the water systems. Three pricing policies were presented: (1) current policy of water works systems, (2) a proposed policy of charging an average price in order to cover variable and fixed costs, (3) a proposed policy of charging an average price to cover fixed costs, variable costs and investment costs. The effects of increases in plant capacity on average costs were analyzed. A cost-trend line was calculated to provide an indication of cost economies and diseconomies. It was also shown that there were significant variations in water use in the watershed.
W69-05510

3F. Conservation in Agriculture

ECONOMICS AND FINANCING OF IRRIGATION PROJECTS,
Ministry of Irrigation and Power (India).
For primary bibliographic entry see Field 06C.
W69-05221

EFFECT OF MOISTURE REGIMES AND HARVESTS ON EFFICIENCY OF WATER USE BY TEN FORAGE CROPS,
Pennsylvania State Univ., University Park.
For primary bibliographic entry see Field 02I.
W69-05268

PESTICIDE LEVELS AND FLUCTUATION IN SOIL BACTERIA IN AN IRRIGATED FIELD AND A POND OF SOUTHWEST TEXAS,
Texas A and M Univ., College Station. Dept. of Plant Sciences.
For primary bibliographic entry see Field 05C.
W69-05272

ASSESSING IMPACTS OF DECLINING WATER QUALITY ON GROSS VALUE OUTPUT OF AGRICULTURE, A CASE STUDY,
Economic Research Service, Salt Lake City, Utah.
For primary bibliographic entry see Field 03C.
W69-05273

RUNOFF WATER-SPREADING ON LEVELED CROPLAND,
Agricultural Research Service, Akron, Colo. Central Great Plains Field Station.
For primary bibliographic entry see Field 04A.
W69-05275

VARIABLE ROW SPACING OF IRRIGATED COTTON AS A MEANS FOR REDUCING PRODUCTION COSTS AND CONSERVING WATER,
Texas Agricultural Experiment Station, El Paso.
D. E. Longenecker, E. L. Thaxton, Jr., and P. J. Lyerly.
Agron J, Vol 61, No 1, pp 101-104, Jan-Feb, 1969. 3 fig, 3 tab, 10 ref.

Descriptors: *Application methods, *Irrigation efficiency, *Cotton, *Water conservation, *Economic feasibility, Crop production, Spatial distribution, Irrigation practices, Texas, Semiarid climates, Plant populations, Evaporation, Furrows, Mature growth stage, Water distribution (Applied), Costs, Water management (Applied), Water utilization.
Identifiers: *Row spacing, Variable row spacing, Lint, Skip-row.

Studies of a new irrigated cotton row spacing pattern have been conducted at El Paso, Texas, since 1964. This new pattern, called Variable Row Spacing (V. R. S.), consisted of alternate wide (1.37m) and narrow (0.66m) rows with furrows only between the 0.66m rows. The conservation of water and reduction of production costs were the purposes of the new pattern. The V. R. S. system presented an opportunity for reducing production costs through application of less water per irrigation, reductions in evaporation, more efficient utilization of applied water, more effective weed control, and earlier maturity of the crop. A major drawback of the method has been the inability of most commercial spindle pickers to harvest the variable row spacing pattern. Adoption of this V. R. S. system would allow a greater efficiency of water use by crops in a semi-arid region where water supplies are limited and where water costs are constantly increasing. (Affleck-Ariz)
W69-05277

WATER MANAGEMENT OF FALL-PLANTED SUGAR BEETS IN SALT RIVER VALLEY OF ARIZONA,
Agriculture Research Service, Phoenix, Ariz. Water Conservation Laboratory.
L. J. Erie, and O. F. French.
Trans of the ASAE, Vol 11, No 6, pp 792-795, Nov-Dec, 1968. 7 fig, 3 tab, 4 ref.

Descriptors: *Water management (Applied), *Sugar beets, *Arizona, *Irrigation efficiency, *Autumn, Irrigation practices, Water utilization, Crop production, Moisture stress, Soil moisture, Water conservation, Soil amendments, Weight, Depth, Soil-water-plant relationships, On-site investigations.
Identifiers: *Salt River Valley, Arizona, Growing season.

There are many management opportunities for conserving water in the production of sugar beets in Arizona. Opportunities are enhanced by the long growing season which included weather extremes that directly affect water use by the plant. During 1965-66 experiments were conducted in the field to determine how much water beets used for full-season maximum production, when irrigation should be given during the growing season, and when the last irrigation should be given to make the most economical use of water. Depth from which beets utilize soil moisture was also studied. Influence of different irrigation regimes on field weights and sugar percentages was not great enough to be statistically significant. It was found that beets could extract water from a depth as great as 5 ft, but over 70 percent of use was from the top 2 ft of soil. In addition since sucrose was not

reduced by soil moisture stress, irrigation could be discontinued 3 to 4 weeks before harvest, for maximum water economy. (Affleck-Ariz)
W69-05279

EFFECT OF EARLY-SUMMER SEEDING OF WINTER WHEAT ON YIELD, SOIL MOISTURE, AND SOIL NITRATE,
Utah State Univ., Logan. Dept. of Plant Science.
W. G. Dewey, and R. F. Nielson.
Agron J. Vol 61, No 1, pp 51-55, Jan-Feb, 1969. 4 fig, 4 tab, 13 ref.

Descriptors: *Wheat, *Planting management, *Soil moisture, *Crop production, *Nitrates, Winter, Summer, Fallowing, Irrigation effects, Irrigated land, Dry farming, Utah, Nitrogen, Sampling, Moisture availability, Soil-water-plant relationships, Depth, Winterkilling.
Identifiers: *Early planting, Plots, Plant survival.

At 4 irrigated and 3 dryland sites in northern Utah winter wheat was planted at monthly intervals from June through October over a four year period. Objectives of the study were (1) to observe effects of early planting of wheat on soil moisture and nitrate reserves which are ordinarily accumulated during the fallow year, (2) to find how this premature utilization of moisture and nitrates affects the yield of wheat, and (3) to determine if the suspected deleterious effect of early planting could be offset by irrigation and addition of nitrogen fertilizer. In both dryland and irrigated trials, yields in the early-seeded plots were significantly below those of plots seeded at the later planting dates. Major factors limiting yields of early-seeded winter wheat appeared to be disease, winterkill, and possibly physiological old age. (Affleck-Ariz)
W69-05280

RELATIONSHIP OF PALMER DROUGHT VARIABLES TO YIELD OF WINTER WHEAT,
Kansas State Univ., Manhattan; Weather Bureau, Silver Spring, Md.
Merle J. Brown, and R. L. Vanderlip.
Agron J, Vol 61, No 1, pp 95-98, Jan-Feb, 1969. 2 fig, 5 tab, 9 ref.

Descriptors: *Droughts, *Wheat, *Variability, *Winter, *Crop production, Precipitation (Atmospheric), Kansas, Soil moisture, Meteorology, Meteorological data, Monthly, Moisture, Subsoil, Temperature, Weather data, Data collections, Correlation analysis, Mathematical models.
Identifiers: *Palmer Drought Index, Meteorological drought, Multiple regression.

A procedure to determine duration and intensity of meteorological drought was developed by Palmer. This study investigated the relationship of Palmer drought variables to yield of winter wheat at specific locations in western Kansas. Yield data at seven locations were correlated with monthly Palmer Drought Index and monthly moisture departure values. Monthly precipitation, monthly Palmer drought index, monthly moisture departure, and estimated monthly subsoil moisture were the variables best correlated with winter wheat yields. Using multiple regression models it was found that monthly point moisture departures accounted for more variation in point winter wheat yield than other variables. Monthly departure values apparently gave a better indication of the weather conditions during critical periods than did the Palmer Drought Index. (Affleck-Ariz)
W69-05283

EFFECT OF FATTY ALCOHOL ON CHANGE IN SOIL WATER DURING THE SUMMER FALLOW PERIOD,
Colorado State Univ., Springfield. Southeastern Colorado Branch Station.
For primary bibliographic entry see Field 02G.
W69-05284

PREDICTING FIELD DISTRIBUTIONS OF SPRINKLER SYSTEMS,
California Univ., Davis. Dept. of Water Science and Engineering.
Volker O. Branscheid, and William E. Hart.
Trans of the ASAE, Vol 11, No 6, pp 801-803, 808, Nov-Dec, 1968. 2 fig, 2 tab, 5 ref.

Descriptors: *Sprinkler irrigation, *Distribution patterns, *Forecasting, *Irrigation systems, *Water distribution (Applied), Distribution systems, Irrigation design, Irrigation efficiency, Spatial distribution, Laterals, Uniformity coefficient, Winds, Wind velocity.
Identifiers: Juxtapositioning.

Distribution of water over a field by sprinkler irrigation is an important aspect of system design and should therefore be known in advance. An approach was given for prediction of field distributions from single-sprinkler patterns. The theoretical method takes into consideration actual location of sprinklers in the field at the time of their operation. A single sprinkler and a lateral line of 13 equally spaced sprinklers were operated independently of one another at a test site. In order that their climatic conditions would be similar, both installations were run at the same time. The HSPA uniformity coefficient was used as a measure of uniformity. Lateralline sprinkler patterns, when combined, gave assumed field distribution. Single sprinkler data, when juxtaposed and overlapped, predicted field distribution as indicated by the uniformity coefficient. Results show that the juxtapositioning procedure is a valid one. (Affleck-Ariz)
W69-05285

STUDIES ON WATER USE IN PEA (PISUM SATIVUM L.),
Punjab Agricultural Univ., Hissar (India). Coll. of Agriculture.
N. K. Behl, J. S. Sawhney, and M. K. Moolani.
Indian J Agric Sci, Vol 38, No 4, pp 623-626, Feb 1968. 1 fig, 3 tab, 3 ref.

Descriptors: *Water utilization, *Water requirements, *Crop production, *Irrigation practices, *Rates of application, Irrigation effects, Flowering, Plant growth, Soil moisture, Soil-water-plant relationships, Consumptive use, Evapotranspiration.
Identifiers: *Peas, India, Grain development.

A study was conducted in Hissar, India, to determine water needs of a pea crop. Irrigation treatments consisted of no irrigation, irrigation at flowering, irrigation at grain development, and irrigation at flowering and grain development. Single irrigation either at flowering or at grain-development stage indicated an increase in yield of about 18 and 10 percent over the control. Two irrigations, one each at flowering and at grain-development stage induced an increase in yield by 27 percent over the control. The calculated rate of water use per day was low in early stages of growth and attained a peak at flowering and grain-development time. (Affleck-Ariz
W69-05287

DETERMINATION OF OPTIMUM CAPACITY OF A STORAGE RESERVOIR FOR IRRIGATION PURPOSES AS A BASIS FOR ALLOCATING COSTS IN MULTIPLE-PURPOSE PROJECTS,
Manuel E. Espinosa.
For 8 volume Proceedings see Vol 2, No 9, W69-03305. International Conference on Water for Peace, 1967, Washington: U. S. Gov't. Printing Office, Vol 8, pp 764-769, 1968. 6 p, 6 charts.

Descriptors: *Irrigation efficiency, Dams, Water demand, Water utilization, Cost allocation.
Identifiers: Rio San Juan, Puerto Rico.

Seasonal fluctuations in stream flow is lowest when irrigation needs are sometimes greatest, thus creating the necessity to create reservoirs capable of storing a large proportion of the mean annu discharge. The establishment of multi-purpose pr jects such as a storage reservoir creates t problem of how to allocate the costs among t various purposes involved. The object of the stu is to highlight specifically the influence of stora capacity on improvements in irrigation condition The percentage ratio between the volume of wat applied to irrigation and the theoretical volume a cording to the law of irrigation is called the 'annu irrigation efficiency.' Through graphical analysis the 'annual irrigation efficiency' the order of op timum reservoir capacity required to meet the d mand for water is estimated. An example showin how this method was applied in the Rio San Juan presented. (Grossman-Rutgers).
W69-05294

PUTTING WASTE WATER TO BENEFICIA USE - THE FLUSHING MEADOWS PROJECT,
Agricultural Research Service, Phoenix, Ariz Water Conservation Lab.
For primary bibliographic entry see Field 05D.
W69-05327

RETURNING WASTES TO THE LAND, A NEW ROLE FOR AGRICULTURE,
Agricultural Research Service, Phoenix, Ariz Water Conservation Lab.
For primary bibliographic entry see Field 05D.
W69-05328

TILLAGE METHODS TO REDUCE RUNOFF AND EROSION IN THE CORN BELT,
Agricultural Research Service, Washington, D. C. Purdue Univ., Lafayette, Ind. Agricultural Experiment Station.
J. V. Mannering, and R. E. Burwell.
Agriculture Information Bulletin 330, pp 1-14. 1968. 14 p, 13 photo, 3 tab.

Descriptors: *Surface runoff, Water loss, Turf, *Soil erosion, Soil stabilization, *Rotations, Slopes, *Slope stabilization, Soil structure, Plant populations, Crop production, Cultivation, *Plant management, *Soil management, *Corn belt.

Recent developments in tillage methods for row crops offer effective ways to combat runoff and erosion. The development of these methods comes at an opportune time because continuous row cropping is increasing in many sections of the Corn Belt. The potential erosion hazard increases when sod-based rotations on sloping soils are replaced by continuous row crops. Sod crops protect the soil from climatic factors that cause erosion. In addition, sod crops improve soil structure for succeeding row crops. The increased use of fertilizer and higher plant populations improve crop yields and increase residue production. Thus the hazard of erosion while the land is in row crops is reduced. These practices have not, however, elimated the hazard. Other soil-conserving practices need to be considered. Investigations have shown that minimum, mulch, and ridge tillage; contour listing; and, interrow seeding reduce soil and water losses while row crops occupy the soil. Although most of these practices are more effective in reducing erosion when the row crop follows a sod crop, they are also beneficial when row crops are grown year after year.
W69-05330

SEASONAL AND DIURNAL VARIATION IN POCOSIN SHRUB MOISTURE CONTENT,
Forest Service (USDA), Asheville, N. C. Southeastern Forest Experiment Station; Forest Service (USDA), Macon, Ga. Southern Forest Fire Lab.; North Carolina Div. of Forestry.
For primary bibliographic entry see Field 02I.
W69-05331

OIL OR FOLIAR FERTILIZATION OF WELL-RAINED AND FLOODED SLASH PINE,
orest Service (USDA), Olustee, Fla. Naval Stores
d Timber Production Lab.
r primary bibliographic entry see Field 02G.
69-05332

4. WATER QUANTITY MANAGEMENT AND CONTROL

A. Control of Water on the Surface

OMPREHENSIVE BASIN STUDY ON WHITE VER BASIN, ARKANSAS AND MISSOURI.
hite River Basin Coordinating Committee.
r primary bibliographic entry see Field 06B.
69-05201

OOD PLAIN INFORMATION, SOUTHWEST ANCH, PRINCE GEORGES COUNTY, ARYLAND.
rps of Engineers, Baltimore, Md.

pared for Maryland-Nat Capital Parks and nning Comm. Corps Eng Flood Plain Rep, Sept 68. 25 p, 3 fig, 8 plate, 6 tab.

scriptors: *Floods, *Flood damage, *Flood ins, Flood control, Non-structural alternatives, ryland, Maximum probable flood, Historic od, Hurricanes.
ntifiers: Southwest Branch, Western Branch uxent River, Prince Georges County (Md), In-nediate regional flood, Standard project flood.

oding of the Southwest branch of the Western nch of the Patuxent River, Prince Georges unty, Maryland is described in a report of flood n problems based on records of rainfall, runoff, historical and present flood heights. Maps, otographs, profiles, and cross sections indicate extent of flooding that has occurred and which be expected to occur in the future. The infor-ion is for use in study and planning ways to imize vulnerability to flood damages by control lood plain use by zoning and subdivision regula-s, the construction of flood protection works, by combinations of these approaches. (Knapp-GS)
9-05203

OOD PLAIN INFORMATION (ANACOSTIA ER), PRINCE GEORGES COUNTY, MARY-ND.
ps of Engineers, Baltimore, Md.

pared for Maryland-Nat Capital Park and nning Comm. Corps Eng Flood Plain Rep, June 8. 49 p, 6 fig, 12 plate, 14 tab.

criptors: *Floods, *Flood damage, *Flood ns, Flood control, Non-structural alternatives, yland, Maximum probable flood, Historic d, Hurricanes.
tifiers: Prince Georges County (Md), costia River, Paint Branch, Indian Creek, Sligo ek, Standard project flood, Intermediate re-al flood.

ding of the Northeast and Northwest branches ne Anacostia River, and Paint Branch, Indian ek, and Sligo Creek, Prince Georges County, yland is described in a report of flood plain blems based on records of rainfall, runoff, and orical and present flood heights. Maps, photo-hs, profiles, and cross sections indicate the ex-of flooding that has occurred and which may xpected to occur in the future. The information r use in study and planning ways to minimize erability to flood damages by control of flood n use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-05204

FLOOD PLAIN INFORMATION, INTRENCHMENT, SUGAR, DOOLITTLE AND DOLESS CREEKS.
Corps of Engineers, Savannah, Ga.

Prepared for DeKalb County. Corps Eng Flood Plain Rep, Apr 1968. 51 p, 24 fig, 35 plate, 18 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, Georgia, Maximum probable flood, Historic flood.
Identifiers: Intrenchment Creek (Ga), Sugar Creek, Doless Creek, DeKalb County (Ga), Standard project flood, Intermediate regional flood.

Flooding of Intrenchment, Sugar, Doolittle, and Doless Creeks, DeKalb County, Georgia is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-05205

FLOOD PLAIN INFORMATION OF PROCTOR CREEK, METROPOLITAN ATLANTA, GEORGIA.
Corps of Engineers, Mobile, Ala.

Prepared for Atlanta Region Metropolitan Planning Comm. Corps Eng Flood Plain Rep, June 1968. 32 p, 3 fig, 11 plate, 11 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, Georgia, Maximum probable flood, Historic flood.
Identifiers: Proctor Creek (Ga), Atlanta (Ga), Standard project flood, Intermediate regional flood.

Flooding of Proctor Creek, Atlanta, Georgia is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches.
W69-05206

FLOOD PLAIN INFORMATION ON HEADWATERS SOUTH RIVER, METROPOLITAN ATLANTA, GEORGIA.
Corps of Engineers, Savannah, Ga.

Prepared for Atlanta Region Metropolitan Planning Comm. Corps Eng Flood Plain Rep, May 1967. 19 p, 9 fig, 15 plate, 31 ref, 1 append.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, Georgia, Maximum probable flood.
Identifiers: South River (Ga), Atlanta (Ga), Standard project flood, Intermediate regional flood.

Flooding of the headwaters of the South River, Atlanta, Georgia is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-05207

TECHNIQUES OF WATER MANAGEMENT OF LAKE OKEECHOBEE AND THE FLORIDA EVERGLADES,
Corps of Engineers, Jacksonville, Fla. South Atlantic Div.
Clifford L. R. Walke.
Int Ass Sci Hydrol Pub No 76, Symp on Hydrol Aspects of Util of Water, Bern, Sept 25-Oct 7, 1967, pp 181-186, 1968. 6 p, 2 fig, 2 ref.

Descriptors: *Water management (Applied), *Florida, *Lakes, Lake stages, Water supply, Water control, Drainage systems, Flow control, Streamflow forecasting, Storage, Canals.
Identifiers: Lake Okeechobee, Central and Southern Florida Flood Control Project.

The initial project for Lake Okeechobee and the Everglades was intended as a means of controlling floods resulting from hurricane winds and rainfall. Now it is a part of the Central and Southern Florida Flood Control Project, which is a vast multi-purpose development providing not only flood control but also water for a variety of uses: irrigation, navigation, recreation, and preservation of the natural scenic beauty and wildlife of the Everglades. A complex system of canals, levees, ponding areas, spillways and pumping stations is required to store, retard and divert the flow from the lake and its tributaries to provide protection and assure the maximum beneficial use for each purpose. The hydrologic techniques used to determine lake and reservoir storage allocations and releases, spillway pumping station capacities, and canal discharges include almost all those encountered in applied hydrology: prediction of flood stages and flows, rainfall-runoff relations, infiltration and evaporation losses, flood routing, and salt-water intrusion. In an area less than 25 ft above mean sea level, subject to the widest variations in precipitation, and with an acute demand for water at all times, there is little margin for error in the use of these techniques. This paper describes the principal features of hydrologic analysis of the Lake Okeechobee-Everglades area. (Knapp-USGS)
W69-05223

RUNOFF WATER-SPREADING ON LEVELED CROPLAND,
Agricultural Research Service, Akron, Colo. Central Great Plains Field Station.
Rome H. Mickelson, Maurice B. Cox, and Jack Musick.
J Soil and Water Conservation, Vol 20, No 2, pp 57-60, March-April 1965. 3 fig, 2 tab, 6 ref.

Descriptors: *Runoff, *Watersheds (Basins), *Water spreading, *Water storage, *Crop production, Overland flow, Excess water (Soils), Water yield improvement, Flooding, Crop response, Consumptive use, Diversion, Colorado, Rainfall-runoff relationships, Storm runoff, Fallowing, Moisture availability.
Identifiers: *Level pans.

A system for diverting waste runoff from agricultural watersheds to level areas for spreading and storage on cropland was developed near Akron, Colorado. Objectives of the work were to evaluate the automatic water-spreading system for utilizing watershed runoff, collect information on the ratio of watershed size to leveled area and evaluate performance of different annual crops under conditions of intermittent flooding on leveled water-storage areas. The spreader system provided 4 to 7 inches of additional available water on leveled areas and this additional moisture effected substantial increases in crop yields. Owing to additional available amounts and uniform distribution of water, water use efficiencies of crops on leveled

areas were double those of crops on unleveled check strips. Runoff water-spreading on leveled cropland has a potential as a moisture conservation practice in arid climates. (Blecker-Ariz)
W69-05275

FLAT CHANNEL TERRACES,
Soil Conservation Service, McCook, Nebr.
For primary bibliographic entry see Field 02J.
W69-05282

HARBOR DEVELOPMENT PORT OF PORTLAND, MAINE.
Greater Portland Chamber of Commerce, Maine; Union Design Groups, Newport, R. I.
For primary bibliographic entry see Field 06B.
W69-05298

THE ORIGIN AND DEVELOPMENT OF THE WATERWAYS POLICY OF THE UNITED STATES,
National Waterways Conference, Inc., Washington, D. C.
William J. Hull, and Robert W. Hull.
Hull and Hull, The Origin and Development of the Waterways Policy of the United States 1967. 47 p, 159 ref.

Descriptors: *Inland waterways, *Interstate rivers, *Rivers and harbors act, *Taxation, Navigation, Legislation, Federal government, Canals, Railroads, Transportation, Natural resources, Water supply, Flood control, Conservation, Recreational facilities, Water management, Water resources development, Water resources planning act, Legal aspects.

The freedom of our nation's waterways is viewed in retrospect. The author presents an in-depth treatment of Congressional actions which have helped maintain our inland waterways as toll-free arteries of commerce. The author outlines the state of the law in the late 18th century; he then traces the evolution of statutory and case law down to the present time. The impact of the congressional crackdown on discriminatory rate policies by railroads designed to force competitive water carriers out of business is given special attention. Over the years, the policy of toll-free waterways persisted, and such policy served a variety of purposes. For example: (1) the unification of the country; (2) the furtherance of westward expansion; (3) the defeat of sectionalism; and (4) the provision of low cost transportation. The maintenance of a free waterways policy has been an essential factor in water resources development. The policy should be vigorously adhered to. (Shevin-Fla)
W69-05338

DELAWARE RIVER BASIN COMPACT.
N J Stat Ann secs 32:11D-1 to 32:11D-110 (1963); N J Stat Ann secs 32:11D-111 to 32:11D-115 (Supp 1968-69).

Descriptors: *Interstate compacts, *Water management, *River basin development, *Water allocation (Policy), Delaware River Basin Commission, Interstate rivers, Delaware River, Project planning, Navigable waters, Administration, Regulation, Water utilization, Flood plain zoning, Water resources development, Legal aspects, Standards, Coordination, Water supply, Water pollution control, Flood control, Watershed management, Hydroelectric power, Financing, State governments.
Identifiers: *Delaware River Basin Compact.

The purposes of the Delaware River Basin Compact are to promote interstate comity; to remove causes of controversy; to secure and protect present developments within the states; to encourage and provide for the planning, conservation and development of the basin's water resources; to provide for cooperation by the signatory parties; and to apply the principle of equal treatment to all water users who are similarly situated and to all users of related facilities without regard to established political boundaries. This compact has an initial duration of 100 years. A commissioner, appointed by the President of the United States and the governors of the signatory states of Delaware, New Jersey, New York and Pennsylvania make up the Delaware River Basin Commission. The general areas dealt with by the Compact are: water supply; pollution control; flood protection; watershed management; recreation; hydroelectric power; and regulation of withdrawals and diversions. (Childs-Fla)
W69-05342

DELAWARE RIVER BASIN COMPACT.

N J Stat Ann secs 32:11D-1 to 32:11D-23 (1963); N J Stat Ann secs 32:11D-111 to 32:11D-115 (Supp 1968-69).

Descriptors: *Interstate compacts, *River basin development, *Project planning, *Water management, Interstate rivers, Delaware River Basin Commission, Regulation, Coordination, Administrative agencies, Legal aspects, Conservation, Water law, Federal government, Federal-state water rights conflicts, Water resources development, Equitable apportionment, Water allocation (Policy), Diversion, Prior appropriation, Administration, Standards, Research facilities, River forecasting, Publications, Use rates, Delaware River.
Identifiers: *Delaware River Basin Compact, Comprehensive plan.

The Commission is to develop plans and projects relating to the water resources of the basin. The Commission has the power, in accordance with the doctrine of equitable apportionment, to allocate the basin's waters to and among the signatory states, and to impose conditions and release requirements related thereto. The commission is also empowered to plan, construct and operate any projects or facilities to accomplish the purposes of the compact. It may establish standards for all projects and facilities that affect the basin's water resources, including water and waste treatment plants, recreational facilities, trunk mains for water distribution, local flood protection works, small watershed management programs, and groundwater recharging operations. In addition, the commission may: conduct and sponsor research on water resources; compile and coordinate systematic stream stage and groundwater level forecasting data; conduct special groundwater investigations; prepare and publish information with respect to the water problems of the basin; and negotiate for finances. The commission may also fix or alter rates of the use of facilities which it owns or operates. (Childs-Fla)
W69-05343

DELAWARE RIVER BASIN COMPACT.

N J Stat Ann secs 32:11D-24 to 32:11D-37 (1963); N J Stat Ann secs 32:11D-111 to 32:11D-115 (Supp 1968-69).

Descriptors: *Interstate compacts, *River basin development, *Water pollution control, Flood protection, Delaware River Basin Commission, Water management, Interstate rivers, Water supply, Surface water, Groundwater, Regulation, Dams, Reservoirs, Storage, Regulated flow, Sanitary engineering, Assessments, Coordination, Treatment facilities, Classification, Warning systems, Delaware River.
Identifiers: *Delaware River Basin Compact.

The Commission is empowered to develop and implement plans and projects for the use of the basin's water for domestic, municipal, agricultural and industrial water supply. For this purpose, the Commission may construct, acquire and operate dams, reservoirs and other facilities for utilization of water resources and regulation of the use thereof. The Commission may survey and investigate, and acquire, construct, and operate projects and fa ties to control potential pollution and abate exis pollution of the basin's water resources. The C mission may classify the waters of the basin establish standards for treatment of wastes. signatory states, in order to prevent pollut agree to enact legislation to enable the m tenance of the basin's waters in a satisfactory dition. The Commission may also plan, const and operate projects and facilities for flood dam reduction. The Commission is to create stand relating to the nature and extent of the uses of in areas subject to flooding. The Commission is powered to acquire interests in lands within area of a flood plain for the purpose of restric its use so as to minimize the flood hazard. (Chi Fla)
W69-05344

DELAWARE AND RARITAN CANAL.

N J Stat Ann secs 13:13-1 to 13:13-12.12 (1968

Descriptors: *New Jersey, *Canals, *Easeme *Water supply, Legislation, Regulation, Brid Flow, Maintenance, Fill, Water sources, Admi trative agencies, Legal aspects, Operation maintenance, Industrial water.
Identifiers: Delaware and Raritan Canal.

Title to the Delaware and Raritan canal, the fee and appendages thereto, and the works and provements erected thereon is vested in the st Custody of the canal and feeder is vested in the partment of Conservation and Development. canal and feeder shall continue to be a pu highway. Maintenance of bridges over the cana the responsibility of the Department of Conser tion and Development. To insure continuous fl and to preserve sanitary conditions, the canal s be kept free of weeds. Water from the canal may sold. A tariff of tolls and lock charges is to established for use of the canal. Easements along across the canal may be granted, and the sale lands not needed is premitted. The canal is to used as a source of industrial water supply and recreational purposes. (Childs-Fla)
W69-05361

DRAINAGE AND FLOWAGE OF LANDS.

N J Stat Ann secs 15:5-1 to 15:5-4, 15:5-9, 15:5- (1939). N J Stat Ann sec 15:5-6 (Supp 1968).

Descriptors: *New Jersey, *Drainage, Legislati Administration, Tides, Grasslands, Marsh Coastal marshes, Marsh management, Drainage fects, Flooding, Legal aspects, Financing, Ov flow, Banks, Bank protection, Planning, Operati and maintenance.

Section 15:5-1 provides for the election of comm sioners by the owners of meadow and marsh lan and for the measuring and assessing of these lan for drainage by the elected commissioners. Secti 15:5-2 limits the assessments for drainage to tho made with reference to the benefits resulting fro such drainage. Section 15:5-3 allows land co tained within the boundaries of a meadow compa to be flooded and for control of the overflow may be agreed upon in sections 15:5-4 and 15:5 of this title. Section 15:5-4 provides that t proposition to have meadow land subject to ove flow may be submitted to the owners of these land however, notice must be given in writing, publish and posted. Section 15:5-6 provides that if t meadow companies abut each other, it may nece sitate the erection of a cross bank to protect o from the overflow or fire of the others, in whi case three commissioners shall be appointed by t county court to lay out the correct bank. Secti 15:5-9 provides for and regulates the operation an financing of various projects and undertakings such companies. Finally, section 15:5-11 deals wit the improvement and protection of islands again tides by owners. (Heckerling-Fla)
W69-05362

EACH FRONTS AND WATERWAYS.
J Stat Ann secs 40:29-1 to 40:29-11 (1967).

escriptors: *Coastal engineering, *Erosion, *En-
oachment, *Shore protection, New Jersey, gislation, Beaches, Waterways, Local govern-nts, United States, Sea walls, Bulkheads, Jetties, ach erosion, Inland waterways, Financing, ms, Condemnation, Legal aspects.

unties bordering the Atlantic Ocean are per-tted to pay funds into the United States Treasury be expended by the Federal Government for the ction of any works necessary to preserve the st of any municipality in the county against en-oachments and to protect the inland waterways, igable rivers, public roads, and public property. e municipality to be protected must make equal ment. Counties may also appropriate funds for purpose of constructing any waterway connect-as a cutoff with any river or for the purpose of pening, widening, and straightening any such terway. A county may also pay funds to a mu-ipality to be used for the improvement of a ok or watercourse. The municipality's plans for rainage system must first be approved by the nty. Work on the proposed improvement shall done by the municipality. Bonds may be issued inance the improvements. Certain counties may end funds to control the flow of water in brooks streams in the county. Flumes, dams, and other ctures may be erected for this purpose. The nty may also expend funds for municipal beach tection. (Childs-Fla)
9-05363

TERWAYS AND WATER FRONTS.
Stat Ann sec 40:14-1 to 40:14-15 (1967).

criptors: *New Jersey, *Inlets, *Channel im-vement, *Erosion control, Legislation, Legal ects, Local governments, Waterways, Streams, als, Inland waterways, Navigable waters, Chan-, Bulkheads, Jetties, Financing, Cities.

unties and municipalities may open or keep n any inlet, stream, canal, basin or other public erway which is either within or forms the boun-of such county or municipality. Counties and nicipalities may appropriate money for port or or commissions. Inland waterways or naviga-streams may be improved by counties or mu-palities through joint action. Counties may ap-priate up to seventy-five hundred dollars in any year for the purpose of constructing a per-ent inlet through which any river or creek ning in such county may be connected with the an. The appropriations may also be used in ing permanent improvements on such inlet. At r own expense, counties and municipalities bor-ng the Delaware River may construct bulk-ds and other structures to prevent erosion by river. (Childs-Fla)
9-05364

MOVAL OF BUSHES, TREES, AND STUMPS OM FLOWED AREA.
Rev Stat Ann tit 17, sec 2800 (1965).

criptors: *Maine, *Dams, *Beds under water, vigation, Legislation, Lumbering, Low water s, Water levels, Water flow, Trees, Shrubs, nneling.
tifiers: Stumps.

ever erects a dam on any public waters shall, in 3 years after a head of water is held and age is created, remove from the flowed area all s, bushes, and stumps to the extent that their shall be at least 5 feet below the surface of the n low-water level maintained during the period ne 1st to December 1st. Also, he must remove growth as he can legally remove from the edge e flowed area so that no dry-ki and debris form e carried away by the water. This statute does apply to dams created solely for logging pur-s where the water is stored for less than 3 ths, nor does the statute require the removal of stumps below the swell of the roots. Any dam maintained in violation of this section shall constitute a public nuisance, and be subject to Maine Rev Stat Ann tit 17, sec 2706 (1965). (Logan-Fla)
W69-05368

NUISANCES-MILLS AND DAMS; FENCES AND BUILDINGS ON PUBLIC WAYS.

Me Rev Stat Ann tit 17, sec 2797 (1965).

Descriptors: *Maine, *Non-navigable waters, *Streams, *Mill dams, Legislation, State governments, Legal aspects, Dams, Public health.
Identifiers: Nuisance (Non-water polluting).

The erection and maintenance of watermills and dams upon or across non-navigable streams shall not be deemed a nuisance unless they become offensive to the neighborhood, injurious to the public health, or occasion injuries or annoyances of a kind not authorized by Maine Rev Stat Ann chapter 91. (Logan-Fla)
W69-05369

DAMAGE TO ICE.
For primary bibliographic entry see Field 06E.
W69-05371

MOORING WATERCRAFT TO BUOYS OR BEACONS.
For primary bibliographic entry see Field 06E.
W69-05373

HARBORS, WHARVES, AND HARBOR MASTERS.

Mich Comp Laws Ann secs 67.35-67.39 (1967).

Descriptors: *Michigan, *Legislation, *Harbors, *Taxes, Sewage treatment, Docks, Cities, Legal aspects, Local governments, Boating regulations, Water quality, Navigable waters, Construction costs, Ditches, Drains, Rates, Rivers, Water purification.
Identifiers: *Harbor masters.

Village councils may levy a general tax to defray the expenses of repairing public sewers, ditches and watercourses, and it may enact ordinances necessary for the protection and control of public drains and sewers. The council may construct and maintain public wharves, docks and other appertenances on navigable waters of the state which are adjacent to the village and it may lease wharfing and landing privileges upon such but not for a period of more than 10 years. The council can require all wharves, docks and landing places, whether public or private, to be constructed and maintained in conformity with such grade as it establishes. The council may prohibit the encumbering of these public facilities and may proscribe rates and charges for their use. The council may provide ordinances for the preservation of the purity of the waters of any harbor, river, or other waters within the village and to regulate the use of the navigable waters to promote the safety and convenience of water craft operating therein. A harbor master may be appointed to enforce such regulations. (F. Molica-Fla)
W69-05377

POIRE V SERRA (PROPRIETY OF LAND FILL BY RIPARIAN OWNER).

106 A 2d 391-393 (N H 1954).

Descriptors: *Landfills, *Sedimentation, *Diversion, *New Hampshire, Judicial decisions, Alteration of flow, Reasonable use, Riparian land, Riparian waters, Deposition (Sediments), Sediment transport, Running waters, Obstruction to flow, Riparian rights, Legal aspects.
Identifiers: Injunctions (Mandatory).

Plaintiffs brought suit to enjoin filling operations in a river adjacent to their property and to obtain removal of the portion of the wall and fill already in place. Plaintiffs contended that the fill was causing an undue amount of sedimentation buildup at their boat dock and constituted an obstruction. Plaintiffs objected to a finding that the present fill was not an obstruction; this court affirmed the holding below. A riparian owner is entitled to beneficial use of water passing through or adjacent to his land without responsibility for the consequences of such use on others; such use, however, must be reasonable. What constitutes a reasonable use depends upon a variety of conditions--the size and character of the stream and the uses to which the water can or is being applied. Whether a diversion of or interference with a stream is rightful must depend upon whether, under all the circumstances such diversion or interference is reasonable. The extent of benefit to one party and inconvenience or injury to the other are factors to be considered in making this determination. The evidence did not show a material change in the river flow, any appreciable sedimentation on the plaintiffs' land, or any substantial damage. (Blunt-Fla)
W69-05381

JOHNSON V RAY (RIGHT TO CONSTRUCT RETAINING WALL)

265 SW 2d 782-784 (Ky 1954).

Descriptors: *Kentucky, *Retaining walls, *Riparian rights, *Streamflow, Judicial decisions, Land tenure, Stream improvement, Legal aspects, Damages, Remedies, Relative rights, Streams, Obstruction to flow, Precipitation excess.
Identifiers: Injunctions (Mandatory), Irreparable damages.

Plaintiff sought and obtained a temporary injunction restraining defendant from building a retaining wall on his side of a creek separating their adjoining tracts of land. Plaintiff alleged that the wall footing was in the creek bed and, as so situated, would cause overflow onto her property. However, plaintiff was unable to prove irreparable damage, and the injunction was dissolved. The defendant subsequently completed the wall. The circuit court then entered a judgment ordering removal of the wall. Defendant appealed. The Court of Appeals held that the evidence tended to prove that the wall constituted a benefit to plaintiff's land rather than a detriment. The wall lessened the chance of overflow, which occasionally occurred during heavy rains. A mandatory injunction is of such serious nature that proof of irreparable injury must be shown before it will issue. The casting of a few rocks on plaintiff's shore was not sufficient injury to warrant an injunction. (Harris-Fla)
W69-05382

CITY OF HARDIN V NORBORNE LAND DRAINAGE DISTRICT (STATUTORY RIGHTS TO MAINTAIN EXISTING LEVEES).

232 SW 2d 921-926 (Mo 1950).

Descriptors: *Missouri, *Levees, *Repulsion (Legal aspects), *Surface runoff, Overflow, Surplus water, Judicial decisions, State governments, Water law, Drainage districts, Construction, Maintenance, reclamation, Remedies, Legislation, Damages, Legal aspects.
Identifiers: Injunction (Prohibitory).

Appellants sought to enjoin respondent drainage district from constructing a new levee. Appellants owned property outside the district, and they alleged that the levee would prevent the natural drainage of overflow water and cause inundation of their property. In 1924, respondents obtained a plan for reclamation, as required by statute, and constructed the present levee. The above mentioned statute also provided powers to maintain and protect the drainage district by strengthening, repairing, and maintaining existing levees. Appellants contended that respondent was seeking to

construct a new levee rather than maintain a pre-existing one. The court held that respondent was acting under statutory power when proposing to raise the height of the existing levee and that, since a new levee was not actually going to be built, a new plan for reclamation was unnecessary. The court further stated that the district was entitled to fend off overflow water under the common enemy doctrine. The overflow water was to be considered surface water and could be dealt with as such under the above mentioned doctrine. (Holt-Fla)
W69-05384

ENDERSON V KELEHAN (UPLAND DRAINAGE OF SURFACE WATERS).

32 NW 2d 286-290 (Minn 1948).

Descriptors: *Minnesota, *Diversion structures, *Overland flow, *Surface runoff, Subsurface runoff, Surface waters, Storm runoff, Precipitation (Atmospheric), Reasonable use, Drainage effects, Drainage engineering, Controlled drainage, Surface drainage, Drainage systems, Natural flow, Legal aspects, Judicial decisions, Ditches, Hydraulic structures.
Identifiers: Easements, Servitudes.

Plaintiff sought to enjoin defendant from diverting certain surface waters onto the land of the plaintiff located below that of the defendant. The court held that a landowner, in effecting a reasonable use of his property for a legitimate purpose and acting in good faith, may drain his land of surface waters and cast them upon the land of another. This is so even if such drainage carries with it some waters which would otherwise have remained on the land until evaporated or absorbed. The abovementioned right is qualified in that a reasonable necessity must exist for such drainage and reasonable care must be taken to avoid unnecessary injury to the servient estate. The benefit accruing to the land to be drained must reasonably outweight the gravity of the harm resulting to the land burdened by the servitude, and, wherever practicable, the natural drainage system should be utilized. The court found that the defendant had complied with the above principles and qualifications and dismissed the complaint. (Katz-Fla)
W69-05390

BURT V MUNGER (EROSION CONTROL AND LANDFILL BY RIPARIAN OWNER).

314 Mich 659, 23 NW 2d 117-120 (1946).

Descriptors: *Retaining walls, *Ownership of beds, *Michigan, *Riparian rights, Check structures, Riparian lands, Hydraulic structures, Lakes, Bank protection, Bank stability, Erosion control, Flood control, Landfills, Judicial decisions, Legal aspects, Reasonable use, Real property, Relative rights.

Plaintiff, owner of a parcel of land abutting an inland lake, sought a declaratory judgment concerning his right to appropriate a portion of the lake bed. Periodic changes in the level of the lake had resulted in erosion of plaintiff's beach head and, to counteract this erosive effect, plaintiff desired to construct a retaining wall extending several feet out on the lake bed. Plaintiff proposed to fill the area between the retaining wall and the shoreline by dredging fill from the lake bottom. Defendant successfully objected to the plaintiff's proposal, contending that a riparian owner may not interfere with the reasonable use of the lake by other riparian owners and that the proposed alterations would effectively and materially curtail the use of the lake by such riparian owners. The court refused to allow construction of the retaining wall in the manner proposed by the plaintiff, recognizing that such construction would increase the extent of the plaintiff's land, thereby reducing the surface area of the lake to the detriment of the other riparian owners. (Katz-Fla)
W69-05391

TURNER V SMITH (RESERVOIR OBSTRUCTING LAND DRAINAGE).
231 SW 2d 110-113 (Ark 1950).

Descriptors: *Natural streams, *Surface waters, *Obstruction to flow, *Arkansas, Judicial decisions, Legal aspects, Watercourses (Legal), Riparian rights, Natural flow doctrine, Surface drainage, Channels, Ditches, Surface runoff, Swamps, Land reclamation, Reservoirs, Damages, Cotton, Crops, Bayous, Levees, Relative rights, Remedies, Riddance (Legal aspects), Repulsion (Legal aspects).
Identifiers: Dominant estate, Servient estate.

Plaintiff sought to enjoin maintenance of a reservoir which was allegedly obstructing the natural drainage of plaintiffs' land. Plaintiffs were upper land holders whose land was flooded and whose crops were damaged following construction of defendant's reservoir. The issue to be decided was whether waters coming upon defendant's property were in natural watercourses or were merely surface waters; if the former, then defendant had no right to impede the flow. In finding for the plaintiff, the court noted that defendant was obstructing the flow of at least two natural watercourses which, even though they temporarily flowed without well-defined banks, never became surface water. The court carefully added that defendant could reclaim his land by confining these streams passing over his land to ditches and channels which would clear his land of water and yet not impede the flow from other property. (Logan-Fla)
W69-05392

DODD V BLEZEK (DETERMINATION OF DOMINANT ESTATE AND DRAINAGE RIGHTS IN NATURAL STREAM).

66 NW 2d 104-109 (Iowa 1954).

DESCRIPTORS: *Surface drainage, *Natural streams, *Obstruction to flow, *Iowa, Natural flow doctrine, Alteration of flow, Flow, Drainage, Elevation, Floods, Backwater, Remedies, Legal aspects, Judicial decisions, Dikes.
Identifiers: *Swales.

Plaintiff sought to enjoin the obstruction of the natural flow of water from the plaintiff's land. The obstruction was caused by defendant's dike. The trial judge held that defendant's land was servient to that of plaintiff's for drainage purposes through three natural swales and an injunction should be issued. The defendant appealed. The court held the trial judge was correct in using the course of flood waters as a consideration in determining the general elevations of land as effects drainage. The court also ruled that a swale was a natural watercourse and that the owner of a dominant estate had the right to drain his estate into a natural watercourse unless there is an increase in water which materially results in damages to the lower estate. (Gabrielson-Fla)
W69-05393

JOHNSON V CITY OF WINSTON-SALEM (ACTION FOR DAMAGES CAUSED BY AN OBSTRUCTED DRAIN PIPE).

81 SE 2d 153-161 (N C 1954).

Descriptors: *North Carolina, *Flood damage, *Subsurface drainage, *Obstruction to flow, Judicial decisions, Drains, Pipes, Drainage, Surface water, Natural flow, Legal aspects, Channel flow, Operation + maintenance, Drainage systems, Culverts.
Identifiers: Natural drainage, Equitable servitudes.

Lower proprietors brought suit to recover from an upper proprietor for flood damage caused when a large subsurface drain pipe running under the upper proprietor's property became obstructed and overflowed. The court stated that the upper property owner had the burden of exercising ordinary care to maintain the artificial drain so as to accommodate the natural flow of surface waters. Wh the purchaser of land had notice of the artificial derground drainage system created by the ver in lieu of a natural channel of open drainage, property passed to the purchaser subject to all isting servitudes with respect to maintenance of underground drainage system. When a private of drainage is connected with a municipal cul without dedication by the private owner or cor by the municipality, the municipality is ordina not liable for damages caused by a break in private line. It was held to be a jury question a whether the upper proprietor had been negligen failing to keep the drain pipe in proper condit (Childs-Fla)
W69-05394

BOAT V VAN VEEN (INTERFERENCE WI WATER FLOW).

44 NW 2d 671-676 (Iowa 1950).

Descriptors: *Levees, *Iowa, *Alteration of fl *Natural flow doctrine, Drainage, Ditches, Da Legal aspects, Judicial decisions, Relative rig Obstruction to flow, Local governments, Floo Flood water, Flood routing.
Identifiers: Injunctions (Mandatory).

Plaintiffs brought action to enjoin maintenance levee and wing dam on defendants' property wh allegedly caused flooding of plaintiffs' land. levee had been constructed from excavated from a drainage canal created in 1915 by the co ty. The wing dam was erected by defendants 1945. The Supreme Court held that the natu flow of water cannot be arrested or interfered w by one landowner (whether servient or domina to the injury of another. The court found that levee was created by the county for drainage provement and had not been interfered with by fendants. Injunctive relief as to the levee was nied. The wing dam, however, substantially creased the flow by narrowing the course for flo water; the court ordered its removal. (Kahle-Fla W69-05395

CICONTE V SHOCKLEY (RUNO NUISANCE).

75 A 2d 242-244 (Del Ch 1950).

Descriptors: *Delaware, *Precipitation exce *Repulsion (Legal aspects), *Riddance (Le aspects), Drainage waters, Runoff, Surface runo Surface waters, Roofs, Flooding, Judicial decisio Legal aspects, Drains, Relative rights, Dischar (Water), Remedies.
Identifiers: Injunctions (Mandatory), Injunctio (Prohibitory).

Plaintiff sought to enjoin continuance of an alleg nuisance resulting from defendant's construction the roof of a house sloping toward plaintiff's adjoi ing lot without gutters and downspouts to carry water. The maintenance of the above mention condition caused flooding of the plaintif premises. The court recognized that an upp proprietor is not required to take any steps prevent the flow of surface water from his premis onto the adjoining land so long as such flow resu from maintenance of the land in its natural stat An upper proprietor may not, by artificial mean collect and discharge surface water in increas and unnatural quantities upon the land of h neighbor so as to cause substantial injury damages. The injunction was granted. (Katz-Fla) W69-05396

LUCAS V FORD (EASEMENT - SURFAC WATER DRAINAGE).

363 Pa 153, 69 A 2d 114-116 (1949).

Descriptors: *Pennsylvania, *Repulsion (Leg aspects), *Riddance (Legal aspects), Drainag

vater, Drainage systems, Pipes, Hydraulic structures, Coal mines, Easements, Surface water, Precipitation excess, Drainage waters, Runoff, Highways, Judicial decisions, Legal aspects, Water pollution, Relative rights.
dentifiers: Injunctions (Prohibitory).

Plaintiff sought to enjoin defendants from allowing lirt and foreign substances to be washed upon plaintiff's property. Defendants operated and maintained a coal tipple which abutted plaintiff's property. Subsequent to construction of a roadway rom an adjacent state highway to the coal tipple, he defendants installed two drainage pipes to revent erosion of their property by surface waters unning off the state highway. These pipes deposit ie matter in question upon the plaintiff's property. The court held that an upper proprietor may ischarge surface water flowing over his land onto ie adjoining lower land by use of natural watercourses. Plaintiff's allegations concerning the hange in quality of the water were insufficient as ie evidence showed that the foreign substances nd dirt complained of originated from the state ighway runoff. (Katz-Fla)
/69-05397

OUNTY COMMISSIONERS OF BALTIMORE OUNTY V HUNTER (DRAINAGE EASEMENT UISANCE).

13 A 2d 910-915 (Md Ct App 1955).

escriptors: *Maryland, *Right of way, *Ditches, Repulsion (Legal aspects), Water conveyance, rains, Drainage systems, Pipes, Precipitation ex-ss, Runoff, Surface waters, Drainage water, ewers, Cities, Local governments, Operation + aintenance, Judicial decisions, Legal aspects, elative rights, Remedies.
entifiers: Injunctions (Prohibitory).

aintiff upper landowners sought to enjoin defenants from obstructing an open drainage ditch. Dendants filed an equitable counterclaim seeking to njoin plaintiffs from excessive discharge and scharge of water and other debris upon the lower operty. The court recognized that the law of aryland concerning drainage easements entitled vners of upper land to have surface water flow turally over the land of lower proprietors. The urt held that plaintiffs' use of the ditch in estion was reasonable. However, the court rected plaintiffs to prevent debris from flowing th the water across the defendants' property. Katz-Fla)
69-05400

LOOD PLAIN INFORMATION OF ELLICOTT REEK IN CITY OF TONAWANDA AND CINITY, ERIE COUNTY, NEW YORK.
rps of Engineers, Buffalo, N. Y.
r primary bibliographic entry see Field 02E.
69-05458

LOOD PLAIN INFORMATION OF DUCK REEK, GARLAND, TEXAS.
rps of Engineers, Fort Worth, Tex.
r primary bibliographic entry see Field 02E.
69-05459

LOOD PLAIN INFORMATION, SOUTH ESQUITE CREEK, MESQUITE, TEXAS.
rps of Engineers, Fort Worth, Tex.
r primary bibliographic entry see Field 02E.
69-05460

LOOD PLAIN INFORMATION, TENMILE REEK, DALLAS COUNTY, TEXAS.
rps of Engineers, Fort Worth, Tex.
r primary bibliographic entry see Field 02E.
69-05461

FLOOD PLAIN INFORMATION OF CATTARAUGUS CREEK, ARCADE, WYOMING COUNTY, NEW YORK.
Corps of Engineers, Buffalo, N. Y.
For primary bibliographic entry see Field 02E.
W69-05462

WATER RESOURCES LAWS IN VIRGINIA (NATURAL SURFACE WATERCOURSES).
For primary bibliographic entry see Field 06E.
W69-05534

RAU V WILDEN ACRES, INC (ACCUMULATION-RIDDANCE).

68 York Legal Record 157-162 (C P Pa 1955).

Descriptors: *Pennsylvania, *Repulsion (Legal aspects), *Riddance (Legal aspects), Overlying proprietor, Reasonable use, Contours, Flow control, Runoff, Drainage water, Surface waters, Precipitation excess, Rain water, Ditches, Natural flow doctrine, Alteration of flow, Obstruction to flow, Real property, Flooding, Judicial decisions, Legal aspects, Remedies.

The plaintiff brought this action to enjoin the owner of a higher, neighboring land from artifically draining surface water from his property onto that of the plaintiff. The defendant contends that the plaintiff's land is servient to an easement of the upper land for drainage purposes and that defendant has acted without negligence and, therefore, any unavoidable loss sustained by the plaintiff is damnum absque injuria (harm without injury). Specifically, the plaintiff alleges that defendant changed the contour of his land in such a manner as to concentrate the waters draining therefrom and to insure that these concentrated waters were quickly removed from defendant's property, the defendant constructed a nine foot deep ditch with raised sides which emptied with considerable force onto the plaintiff's property. The court determined that the use of defandant's land for the purpose of a sub-division was reasonable but that the diversion of surface water from its natural flow by construction of the ditch with the resultant inundation of plaintiff's land was unreasonable. (Katz-Fla)
W69-05544

LAWRENCE V EASTERN AIRLINES (DIVERSION OF NATURAL FLOW).
81 So 2d 632-634 (Fla 1955).

Descriptors: *Florida, *Diversion, *Natural flow, Surface runoff, Rainfall disposition, Surface waters, Legal aspects, Cities, Natural flow doctrine, Remedies, Judicial decisions, Damages, Ditches, Drainage, Dams, Alteration of flow, Riparian rights, Relative rights, Running waters.
Identifiers: *Nuisance.

Plaintiff brought this action for damages against defendant airline and town for private nuisance caused by the diversion of the natural flow of water onto plaintiff's land. The court held that no person has the right to gather surface waters naturally flowing in one direction by drainage, ditches, dams, or otherwise, and divert them onto the lands of the lower owner so as to cause injury. Furthermore, plaintiff could recover damages for such diversion even though some of the alleged acts of defendants had antedated the plaintiff's acquisition of his property. The court found plaintiff's complaint sufficient under the liberal system of pleading to withstand a motion to dismiss. (Reed-Fla)
W69-05546

DROGMILLER V OLSON (OBSTRUCTION TO NATURAL COURSE OF DRAINAGE).

40 NW 2d 292-303 (Iowa 1949).

Descriptors: *Iowa, *Ditches, *Dikes, *Check structures, Hydraulic structures, Flood control, Flood protection, Drainage water, Drainage systems, Highways, Roadbanks, Repulsion (Legal aspects), Riddance (Legal aspects), Natural flow, Legal aspects, Judicial decisions, Prescriptive rights, Artificial watercourses.

Plaintiff sought to compel removal of claimed obstructions placed along a public highway by the defendant Board of Supervisors. Such obstruction allegedly interfered with the natural flow of surface waters from the plaintiff's land. The defendant asked that the plaintiff be enjoined from diverting water onto a public highway. The plaintiff had constructed an artificial watercourse diverting water by means of a ditch to a channel running beneath the defendant's bridge span. In response to requests of landowners downstream from the channel the defendant constructed a wing dike to repel the waters being so diverted by the plaintiff. The court refused to sustain the plaintiff's contention that the artificial watercourse had become a natural watercourse, which may occur as between private individuals, since prescriptive rights cannot be acquired against the public. The plaintiff was ordered to remove his dike. To insure against flood damage to all parties concerned, the Board was ordered to remove its dike within thirty days after plaintiff removed his and was further ordered to remove such accumulated silt from beneath its bridge span as was necessary to facilitate drainage of the waters naturally flowing there. (Katz-Fla)
W69-05547

TOWN OF VIENNA V STATE (PRESCRIPTIVE RIGHTS DOCTRINE AS APPLIED TO PUBLIC PROPERTY).
119 N Y S 2d 545-552 (Ct Cl 1953).

Descriptors: *Prescriptive rights, *Flood damage, *Dams, *New York, Judicial decisions, State governments, Cities, Land use, Navigation, Canals, Watercourses, Easements, Lakes, Dam construction, Diversion, Flood waters, Rivers, Water level fluctuations, Water law.
Identifiers: *Public purposes.

Plaintiff, a municipality, brought suit against the State of New York to recover for flood damage to a highway caused by the state's dam. The highway, which was dedicated to the public use was used continuously except for the annual springtime flooding. Flooding was caused by the maintenance of the water level behind the dam at an unchanged level for purposes of navigation. The defendant contended that the state had acquired a prescriptive right to continue to maintain the water level at that height and to divert the resulting flood waters on to neighboring lands. Defendant based this contention on the fact that the annual flooding had occurred for the last fifteen years without interruption or complaint. The court held for the plaintiff, ruling that the doctrine of prescription was not available to the defendant. It is settled law that there can be no prescriptive right against property dedicated to a public use. As a consequence, the defendant did not have an easement to annually flood the public highway. (Stewart-Fla)
W69-05549

BUDA V STATE (ARTIFICIAL CONTROL OF SURFACE WATERS).

97 NYS 2d 37-54 (Ct Cl 1950).

Descriptors: *Aqueducts, *Flood waters, *Engineering, *Structures, Judicial decisions, Streamflow, New York, State governments, Precipitation excess, Surface waters, Surface runoff, Creeks, Ditches, Canals, Flood damage, Muck soils, Soil porosity, Culverts, Erie Canal, New York State Barge Canal, Legal aspects.
Identifiers: Proximate causation.

Plaintiff brought suit to recover for damage to land cause by overflow of a creek. Plaintiff alleged that the overflow was caused by the negligent reconstruction of the defendant's aqueduct which car-

ried waters of the Erie Canal above the creek. In addition, the plaintiff alleged that, had the aqueduct been in tact on the dates of the flooding, such flooding would not have occurred. On the basis of expert testimony, the court found that the defendant was not negligent and entered judgement accordingly. The proximate cause of the flood was excess precipitation. There was nothing improper about the reconstruction method. Ordinarily, in the obstruction of streams or construction of dams, there is a good chance that accumulating waters will overflow onto neighboring lands. In such case, the party constructing the dam may be liable for damages. In this case, the structure was placed above the stream. There was no structure erected in the stream which would cause flooding. As a result, there is no liability imposed on the defendant. (Stewart-Fla)
W69-05550

BOBO V YOUNG (ARTIFICIAL DRAINAGE OF SURFACE WATERS AND NATURAL FLOW).

61 So 2d 814-816 (Ala 1952).

Descriptors: *Alabama, *Dams, *Natural flow, *Surface waters, Judicial decisions, Surface drainage, Runoff, Streamflow, Ditches, Drainage waters, Slopes, Running waters, Abatement, Flood control, Watercourses, Natural streams, Obstruction to flow, Legal aspects, Backwater, Relative rights.
Identifiers: *Estoppel, Trespass, Nuisance, Consent, Affirmative defenses.

Plaintiff, an upper riparian landowner, brought suit to compel removal of a dam which defendant had built. It was alleged that the dam caused water to back up onto plaintiff's property. Ordinarily, the casting of water upon the land of an upper proprietor is a trespass for which the tortfeasor must pay damages. However, the defendant alleged and proved that he had obtained plaintiff's consent to the construction of the dam. Consent is a good defense to an action for trespass. The defendant acted in reliance on plaintiff's manifestations of assent. Plaintiff is now estopped to claim trespass and to recover for resulting damages. (Stewart-Fla)
W69-05551

PETERSON V WISCONSIN RIVER POWER CO (PROPERTY ENCROACHMENT BY IMPOUNDED WATERS).

264 Wis 84, 58 NW 2d 287-289 (1953).

Descriptors: *Wisconsin, *Dams, *Damages, *Seepage, Reservoirs, Condemnation, Eminent domain, Flooding, Flood damage, Water level fluctuations, Impounded waters, Operation and maintenance, Real property, Surface drainage, Natural flow doctrine, Judicial decisions, Legal aspects, Hydraulic structures, Hydroelectric plants, Levees.

Plaintiffs brought action against defendant power company for damages to their land caused by seepage of water from the defendant's Wisconsin River dam. The plaintiffs specifically alleged that the dam created a large body of water behind the dam and that the raised water level of that lake had encroached upon plaintiffs' lands and destroyed the drainage on these lands. The defendants denied any encroachment upon plaintiffs' property and, by way of a counterclaim, sought to have any damages declared by the court to have been incurred by the plaintiffs termed permanent and to have damages awarded in conformity therewith. The court held that if the damages alleged are proved to be temporary, then the plaintiffs are entitled to money damages. If the damages proved are of a permanent nature, then the plaintiffs cannot seek recompense for such damages in tort, but must commence condemnation proceedings in county court. The cause was remanded to determine the nature of the injury. (Katz-Fla)
W69-05552

COATES V UNITED STATES (TAKING OF PROPERTY FOR PUBLIC PURPOSE WITHOUT JUST COMPENSATION).
93 F Supp 637-640 (Ct Cl 1950).

Descriptors: *Eminent domain, *Surface water, *Soil erosion, *Deposition (Sediments), Missouri River, Engineering structures, Navigable rivers, Floods, Riparian owners, Land use, Crop production, River flow, River beds, Soil invasion, Judicial decisions, Damages, Alteration of flow, Compensation.
Identifiers: *Negligence.

Plaintiffs brought suit to recover for damage to their farm land. To improve the navigability of the Missouri River, the defendant erected certain structures which changed the character, course, and flow of the river. These changes caused flooding and erosion of the plaintiffs' property, followed by the deposition of several feet of sand onto the land; this destroyed its productivity. The defendant contended that it is not liable, where there is no direct invasion, for damages caused by a change in the character and course of the waters resulting from the lawful and non-negligent erection of structures. The plaintiffs contended that the construction by defendant raised the water level above its safety mark and directly caused the damage. Such action constituted a taking of private property for public purpose without just compensation. The court found for the plaintiff. It held that the defendant's acts were not to maintain the status quo of the river but to alter natural conditions. If these acts directly and necessarily caused the damage, the plaintiffs are entitled to recover for invasion and a taking of private property without just compensation. (Stewart-Fla)
W69-05554

GWINN V MYERS (SUIT TO REMOVE OBSTRUCTION TO NATURAL WATERCOURSE).

129 NE 2d 225-229 (Ind 1955).

Descriptors: *Indiana, *Watercourses (Legal), *Natural streams, *Surface runoff, Judicial decisions, Riparian rights, Obstruction to flow, Ditches, Channels, Drainage, Tile drains, Subsurface drains, Banks, Surface drainage, Surface waters, Legal aspects.

Suit was brought to compel removal of a dam constructed by defendant upon his land at its boundary with land of plaintiff. In affirming the lower court decision for plaintiff the court took notice that a lower riparian owner (defendant herein) may protect himself against surface water of the upper riparian owner. But once this surface water reaches or becomes a natural watercourse, one which flows in a definite direction within banks and forms a channel that is permanent for all practical purposes, it takes on other legal characteristics. Among these is that a natural watercourse may not be obstructed by a lower landowner. The factual issue involved was whether the water flowing in a surface channel, which was above a tiled drainage ditch that had been covered, was a natural watercourse. The court held that it was. (Logan-Fla)
W69-05557

REESE V STATE (DAMAGE TO LAND DUE TO DIVERSION OF STREAM).
72 NYS 2d 209-219 (Ct Cl 1947).

Descriptors: *New York, *Alteration of flow, *Diversion, *Channel improvement, Dredging, Damages, Judicial decisions, State governments, Riparian rights, Streamflow, Natural flow, Riparian land, Erosion, Soil erosion, Flood damage, Nonnavigable waters, Eminent domain, Legal aspects, Compensation.

efendant state, in connection with the construction of a bridge over a creek, dredged the bed of the creek on claimant's farm. This action changed the course and channel of the creek and diverted the flow of the stream causing the top soil from part of the farm to be washed away. The dredging w done without the claimant's permission. Claima brought suit, alleging negligence by the state changing the channel, and praying for compen tion for the appropriation of their land by the sta The state contended that the allegations failed state a cause of action. The court held that the st was negligent and the trespass on claimant's land dredge the creek created a wrongful conditi which constituted a continuing trespass. Wh real estate is actually invaded by superinduced a ditions of water so as to destroy or impair its usef ness, there is a taking within the meaning of t Constitution for which compensation must made. (Heckerling-Fla)
W69-05560

CORNETT V HEBERT (OBSTRUCTION T FLOW OF SURFACE WATER).
31 So 2d 446-450 (Ct App La 1947).

Descriptors: *Louisiana, *Easements, *Drainag *Dams, Natural flow, Alteration of flow, Obstru tion to flow, Relative rights, Legal aspects, Righ of-way, Culverts, Canals, Ditches, Drainage wat Drainage effects, Surface waters, Develop waters, Damages, Drainage practices, Irrigatio Judicial decisions.
Identifiers: Equitable servitudes.

Plaintiff brought suit praying that defendant be o dered to remove a dam or obstruction which constructed on his own property at a point where large culvert, situated underneath an irrigatio ditch, carried drainage water from plaintiff's pr perty. The property of the parties was contiguou Plaintiff's property was higher than the defendant and the natural flow of water was onto defendant land. The dam set up by defendant impeded th natural drainage. The ditch was dug over twen years prior to the commencement of this action c plaintiff's land. Plaintiff alleges that, even if th drainage is not a natural flow, a servitude has bee acquired by him and defendant may not now co struct the dam. The court held that defendant owe plaintiff a servitude of drainage because the natur flow was from plaintiff's land to defendant's lan Plaintiff was also entitled to recover for damage t the grass which he had planted on his land an which was injured by ponding caused by the mai tenance of the dam. (Heckerling-Fla)
W69-05562

BRAY V CITY OF WINTER GARDEN (SUR FACE WATERS CAST ON LOWER PROPER TY).

40 So 2d 459-462 (Fla 1949).

Descriptors: *Florida, *Reasonable use *Drainage, *Alteration of flow, Judicial decisions Damages, Cities, Riparian rights, Relative rights Water pollution, Surface waters, Culverts, Sewers Ditches, Canals, Waste disposal, Waste wate disposal, Industrial wastes, Natural streams, Lega aspects.
Identifiers: Injunctions (Prohibitory).

Plaintiffs brought this suit to enjoin the discharge o surface waters upon their lands and to collect fo the damage they had suffered. Plaintiffs allege that the defendant municipality maintained system of culverts, sewers, ditches, and canals fo the collection and disposal of surface waters, and charged that the city not only permitted water to accumulate in such quantities that when discharged it inundated their lands, but also that it permitted individuals and corporations to use the conduits fo discharge of industrial waste. The question in the trial court was whether, under the facts in the case, the lower property owned by plaintiffs, which was planted in citrus trees, was rendered useless because the city (1) unlawfully overtaxed the natural watercourse and (2) allowed the waters to become contaminated by the discharge of industrial waste. The court affirmed the chancellor's decisions, holding that defendant was not chargeable

th any overflow which had resulted from its ainage system. There had been no unreasonable e of the watercourse and thus, no damage for nich the city could be held accountable. leckerling-Fla)
69-05563

ORRIS V WINTERS (ACTION TO REMOVE N OBSTRUCTION TO WATER FLOW).

Delaware County Reports 5-7 (C P Pa 1947).

escriptors: *Obstruction to flow, *Easements, urface water, *Pennsylvania, Flooding, Judicial cisions, Real property, Natural flow, Watercour-, Discharge, Drainage, Legal aspects.
entifiers: Equity, Injunctions (Mandatory).

th plaintiff and defendants received title to their pective properties from a common grantor. ere was an eight-foot driveway between the two operties which the deeds reserved to the property ners as a common 'automobile driveway, ssageway and watercourse.' Defendants erected three-inch curbing along their side of the veway which blocked and dammed up the natu- watercourse from plaintiff's to defendants' pro- ties, causing the water to back up on plaintiff's operty. Plaintiff asked that defendants be trained from maintaining the curb. The court ted that an easement naturally exists for the charge of surface water from property at a her level across adjacent property at a lower el. Since the deed made the driveway a water- rse, defendant can do nothing to stop the natu- drainage. The court held that the curb must be moved. (Childs-Fla)
9-05567

IPER V HEYWOOD-HALL CONSTR CO LAIM OF ARTIFICIALLY INCREASED AINAGE ON PART OF UPPER LAN- WNER).

primary bibliographic entry see Field 06E.
9-05568

BERMAN V FUNKHOUSER (UPPER LAN- WNER'S RIGHT TO HAVE SURFACE TER DRAIN UPON LOWER LANDOWNER).

primary bibliographic entry see Field 06E.
9-05570

ITED STATES V KANSAS CITY LIFE IN- RANCE CO (FLOODING, UNDERFLOW-).

U S 799-815 (1950).

criptors: *Missouri, *Mississippi River, *Un- low, *Percolation, Runoff, Drainage, Surface ers, Streams, United States, Federal govern- t, Flooding, Ditches, Dams, Water level fluc- ions, High water mark, Beds, Boundaries (Pro- y), Real property, Easements, Navigable ers, Riparian rights, Riparian lands, Judicial sions, Legal aspects.
tifiers: Servitudes.

pondent owned farm land abutting a non- gable tributary of a navigable river. The United es, in the interest of navigation, constructed a which caused the waters of the river to be ntained at the ordinary high water level. pondent alleged that maintenance of the river ch a level obstructed the drainage of surface r from his lands and rendered such lands sable for agricultural purposes. The govern- t contended that the navigation servitude ex- ed beyond the bed of the river to the Respon- 's property and, therefore, that recovery ld be denied. The court held that the naviga- servitude possessed by the government ex- ed only to the limit of the stream bed as neated by the ordinary high water mark. The t further stated that the obstruction of the natural surface flowage from respondent's lands due to super saturation or underflowing of respondent's land was a taking of property for which compensation must be given. (Katz-Fla)
W69-05572

OSTLUND V STEARNS COUNTY (ARTIFICIAL ACCUMULATION OF SURFACE WATERS).
For primary bibliographic entry see Field 06E.
W69-05577

EARLY V SOUTH CAROLINA PUBLIC SERVICE AUTHORITY (CONSTRUCTION OF DAM AND DIVERSION OF RIVER).

90 SE 2d 472-481 (S C 1955).

Descriptors: *South Carolina, *Diversion dams, *Alteration of flow, *Public works, Damages, Judicial decisions, Rivers, Eminent domain, Navigable rivers, Non-navigable waters, Diversion structures, Salt water, Encroachment, High water mark, Fresh water, Hydroelectric plants, Water control, Dams.

Respondents brought this action for damages to their land resulting from the construction of a dam across the river which flowed past this land. The dam diverted a large part of the flow of fresh water to another stream. This diversion caused salt water from the ocean to invade the river and its tributaries which, at abnormal high tides, resulted in the spreading of salt over the land. It was contended that such action amounted to a taking of property for public use entitling them to just compensation under the provisions of the state constitution. Appellant admitted the construction of the dam and the diversion of the water but denied that there had been damage to any of respondents' land. It also contended that it was acting as a state agency exercising a sovereign power to improve navigation and that respondents' property was subject to navigation servitude. The court held that the acts of appellant constituted a taking of respondents' property within the purview of the state constitutional provision and that the damage award was supported by the evidence. (Heckerling-Fla)
W69-05578

EAVES V CITY OF OTTUMWA (LIABILITY FOR FLOOD DAMAGE).
For primary bibliographic entry see Field 06E.
W69-05587

CARLSON V A AND P CORRUGATED BOX CORP (FLOODING CAUSED BY NEGLIGENT MAINTENANCE OF DAM).
364 Pa 216, 72 A 2d 290-294 (1950).

Descriptors: *Pennsylvania, *Dams, *Flash floods, *Dam failure, Spillways, Embankments, Disasters, Rupturing (Dam failure), Overflow, Retaining walls, Damages (Storms), Cloudbursts, Backwater, Judicial decisions, Precipitation excess, Legal aspects.
Identifiers: *Acts-of-God, Proximate cause.

Plaintiffs brought this action for flood damage allegedly caused by defendant's negligence in failing to properly maintain its dam. On the night of the flooding, a heavy rain began and continued during the following day. The evidence adduced tended to show that negligent maintenance of the dam caused it to burst during the rainstorm, precipitating general flooding and specific damage to plaintiffs' properties. The court held that the fact that some other cause concurred with the negligence of defendant did not relieve defendant of liability unless he could show that such other cause would have produced the injury notwithstanding his own negligence. It is a familiar legal doctrine that where two tortfeasors are guilty of concurrent negligence, each is responsible for the full amount of the resulting damage and is not entitled to any apportionment of liability. There was no reason why the same rule should not apply where one of the operative agencies was a force of nature. Therefore, the court held defendant liable for the total damage caused by the flood, notwithstanding the face that a rainstorm caused the waters of the stream to rise. (Reed-Fla)
W69-05588

IODICE V STATE (DUTIES OF DAM OWNERS).
For primary bibliographic entry see Field 06E.
W69-05589

GOLDEN V AMORY (LIABILITY FOR FLOODING).
For primary bibliographic entry see Field 06E.
W69-05590

BLACK RIVER REGULATING DIST. V ADIRONDACK LEAGUE CLUB (CONDEMNATION PROCEEDINGS).
For primary bibliographic entry see Field 06E.
W69-05591

TAYLOR V STATE (PRESCRIPTIVE RIGHT TO FLOOD LAND).
For primary bibliographic entry see Field 06E.
W69-05592

NIXON V WELCH (SURFACE DRAINAGE EASEMENTS).

24 NW 2d 476-481 (Iowa 1947).

Descriptors: *Iowa, *Surface drainage, *Easements, *Ditches, Judicial decisions, Surface runoff, Surface waters, Drainage districts, Drainage systems, Drainage, Culverts, Artificial watercourses, Prescriptive rights, Natural flow doctrine, Relative rights, Legal aspects, Local governments.
Identifiers: Injunctions (Mandatory), Dominant estate, Servient estate.

Plaintiffs owned land along the east side of a road, and defendants owned land along the west side. Surface water on certain portions of plaintiffs' land drained in a southwesterly direction, through a culvert under the road, and across an artificial ditch on defendants' land. In 1940, defendant county caused the road to be graded, and the culvert was removed. The drainage ditch across defendants' land became filled with soil by natural processes. Plaintiffs claimed an easement for the surface water drainage and sought to have the culvert restored and the ditch cleared of debris. Defendants contend that since plaintiffs' land is within a certain established drainage district he is deprived of the rights of free flowage of surface water as between dominant and servient estates. The court held that the mere fact that plaintiffs' land was situated in an established drainage district did not affect plaintiffs' rights. Plaintiffs were entitled to have the culvert restored and the ditch cleared at their own expense. Easement rights could be acquired by prescription even though the artificial ditch was not legally established. (Molica-Fla)
W69-05593

JONES V LUCAS (SURFACE DRAINAGE).

326 Mich 455, 40 NW 2d 220-225 (1949).

Descriptors: *Michigan, *Surface drainage, *Farm management, *Cranberries, Judicial decisions, Farms, Drainage water, Surface runoff, Drainage, Easements, Flooding, Natural flow, Legal aspects.
Identifiers: Injunctions (Prohibitory), Restrictive covenants, Equitable Servitudes.

Plaintiff and defendant purchased adjacent land from a common grantor. Defendant's deed made his land subservient to plaintiff's in regard to the flooding of plaintiff's land to achieve an adequate surface water level in which to grow cranberries. The natural flow of drainage was from defendant's

property to the land of plaintiff. Plaintiff sought an injunction to restrain defendant from draining his land since such drainage caused the water level on plaintiff's land to decrease. The court held that injunctive relief was proper in this case. Sufficient evidence had been adduced to show that, in making defendant's estate subservient to plaintiff's, the intent of the parties was to promote cranberry husbandry on plaintiff's land. (Molica-Fla)
W69-05594

STATE ROADS COMMISSION V BERRY (CONDEMNATION AWARDS).
For primary bibliographic entry see Field 06E.
W69-05596

TALBOT V KERN (SERVITUDES OF DRAINAGE).
For primary bibliographic entry see Field 06E.
W69-05597

BROWN V BLANKENSHIP (SUBSERVIENT DRAINAGE).
For primary bibliographic entry see Field 06E.
W69-05598

LEWALLEN V DAVENPORT (DAMAGE FROM BACKING SURFACE RUNOFF).

255 SW 2d 16-17 (Ky Ct App 1953).

Descriptors: *Kentucky, *Repulsion (Legal aspects), *Surface drainage, *Natural flow, Flood damage, Backwater, Damages, Earth dams, Overlying proprietor, Water law, Judicial decisions, Legal aspects, Surface runoff, Surface waters, Natural flow doctrine, Obstruction to flow, Drainage, Relative rights, Diversion structures.

Plaintiff owned land adjacent to a state highway. Defendant's land adjoined, at a lower elevation, plaintiff's lot. Reconstruction of the highway by the state caused water to drain over plaintiff's lot and onto defendant's land. To prevent water from flowing onto his land, defendant created a dirt fill which caused water to back onto plaintiff's land. Plaintiff brought this action to recover for flood damage to his grist mill. The trial court directed a verdict for the plaintiff, ruling that defendant's possible claim against the Commonwealth was no defense. The appellate court affirmed, holding that a landowner has no right to intentionally divert the natural flow of water to the injury of a neighbor on the ground that such diversion prevents damage to his land. The court found no merit in defendant's contention that plaintiff had no right to permit the state to shift drainage over his lot, nor in the argument that damage would have been minimized had the plaintiff moved or elevated the mill. (Wheeler-Fla)
W69-05600

4B. Groundwater Management

PUTTING WASTE WATER TO BENEFICIAL USE - THE FLUSHING MEADOWS PROJECT,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 05D.
W69-05327

RETURNING WASTES TO THE LAND, A NEW ROLE FOR AGRICULTURE,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 05D.
W69-05328

UNPROTECTED WELLS.
For primary bibliographic entry see Field 06E.
W69-05367

4C. Effects on Water of Man's Non-Water Activities

WETLANDS (CONTROL AND REGULATION IN MAINE).
For primary bibliographic entry see Field 06E.
W69-05366

MALICIOUS MISCHIEFS-PUBLIC UTILITIES.

Me Rev Stat Ann tit 17, secs 2351-2353 (1965).

Descriptors: *Maine, *Utilities, *Electricity, *Water works, State governments, Legislation, Legal aspects, Cities, Electrical equipment, Artificial watercourses, Docks, Piers, Pipelines, Reservoirs, Dams, Fish passages, Canals, Mills.

Section one imposes a punishment of a fine not more than $1000 or imprisonment for not more than 3 years for the willful or malicious destruction, removal, etc., of wharfs, piers, docks, pipelines, reservoirs, dams, fishways, canals, etc. The second specifies the punishments for the unlawful and intentional tapping of water pipes or fixtures belonging to any water company, city or water district. Section three applies to the unlawful and intentional destruction or injury to apparatus belonging to gas or electric companies; the tampering with gas, water or electric meters so as to alter their registration of amount supplied; and, the tampering or interference with pipes of fixtures of these companies. Sections two and three carry a possible fine of not more than $100 or imprisonment for not more than 11 months, or both. (Logan-Fla)
W69-05374

HIGHWAYS.
Mich Comp Laws Ann, secs 230.4, 235.1-235.8a (1967).

Descriptors: *Michigan, *Highways, *Legislation, *Local governments, Legal aspects, Cities, Drainage, Right-of-way, Drainage systems, Drainage programs, Drains, Culverts, Bridges, Cost sharing, Cost allocation, Obstruction to flow, Navigable waters, Streams, Administrative agencies.
Identifiers: Penalties (Civil).

Obstruction of the navigation of any stream declared to be a public highway or obstruction of highway drainage ditches by diversion or blockage carries a maximum penalty of $25. The county drain commissioner may lay drains along public highways after obtaining a release from the owners of the land involved and compensating them therefore. A bridge or culvert used to accommodate a drain which crosses a highway must be of a permanent nature and able to sustain a 15 ton moving load. The cost of construction shall be born according to the nature of the highway. The consent of the highway commissioner of a township, in which an open drain is to be laid along the highway, is necessary prior to construction. The cost of such drain shall be apportioned by the county drain commission among those benefited. When necessary the highway commission may secure the right of way to drain water across land adjacent to the highway. The purchase price must be approved by the township board. The highway commission shall make an annual report to the electors of the township. (Molica-Fla)
W69-05378

HIGHWAYS.

Mich Comp Laws Ann, secs 254.5, 254.22, 254.25-254.32 (1967).

Descriptors: *Michigan, *Legislation, *Highways, *Local governments, Bridges, Culverts, Bridge construction, Navigable waters, Obstruction to flow, Costs, Reimbursable costs, Alteration of fl
Navigation, Streams, Ships, Channels, Perm
Boundaries (Surfaces), Administrative agencies

Commissioners in charge of construction or ma
tenance of bridges or culverts may provide for
removal of any booms, rafts, logs, etc., when s
are a menace to its construction or maintenan
Failure to comply with the commissioner's orde
removal is a misdemeanor. Bridges or culv
across navigable streams must not interfere w
the navigation of the stream or logs floating ther
and must afford reasonable passage for vessels
timber. No one may alter the stage of water or
channel of any watercourse before securing a w
ten permit from the commissioners having jurisc
tion over all the bridges and culverts or the wa
course affected. One obtaining a permit is liable
all of the expenses resulting from bridge and bri
approach work made necessary by the alterat
and the maintenance thereof as determined by
commissioners. Anyone owning a water work h
ing a race crossing a public highway must maint
a sufficient bridge or culvert across the same. T
act does not apply to any bridge across any ri
forming the boundary between Michigan and
foreign country. (F. Molica-Fla)
W69-05379

**STATE SQUIRE V CITY OF CLEVELA
(FILL LAND AND HIGHWAY USE AS TO L
TORAL RIGHTS).**
74 NE 2d 438-459 (Ohio Ct App 1947).

Descriptors: *Ohio, *Access routes, *Ripari
rights, *Riparian lands, Legislation, Citi
Highways, Landfills, Beds, Lakes, Lake Erie, Gr
Lakes, Reasonable use, Condemnation, Emine
domain, Public benefits, Public rights, Public lan
Legal aspects, Judicial decisions, Littoral, Navig
tion, Piers.
Identifiers: State statutes.

Plaintiff sought a declaratory judgment concerni
the rights of the parties in certain landfills adjace
to plaintiff's littoral lands. The plaintiff also soug
to enjoin defendant from maintaining
thoroughfare over the landfill. The defendant co
tended that its activities were sanctioned by st
statute authorizing cities to construct margi
thoroughfares along the shoreline and across lan
fills along Lake Erie. The plaintiff argued that pa
of the enabling statute relied on by the defenda
was unconstitutional in regard to certain issues n
at bar. The plaintiff contended that the enti
statute was void due to the invalidity of that se
tion. The court upheld the statute despite partial i
validity. Plaintiff contended that defendant was n
conforming to the statutory requirement that t
thoroughfare be utilized for purposes of commer
and navigation. The court held that the highw
regulation forbidding truck travel was therefore
legal, but denied plaintiffs further contention th
their littoral rights to wharf out into navigab
water had been violated, recognizing that plaintif
could retain access to such water by constructio
of overpasses and underpasses. (Katz-Fla)
W69-05555

**DEYO V ATHOL HOUSING AUTHORIT
(DAMAGE FROM WATER DISCHARGE).**

140 NE 2d 393-395 (Mass 1957).

Descriptors: *Repulsion (Legal aspects
*Drainage water, *Local governments, Surfac
waters, Water law, Water rights, Drainage, Ob
struction to flow, Water control, Flow contro
Pipelines, Sewers, Subsurface water, Subsurfac
drainage, Water table, Public lands, Road co
struction roadbanks, Basins, Flow resistance.

Plaintiff sued the own of Athol and the Athol Hou
ing Authority for property damage caused by wate
discharge from adjoining lands. The discharge wa
allegedly caused by defendant's activities in in
stalling drainage trenches and pipelines during co

uction of a road. While the court conceded that ne of the damage was caused by the activities of 'endant, it also found that part of the damage s caused by the natural accumulation of water plaintiff's land. Drainage of the accumulated ter was impeded by the presence of the road. On principle that the obstruction of surface water v affords no cause of action by a person who suf- loss therefrom against one who does no act in- sistent with the due exercise of dominion over own soil, the supreme court held that defen- ts could not be held liable for the damage sed by the maintenance of this obstruction ab- a finding of a right in the plaintiffs to drain r the land where the road was maintained. (Car- ers-Fla)
9-05556

ANCE V STATE (DAMAGES FOR AP- OPRIATION OF RIPARIAN RIGHTS BY THE TE).
primary bibliographic entry see Field 06E.
9-05580

. Watershed Protection

LAGE METHODS TO REDUCE RUNOFF D EROSION IN THE CORN BELT,
icultural Research Service, Washington, D. C.; due Univ., Lafayette, Ind. Agricultural Experi- t Station.
primary bibliographic entry see Field 03F.
9-05330

GINEERING TECHNIQUES AND PRINCI- S APPLIED TO SOIL EROSION CONTROL,
st Service (USDA), Fort Collins, Colo. Rocky ntain Forest and Range Experiment Station.
hard H. Heede.
st Service USDA, Research Note RM-102, pp 1968. 7 p, 2 photo, 11 ref.

criptors: Soil erosion, *Soil stabilization, ssed waterways, Watershed management, sion control, Cultivated lands, Dams, Vegeta- establishment, *Check structures, *Hydraulic neering, Land reclamation.
tifiers: *Italian hydraulic reclamation.

basic approaches to erosion control are (1) re- g natural forces, and (2) utilizing them. Exam- of (1) are check dams and grassed waterways;), Italian hydraulic reclamation where erosive s are used to stabilize watersheds. Objective of is to establish a vegetation cover.
-05333

AL ASPECTS OF THE SMALL TERSHED PROGRAM IN IOWA,
Univ., Iowa City. Agricultural Law Center.
les Campbell, William N. Hines, and Marshall s.
l Aspects of the Small Watershed Program in Sept 1965. 37 p, 135 ref.

riptors: *Iowa, *Watersheds, *Watershed gement, *Watershed protection and flood ntion act, Legal aspects, Floods, Water rces, Water conservation, Flood control, watersheds, Forest management, Navigable ns, Soil conservation, Natural resources, s, Legislation, River basin development, rvoirs, Beneficial use, Wildlife, Recreation, on.
ifiers: *Soil conservation district, Department griculture, Agricultural Conservation Pro- Army Corp of Engineers, Potomac River.

uthors first discuss the historical aspects of roblem, of watershed development primarily ederal governmental activity in this area. The s Flood Control Acts are employed as a od of structuring the discussion of watersheds. leads to a more concentrated study of the ems and developments in Iowa water law. A detailed treatment of the Iowa situation is pursued. The organization and financing of the Small Watershed Project in Iowa is discussed in depth. The system for applying for watershed projects in various communities is considered. The authors enumerate the powers they consider necessary for success of the project and discuss the problems inherent in such an undertaking. Detailed recommendations are also included in an effort to outline a workable and effective method of watershed development. (Shevin-Fla)
W69-05339

DELAWARE RIVER BASIN COMPACT.

N J Stat Ann secs 32:11D-38 to 32:11D-110 (1963); N J Stat Ann secs 32:11D-111 to 32:11D-115 (Supp 1968-69).

Descriptors: *Watershed management, *Hydroelectric power, *Financing, Interstate compacts, Withdrawal, Delaware River Basin Commission, Interstate rivers, Projects, Erosion control, Runoff, Soil management, Forest management, Wildlife management, Recreation, Recreation facilities, Administration, Dams, Transmission (Electrical), Diversion, Water shortage, Permits, Regulation, Capital.
Identifiers: Intergovernmental relations, Comprehensive plan, Delaware River Basin Compact.

The Delaware River Basin Commission is to promote sound practices of watershed management in the basin, including projects and facilities to retard runoff and water flow and prevent soil erosion. The Commission is to provide for the development of water related public sports and recreational facilities. The waters of the Delaware River and its tributaries may be impounded and used by or under authority of the Commission for the generation of hydroelectric power. The Commission may regulate and control withdrawals and diversions from surface and ground waters of the basin. Various rules are established for the purpose of avoiding conflicts of jurisdiction. The procedures and limits for capital financing are provided. The Commission is to adopt, and may review and revise, a comprehensive plan for the immediate and long range development and use of the water resources of the basin. The Commission shall annually adopt a water resources program based upon the comprehensive plan. The Commission has the power of condemnation to accomplish the purposes of the compact. (Childs-Fla)
W69-05345

DICKSON V BOARD OF COMM'RS OF CADDO LEVEE (EXPROPRIATION OF RIPARIAN LAND BY THE STATE).
For primary bibliographic entry see Field 06E.
W69-05585

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

OIL SPILLAGE STUDY, LITERATURE SEARCH, AND CRITICAL EVALUATION FOR SELECTION OF PROMISING TECHNIQUES TO CONTROL AND PREVENT DAMAGE,
Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.
For primary bibliographic entry see Field 05G.
W69-05262

DETERMINATION OF ORGANOCHLORINE INSECTICIDES IN SOILS AND WATERS,
Wisconsin Univ., Madison. Dept. of Soils; Agricultural Research Service, Washington, D. C.
H. B. Pionke, and G. Chesters.
Soil Sci Soc America Proceedings, Vol 32, No 6, pp 749-759, Nov-Dec 1968. 10 p, 82 refs. OWRR Project B-016-WIS.

Descriptors: *Analytical techniques, *Organochloride insecticides, *Application methods, Column chromatography, Thin-layer chromatography, Gas liquid chromatographic techniques.
Identifiers: *Soil, *Water, Methods of equilibrating.

Pertinent references on the determination of organochloride insecticides in soil and water samples are reviewed. The particular methods are chosen because of their applicability to heterogeneous systems which often provide problems due to coextraction of indigenous components. The review is divided into three principal sections, i.e., extraction of organochlorine insecticides from soils and waters, cleanup of soil and water extracts, and analysis of purified soils and water extracts. Criteria used in evaluating extraction procedures were based on methods of equilibrating the insecticide with the soil sample and the control of possible insecticide losses through degradation and volatilization. A large portion of the methods of final analysis of purified extracts is given over to gas-liquid chromatographic techniques. The gas-liquid chromatographic methods are discussed on the basis of peak resolution, detection and measurement of the insecticides, and confirmation of their identity. Thin-layer chromatographic, spectrophotometric, and other methods of determination of organochlorine insecticides in purified extracts are evaluated.
W69-05325

COMPONENTS OF WOOD PULP BLEACH EFFLUENTS,
Pulp Manufacturers Research League, Inc., Appleton, Wis.
J. W. Collins, A. A. Webb, H. P. Didwania, and B. F. Lueck.
Environ Sci and Technol, Vol 3, No 4, pp 371-377, Apr 1969. 7 p, 10 fig, 3 tab, 17 ref.

Descriptors: *Water pollution sources, *Pulp wastes, Sulfite liquors, Phenols, Biochemical oxygen demand, Cellulose, Lignins, Organic wastes, Pulp and paper industry, Analytical techniques, Chromatography, Spectrophotometry.
Identifiers: Kraft pulp waste, Pulp-bleaching wastes, Sulfite wastes, Gel chromatography, Catechols.

Chlorination and alkaline extraction bleach effluents from a sulfite and a kraft wood pulp mill were concentrated by reverse osmosis and their dominating chemical properties investigated. The solids were high in ash and the organic residues were highly colored. Biological oxygen demand was found to be due to relatively high molecular weight species as well as to low molecular species. The ultraviolet spectra and ionization difference spectra of the effluents and fractions obtained by gel chromatography on two Sephadex gels in series are presented. Some of the ionization difference spectra were lower in intensity than expected for alkaline extraction products of chlorinated lignin. Other spectra suggested that much of the color in a kraft chlorination effluent was of carbohydrate origin. Catechol groups were found to be stable end-products of a sulfite pulp chlorination. (Knapp-USGS)
W69-05402

DEVELOPMENT OF BIOLOGICAL INDICES TO POLLUTION LEVELS IN STREAMS AFFECTED BY ACID MINE DRAINAGE AND OIL FIELD BRINE WASTES,
Ohio State Univ., Columbus.
Charles A. Dambach, and John H. Olive.
Ohio State Univ Water Resources Res Center Proj 103 Completion Rep, Feb 1969. 90 p, 14 fig, 17 tab, 68 ref. OWRR Project A-003-OHIO.

Descriptors: *Pollutant identification, *Bioindicators, *Acid mine water, *Brines, *Water pollution effects, Aquatic life, Morbidity, Toxicity, Fouling, Phytotoxicity, Analytical techniques, Bioassay, Mayflies, Midges, Bacteria, Water quality, Ohio.
Identifiers: Biological pollution indices, Acid mine drainage, Oilfield wastes.

Biological criteria are presented for use in setting water quality standards to assure desirable levels of aquatic life in streams. Stream monitoring devices for water quality parameters critical to aquatic life are available but not in sufficient numbers. Quantitative and qualitative studies of aquatic organisms may be used to measure these parameters because many organisms are sensitive to variation in the important environmental conditions to be monitored. For examples, mayflies appear in abundance only where oxygen availability is continuously high, and some midges appear only with nearly anaerobic conditions. The biocommunity structure of polluted streams was studied in Raccoon Creek in SE Ohio and in 2 headwater tributaries of the Scioto River in central Ohio. Benthic macroinvertebrate and algal communities are described in terms of the relative abundance of organisms and the species diversity index of Wilm and Dorris. An inventory of collected organisms is included. The biological data are related to the physico-chemical character of each stream. (Knapp-USGS)
W69-05407

WATER QUALITY INVESTIGATION, PART 1 - BASIC DATA, FORT LOUDOUN RESERVOIR, APRIL 1966 - JUNE 1968,
Tennessee Univ., Knoxville. Dept. of Sanitary Engineering.
F. C. Larson.
Tenn Water Resources Res Center Tech Bull No 1, Aug 1968. 85 p, 1 fig, 2 tab. OWRR Project A-006-TENN.

Descriptors: *Data collections, *Water quality, *Reservoirs, *Tennessee River, *Tennessee, Temperature, Dissolved oxygen, Biochemical oxygen demand, Hydrogen ion concentration, Conductivity, Color, Suspended load, Coliforms.
Identifiers: *Fort Loudoun Reservoir (Tenn), Apparent color, Centrifuged color.

Data are compiled for use in study of the relationships of water quality parameters in a reservoir during controlled discharges. Fort Loudoun Reservoir on the Tennessee River is about 55 mi long and has a capacity of about 386,000 acre-ft. The water is used for public supply, recreation, commercial fishing, navigation, stock water, irrigation, and power production. Samples were taken from the top, middle, and bottom of the reservoir at 10 cross sections shown on a map. The tabulated data include temperature, dissolved oxygen, biochemical oxygen demand, pH, conductivity, apparent color, centrifuged color, suspended solids, and coliforms. (Knapp-USGS)
W69-05416

IDENTIFICATION AND DIFFERENTIATION OF HEAVY RESIDUAL OIL AND ASPHALT POLLUTANTS IN SURFACE WATERS BY COMPARATIVE RATIOS OF INFRARED ABSORBANCES,
Federal Water Pollution Control Administration, Cincinnati, Ohio.
Fred K. Kawahara.
Environ Sci and Tech, Vol 3, No 2, pp 150-153, Feb 1969. 4 p, 4 fig, 4 tab, 10 ref.

Descriptors: *Oily water, *Analytical techniques, *Water pollution sources, *Asphalt, Oil-water interface, Lake Michigan, Spectrophotometry, Absorption, Infrared radiation, Surface waters, Taste, Odor, Oil wastes.
Identifiers: *Petroleum products, Oil spills, Autoxidation.

To determine the chemical nature of the heavy petroleum products in the 1967 Lake Michigan oil spill, a procedure for characterization and identification of the tarlike materials was needed. Samples from beach water were analyzed by infrared spectrophotometry. The unknown spectra would not match the known spectra, since autoxidation caused changes in the unknown specimen. By comparative ratios of infrared absorbances, the identity of the critical unknown samples was established. Although asphalt and heavy residual oil have similar infrared spectra, there is a sharp distinction between them. Samples from 7 companies were tested, using the new method for rapid identification and for distinguishing the 2 types of petroleum products which can coexist in surface waters as pollutants. (Lang-USGS)
W69-05421

PREDICTING TEMPERATURES OF SMALL STREAMS,
Oregon State Univ., Corvallis. Forest Research Lab.
For primary bibliographic entry see Field 02E.
W69-05427

RESERVOIR FISHERY RESOURCES,
American Fisheries Society, New York.
For primary bibliographic entry see Field 02H.
W69-05463

5B. Sources of Pollution

SOURCES OF COAL MINE DRAINAGE POLLUTION, WHEELING CREEK WATERSHED, OHIO.
Federal Water Pollution Control Administration, Wheeling, W. Va. Ohio Basin Region.

Fed Water Pollut Contr Admin, Mine Drainage Unit Work Doc No 25, June 1968. 22 p, 2 fig, 4 tab, 1 append.

Descriptors: *Acid mine water, *Coal mines, *Water pollution, *Ohio, Iron, Sulfates, Turbidity, Water quality, Strip mines.
Identifiers: Wheeling Creek (Ohio), Bituminous coal mines.

Field studies of stream quality and sources of mine drainage were made in the Wheeling Creek watershed (108 sq mi). The area, mined for bituminous coal for 150 yr. left hundreds of underground voids and large surface-mined areas capable of producing acidic and mineralized drainage. Part of nearly every tributary to the main stream is affected by mine discharges of excessive dissolved iron, sulfate, hardness, and total mineralization. Precipitation of iron compounds, particularly in Wheeling Creek, causes additional problems of high turbidity and unsightly stream conditions. Some 160 mine sites and an estimated 12,000 acres of strip-mined area were investigated. Samples were collected from 120 drainage sources; 72 were discharging at the time. Discharges from the coal mine sources ranged from 1 to 306 gpm and totalled 2.1 million gpd. The pH values ranged from 2.3 to 8.4 and acidity concentrations from 0 mg/l to 20,950 mg/l. Active mining operations contributed only a small percentage of the total discharge volume and chemical loadings. Strip mines and mine refuse areas contributed equally small percentages of the total. Inactive or abandoned underground (drift) mines are the principal drainage pollution sources in Wheeling Creek. Fifteen principal mine drainage sources were found to contribute 72% of the sulfate loading and nearly 40% of the iron loading discharged to the streams. Physical abatement of these principal sources and at least 1/2 of all sources would improve water quality in Wheeling Creek to a tolerable level. (Lang-USGS)
W69-05202

OIL SPILLAGE STUDY, LITERATURE SEARCH, AND CRITICAL EVALUATION FOR

SELECTION OF PROMISING TECHNIQ TO CONTROL AND PREVENT DAMAGE,
Battelle Memorial Inst., Richland, Wash. Pac Northwest Labs.
For primary bibliographic entry see Field 05G.
W69-05262

NITROGEN CYCLE IN SURFACE AND S SURFACE WATERS,
Wisconsin Univ., Madison.
S. Witzel, E. McCoy, O. J. Attoe, L. B. Polkows and K. T. Crabtree.
Water Resources Center, Univ., of Wiscon Technical Completion Report, December 1968 p, 15 tab, 12 fig, 27 ref. OWRR Project B-004-W

Descriptors: *Domestic animals, *Wastes, Fe izers, *Essential nutrients, *Nitrification, Cr Toxicity, Soil porosity, Irrigation, Ground wa Runoff, Frozen ground, Soil erosion, Water po tion, *Denitrification, Phosphorus compounds, gae, Aquatic plants.
Identifiers: *Nitrogen Cycle, *Farm waste, Gro water, *Nitrates, Eutrophication, *Water pollut sources, Agricultural watersheds.

Autotrophic and heterotrophic nitrification h been studied with 191 samples of shallow wa from streams, farm ponds and adjacent soils. Of chosen for repeated tests, 45 produced NO sub 2 ranging 5-154 microgram/ml, av. 48 mic gram/ml. Only 2 produced NO sub 3-N at 33 a 46 microgram/ml. Of 167 stock cultures of soil f gi, the main producers were in the Aspergi flavus-oryzae and A. wentii groups (75% yiel 65-100 microgram/ml of NO sub 3-N) and Penicillium genus (21 of 24 species yielded 7 microgram/ml of NO sub 3-N from NO sub 2 not from organic N). Nitrifiers of NO sub 2, I sub 3 type were found in 5 other genera. Resid NO sub 3 following crop maturity migra downward from 12 inches to aquifer depth at feet over winter on Waupun and Plainfield so respectively. One Wisconsin community had wells with 34.5% unsafe containing high NO su and another had 550 wells with 1/3 unsafe. Surfa waters received less than 5.7 lb. N and 2.53 lb per A. in flood flows from a 1346 A. watersh 3.62 lb. N and 1.14 lb. P per A. from 3 farm ar totaling 246 A. Lancaster plots receiving 15 t dairy cow wastes per A. lost 19.8% more N a 11.3% more P when applied on frozen ground i year of high winter runoff.
W69-05323

UNWHOLESOME PREMISES; REMOVAL AN REHABILITATION AT OWNER'S EXPENSE.

Mich Comp Laws Ann secs 67.49-67.50 (1967).

Descriptors: *Michigan, *Legislation, *Lo governments, *Stagnant water, Odor, Drains, (ties, Assessments, Abatement, Pollution aba ment, Public health.

Village councils may rectify, or cause an owner, c cupant, or person in charge to rectify any premis cellar, vault, lot, drain, or place, which unwholesome, damp, offensive, etc., or which covered by stagnant or impure water or produc offensive exhalations. They may remove, or requ the owner or occupant to remove any buildi fence, or structure if it is ruinous or liable to cau injury to persons or property. If the owner or occ pant of such lot or premises fails to abate nuisance after notice by the council or board health to do so, he is liable for the expenses i curred by the council in causing the same to done. The expenses may be recovered as a spec assessment on the premises or by court action. (Molica-Fla)
W69-05376

COMPONENTS OF WOOD PULP BLEACH E FLUENTS,
Pulp Manufacturers Research League, In Appleton, Wis.

primary bibliographic entry see Field 05A.
9-05402

ELOPMENT OF BIOLOGICAL INDICES POLLUTION LEVELS IN STREAMS AF-TED BY ACID MINE DRAINAGE AND OIL LD BRINE WASTES,
State Univ., Columbus.
primary bibliographic entry see Field 05A.
-05407

TER QUALITY INVESTIGATION, PART 1 - IC DATA, FORT LOUDOUN RESERVOIR, IL 1966 - JUNE 1968,
essee Univ., Knoxville. Dept. of Sanitary En-ering.
rimary bibliographic entry see Field 05A.
-05416

NTIFICATION AND DIFFERENTIATION HEAVY RESIDUAL OIL AND ASPHALT LUTANTS IN SURFACE WATERS BY IPARATIVE RATIOS OF INFRARED AB-BANCES,
ral Water Pollution Control Administration, nnati, Ohio.
rimary bibliographic entry see Field 05A.
05421

LONGITUDINAL DIFFUSION COEFFI-T IN THE DELAWARE RIVER ESTUARY DETERMINED FROM A STEADY-STATE EL,
gical Survey, Philadelphia, Pa.
rimary bibliographic entry see Field 02L.
05428

SPHORUS IN FLOWING WATERS,
al Water Pollution Control Administration, nnati, Ohio.
l E. Keup.
Res (Pergamon Press, Great Britain), Vol 2, 3-386, 1968. 14 p, 2 fig, 1 tab, 48 ref.

iptors: *Phosphorus compounds, *Surface , Groundwater, Water pollution sources, ical wastes, Fertilizers, Percolation, nts, Eutrophication, Biodegradation, Sedi-tion.
iers: Phosphorus distribution (Surface).

ources of phosphorus to flowing waters are ed on the basis of point of origin and quanti-hosphorus within a stream is assimilated out flowing water mass. Biota is the principal of assimilation which occurs in both au-hic and saprophytic ecosystems. The rate nt of assimilation can be estimated. After al from the flowing water, the phosphorus is rarily stored in bottom deposits or trans-as a portion of the stream's bed-load. Long-orage is effected when the phosphorus is bu-deltas, or deposited on flood plains. (Knapp-

5445

RODDENBERY CO INC V CARTER AGES FOR POLLUTION OF STREAM).
d 448-451 (5th Cir 1952).

tors: *Georgia, *Water pollution, ges, *Industrial plants, Pollution abatement, ollution effects, Industrial wastes, Streams, able use, Riparian rights, Judicial decisions, water disposal, Waste water (Pollution), Ci-gal aspects.
ers: Remittitur.

f brought suit for damages to land and cattle g from the discharge of waste and refuse by nt's plant into a stream flowing through 's land. By arrangement between defendant pickle company and defendant city, waste from the pickle plant was dumped as sewage into the stream. This not only polluted the stream causing cattle who drank from it to die, but injured the lands bordering the stream. Plaintiff suffered permanent damages measured by the loss in the market value of the land. The defendants assigned as error the charge to the jury as to the measure of damages and the overruling of their objection to the introduction to certain evidence by plaintiffs. The court was of the opinion that the conduct of defendant in turning the refuse and waste into the creek was clearly wrongful and that, but for the errors complained of, a judgment for plaintiff would have been justified. The case ought not to be sent back for a new trial unless such disposition is clearly necessary to obtain substantial justice. Therefore, the court order remittitur of a portion of the damage award and affirmed the lower court. (Heckerling-Fla)
W69-05559

AMERICAN CYANAMID CO V COMMONWEALTH (POLLUTION ABATEMENT).
For primary bibliographic entry see Field 05G.
W69-05575

STATE V GLIDDEN CO (CONSTITUTIONALITY OF WATER POLLUTIONS CONTROL STATUTE).
For primary bibliographic entry see Field 05G.
W69-05586

5C. Effects of Pollution

WATER FOR LIVING,
World Health Organization, Geneva (Switzerland).
M. G. Candau.
For the 8 Volume Proceedings, see Vol 2, No 9, Field 06B and W69-03305. Int Conf on Water for Peace, Wash. D C, Vol 1, pp 85-89, 1968. 5 p.

Descriptors: *Public health, *Water supply, Waste disposal, Social aspects, Legal aspects, Water utilization, Water pollution effects, Water pollution control, Diseases.
Identifiers: World Health Organization, Water-borne diseases.

The objective of the World Health Organization as defined by its constitution is the attainment by all peoples of the highest possible level of health. Predominant among the environmental factors which impinge on public health is water. Cholera pandemics ravaged Asia, Europe and the American continent during the 19th century. In the last 5 years cholera has spread to countries which have not experienced this scourge for many years. In addition to cholera, typhoid and para-typhoid, bacillary and amoebic dysenteries and the diarrhoeal diseases, together are the leading causes of death and disability in the less developed areas of the world. Water plays an important role in the spread and control of these and other diseases. It has been estimated that there are 5,000,000 deaths and about 500,000,000 people sick from water-borne diseases each year. Expanding populations, increased industrialization, and the accelerated use of pesticides and herbicides have all had their influence upon natural bodies of water. Less than one-third of the urban dwellers in the world are being provided with piped water supplies in their houses and another third of the total of these city dwellers have no reasonable access to a safe water supply, or, indeed, to water in any reasonable quantity. The most important water-borne diseases are malaria, bilharziasis and filariasis. The proper design and management of water resources projects can usually minimize and often eliminate their effect. The World Health Organization has active programs of assistance to its Members for the control of water-borne and water-related diseases. (K-napp-USGS)
W69-05219

OIL SPILLAGE STUDY, LITERATURE SEARCH, AND CRITICAL EVALUATION FOR SELECTION OF PROMISING TECHNIQUES TO CONTROL AND PREVENT DAMAGE,
Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.
For primary bibliographic entry see Field 05G.
W69-05262

PESTICIDE LEVELS AND FLUCTUATION IN SOIL BACTERIA IN AN IRRIGATED FIELD AND A POND OF SOUTHWEST TEXAS,
Texas A and M Univ., College Station. Dept. of Plant Sciences.
Robert G. Taylor, and Howard G. Applegate.
The Southwestern Naturalist, Vol 13, No 4, pp 393-400, Dec 1968. 3 fig, 2 tab, 18 ref.

Descriptors: *Irrigated land, *Pesticide residues, *Soil bacteria, *Fluctuation, *Ponds, Texas, Stagnant water, Moisture availability, Bacteria, Irrigation water, DDT, Chlorinated Hydrocarbon pesticides, Cultivated lands, Turbidity, Silts, Pesticide drift.
Identifiers: Non-irrigated soils.

A study of pesticide effects on bacterial populations was conducted from June through August 1966 in a typical irrigated field in the Presidio area of Texas. Bacterial populations of field soil were directly correlated to the moisture of irrigation. Non-irrigated soil with adequate moisture for bacterial growth yielded an inverse relation between pesticide levels and bacterial numbers. It was suggested that from the data on non-irrigated soils that there was a connection between bacterial populations and breakdown of the chlorinated pesticide DDT. Adjacent to cultivated fields a stagnant body of water was examined for microbial numbers and pesticide levels. After each rainfall, when the pond was turbid and muddy from eroded bank soil, both bacterial numbers and pesticide levels rose. (Afleck-Ariz)
W69-05272

A LETHAL INDEX FOR CLASSIFYING CHEMICALS WHICH AFFECT WATER QUALITY OF AQUATIC LIFE,
Idaho Univ., Moscow. Water Resources Research Inst.
Craig MacPhee, and Dennis Norman.
Research Technical Completion Report, January 1969. 38 p, 2 tab, 4 fig, 31 ref. OWRR Project A-013-IDA.

Descriptors: Bioassay indicators, Water pollution, Toxicity, Fishkill, Water quality.

Seventeen toxic chemicals were bioassayed to investigate the possibility of measurable physiological responses to death in northern squawfish. Lethal indices, dependent upon concentration and temperature for each chemical, in terms of time between loss of equilibrium and death, were established. The physiological process of suffocation caused by the action of heavy metals and organic compounds of lactic acid, formaldehyde, and p-nitrophenol was identifiable and unaffected by concentration or temperature. The anesthetic effect of p-chlorophenol was discrete and also unaffected by concentration or temperature. The physiological actions of nitrites, other phenols, chlorinated hydrocarbons, and organophosphorus compounds were not discretely identifiable and the data indicate multiple physiological effects for these chemicals depending on concentration.
W69-05303

DEMONSTRATION OF A TOXIN FROM APHANIZOMENON FLOS-AQUAE (L.) RALFS,
New Hampshire Univ., Durham; National Marine Water Quality Lab., Kingston, R. I.
Philip J. Sawyer, John H. Gentile, and John J. Sasner, Jr.
Canadian Journal of Microbiology, Vol 14, No 11, pp 1199-1204, 1968. 7 p, 1 tab, 4 fig, 23 ref. OWRR Project A-013-NH.

Descriptors: Cyanaphyta, Algal control, *Algal toxins membrane, Northeast U.S.
Identifiers: Aquatic algae, Water pollution, *Toxicity, Biological membranes, Humid area.

A potent toxin was extracted from a natural population of the blue-green alga, Aphanizomenon flos-aquae. The toxin is thermo- and acid-stable; alkaline labile; soluble in water and ethanol; insoluble in acetone, ether, and chloroform; and readily dialyzable. Preliminary studies show that the alga contains a toxin which, when released from lysed cells, operates at the membrane level, destroying excitability without alteration of the transmembrane resting potential.
W69-05306

IDENTIFICATION OF ZOOGLOEA SPECIES AND THE RELATIONSHIP TO ZOOGLOEAL MATRIX AND FLOC FORMATION,
Ohio State Univ., Columbus.
B. A. Friedman, and P. R. Dugan.
Jour. Bacteriol. Vol 95, pp 1903-1909, May 1968. 7 p, 2 fig, 3 tab, 17 ref.

Descriptors: *Zoogloea bacteria, Zoogloea matrix, Gelatinous matrix, Bacterial flocculation, Zoogloea identification.
Identifiers: Bacteria zoogloea, *Zoogloeal matrix, Flocculation, Matrix gelatinous, *Floc formation.

Three floc-forming, gram-negative, polarly flagellated rods were isolated and characterized. These isolates were compared to four similar floc-forming organisms previously isolated in another laboratory and classified as two species of Zoogloea, one of Pseudomonas, and as one unidentified gram-negative rod. Possession of zoogloeal matrix or flocculent growth habit was examined in relation to growth and biochemical patterns of the bacteria. A possible relationship of Zoogloea to other gelatinous matrix-producing bacteria is discussed.
W69-05313

THE MICROBIAL FLORA OF ACID MINE WATER AND ITS RELATIONSHIP TO FORMATION AND REMOVAL OF ACID,
Ohio State Univ., Columbus. Water Resources Center.
For primary bibliographic entry see Field 05G.
W69-05314

BIOLOGICAL ASPECTS OF EUTROPHICATION IN LAKES MENDOTA, CRYSTAL, TROUT AND GREEN,
Wisconsin Univ., Madison. Lab. of Limnology,
For primary bibliographic entry see Field 02H.
W69-05324

REYNOLDS METAL CO V BALL (SUIT TO RECOVER DAMAGES FOR ALLEGED DEPOSIT OF SEDIMENT CONTAINING POISONOUS SUBSTANCES).

232 SW 2d 441-443 (Ark 1950).

Descriptors: *Arkansas, *Toxicity, *Water pollution sources, *Sediments, Judicial decisions, Legal aspects, Water pollution, Water pollution effects, Overflow, Vegetation, Sedimentation, Sediment transport, Streams.

Plaintiff brought action against defendant metal company to recover damages for injury to his land alleged to have been caused by deposits of sediment containing poisonous substances coming from defendant's plant. Court found no legal issue to be involved since the law is settled that if defendant discharged poisonous substances from its plant into a creek, and these substances, during periods of normal overflow, lodged as sediment upon plaintiff's land, destroying vegetation and depreciating the value of the land, plaintiff could recover damages. However, a factual matter as to whether the plaintiff had established that defendant was discharging poisonous substances into the creek was involved. In reversing and remanding for a new trial the court ruled that plaintiff had not satisfactorily established such fact. (Logan-Fla)
W69-05385

GARGAC V SMITH-ROWLAND CO (POLLUTION OF LAKE BY INDUSTRIAL WASTES).
170 F 2d 177-181 (7th Cir 1948).

Descriptors: *Virginia, *Industrial wastes, *Water pollution effects, *Overflow, Organic matter, Organic wastes, Fertilizers, Damages, Fishkill, Water pollution sources, Water pollution, Pollutants, Odor, Livestock, Agriculture, Water law, Ditches, Judicial decisions, Industrial plants.

Defendant corporation, while operating its fertilizer plant, emptied organic wastes into a pond on its premises. The large volume of material caused the pond to overflow into a ditch which in turn carried the wastes into a lake adjoining plaintiffs' property. Plaintiffs sued for damages, alleging the resulting pollution caused nauseating odors, injury to livestock, and fishkill. Defendant, basing his argument on an Illinois case, contended there could be no recovery for disagreeable odors created as an incident to operation of an industrial plant. The trial court found for plaintiffs. The appellate court affirmed, noting that the case on which defendant relied concerned an industrial community, not agricultural, as was involved here, and that this situation resulted in additional damages. A statement of one plaintiff, made prior to the period involved, that there was nothing improper in the plant's operations, insofaras that plaintiff was concerned, was held properly limited by the trial court to bear on the credibility of the particular plaintiff. Plaintiffs' action was held to be proper even though defendant had ceased operations in this state. (Wheeler-Fla)
W69-05387

RESERVOIR FISHERY RESOURCES,
American Fisheries Society, New York.
For primary bibliographic entry see Field 02H.
W69-05463

EFFECTS OF PHOSPHATE CONCENTRATION ON CELL DIVISION RATES AND YIELD OF A TROPICAL OCEANIC DIATOM,
Scripps Institution of Oceanography, San Diego, Calif. Inst. of Marine Resources.
William H. Thomas and Anne N. Dodson.
Biological Bull, Vol 134, No 1, pp 199-208, Feb 1968. 4 fig, 2 tab, 14 ref.

Descriptors: *Diatoms, *Phosphates, *Primary productivity, *Yield equations, Oceans, Eutrophication, Cycling nutrients, Phosphorus compounds, Phytoplankton, Water pollution effects, Pacific Ocean.
Identifiers: *Tropical oceans, *Northeastern tropical Pacific, *Cell division, Costa Rica Dome, Asterionella japonica, Chaetoceros gracilus, Phaeodactylum tricornutum.

Authors measured cell division in cultures of diatom Chaetoceros gracilis grown in media with different initial phosphate concentrations. Organism's growth rate was limited by phosphate concentrations below approximately 0.22 microgramatoms/liter and appeared to be a linear function rather than hyperbolic. In hyperbolic relationship, mu = (mu-sub-m) (S/ (K-sub-s + S)) = (1/x) (dx/dt), relating growth rate, mu, to nutrient concentrations, S, where mu-sub-m = maximum specific growth rate, x = biomass, and t = time, K-sub-s is a saturation constant numerically equal to S at which mu = mu-sub-m/2. K-sub-m for these data is about 0.12 microgram-atoms/liter. Data substantiate Thoma's earlier suggestion that phosphate does not limit phytoplankton growth in northeastern tropical Pacific, and they verify other authors' use of linear relationship in productivity equations. Authors attribute pauses in cell division at low phosphate concentrations to induced phosphatases acting on stored intracellular phosphorus or f extracellular concentrations. Final cell nu were linearly related to initial phosphate co tration up to approximately 0.8 micro atoms/liter. Phosphorus/cell is 2 nannomicro atoms/cell or 10 picomicrogram-atoms/ micron. Diatom's increased growth upon ad of boron suggests requirement for that nut (Eichhorn-Wisc)
W69-05530

ACCUMULATION OF PHOSPHORUS-32 ZINC-65 BY LIVING AND KILLED PL TON,
Battelle-Northwest, Richland, Wash. P Northwest Lab.
C. E. Cushing, and D. G. Watson.
Oikos, Vol 19, pp 143-145, 1968. 1 tab, 6 ref.

Descriptors: *Phosphorus radioisot *Radioecology, *Zinc radioisotopes, *Plan Columbia River, Analytical techniques, Phosphorus, Cycling nutrients, Radioche analysis, Radioisotopes, Water pollution ef Water pollution sources, Absorption, Adsorp Phytoplankton, Periphyton, Photosynthesis.
Identifiers: *Radioactive accumulation, *Rad tive uptake, Hanford Laboratories, Atomic tors, Gamma-ray spectrometry, Differential sorber techniques.

Authors enclosed plankton (collected at a si the Columbia River upstream of the outfall atomic reactors of the Hanford Laboratorie nets, floated them through the outfall area, picked them up downstream at a distance abo kilometers from the initial point. They determ planktonic zinc-65 concentrations by counting single-channel gamma-ray spectrometer phosphorus-32 by differential absorber techni Mean radiophosphorus concentrations in nanr ries/gram of dry weight (standard erro parentheses) for eight samples each were: li 0.80 (0.120); killed, 0.49 (0.098). Similar v for radiozinc were: living, 3.51 (0.189); ki 5.04 (0.171). Treatment differences are sta cally significant by t-test at probability levels for radiozinc and 0.10 for radiophosph Authors suggest that differences in accumul due to treatments result from unmasking o tionic binding sites for zinc and enhancemer leaching out of cellular phosphorus as a resu cell death. Above figures for accumulation ca compared to those earlier determined by aut for natural populations: radiophosphorus, (1.45); radiozinc, 8.40 (1.08). Authors sugg number of experimental and ecological fa which may account for enhanced accumulatio natural populations over that of their experim ones. (Eichhorn-Wisc)
W69-05531

MASONITE CORPORATION V GUY (FI KILL: EFFECTS OF WATER POLLUTION).

77 So 2d 720-722 (Miss 1955).

Descriptors: *Mississippi, *Stream pollut *Fishkill, *Sewage effluents, Judicial decisi Path of pollutants, Pollutant identification, P tion abatement, Oxygen sag, Minnows, Comm cial fishing, Fish management, Water pollutio fects, Industrial wastes, Liquid wastes, Sewer Biochemical oxygen demand, Damages.
Identifiers: *Comparative damages.

The plaintiff brought this suit to recover for the of minnows he had trapped. The fish died result of alleged stream pollution by the defend The defendant owned a wood manufacturing p and often discharged effluents into the stre These effluents reduced the oxygen content in water to a point where it would not sustain aqu life. The court affirmed recovery for the plai but reversed the issue of damages and reman the case. It appeared from the evidence that ot parties had also discharged sewerage and

h contributed to the pollution. In such cases, defendant would be liable only for his proportate share of damages. (Stewart-Fla)
-05553

Waste Treatment Processes

GE TREATMENT PLANTS OF THE CHER ASSOCIATION AND THEIR IMTANCE FOR IMPROVING CONDITIONS HE RHINE,
hergenossenschaft, Essen (West Germany).
iop.
he 8 Volume Proceedings, see Vol 2, No 9, 06B, and W69-03305. Int Conf on Water for e, Wash, D C, Vol 4, pp 111-119, 1968. 9 p, 7

riptors: *River basin commissions, *Waste treatment, *Rivers, *Water pollution treat- Chemical wastes, Phenols, Biodegradation, g, Mine drainage, Mine wastes, Municipal s.
fiers: Germany, Rhine River, Emscher basin, her Association, Ruhr basin.

scription is presented of conditions in the her basin one of the first basins in which inal development necessitated that all water gement be put under one administration. ssions from coal-mining and the attendant ge disturbances resulted in extensive ps. The Emscher Association was created in as a self-governing body to remedy existing lties and build a network of receiving waters which could be adjusted reliably to any fubsidence. Representative of the scope of done are the double relocation of the cavedscher mouth and the 70 pumping stations ucted to drain large parts of the Emscher Up to World War I this waterway had such a atural purification capacity that mechanical ent of all wastes within the basin was fully ctory. After World War I, because of an in- in phenol load in the Rhine, the Emscher ation built dephenolating plants at the collie- he waste-water load on the Rhine increased rkedly that in 1965 the Association initiated ical treatment. The plant is a mere 1/15 of rojected large-scale biological Emscher treatment plant, in which all the Emscher up to 30 cm m/sec is to be treated biologi- Work on the plant, probably the largest in e, was started on December 1, 1966. Con- on costs are estimated at present to amount 150 millions. Once in operation the load on ine from within the Emscher basin will be d to 1/10 of its present amount. (Vorhis-
5218

NG WASTE WATER TO BENEFICIAL THE FLUSHING MEADOWS PROJECT,
ltural Research Service, Phoenix, Ariz. Conservation Lab.
n Bouwer.
2th Annual Arizona Watershed Symposium, x, Arizona, 18 September 1968, pp 25-30. 6 1 tab, 6 ref.

tors: Sewage effluent, *Waste water l, Waste water treatment, Water pollution, vaste treatment, Soil percolation, *Waste eclamation, Induced infiltration, *Ground recharge, Irrigation, Denitrification, nics.
ers: Surface spreading, Recharge basins, Exntal recharge project, Flushing Meadows , Phoenix (Arizona).

ral Arizona, decreasing water supplies and ng population make reuse of municipal vater mandatory. An experimental project Phoenix has shown that the hydrogeology alt River bed is uniquely suited for reclaimer from sewage effluent by surface spread- ground water recharge. The project contains six recharge basins 20 x 700 ft each. Four basins are in bermudagrass, one basin is covered with a gravel layer, and another is in bare soil. The grass basins had the highest infiltration rates, the gravel basin the lowest. Including dryup periods, an annual recharge rate of about 300 ft should be attainable. With short inundation periods (2 days) all nitrogen in the sewage effluent was converted to nitrate in the reclaimed water. With long inundation periods (10 days) 90% removal of the nitrogen was obtained, probably because of denitrification. The usual reductions in BOD, coliforms, and phosphorus were observed. Horizontal and vertical hydraulic conductivity of the aquifer were evaluated by electric analog, using water level data from two observation wells. Plans for a large-scale recharge project consisting of strips of recharge basins on each side of the river bed and wells in the center of the river bed were developed.
W69-05327

RETURNING WASTES TO THE LAND, A NEW ROLE FOR AGRICULTURE,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
Herman Bouwer.
Jour Soil and Water Conservation, Vol 23, No 5, pp 164-169, 1968. 5 p, 2 fig, 1 tab, 22 ref.

Descriptors: Sewage effluent, *Waste water disposal, Waste water treatment, Water pollution, *Soil waste treatment, Soil percolation, *Waste water reclamation, Induced infiltration, *Ground water recharge, Irrigation, Denitrification, Economics.
Identifiers: Surface spreading, Recharge basins, Experimental recharge project, Flushing Meadows Project, Phoenix (Arizona).

Land disposal of treated sewage or other liquid waste reduces pollution loads on streams and lakes. After infiltration and percolation through the soil, biodegradable material, microorganisms, phosphorus, nitrogen, heavy metals, fluorides, and other substances are effectively removed. Thus, the waste water that has percolated to the water table and then moved as ground water for some distance can be collected as reclaimed water suitable for reuse. Under favorable hydrogeologic conditions, the cost of waste water renovation by surface spreading for ground water recharge is a fraction of that of comparable tertiary in-plant treatment. Several types of land disposal of ground water recharge systems are discussed and design and operating criteria are presented. For the experimental recharge project near Phoenix, Arizona, sequences of long inundation periods (10 days) yielded much lower nitrate levels in the reclaimed water than sequences of short inundation periods (2 days). This is attributed to denitrification. In view of the increasing amounts of waste water and the urgent need for pollution control of surface waters, agriculture's role in the future will not only be to provide food and fiber, but also to serve as a medium for receiving and renovating treated sewage and other wastes.
W69-05328

WATER QUALITY CHANGES IN CONFINED HOG WASTE TREATMENT,
Kansas Univ., Lawrence.
Ross E. McKinney, and Robert Bella.
Contrib No 24, Kans Water Resources Res Inst Proj Completion Rep, 1968. 88 p, 21 fig, 12 tab, 13 ref. OWRR Project A-011-KAN.

Descriptors: *Farm wastes, *Waste treatment, *Aerobic treatment, *Hogs, Farm lagoons, Settling basins, Soil disposal fields, Sewage treatment, Disposal, Environmental engineering, Sludge disposal, Waste storage.
Identifiers: Hog farm wastes.

Treatment methods for the wastes of confined hogs are examined. Confined-animal wastes are a major pollution problem. There are about 55 million hogs in the U.S., and their wastes are largely untreated. When they occupy a large area, foraging for food, this is no problem, but under confinement the problem is similar to that of municipal waste disposal. A facility consisting of an aerobic biological treatment system for 10,000 hogs was studied. An important consideration was odor control because of a nearby metropolitan area. Recycled effluent was used for raw-waste input dilution, and paddle-wheel aerators were selected for high oxygen transfer efficiency and low operating cost. Each building had an aeration ditch under its slotted floor for aerobic processing, and final disposal was by a 2-stage infiltration pond system and field spreading of solids. Measurements were made of DO, BOD, COD, pH, suspended solids, N, and trace metals. Chemical analysis results and cost data are tabulated. Operation expense is about 1-2 cents per hog per day. Stream pollution is prevented or greatly reduced and odors are no problem. (Knapp-USGS)
W69-05417

TREATING COKE PLANT WASTE,
Bethlehem Steel Corp., Pa. Homer Research Lab.
Paul D. Kostenbader, and John W. Fleckstein.
Ind Water Eng, Vol 6, No 2, pp 30-31, Feb 1969. 2 p, 1 fig, 1 photo.

Descriptors: *Waste water treatment, *Industrial wastes, *Phenols, Ammonia, Biodegradation, Aeration, Oxidation, Oxidation lagoons.
Identifiers: Coking wastes, Steel mill wastes, Cyanide, Thiocyanates.

Phenols and other organics in coke plant wastes are biologically oxidized, and thiocyanate is oxidized to sulfate in a steel mill coking waste treatment plant in Bethlehem, Pennsylvania. Over 4,000 lb of phenol per day are treated in a weak ammonia liquor from the cooling and cleaning of coking gases. The effluent contains less than 0.1 ppm phenol. Because ammonia inhibits biodegradation, ammonia levels are kept below 2,000 ppm. At 80-95 deg F the oxidation efficiency is over 99.8%. Phosphorus is a necessary nutrient in both phenol and ammonia degradation, so phosphoric acid is added at a 1:70 phosphorus: phenol ratio. The pH is unregulated because no change in biological activity with pH can be detected. Foaming is controlled with water sprays. Thiocyanate oxidation averages 70%, and the forms of cyanide discharged are non-toxic. The plant is designed to handle 1,500,000 gpd with 5,000 ppm phenol. Equipment consists of a 1 million gal storage tank, a 130 X 40 X 12 ft aeration pond, 8 surface aerators with a total capacity of 15,000 lb oxygen per day, and a 40 ft diam by 9 ft deep clarifier. (Knapp-USGS)
W69-05422

PROCEEDINGS OF SYMPOSIUM ON BETTER WATER AND SEWER SERVICES FOR SMALL COMMUNITIES IN NORTH CAROLINA,
North Carolina Univ., Chapel Hill. Inst. of Government; and North Carolina State Univ., Raleigh. Water Resources Research Inst.
For primary bibliographic entry see Field 06B.
W69-05424

PORTABLE WATER PURIFIERS FOR COSTA RICA,
Fried-Krupp, Essen (West Germany). Zentralinstitut fuer Forschung und Entwicklung.
Rudolf Brylka.
For the 8 Volume Proceedings see Vol 2, No 9, Field 06B and W69-03305. Int Conf on Water for Peace, Wash, D C, Vol 3, pp 752-757, 1968. 6 p, 4 fig.

Descriptors: *Water purification, *Potable water, *Disasters, Volcanoes, Water pollution sources, Water supply, Filtration, Flocculation, Chlorination.
Identifiers: *Costa Rica, San Jose, Emergency water supply.

The Irazu volcano eruptions from March 1963 to December 1964 greatly impaired the water supply to San Jose and the surrounding areas, because the local waterworks, for lack of any groundwater, had to procure raw water from surface sources. Output of the existing supply system fell off because the surface water was polluted with ash, mud, and other eruption products. The German Federal Republic, under its development aid program delivered to Costa Rica portable water purifiers in capacities ranging from 0.3 to 35 cu m/hr. Two of the water purifiers were mounted on a trailer and 5 were mounted on a base plate, all having an aggregate capacity of 120 cu m/hr. Raw water was drawn from collapsible storage basins made from coated synthetic fabrics. The purifiers included filters filled with crushed lava and activated carbon and a chemicals feeder, so that treatment involved all necessary processes such as chemical flocculation, chlorination, filtration, and adsorption. A simple laboratory, pumps, and hoses were delivered with the purifiers. The purification units are used to feed clean surface water into the distribution systems in the outskirts of San Jose. (Vorhis-USGS)
W69-05456

5G. Water Quality Control

PESTICIDES: NOT ENOUGH KNOWN.

Nature, Vol 221, No 5178, pp 302-303, Jan 25, 1969. 2 p.

Descriptors: *Pesticides, *Pesticide residues, *Foods, Data collections, Legislation, Organizations, Analysis, Sampling Ecosystems, Pollutants.
Identifiers: Britain, Research needs.

As pollution of the global ecosystem by pesticides increases, it is stressed that more research is needed on most aspects of contamination. This conclusion is based upon findings of a study group in Britain which compiled information from 59 private and public organizations; it reveals widespread ignorance about this problem. Knowledge is needed, prior to legislation, on the metabolism of pesticides, the accumulation of pesticides in foods and simpler, quicker procedures for analyzing pesticide residues. A system is needed for sampling imported foods. The study group recommended that the government collect published and unpublished data, persuading industry to release new information; government chemists should be organized to collect samples for analysis; and a new committee should be formed to deal with pesticides in foodstuffs. This committee, to which the Med and Agr Res Counc and the Ass of Pub Anal should contribute members, would initiate research, collate and publicize results and make recommendations for limits of contamination. (Lang-USGS)
W69-05215

LARGE TREATMENT PLANTS OF THE EMSCHER ASSOCIATION AND THEIR IMPORTANCE FOR IMPROVING CONDITIONS OF THE RHINE,
Emschergenossenschaft, Essen (West Germany).
For primary bibliographic entry see Field 05D.
W69-05218

WATER FOR LIVING,
World Health Organization, Geneva (Switzerland).
For primary bibliographic entry see Field 05C.
W69-05219

OIL SPILLAGE STUDY, LITERATURE SEARCH, AND CRITICAL EVALUATION FOR SELECTION OF PROMISING TECHNIQUES TO CONTROL AND PREVENT DAMAGE,
Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.
G. J. Alkire, C. D. Becker, M. W. Cook, Diana Davis, and C. E. Leach.
Available from CFSTI as AD-666 289 HC $3.00, MF $0.65. Res Rep for Dep Transp, U S Coast Guard, Nov 20, 1967. Total 281 p, 2 fig, 16 tab, 761 ref, 8 chapter.

Descriptors: *Oily water, *Water pollution sources, *Water pollution treatment, Oil wastes, Ships, Navigation, Transportation, Pipelines, Path of pollutants, Biodegradation, Coagulation, Flotation, Oxidation.
Identifiers: *Oil spills, Oil tankers, Oil spill cleanup, Oil shipping technology, Oil slick removal.

Literature on the current state of technology of prevention and control of major oil spillage on water, the restoration of the shoreface and waterfowl, the effects of oil pollution, and the effect of corrective measures on aquatic life are reviewed and evaluated. Over 700 references are listed. Ship size increases, tank arrangement changes, hull proportions, bridge (ship) locations, structural design, machinery design, pumping changes, manning level reduction, and some operating practices all tend to increase the probability and severity of spills. Operating practices are being adopted, however, to reduce spillage hazards. They include oil and ballast separation, better navigation techniques, restricted traffic lanes, radar, and better weather forecasting. Regulation of offshore production to reduce spillage is both by government action and by oil companies to improve public relations but failures are still likely. Transmission line safety codes are designed to reduce hazards. Oil spills are studied by aerial surveys including spectrophotometric, ultraviolet, infrared, radar, and microwave imaging. Chemical treatment includes use of absorption and sinking agents and gelling agents. All dispersants and emulsifiers are toxic to some extent, and general opinion is against them. Oil may be confined by booms and then either burned or recovered. Technology for reclamation of recovered oil is highly developed but largely unused. (Knapp-USGS)
W69-05262

THE MICROBIAL FLORA OF ACID MINE WATER AND ITS RELATIONSHIP TO FORMATION AND REMOVAL OF ACID,
Ohio State Univ., Columbus. Water Resources Center.
Patrick Dugan, and Chester Randles.
Research Project Completion Report, Oct 1968. 124 p, 41 fig, 16 tab, 41 ref. OWRR Project A-002-Ohio.

Descriptors: Water pollution, Pollution abatement, *Acid mine water, *Acid microflora, Acid abatement, Acid metabolism, Acid tolerant bacteria, Sulfur metabolism, Sulfate metabolism, Water quality, Coal drainage, Mines, Iron metabolism.
Identifiers: Stream pollution, Mine acid, *Micoorganisms, Bacteria.

The ecology and distribution of microorganisms in acid drainage associated with coal mines indicates that biological production of acid, sulfate, and ferric ions occurs in gob piles and mines but not in receiving streams. Surges of acid are flushed into receiving waters via rainfall or other runoff. Hydrogen ion is the most toxic component to a normal heterotrophic microflora of a receiving stream sulfate has some toxic influence and ferric ion has little toxicity. Acid tolerant heterotrophs exist in highly acid streams and proliterate there. Metabolic byproducts from acid tolerant bacteria would tend to revert streams to a normal condition if acid pollution was abated. Sulfate reducing bacteria can convert sulfate to sulfide and concomittantly remove acid. This represents a potential means for treatment of acid water in specific cases.
W69-05314

NITROGEN CYCLE IN SURFACE AND SUBSURFACE WATERS,
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 05B.
W69-05323

DETERMINATION OF ORGANOCHLOR INSECTICIDES IN SOILS AND WATERS,
Wisconsin Univ., Madison. Dept. of Soils. Agr tural Research Service, Washington, D. C.
For primary bibliographic entry see Field 05A.
W69-05325

DELAWARE RIVER BASIN COMPACT.
For primary bibliographic entry see Field 04A.
W69-05342

DELAWARE RIVER BASIN COMPACT.
For primary bibliographic entry see Field 04A.
W69-05343

DELAWARE RIVER BASIN COMPACT.
For primary bibliographic entry see Field 04A.
W69-05344

DUMPING OF OIL.

Me Rev Stat Ann tit 17, sec 2794 (1965).

Descriptors: *Maine, *Water pollution, wastes, *Oil, Legislation, State governments, P tion abatement, Chemical wastes, Water pollu sources, Industrial wastes, Rivers, Streams, La Ponds, Tidal waters, Wells, Groundwater, Sur waters, Seepage, Percolation.

The intentional placement or direct deposit of petroleum base products or materials contai significant quantities of such oil into or on banks of any river, stream, permanent or temp ry lake, pond, or tidal waters or on the ice the where such materials may find its way into watercourse of tidal waters is prohibited. prohibited is the deposit of such materials into wells or on ground surfaces in such a manner oil will percolate, seep, or otherwise find ac into groundwaters or into wells used for production of water. (Logan-Fla)
W69-05370

TENNESSEE VALLEY SAND AND GRAVEL V PILLING (LIABILITY FOR SEDIMI DUMPING WHICH MAKES CREEK BED SH LOWER, WHICH CAUSES MORE FLOODIN
47 So 2d 236-244 (Ala 1950).

Descriptors: *Gravels, *Pollution abatem *Sediments, *Alabama, Judicial decisions, L aspects, Streams, Riparian rights, Riparian la Hydraulic structures, Mining, Silts, Water pollu sources, Pasture management, Grazing, Pastu Muck soils, Damages.
Identifiers: Debris.

Plaintiff brought an action for damages to his l allegedly caused by negligent mining operation the defendant. A judgment for the plaintiff was tered awarding damages for the abatable nuisa created by the defendant's mining operations. plaintiff contended that the defendant had ca the creek abutting her property to overflow m frequently by dumping wastes into the stream causing muck and debris buildup. These overfl cast muck upon plaintiff's pasture land, mal that land unfit for grazing. Damages were awar to plaintiff for actual injuries incurred, but court refused to make any award for prospec damages. (Katz-Fla)
W69-05386

GREEN V MCCLOUD (ACTION TO ENJ SEWAGE FLOW).

303 Ky 207, 197 SW 2d 258-261 (1946).

Descriptors: *Kentucky, *Domestic wa *Water pollution, Prescriptive rights, Sew sludge, Sewage effluents, Livestock wa Disposal, Farm wastes, Decomposing org matter, Riparian waters, Dairy industry, Distr

n systems, Nuisance (Water law), Legal aspects, licial decisions, Poultry.

intiff brought suit to enjoin defendant from in-fering with a sewer line which belonged to plain- and another. Defendant filed a counterclaim, solidated with an action against two others to oin them from allowing sewage from residences outbuildings to run through open ditches or bu- pipes in the bed of small stream near defen- t's property. From adverse judgments, defen- t appealed. While there is no prescriptive right maintain a nuisance, the fact that defendant ed onto the land upon which the nuisance ex- is an important factor to be considered in rmining the equities. The court found that the ence authorized a finding that the sewer line otying sewage from residences and outbuildings the small stream did not constitute a nuisance ch would be enjoined and consequently af- ed the judgments. (Reed-Fla)
9-05389

TIFICIAL MIXING OF DENSITY-ATIFIED FLUIDS: A LABORATORY IN-TIGATION,
ceton Univ., N. J. Lewis F. Moody rodynamics Lab., and Princeton Univ., N. J. t. of Civil and Geological Engineering.
primary bibliographic entry see Field 02H.
9-05412

TER POLLUTION CONTROL USING BY-S PIPING,
fornia Univ., Los Angeles. Graduate School of ness; and Purdue Univ., Lafayette, Ind. Kran- Graduate School.
. Graves, G. B. Hatfield, and A. Whinston.
er Resources Research, Vol 5, No 1, pp 13-47, uary 1969. 35 p, 9 fig, 14 tab, 6 ref, 1 append.

riptors: *Water pollution control, *Linear ramming, *Water quality control, Mathemati- model, Water pollution, Dissolved oxygen, hemical oxygen demand, Wastes, Water treat- , Taxes.
ifiers: *By-pass piping, *Water quality gement, *Delaware Estuary, Dual variables, solution.

paper presents a mathematical model of re- l water quality management using by-passing g. The model is developed within the work of linear programming and a large-scale em is solved using semi-realistic data from the ware Estuary. The solvability of the linear pro- ming problem, as well as the general relation- between the primal and dual problems is sum- ed in a general theorem. A methodology for zing large-scale water pollution problems and determining optimal solutions to these ems is developed and a program for con- g water quality by using by-pass piping is ob- l. The method appears to have wide applica- n the fields of water resources and sanitary en- ring. The technique of generation of elements d in conjunction with the truncated tablean to le efficient solutions. A possible method of on is indicated based on the values of the dual les.
05503

OR RESEARCH PROBLEMS IN WATER LITY,
rch for the Future, Inc., Washington, D. C.
st F. Gloyna.
ain entry see Vol 2, No 12, Field 06B, W69- . Water Research, pp 479-493, Johns Hop- ress, Baltimore, 1966. 15 p, 3 tab, 19 ref.

ptors: *Water management, *Water quality, r pollution, *Water quality control, Water d, Cities, Industries, Fish, Wildlife, Recrea- Flood control, Navigation, Drainage, Water

iers: *Research problems, Stream use.

There are conflicting demands for water. Today the three leading water users--municipalities, industries, and agriculture--are being challenged by fish and wildlife, recreation, flood control, power, and navigation. While each interest exerts its influence on both quality and quantity, the effects of water use become more pronounced. To provide for a continued supply of usable water there must be an accelerated flow of ideas from the research laboratory to the field of application. This paper describes the nature of pollution, some dimensions of the quality question, the current status of water renovation, and research needs. Considerable background information is provided as research requirements are all too often based on a limited interpretation of pollution. (Loeb-Rutgers)
W69-05519

QUALITY: WATER'S FOURTH DIMENSION,
California Univ., Berkeley.
P. H. McGaukey.
Water Policy Conference, Report No 3, California University at Davis, pp 44-48, Jan 11-13, 1961. 5 p, 3 charts.

Descriptors: *Water quality, *Impaired water quality, Water pollution, Water resources, Water utilization, Urbanization.
Identifiers: Industrialization.

As America has moved into an urban-industrial-agricultural economy (as contrasted with its earlier agrarian state), the quality of the water supply has changed. It is evident that the urban population and its supporting industrial and commercial activities will be an increasingly serious contributor to a decline in water quality. The more intensive use of water made necessary by an expanding population and increasing technology inevitably leads to a lowering of water quality. The maximum benefit to all users will require management of water quality on par with, and coordinated with, management of water quantity. Our relatively fixed water resources have some maximum capacity to accept impurities and yet continue to serve all beneficial uses. (Winn-Rutgers)
W69-05524

THE COMPETITION FOR WATER QUALITY: AGRICULTURE,
California Univ., Davis.
Milton Fireman.
Water Policy Conference, Report No 3, California University at Davis, pp 49-56, Jan 11-13, 1961. 8 p.

Descriptors: *Irrigation water, *Water quality, *Impaired water quality, Water pollution, Water resources, Water utilization, Water properties, Agriculture, California.

Farmers and agriculturists are interested in the effects of irrigation waters on plant-soil-water relationships and on the chemical and physical properties of the soil, particularly as they affect crop production. The principal characteristics which determine the quality of water for irrigation are: (1) total concentration of soluble salts, (2) sodium concentration and (3) the concentration of boron, lithium or other toxic substances. Water users degrade irrigation water supplies directly or indirectly by (1) concentrating the harmful constituents already in water, (2) by adding salts to ground water, (3) by adding salts or other harmful materials to the soil where they are picked up during irrigation, or (4) by disposing harmful materials in the irrigation stream. However, because of our increasing awareness of water quality problems, the author states that these problems will be critical only on a local basis and in particular situations. (Winn-Rutgers)
W69-05525

THE COMPETITION FOR WATER QUALITY: INDUSTRY,
Ethyl Corp., Pittsburg, Calif.
James Gill.
Water Policy Conference, Report No 3, California University at Davis, pp 57-60, Jan 11-13, 1961. 4 p.

Descriptors: *Industries, *Water quality, Impaired water quality, Water utilization, Water pollution, California, Water law.
Identifiers: California Water Pollution Control Act.

In recent years there has been increased competition for water quality and quantity. The goals set for water quality must not be unrealistic. Instead they must be based on thorough analyses of contemporary conditions and needs, with flexibility built-in to meet the unknown needs of the future. It is difficult, if not impossible, to specify any single set of water quality standards for industry. As with all other users, the quality required is dependent on the use to be made of the water. Industry, recognizing its community responsibilities, supports the establishment of sound water quality requirements designed to provide for full utilization of water resources. The Water Pollution Control Act in California is an example of constructive legislation. (Winn-Rutgers)
W69-05526

THE COMPETITION FOR WATER QUALITY: DOMESTIC USE,
City of San Diego, Calif.
Paul Beerman.
Water Policy Conference, Report No 3, California University at Davis, pp 57-60, Jan 11-13, 1961. 3 p.

Descriptors: *Water quality, *Domestic water, Political aspects, Water utilization, Planning, Water allocation (Policy).

The long range objective in providing water for domestic use is to obtain, at reasonable cost, an adequate quantity and quality of water to satisfy household needs. Unlike the agriculturists, the domestic user is able to pay for the treatment of the water which he utilizes. The domestic water user of 1970 will not have a quality problem much more severe than the present one, but he will have to be convinced of the great need for research on the reuse of water, water conservation, waste treatment and other problems. Mainly, he will have to learn that these problems cannot be solved without more cooperation between political groups. The consumer of the 1980's and beyond may have to share the quality as well as the quantity of his water. (Winn-Rutgers)
W69-05527

ECONOMIC ALTERNATIVES,
California Univ., Berkeley.
Michael F. Brewer, and Stephen C. Smith.
Water Policy Conference, Report No 3, California University at Davis, pp 126-34, Jan 11-13, 1961. 7 p.

Descriptors: *California, *Governments, *Planning, State governments, Economics, Institutions, Hydroelectric power, Water resource development, Flood control, Water supply, Financing, Pricing, Contracts, Coordination.
Identifiers: Agency coordination, Water delivery contracts.

Improved flood control, better water quality control and more recreation facilities are among the benefits expected to result from California's water investment program. To proceed efficiently, the program needs reasonable, up-to-date estimates of the volume, quality and timing of the benefits which are to flow from alternative investment programs. Decisions still must be made in several areas. There are still alternatives in agency coordination, alternatives in financing, alternatives in pricing and alternatives in contract form. The various alternatives differ in their economic consequences. Adequate data, professional studies and critical thinking are necessary to choose the best possible set of alternatives. (Winn-Rutgers)
W69-05528

CLARK V GIFFORD-HILL AND CO (WATER POLLUTION BY MINING).

100 F Supp 879-881 (WD La 1951).

Descriptors: *Louisiana, *Mining, *Water pollution, *Overflow, Mud, Damages, Judicial decisions, Water pollution effects, Pollution abatement, Water pollution sources, Streams, Water management (Applied), Lakes, Mine drainage, Mine wastes, Quarries, Mineral industry, Industrial wastes, Legal aspects.
Identifiers: Injunctions (Prohibitory).

At the time of this suit, and for a considerable time prior thereto, defendant had been digging and mining gravel on its own property, which was so situated that large areas of land and small streams drained into its gravel pit. This caused a continued increase of muddy water as more space was provided by the removal of top soil and gravel. Although defendant attempted by appropriate means to stop the muddy water from flowing out of the diggings, during hard rains it overflowed, muddying a certain stream and causing damage to the plaintiff. The defendant had built levees which make it reasonably certain that there would be no more overflow. Further, defendant set up a plan to completely drain the diggings of polluted water in order to eliminate the hazard once and for all. Plaintiff, in addition to damages, requested an injunction against further pollution. The court granted the injunction, holding that the defendant should be restrained from further polluting the creek until it had returned the old digging area to normal conditions which prevailed before the gravel operations were begun. (Heckerling-Fla)
W69-05561

AMERICAN CYANAMID CO V COMMONWEALTH (POLLUTION ABATEMENT).

187 Va 831, 48 SE 2d 279-286 (1948).

Descriptors: *Virginia, *Administrative agencies, *Water pollution, *Water pollution control, Legislation, Pollution abatement, Acids, Acidic water, Acidic streams, Fish conservation, Wildlife conservation, Industrial wastes, Judicial decisions, Legal aspects.
Identifiers: Statutory interpretation, Penalties (Criminal).

Defendant was convicted under the Virginia Fish Law for casting colloids and sulfuric acid into the Piney River. Defendant contends that the State Water Control Law repealed the fish law or so far subordinated it that the defendant cannot be convicted under the fish law on the facts of this case. The control law empowered the Water Control Board to supervise and administer all laws relating to pollution of state waters. The defendant contends, therefore that the fish commission did not have authority to proceed against defendant. The court held that the control law expressly stated that its provisions merely supplemented and did not repeal prior legislation. It did require, however, that prior existing legislation be administered in accordance with the purposes of the control law. The court determined that the conviction of defendant prior to obtaining a control board permit sanctioning the pollution was lawful, but that the subsequent conviction, antecedent to securing such a permit, was not in accord with the purposes of the control law and was unlawful. (Katz-Fla)
W69-05575

STATE V GLIDDEN CO (CONSTITUTIONALITY OF WATER POLLUTIONS CONTROL STATUTE).

228 NC 664, 46 SE 2d 860-863 (1948).

Descriptors: *North Carolina, *Water pollution control, Legal aspects, Fish conservation, Fish toxins, State government, Judicial decisions, Relative rights, Legislation, Pollutants, Discharge (Water), Effluents.
Identifiers: Penalties (Criminal), Equal protection clause.

A North Carolina Statute made it unlawful to pollute the waters of the state or to discharge into such waters any deleterious or poisonous substance inimical to fish. The statute did not apply to corporations chartered before March 4, 1915. Penalties for violation included fine or imprisonment. The defendant company was charged with violation of the statute, was convicted, and was fined $5,000. Defendant appealed. The superior court sustained a demurrer to the arrest warrant, holding the statute was unconstitutional. The State appealed, and the Supreme Court of North Carolina held that the broad nature of the exception to the statute was not related to any useful purpose comprehended by the statute. Class legislation is not offensive if founded upon reasonable distinctions and uniformly applied to all members of the same class. However, in this situation, the 'cut off' date used to define classes within the statute was discrimatory and, thus, violative of the 14th amendment equal protestion clause. (Harris-Fla)
W69-05586

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

PROCEEDINGS OF SYMPOSIUM ON BETTER WATER AND SEWER SERVICES FOR SMALL COMMUNITIES IN NORTH CAROLINA,
North Carolina Univ., Chapel Hill. Inst. of Government; and North Carolina State Univ., Raleigh. Water Resources Research Inst.
For primary bibliographic entry see Field 06B.
W69-05424

A COMMENT ON OPTIMIZATION METHODS FOR BRANCHING MULTISTAGE WATER RESOURCE SYSTEMS,
Michigan Univ., Ann Arbor.
E. F. Brater.
Water Resources Research, Vol 5, No 1, pp 317-318, February 1969. 2 p, 1 tab, 2 ref.

Descriptors: *Dynamic programming, Optimization, Resources, Water distribution, Linear programming, Digital computers.
Identifiers: *Iteration, *Optimization methods, *Branching multistage systems, Nonlinear programming.

The author comments on a paper by Meier and Beightler which demonstrated the application of dynamic programming to the optimization of a five reservoir system in which two reservoirs are on a branch that enters the main stream at the middle of the three main reservoirs. The author calls attention to several numerical errors in the above paper. In equation 16 the values of d* sub 1 and d* sub 2, derived from the author's solution should be 7.10 instead of 6.10 and 2.12 instead of 3.12, respectively, and the maximum return is slightly greater than 355 rather than 354. It has been demonstrated by Loucks that nonlinear programming and linear programming optimizing techniques can also be applied to the solution of this same problem. Problems of this type can also be solved by iteration. Perhaps the most important advantage of an iteration technique is that in addition to finding the particular set of water allocations that produce the maximum return, many other sets of allocations are found that produce near maximum returns and which might be more desirable than the absolute maximum. A typical procedure for an iteration solution is described. (Loeb-Rutgers)
W69-05499

OPTIMIZATION METHODS FOR BRANCHING MULTISTAGE WATER RESOURCE SYSTEMS--A REPLY TO A COMMENT BY E. F. BRATER,
Texas A and M Univ., College Station; and Texas Univ., Austin.
W. L. Meier, Jr., and C. S. Beightler.
Water Resources Research, Vol 5, No 1, pp 319-320, February 1969. 2 p, 4 ref.

Descriptors: *Dynamic programming, Optimi
tion, Decision making, Computers.
Identifiers: *Optimization methods, *Branch
water systems, *Iteration, *Enumeration, Optir
decision, Convergence, Optimum solution.

The authors discuss two points that Brater rai
on their earlier paper. First, there is a numeri
error in the authors' paper. The correct values c
sub 1 and d sub 2 in Equation 16 should be 7
and 2.11 respectively. Furthermore, the total m
imum return is slightly greater than 355. These
rors were typographical errors. Brater also sta
that optimization as an end-product to ratio
decision making is not new. However, the n
aspect of modern optimization technology is t
the techniques developed that accelerate conv
gence to an optimal decision. Optimizat
methods such as that proposed by the auth
speed convergence to an optimum by limiting
necessary evaluations. An enumeration meth
similar to Brater's provides an equivalent answer
the authors' method if it converges to the absol
optimum value. Even here the analyst can't guar
tee that the absolute optimum has been reach
However, dynamic programming always achie
the absolute optimum solution. The authors st
that Brater's 'iteration' method used on proble
like that faced by the State planning agency
Texas would lead to ruin. Since water research
often concerned, as in the authors' earlier pap
with optimization problems, this paper is applica
to present water studies. (Loeb-Rutgers)
W69-05501

**EFFECT OF THE LENGTH OF THE TIM
PERIOD ON SERIAL CORRELATION,**
Canterbury Univ., Christchurch (New Zealand).
For primary bibliographic entry see Field 06D.
W69-05506

**AN ALTERNATIVE PROOF OF HANNAN
THEOREM ON CANONICAL CORRELATIO
AND MULTIPLE EQUATION SYSTEMS,**
Thomas J. Watson Research Center, Yorktov
Heights, N. Y.; and Ohio State Univ., Columbus.
For primary bibliographic entry see Field 06D.
W69-05511

**USE OF THE DURBIN-WATSON STATISTIC
INAPPROPRIATE SITUATIONS,**
Stanford Univ., Palo Alto, Calif.
For primary bibliographic entry see Field 06D.
W69-05516

FACTOR ANALYSIS AND REGRESSION,
Illinois Univ., Urbana.
For primary bibliographic entry see Field 06B.
W69-05517

6B. Evaluation Process

**COMPREHENSIVE BASIN STUDY ON WHI
RIVER BASIN, ARKANSAS AND MISSOURI.**
White River Basin Coordinating Committee.

Compr Basin Study, White River, Arkansas a
Missouri, Main Rep, Vol 1 of 6 vol, June 1968. 1
p, 18 fig, 2 plate, 40 tab, 5 append.

Descriptors: *Water resources development, *M
tiple-purpose projects, *River basin developme
*Arkansas, *Missouri, Planning, Water suppl
Flood control, Recreation, Irrigation, Channel i
provement, Dams, Reservoirs, Inter-Agen
cooperation, Interstate rivers, Interstate commi
sions.
Identifiers: White River Basin (Ark-Mo), Cor
prehensive Basin Plan.

A comprehensive study was made of the water a
land resources and needs in the White River basi
Arkansas and Missouri, plans were formulated f
land and water resource uses, and programs
meet the needs were designed. The basin has

of about 27,765 sq mi, of which 62% is forest the remainder is principally farmland. The n economic activities are agriculture and light ıstry. Flood losses average about $97 million yr and 3,400,000 acres suffer wetness hazard. er availability is sufficient for all purposes but ral headwater communities will need to in- se their water facilities to meet expected de- d. The 1965 municipal industrial use was about ngd, and by the yr 2000, use is expected to be mgd. Pollution is a problem only downstream pringfield, Mo. and Fayetteville, Ark. The com- ensive plan of development includes 7 main and major tributary multiple-purpose naviga- improvements, land reclamation, farm ponds, ation works, channel improvements, recreation lopment, stream gage installation, and water ity control projects. Total cost is estimated to 226,159,500 with a benefit-cost ration of 2.7:1. pp-USGS)
-05201

STATE VIEWPOINT ON RIVER BASIN NNING,
York State Dept. of Conservation, Albany. of Water Resources.
olas L. Barbarossa.
E Proc, J Waterways and Harbors Div, Vol 94, VW2, Pap 5955, pp 217-238, May 1968. 22 p, g, 2 tab, 12 ref, append.

riptors: *River basin development, *Planning, ter resources development, *Water Resources ning Act, Governments, Management, Water gement (Applied), Water policy, Appalachi- lountain Region, New York, Political aspects, l aspects, Social aspects, State governments, state, Federal-State water rights conflicts.
ifiers: Water resources council, River basin ning.

inistrative and policy implications of water rces planning and development are discussed regard to planning concepts, federal-state- relationships, implementation and manage- , and new trends. Inconsistent national water ies, overlapping new programs, and the ıd of federal agencies with divided jurisdic- dictate the need to strengthen the role of the s as partners with federal and local govern- s. Recent federal legislation (Appalachia and r Resources Planning Acts, especially) will the states in this respect. The newly created r Resources Council can provide top-level dination and may ultimately resolve competi- situations at the federal level. States generally not taken advantage in the past of available rtunities, because they failed to provide the s and motivation for partnership planning and opment. Current trends indicate that mutual dependence among all levels of government ncrease. New York State policies, organiza- and programs are described to illustrate grow- tate responsibilities. Guidelines for the states eveloping policies and organizations are nted.
-05209

ERGRATING HUMAN-SOCIAL OURCES INTO THE WATER RESOURCE ELOPMENT PROJECT,
American Center for Integral Development nd and Water Resources.
en L. Brower.
he 8 Volume Proceedings, see Vol 2, No 9, 06B and W69-03305. Int Conf on Water for e, Wash, D C, Vol 6, pp 454-463, 1968. 10 p, 6 ref.

riptors: *Social aspects, *Water resources opment, *Social adjustment, *Human rces, Attitudes, Water management (Ap-), Planning, Water utilization, Economic im- Irrigation.
ifiers: Human-social forces.

Major resource systems that interact and influence the success of water resource development projects are (1) the natural or physical, (2) economic, and (3) human-social and are composed of inter-related, interdependent sub-systems. Complex sets of direct and indirect relationships exist between people and the development of water resources. The human-social resource system influences and modifies the way water is utilized and conversely the introduction of a new water use, as irrigation, changes people's way of life. The decision to irrigate implies that water is a central concern either for man's economic survival, success or for the preservation of life. The resulting concerns introduce emotion-ladden decisions related to the acquisition, use, and control of water. The rational physical designs for the development of the irrigation project frequently are rendered less effective because of these intervening human-social factors. Conceptual, analytic, and methodological means are available for making water resource development technically and operationally adequate. These take into account the human-social factors which frequently contain the forces which block or reduce the effectiveness of water development projects. A paradigm defining 4 basic types of water resource planning and implementation models is presented and takes into account human-social forces which influence the success or failure of a water resource development project. (Lang-USGS)
W69-05217

THE UTILITY OF DISASTERS,
Duke Univ., Durham, N. C.
Louis De Alessi.
Kyklos, Vol 21, No 3, pp 525-33, 1968. 9 p.

Descriptors: *Disasters, Prices, Behavior.
Identifiers: *Charity, Utility analysis, Firm behavior, Individual behavior.

Empirical evidence suggests that charity increases following a disaster. The explanatory hypothesis implied by non-economists, and stated explicitly by at least some economists, is that disasters induce short-run structural changes in individual utility functions. This essay suggests that economic theory already predicts an increase in post-disaster charity. It follows that structural changes in utility functions are not a necessary condition for explaining the behavior observed, including the behavior of prices. This essay also extends the analysis to the post-disaster behavior of business firms by applying the utility maximization hypothesis to the behavior of individual decision makers within the firm. This article has relevance to theoretical treatments of flood damage and water disasters as they may effect individual utility functions and post disaster policy. (Winn-Rutgers)
W69-05288

TESTING FOR SERIAL CORRELATION AFTER LEAST SQUARES REGRESSION,
Australian National Univ., Canberra.
E. J. Hannan, and R. D. Terrell.
Econometrica, Vol 36, No 1, pp 133-50, Jan 1968. 18 p, 22 ref.

Descriptors: *Correlation analysis, Regression analysis, Fourier analysis, Efficiencies.
Identifiers: *Spectral density function, *Significance points, *Circular serial correlation, Exogenous, Residuals, Autocorrelation.

Fourier methods are used to investigate tests for the significance of the residuals from a regression. In a multiple regression on fixed regressors it is shown that if the regressors have spectra concentrated at the origin of frequencies then the upper bound of the Durbin-Watson test statistic is likely to be relevant. The structure of the spectral density matrix of regressors which makes least squares an efficient method for a disturbance with any continuous spectral density is also discussed. An alternative proof is offered for testing serial independence of the residuals from any 'just identified' or 'overidentified' equation in a multiple system of equations. Test procedures for different forms of serial dependence are discussed, and an example of this kind is investigated. Attention is focused on the case where the exogenous variables in the regression have spectra concentrated at the origin of frequencies. This article has relevance to many water simulation and empirical demand studies which by the nature of the data often exhibit significant serial correlation of the residuals. (Sokoloff-Rutgers)
W69-05289

AN INCOME-NET WORTH APPROACH TO MEASURING ECONOMIC WELFARE,
Wisconsin Univ., Madison.
Burton A. Weisbrod, and W. Lee Hansen.
Am Econ Rev, Vol LVIII, No 5, 1315-1329, Dec 1968. 15 p, 5 tab, 2 fig, 15 ref.

Descriptors: *Income, *Welfare (Economics), Taxes, Progressive taxes, Regressive taxes.
Identifiers: *Net worth, Economic position, Consumption behavior estimation, Current income.

The objective of this paper is to present an empirical measure of economic welfare, hereafter called economic position, which integrates current money income and current net worth. The proposed measure rests on the assumption that current income and current net worth are both important determinants of the economic position of a consumer unit. Merging income and net worth gives rise to difficulties, for income is a flow while net worth is a stock. The procedure proposed involves converting net worth into a flow by translating it into an annuity. The economic position for any given consumer unit at any given time is the sum of its current annaul adjusted income and the annual lifetime annuity value of its current net worth. Economic welfare as a benefit measure can be utilized in water benefits analysis particularly related to consumer water demand and the income distribution effects of water development projects. (Winn-Rutgers)
W69-05290

MONEY, MULTIPLIER ACCELERATOR INTERACTION AND THE BUSINESS CYCLE,
Carnegie-Mellon Univ., Pittsburgh, Pa. Pennsylvania Univ., Philadelphia.
Michael C. Lovell, and Edward Prescott.
Southern Econ Jour, Vol 35, No 1, pp 60-72, July 1968. 13 p, 3 fig, 19 ref, append.

Descriptors: Investment, Interest rate, Stability, Governments, Federal government, Growth rates.
Identifiers: *Money, Federal Reserve System, *Economic stability, Money supply, Business cycle, Monetary policy, Multiplier.

It has been argued that the fact that the money supply moves cyclically constitutes prime facie evidence that the best efforts of the Federal Reserve System contribute to economic instability. It has been asserted that given the limited state of current knowledge, discretionary monetary policy should be replaced by the simple rule of having the money supply increase at a constant rate. In analyzing these issues a model constituting a synthesis of the real theory of the business cycle provided by the multiplier-accelerator framework of Samuelson with the IS-LM apparatus developed by Hicks for the static analysis of the role of money in the determination of aggregate income is used. The effects of alternative stabilization policies which might be pursued by monetary authorities are analyzed for a deterministic world and for one complicated by stochastic disturbances. The analysis shows that the United States economy might be subject to greater instability if discretionary monetary policy were replaced by the Friedman-Shaw rule. Federal water projects can be conceived of as possible anti-cyclical expenditure possibilities. The role of money and monetary policy can be both augmenting and competitive to fiscal policy and this article has relevance to theoretically relating the fiscal effects of water projects to monetary actions. (Winn-Rutgers)
W69-05291

WATER RESOURCES POLICY AND POLITICAL INSTITUTIONS.
Federal Council for Science and Technology, Washington, D. C.

Panel Report, Office of Science and Technology, Washington, D. C.: U. S. Government Printing Office, July 1968. 18 p.

Descriptors: *Research and development, *Institutional constraints, *Water law, *Water resources development, Administrative agencies, Federal project policy, Measurement, Watershed management.
Identifiers: *Implementation techniques, Transbasin decision.

This panel report points out the inadequate amount of available research on water resources policy and political institutions. It contends that water policies have a far greater impact on water management than any scientific innovation. It also proposes development of appraising techniques to evaluate existing policies and institutional arrangements so that needed changes can be quickly identified; and that the Executive Office of the President take the lead in assuring that such a basic research program be developed. The report questions the existing policy of planning and developing water management by river-basin units and calls for comparative analysis studies between river-basin concepts and compact or small watershed management programs. Also questioned is the extent to which duplicate federal programs complicate or impede the resolution of conflicting water management needs. Another widely accepted concept questioned in this report is whether multi-purpose planning produces concurrent multi-purpose benefits. Suggested research to determine this is the use of the 'post-audit' technique and analyses of both multi-purpose and single purpose projects. Other research needs identified are: (1) research to determine what type of grant programs are most effective and efficient; (2) the effect of inequitable allocation of financial responsibility; and, (3) how institutional arrangements affect the role of the private sector in water resources development. (Starr-Chicago)
W69-05295

WATER LAW, POLITICS, AND ECONOMICS: OUR COMPLEX WATER LAWS AND WATER USE CUSTOMS,
Oregon State Univ., Corvallis. Water Resources Research Inst.
For primary bibliographic entry see Field 06E.
W69-05296

WATER LAW, POLITICS, AND ECONOMICS: FEDERAL CONTROL OF WATER RESOURCES,
Oregon State Univ., Corvallis. Water Resources Research Inst.
For primary bibliographic entry see Field 06E.
W69-05297

HARBOR DEVELOPMENT PORT OF PORTLAND, MAINE.
Greater Portland Chamber of Commerce, Maine; Union Design Groups, Newport, R. I.

Greater Portland Chamber of Commerce, February 1969. 123 p, 10 maps, 19 illus.

Descriptors: *Harbors, *Land use, *Public benefits, Shoreline protection, Water quality, Aesthetics, Legal aspects, Financial feasibility.
Identifiers: *Portland (Maine), Residential development.

The report advocates planning wherein proposals and recommendations by special interest groups are presented in an effort to influence and guide public policy. The pressure of higher priorities for development and urban renewal in Portland and South Portland has deferred public action or waterfront developments. The planning and development goals underlying this study are: (1) maximum public and private benefit from the use of waters for navigation, recreation and commerce; (2) maximum public and private benefits from the use of waterfront land areas for industrial, commercial, recreational and residential purposes; (3) maximum aesthetic and amenity value; (4) reconciliation of conflicting land uses; (5) relating waterfront development to regional and local planning; and, (6) classification and coordination of port development responsibilities. Some of the specific objectives outlined are: (1) elimination of blight and decay; providing facilities and services to support expansion of industry, commerce, recreation and housing; (3) developing viable programs for environmental improvement; and, (4) developing legislative and fiscal programs to support these activities. (Starr-Chicago)
W69-05298

THE PLAN AND PROGRAM FOR THE BRANDYWINE.
Chester County Water Resources Authority, West Chester, Pa.; and Pennsylvania Univ., Philadelphia. Inst. for Environmental Studies.

Institute for Environmental Studies, University of Pennsylvania, October 1968. 277 p, 32 map, 87 tab, 6 illus, 22 graphs, 1 append.

Descriptors: *Land use, *Flood plain zoning, *Easements, *Water quality, Community development, Growth rates, Social aspects, Psychological aspects.
Identifiers: *Chester County (Pennsylvania), Water districts, Flood plain management.

Proposals for the wise use of the water and land resources of the Upper East Branch of Brandywine Creek, in Chester County, Pennsylvania are presented. Preservation of the water supply and water quality, accommodation of normal growth and preservation of the natural amenities are the principal planning goals. Three recommendations are made, and a program based on the acceptance by the public of these recommendations, is outlined: (1) Further development dept out of the flood plains and 300 foot wide strips on each side of stream with limited development in wooded areas and on steep slopes; (2) Townships should undertake long range planning for the design, financing and construction of sewerage and water supply systems to accommodate future growth; and, (3) Townships should enact strong regulations governing layout of subdivisions, roads and storm sewers. Given public acceptance of these recommendations, the Chester County Water Resources Authority will proceed with the following program: (1) Establish a Water Resource Protection District; (2) Purchase conservation easements from owners of land in the District who agree voluntarily to sell such easements in a single sub-basin where owners of at least 80% of the lands agree; (3) Authority would require initial financial support from both the County Commissioners and outside agencies; and, (4) Extend the easements -purchase program to other sub-basins so that eventually all of the land in the District would be placed under development restrictions. The recommendations made are the result of the hydrologic, legal, attitudinal, economic, demographic and other technical studies contained within this report. (Starr-Chicago)
W69-05299

PROCEEDINGS-SYMPOSIUM ON BETTER WATER AND SEWER SERVICES FOR SMALL COMMUNITIES IN NORTH CAROLINA.
North Carolina Univ., Chapel Hill. Water Resources Research Inst.
For primary bibliographic entry see Field 03D.
W69-05312

EAST FORK DUCK CREEK WATERSHED; NOBLE AND WASHINGTON COUNTIES, OHIO.
Soil Conservation Service, Washington, D. C.

Preliminary Investigation Report, pp 1-12, 1968. 12 p, 5 tab.

Descriptors: *Cost-benefit ratio, Flood pla *Flood damage, Roads, Flood control, *Flood p tection, Watershed, *Watershed managment, C servation, Resource development, Ol *Washouts.
Identifiers: *East Fork Duck Creek Watershed.

In view of the unfavorable benefit-cost ratio flood prevention found in this study, no feasi watershed work plan can be developed at this ti The level of protection provided by this system not meet Soil Conservation Service standa throughout the flood plain. Courses of action wh may justify continued pursuit for the watersh were discussed with local people. These possi courses include: (A) Attempt to get affected ro abandoned, or relocated, with other funds, so t road costs will not be a project cost. (B) Postpo further action until present PL-566 procedures liberalized. (C) Use most feasible portions of best project alternate for consideration unc Buckeye Hills Resource Conservation a Development Project.
W69-05329

PROCEEDINGS OF SYMPOSIUM ON BETTI WATER AND SEWER SERVICES FOR SMA COMMUNITIES IN NORTH CAROLINA,
North Carolina Univ., Chapel Hill. Inst. of Gover ment; and North Carolina State Univ., Raleig Water Resources Research Inst.
David H. Howells.
Water Resources Res Inst Rep No 15, Univ N Chapel ill, Dec 4, 1968. 113 p, total 6 fig, 5 r OWRR Project A-999-NC.

Descriptors: *Planning, *Water resources develo ment, *Sewage, *Rural areas, Waste water tre ment, Governments, Institutions, Area redevelo ment, Administration, Legislation, Program North Carolina, Community development.
Identifiers: Rural sewage planning, Rural wat resources.

A seminar was held to examine current water a sewer programs for small North Carolina towns the context of Federal and State programs, Sta law, and planning for financing, construction, a management of water and sewer systems. Th strengths and weaknesses of present government arrangements for planning are discussed in deta and recommendations are made for their study an modification. The problems considered are large those of urbanization. Both central cities an declining rural areas face declining tax bases an demand for more services, for which one successfu solution discussed is regionalization of goverr ments. (Knapp-USGS)
W69-05424

BROAD SCOPE OF NAVIGATION' ECONOMIC IMPACT,
Tennessee Valley Authority, Knoxville. Div. c Navigation Development.
Minard I. Foster.
ASCE Proc, J Waterways and Harbors Div, Vol 9 No WWI, Pap 6389, pp 23-34, Feb 1969. 12 p, fig, 5 tab.

Descriptors: *Navigation, *Economic impact, Em ployment, Industrial production, Industries, Socia impact, Tennessee Valley Authority Project, Politi cal aspects.
Identifiers: Decatur (Ala).

A new development associated with the economic impact of navigation is the rise of waterfront indus trial complexes where industries once were few o non-existent. The numerical estimate of job required to furnish inputs to waterfront plants an the number of jobs required to utilize non-final out put of these plants provides a clue to the economic or locational impact of this dynamic segment of industry. Publicly available information concerning the input-output relationships between types of in-

istry and the tendency of some kinds of plants to awn new ones furnishes an insight into their onomic linkages. A comprehension of the far-aching influence navigation has upon economic owth in rural as well as urban areas may be of sig-ficant benefit in the process of making decisions public investments to provide navigation in uations were other aspects are conducive to such owth. (Knapp-USGS)
69-05449

EGIONAL RESEARCH IN WATER IN THE ORTH CENTRAL REGION,
uth Dakota State Univ., Brookings; and Wiscon- Univ., Madison.
ordon D. Rose, and Dean T. Massey.
portunities for Regional Research on Water sources Problems, pp 1-19, Iowa City, Universi- of Iowa, 1968. 20 p, 44 ref.

scriptors: *Central U S, *Administration, *Re-nal analysis, Networks, Regions, Manpower, onomics, Legal aspects, Water resources, nning, Coordination.
ntifiers: *North Central Region Research Pro- t NC-57, Hatch Act.

e purpose of this paper is to re-examine legal and nomic regional water resources research in the rth Central Region of the U S. Part one outlines organizational structure for regional research acted by Congress and the interpretation the operative State Research Service has given that islation in their Manual of Procedures for operative Regional Research. The second part iews the history and accomplishments of North ntral Region Research Project NC-57, a project anized in the region to study the legal and nomic aspects of water resources. The authors nclude that a modification in the present method conducting regional research is necessary; cur-t activities could be conducted equally well hout a regional project. In fact, most of these ac-ties would have been conducted if the NC-57 ject had not existed. (Winn-Rutgers)
9-05478

SCUSSION OF REGIONAL RESEARCH IN E NORTH CENTRAL REGION,
pt. of the Interior, Washington, D. C.
and R. Renne.
portunities for Regional Research on Water sources Problems, pp 20-22, Iowa City, Univer- of Iowa, 1968. 3 p.

scriptors: *Water Resources Research Act, entral U S, *Coordination, *Regional analysis, ministration, Manpower, Regions, Water ources.

e amended Water Resources Research Act of 4 provides for regional research in Water ources. However, true regional research is not y to achieve. After three full years of operation, Office of Water Resources Research in the De-tment of the Interior has very little truly re-nal water research in operation. The Office of ter Resources Research is sponsoring many er research projects in the North Central Re-n. These projects contain little, if any, duplica-s with NC-57 projects. The relationship ween the two programs is supplemental, not licative. (Winn-Rutgers)
9-05479

NCEPTUAL ISSUES IN THE CONDUCT OF GIONAL RESEARCH ON THE ECONOMICS WATER,
gon State Univ., Corvallis.
ery N. Castle.
portunities for Regional Research on Water ources Problems, pp 23-32, Iowa City, Univer- of Iowa, 1968. 10 p.

scriptors: *Regional analysis, *Water resource elopment, *Methodology, Social aspects, Water transfer, Political aspects, Economics, Economic efficiency, Institutions.
Identifiers: *Interdisciplinary research, *Multidisciplinary research, Regional research, Externalities, Economic growth.

The author's main ideas can be summarized as follows: (1) Water research is mission oriented research stemming from specific social problems; (2) The solution of most social problems requires the contribution of more than one discipline; (3) Successful regional research in economics is comparatively rare; (4) The involvement of more than one discipline adds to the complexity of regional research; (5) Perhaps the most fruitful use of other disciplines is in problem formulation; (6) Since water is not an expensive production or consumption item, the naive application of an efficiency framework may not result in the most useful research; (7) Water gives rise to externalities. Institutional devices have developed in response to these externalities.
W69-05480

DISCUSSION OF CONCEPTUAL ISSUES IN THE CONDUCT OF REGIONAL RESEARCH ON THE ECONOMICS OF WATER,
Kansas State Univ., Manhatten.
E. S. Bagley.
Opportunities for Regional Research on Water Resources Problems, pp 33-36, Iowa City, University of Iowa, 1968. 4 p.

Descriptors: *Regional analysis, Methodology, Water resource development, Resource development.
Identifiers: Interdisciplinary research.

Regional research does not require any unique or special methodology. The unique research problems encountered in regional research are not methodological or theoretical, but largely procedural, stemming from the political subdivisions involved in the organization, financing and conduct of research. There has been overinvestment in water development. The emphasis on engineering feasibility may have been in part responsible for inadequate attention to economic factors. Legal and political factors may have contributed to a too narrow regional scope in conceiving of the problem. However, one must ask why these influences are less likely to forestall overinvestment in water than in land or other resources. (Winn-Rutgers)
W69-05481

REGIONAL AND NATIONAL PLANNING OF AGRICULTURAL RESEARCH,
North Central Agricultural Experiment Station, Iowa City, Iowa.
George M. Browning.
Opportunities for Regional Research on Water Resources Problems, pp 37-43, Iowa City, University of Iowa, 1968. 7 p.

Descriptors: *Methodology, Agriculture, Research and development, Planning, Regional analysis.

The author discusses several recommendations made by the joint USDA and State agricultural experiment station (SAES) Task Force designated to conduct the long range study of agricultural research. These recommendations are guidelines for research. No single research approach or organizational arrangement can provide the information necessary to answer all the questions concerning agriculture. The most important single ingredient for a successful research and development program is the individual scientist with a new idea. Resources are not available to permit research on all the proposed projects. This emphasizes the importance of identifying the most important problems and placing priorities on them. This article can be applied to water research. The clear dependence of agriculture upon water supply and the inherent concern of agriculture with water problems make this article relevant to issues in water research. (Winn-Rutgers)
W69-05482

WATER ALLOCATION: SUPPLY AND DEMAND RELATIONSHIPS,
Iowa State Univ., Ames.
John F. Timmons.
Opportunities for Regional Research on Water Resources Problems, pp 44-56, Iowa City, University of Iowa, 1968. 13 p, 1 tab.

Descriptors: *Water allocation (Policy), *Pricing, Water Demand, Water resource development, Water supply, Water shortage, Water quality, Water users, Water right.
Identifiers: *Opportunity costs, Institutional rationing, Value productivity.

The author begins this article by reconsidering some relevant concepts such as the mythology of uniqueness and shortages imputed to water, the sanctity of the present allocative devices, and the homogeneity illusions of water. The author then notes that approximations of water supply and demand should not be considered as aggregates but as segmented differentiated supply and demand approximations derived from relevant estimators. When the demand for water exceeds its supply, research is concerned with allocating a scarce resource among completing ends. There is opportunity for research concerned with the development of water use firms identified by water use entities at appropriate levels of aggregation and decision making. (Winn-Rutgers)
W69-05483

DISCUSSION OF WATER ALLOCATION: SUPPLY AND DEMAND RELATIONSHIPS,
South Dakota State Univ., Brookings.
Arthur J. Matson.
Opportunities for Regional Research on Water Resources Problem, pp 57-60, Iowa City, University of Iowa, 1968. 4 p.

Descriptors: *Water allocation (Policy), Water demand, Water supply, Water resources development, Water rights.
Identifiers: Opportunity costs.

In his comment on Dr. Timmon's paper, the author discusses the following points: (1) Closing options may be part of the costs offsetting the benefits assumed from the allocation of water supplies and the investment in water resource development; (2) Preserving flexibility in use and assuring certainty in claiming rewards from investments are conflicting features of development policy; (3) Improvement in the state of knowledge could place choices in allocation under ordinal, if not cardinal, criteria; (4) A challenge for the economist is to generate educational material on issues that will be useful at a level of aggregation that promotes agreement among local people and hence promotes economic allocation of resources. (Winn-Rutgers)
W69-05485

WATER RESOURCE DEVELOPMENT: PUBLIC AND PRIVATE INVESTMENT,
Michigan State Univ., East Lansing.
A. Allan Schmid.
Opportunities for Regional Research on Water Resources and Problems, Iowa City, University of Iowa, 1968, pp 61-78. 18 p, 36 ref.

Descriptors: *Return (Monetary), *Investment, *Resource development, *Resource allocation, Economic efficiency, Economics, Resources, Regional analysis, Interest rate, Profits, Flood control.
Identifiers: *Nonmarginal economics, Surplus crops.

This article is concerned with the problem of how to put water development investments in a context which will help decision makers to make judgments on the major directions in resource use. Comparisons of returns between projects in entirely different branches of economic activity are likely to be less meaningful than comparisons between projects in the same branch. However, solutions to the problems of resource allocation seem to require substantial reallocation of resources among the dif-

ferent branches of economic activity. The problem is further complicated in that the real issue is not which activity has the highest return when considered alone, but what is the proper mix of investments and how does one affect the returns of the other. Here the problem becomes one of coordination and timing of various kinds of human and nonhuman resource development projects. (Winn-Rutgers)
W69-05486

DISCUSSION OF WATER RESOURCE DEVELOPMENT: PUBLIC AND PRIVATE INVESTMENT,
Wisconsin Univ., Madison.
William B. Lord.
Opportunities for Regional Research on Water Resources and Problems, Iowa City, University of Iowa, 1968, pp 79-83. 5 p, 2 ref.

Descriptors: *Resource development, *Investment, Economics, Regional analysis, Planning.
Identifiers: Nonmarginal economics.

The systems analysis approach to problem solving is becoming more common. Many of the traditional approaches of economic analysis, such as the theory of the firm, eliminate by assumption systems effects. Techniques need to be developed for the evaluation of nonmarginal changes. Better empirical tools are also needed for nonmarginal analysis. Economists can contribute to three areas which concern regional research: (1) the delineation of the optimal planning unit, (2) the study of regional institutions, and (3) the evaluation of regional investment alternatives. Water development projects are an aspect of the overall regional development program and hence this article can refer to the problems and issues involved in regional water activities. (Winn-Rutgers)
W69-05487

REGIONAL ECONOMIC DEVELOPMENT AND WATER,
Iowa State Univ., Ames.
Wilbur R. Maki.
Opportunities for Regional Research in Water Resources Problems, Iowa City; University of Iowa, 1968, pp 84-104. 21 p, 2 fig, 5 tab, 17 ref.

Descriptors: *Regional analysis, *Resource development, Distribution patterns, Cities, Industries, Population, Community development, Investment, Water utilization.
Identifiers: *Regional growth stages, Regional economic development, Central areas, Peripheral areas.

A geographic redistribution of population and industry is occurring at a rapid rate. With increased population and economic concentration in central areas, improved access to peripheral areas is a growing concern of both the center and periphery population. Conflicts may develop over water use because water is mainly valued for its income generating effects in the peripheral areas while it is primarily valued as an element supporting area residential activities and amenities in the central area. Metropolitan centers, because of their dominant status in a geographic grouping of subareas, are centers for organizing multi-purpose information systems. Public information on private investment opportunities and social investment requirements is a critical input in the resource development process.
W69-05488

DISCUSSION OF REGIONAL ECONOMIC DEVELOPMENT AND WATER,
Pennsylvania State Univ., University Park.
J. Dean Jansma.
Opportunities for Regional Research in Water Resources Problems, Iowa City, University of Iowa, 1968, pp 105-107. 3 p, 5 ref.

Descriptors: *Regional analysis, Water resources development, Economic efficiency.
Identifiers: Regional growth.

Some research is available on the increase in efficiencies attained through spatial concentration. However, there are private and social costs of amortizing prior investment in the peripheral areas. While it may be advantageous in a national efficiency framework to have programs which require that investments be made in viable growth centers, perhaps we have not considered the cost of absolescence in the nonviable areas. There is no single goal of regional growth. The goal is dependent on whether one is concerned with (1) increasing aggregate regional income, (2) increasing per capita income, or (3) decreasing interregional differences in factor prices. The behavioral patterns are not only different for the three groups but they may be contradictory. The role of water resources in the development pattern has relevance to all of considerations of regional growth mentioned above. (Winn-Rutgers)
W69-05489

DATA SYSTEMS AND INFORMATION RETRIEVAL ADAPTABLE TO WATER RESOURCES,
Department of Agriculture, Washington, D. C.
Paul L. Holm.
Opportunities for Regional Research on Water Resources Problems, pp 108-129, Iowa City, University of Iowa, 1968. 22 p, 2 fig, append.

Descriptors: *Information retrieval, *Data storage and retrieval, Data collections, Data processing, Documentation.
Identifiers: *Data systems, Data base systems, Reference systems, Text processing systems, Data banks, Analytical data systems, Data systems.

Without adequate data the most sophisticated planning and research techniques are useless. Much attention has been given to developing the tools of information retrieval and data systems. The information retrieval systems which have been developed can be classified into three groups: data base, reference and text processing systems. The data contained in a data system provides the basis for developing information. In some systems the data is analyzed by the system, while in others it is not. This difference provides a basis for classifying data into two categories: data banks and analytical data systems. A detailed statement of the content of data systems required in regional water research can be made only after research scientists decide what types of data are required. (Winn-Rutgers)
W69-05490

A DISCUSSION OF DATA SYSTEMS AND INFORMATION RETRIEVAL ADAPTABLE TO WATER RESOURCES,
Pennsylvania State Univ., University Park.
John C. Frey.
Opportunities for Regional Research on Water Resources Problems, pp 130-133, Iowa City, University of Iowa, 1968. 4 p.

Descriptors: *Information retrieval, *Data storage and retrieval, Data collection, Data processing, Documentation.
Identifiers: Data systems.

Data banks and information retrieval programs are developments which help man increase his capacity to recall. If there are limits to the resources that can be used to build data systems and information retrieval programs, care must be taken in selecting inputs of data and information. Advisory panels representing users and potential users from many different walks of life can be used to guide the input selection process. A clue to input priorities may also be obtained from user requests. A problem in the operation of data banks is that some of the data may have limitations or logical use restrictions which are not revealed by the print outs. The full benefit of a central facility may best be realized by establishing satellite collection and distribution stations. This article is relevant to water research data banks and retrieval systems. (Winn-Rutgers)
W69-05491

LONG SWINGS,
Queen's Univ., Kingston (Ontario).
Jon P. Harkness.
Rev Econ and Stat, Vol LI, No 1, pp 94-96, Febru ry 1969. 3 p, 1 tab.

Descriptors: *Regression analysis, Fourier analys Leakage, Frequency.
Identifiers: *Spectral analysis, *Long swings, *H monic regression, *Long cycles, *Trend remov deviation from trend, Trend, Exponential tren Polynomial trend, Lags.

In a recent article, this writer presented the resu of a spectral analysis of a wide variety of historic time series in order to test the existence of lo swings in the Canadian economic experienc While several similar studies had been carried o on the United States data, it was argued that su studies had generally been poorly conceived bo with respect to spectral analysis and to the partic lar version of the long-swing hypothesis bei tested. A new test for long cycles in deviations fro the trend of an economic variable was to be mo compatible with spectral analysis. It is the intent this note to briefly present the findings of a simil test carried out on the United States data. The ha monic regression is discussed as a method of tren elimination. Harmonic regression expresses th given time series as a trignometric polynomial fun tion of time. Spectral analysis has been used ar can be used in many types of water researc problems such as demand studies and water flo analysis. (Loeb-Rutgers)
W69-05498

WELFARE ECONOMICS, ECONOMI GROWTH AND THE CHOICE O TECHNIQUES,
Warwick Univ., Coventry (England).
S. K. Nath.
The Journal of Development Studies, Vol 4, No 2 pp 220-240, Jan 1968. 21 p, 15 ref.

Descriptors: *Economics, *Social value, Socia aspects, Economic efficiency, Welfar (Economics), Value, Resource allocation, Invest ment, Cost-benefit analysis.
Identifiers: *Value judgments, *Criteria Technological efficiency, Economic growth, Sec toral allocation, Rate of turnover criteria, Rate o surplus criteria.

No practical economic problem can be meaning fully discussed without explicitly starting with som social objectives and some idea of their relativ weights. Arguments and criteria which are paraded as technical, economic or non-controversial tests o suitability or efficiency inevitably beg a number o value judgments which need to be made explicit. A times accounts of cost-benefit analysis seem to sug gest that such an analysis must necessarily proceed on the basis of the market value of things; but i logic there is no such necessity. What elements are to be considered as costs and what are to be con sidered as benefits and how they are to be evalu ated are questions which can only be answered by specific social welfare function or statement of given country in a given situation. This article has relevance to water resource studies that utilize the familiar cost-benefit methodology. By calling atten tion to the role of value judgments in these analyses, the article provides a broader perspective to water resource development programs.
W69-05500

THE TENNESSEE VALLEY AUTHORITY: ECONOMIC IMPACT OF ITS COMPREHENSIVE WATER DEVELOPMENT PROGRAM,
George H. R. Taylor.
For 8 volume Proceedings see Vol 2, No 9, Field 06B, W69-03305. International Conference on Water for Peace, Vol 8, May 1968, pp 664-679. Washington, D C: U S Government Printing Office, 16 p.

Descriptors: *Water resources development, Labor, Flood control, Navigation, Electric power,

eforestation, Benefits, Employment, Income, Fer-
lizers, Erosion control, Forestry, Mineralogy,
ecreation, River basins.
lentifiers: *Tennessee Valley Authority, *River
ntrol, Economic program, Industrialization, Job
eation, Farm income, Economic growth,
conomic regions.

his paper analyzes the TVA resources based
conomic program in both its direct and indirect
pects, and in its intra-regional and extra-regional
pects. The problems dealt with are industrializa-
on; employment patterns and wage levels;
engthening of organized labor; personal income;
b creation; expansion of economic and other ac-
ities by state and local entities; farms practices
d farm income and use and cost of electric
wer. These problems are treated as they have
en affected by TVA programs in electric power;
vigation; fertilizer and demonstration farms; ero-
on control; forestry; minerals; recreation; tributa-
development; economic research and coopera-
e planning with non-federal entities. The
levancy of the TVA experience in developing a
er basin's resources base to aid in stimulating
onomic growth, diversity and broadened options
the people of the region is discussed as applica-
e to, (1) other U. S. river basins or economic re-
ons and (2) developing nations.
69-05502

ROCEEDINGS OF THE THIRD ANNUAL MERICAN WATER RESOURCES CON-ERENCE.
nerican Water Resources Association, Urbana,

oceedings of the Third Annual American Water
sources Conference, Nov 8-10, 1967, Urbana,
nois. 669 p.

escriptors: Water, Water quality, Water
ources, Water resources development, Water
y, Water analysis, Water demand, Water
nagement (Applied), Water policy, Water pol-
ion, Economics, Water utilization, Regional
alysis, Planning.

is book contains all the papers presented during
e ten sessions of the Third Annual American
ater Resources Conference. The articles deal
h many aspects concerning water resources in-
ding water quality management and protection,
al and institutional considerations, water
ources planning, and water supply augmenta-
n. Although the articles are primarily concerned
h water problems within the United States, a few
icles consider U. S. participation in international
orts designed to make better use of water.
inn-Rutgers)
69-05508

E INTERINDUSTRY FACTOR-CONTEXT ATRIX: AN APPLICATION FOR THE ANAL-IS AND PROJECTION OF REGIONAL ATER REQUIREMENTS,
lifornia Univ., Berkeley.
erard M. Lofting, and H. Craig Davis.
oceedings of the Third Annual American Water
sources Conference (American Water
sources Assn: Urbana, Ill), 1967, pp 294-303. 10
fig.

escriptors: *Water requirements, *Cost-benefit
alysis, *Input-output analysis, Forecasting, Re-
nal analysis, Mathematical models, Leontief
dels, Planning.
ntifiers: Interindustry analysis, Interindustry fac-
-content matrix, Water content matrix.

nefit-cost analysis is often used to evaluate the
tability of a given project. This analysis is in-
iably a form of partial equilibrium analysis with
tain gross assumptions made about the growth
effective demand and with the assumption that
er factors remain unchanged. For the greatest
iciency in investment planning, it appears neces-
sary to begin with the structure of the economy and its expected growth and then work back to the project on an iterative basis rather than begin with the project and let the economy structure itself around the project. Quantitatively, the effect of a unit change in final demand can be traced through the typical interindustry table and the effects on interindustry purchases and gross output can be analyzed for any sector. Analysis in this article applies to a region that is relatively self-contained. Ultimately the multiregional approach to water planning problems must be faced. (Winn-Rutgers)
W69-05509

DISTRIBUTED LAGS: A SURVEY,
Chicago Univ., Ill.
Zvi Griliches.
Econometrica, Vol 35, No 1, pp 16-49, January 1967. 34 p, 6 fig, 68 ref.

Descriptors: Regression analysis, Markov processes, Monte Carlo method.
Identifiers: *Distributed lags, Lag generation function, Lag operators, Pascal distribution, Serial correlation, Identification, Adaptive expectations model.

Several recent generalizations of the geometrically declining distributed lag model are reviewed and the associated statistical estimation problems are discussed. Attention is drawn to the practical difficulties of distinguishing between different lag schemes and models on the basis of usual economic data. This leads to a discussion of the more general problem of estimating mixed autoregressive schemes with serially correlated disturbances and a review of the existing theoretical rationale for the various suggested distributed lag models. In view of the extensive use of distributed lags in econometrics, this article might provide the researcher in water problems with sufficient insight so as to allow the use of distributed lags in many empirical problems in water research.
W69-05514

RATIONAL DISTRIBUTED LAG FUNCTIONS,
California Univ., Berkeley.
Dale W. Jorgenson.
Econometrica, Vol 32, No 1, pp 135-149, January 1966. 15 p, 15 ref.

Descriptors: *Approximation method, Regression analysis, Probability, Estimating.
Identifiers: *Distributed lag functions, Parameters, Generating function, Pascal distributed lag, Koyck method.

The purpose of this paper is to introduce a class of distributed lag functions having the properties that an arbitrary distributed lag function may be approximated to any desired degree of accuracy by a member of this class and that the number of parameters required for a satisfactory approximation is less than that required for an equally good approximation by a finite distributed lag function. Such a technique might prove useful when investigating water problems via econometric methods where water flow simulations and regressions may be expressed in distributed lag form.
W69-05515

FACTOR ANALYSIS AND REGRESSION,
Illinois Univ., Urbana.
John T. Scott, Jr.
Econometrica, Vol 34, No 3, pp 552-562, July 1966. 11 p, 2 tab, 27 ref.

Descriptors: *Regression analysis.
Identifiers: *Factor analysis, *Multicollinearity, Indexes, Intercorrelation, Principal component analysis, Errors in variables, Statistical tests.

The underlying hypothesis in factor analysis is that a set of related variables can be adequately described by a set of factors less in number than the set of variables. The procedures of factor analysis obtain the values for the factors and the values for coefficients of regression where the variables are regressed upon the factors. These coefficients of regression are referred to in the psychological and factor-analysis literature as factor loadings or factor coefficients. Factor analysis has been used very little by economists. Some economists have used the first principal component of factor analysis in the construction of indexes. Factor analysis appears to be a particularly appropriate tool in the economic field where many 'independent' variables have high intercorrelation and where there are errors in all variables. Stochastic linear equations can be obtained from factor analysis which give better coefficients than do least squares regression equations. As such, the above method can replace or improve traditional least squares approaches to water research problems. The paper presents the factor model and its assumptions, provides references for stochastic methods of factors analysis and suggests test statistics. (Loeb-Rutgers)
W69-05517

AUTOCORRELATION BETWEEN FIRST DIFFERENCES OF MID-RANGES,
Birmingham Univ. (England).
H. E. Daniels.
Econometrica, Vol 34, No 1, pp 215-219, January 1966. 5 p, 6 ref.

Descriptors: Average.
Identifiers: *Autocorrelation, *First differences, *Mid-ranges, Spurious correlation.

It is known that if in a time series constructed from independent increments the individual items are replaced by, say, monthly averages, spurious correlation is introduced between successive first differences of the averages. The corresponding correlation for other statistics such as the mid-range is studied here. It is shown that the effect is even more pronounced when mid-ranges are used in place of averages. The danger of misleading conclusions is therefore greater, not less, when mid-ranges are used in place of averages. This problem exists for any empirical water analysis employing first differences and/or averages of increments as variables.
W69-05520

THE ESTIMATION OF MARGINAL PRODUCT FROM A COBB-DOUGLAS PRODUCTION FUNCTION,
New South Wales Univ., Kensington (Australia).
P. R. Fisk.
Econometrica, Vol 34, No 1, pp 162-172, January 1966. 11 p, 5 tab, 8 ref.

Descriptors: *Marginal productivity, Sampling.
Identifiers: *Marginal product, *Cobb-Douglas Production Function, Sampling properties, Normally distributed errors, Bias, Precision, Variance matrix.

The sampling properties of the usual estimator of marginal product from a Cobb-Douglas production function are studied under the assumption of normally distributed errors. The asymptotic normality of these estimators is demonstrated and certain special cases are considered for which the asymptotic distribution is particularly simple. An alternative estimator of marginal product is suggested which has both a smaller bias and greater precision than the usual estimator. Estimators of the variance-covariance matrix of all marginal product estimators mentioned are given. These are accurate to order n raised to the -1. Production functions are necessarily implicit in any investigation of water supply and water costs and represent in economic theory an important aspect of the link between theoretical economics and water research. The results of this paper have relevance to the properties of water production and cost studies.
W69-05521

ECONOMIC ALTERNATIVES,
California Univ., Berkeley.

For primary bibliographic entry see Field 05G.
W69-05528

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

ECONOMICS AND FINANCING OF IRRIGATION PROJECTS,
Ministry of Irrigation and Power (India).
K. P. Mathrani.
For the 8 Volume Proceedings, see Vol 2, No 9, Field 06B and W69-03305. Int Conf on Water for Peace, Wash, D C, Vol 7, pp 412-419, 1968. 8 p, 1 tab.

Descriptors: *Economics, *Irrigation, *Expenditures, *Costs, Cost-benefit ratio, Cost repayment, History, Long-term planning, Future planning (Projected), Government finance, Irrigable land.
Identifiers: *India, *Irrigation capital, *Irrigation potential.

Since 1950 when India embarked on a planned economy, irrigation works are begun by State Governments only with the approval both of the Government of India and the Planning Commission. During the three 5-year plans, expenditures on irrigation projects have amounted to 12,500 million rupees ($1,670 million) as compared to 1,560 million rupees ($210 million) in the whole pre-plan period. The ultimate irrigation potential of the country is about 200 million acres, and the more than half is expected to be developed by the end of the fourth Plan (1971). To develop the remaining potential, and investment of about 60,000 million rupees will be necessary. These projects are likely to be more difficult and proportionately more expensive than ones executed in the past. The paper reviews briefly the history of irrigation development in India, methods used in calculating cost-benefit ratios, and in obtaining irrigation revenues. (Vorhis-USGS)
W69-05221

A STUDY OF THE EFFECT OF TAXATION ON THE SIX PRIVATE OR QUASI-MUNICIPAL WATER UTILITIES IN RHODE ISLAND,
Rhode Island Univ., Kingston. Water Resources Center.
Marvin Pitterman.
Completion Report Washington, D. C. June, 1966, 21 pp. OWRR Project A-005-RI.

Descriptors: *Water utilities, *Taxes, Consumer.
Identifiers: *Rhode Island, Franchise tax, Revenue.

The important conclusions reached in this study were: (1) Taxes do not detract from the private or quasi- municipal water utilities development. (2) Utilities taxation does not lessen the quality of service to the consuming public. (3) The private or quasi-municipal water utility bears the impact of utility taxation. (4) The incidence of utility taxation is borne by the consuming public. (5) Rate increases must be slightly higher due to utility taxation. (6) The Utility Commission protects the consumer from unwarranted rate increases. (7) The utility taxation does not prevent water utilities from servicing expanding areas.
W69-05316

DISCUSSION OF WATER RESOURCE DEVELOPMENT: PUBLIC AND PRIVATE INVESTMENT,
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 06B.
W69-05487

PROCEEDINGS: WATER POLICY PRICING CONFERENCE,
California Univ., Los Angeles.
Arthur F. Pillsbury.
Proceedings: Water Policy Pricing Conference, California University at Los Angeles, March 19, 1968. 109 p.

Descriptors: *Pricing, *Water rates, Public utilities, Utilities, Water policy, Economics, Legal aspects, Welfare (Economics), Financing, Cost allocation.
Identifiers: Accounting.

This book contains the seven papers and panel discussion presented at the Water Pricing Policy Conference sponsored by the Advisory Council of the Water Resources Center at the University of California. The main conclusion of this conference is that planners, economists, lawyers, auditors, financial consultants, and consumers should all be involved in the development of equitable pricing policies. Improvements are needed in the methods of policy development. Several suggestions to this problem were offered by the participants of the conference. (Winn-Rutgers)
W69-05492

LEGAL CONSTRAINTS IN WATER PRICING POLICY,
Martin McDonough.
Proceedings: Water Pricing Policy Conference, California University at Los Angeles, pp 42-50, March 19, 1968. 9 p.

Descriptors: *Legal aspects, *Pricing, *Water rates, Judicial decisions, Public utilities, Water distribution (Applied), Discriminatory pricing.
Identifiers: *Rate level, *Rate structure.

Discussion of water pricing is frequently divided between rate level and rate structure consideration. The local public body exercising the management function of rate making will in most cases be strongly influenced by the public utility tradition of raising at least enough money from rates to cover all the costs pertaining to the water system. The law generally does not determine for the policy maker what proportion of the necessary funds he must raise by rates, as distinguished from other sources of revenue. With respect to rate structure, the extent to which different rates may be charged to different classes of customers, the legal situation is more complex. Where the difference in rates is to achieve social objectives, to meet competition or to reflect some other noncost related consideration, most legal questions arise as to whether or not the discrimination is due. (Winn-Rutgers)
W69-05493

THE ACCOUNTANT'S VIEWPOINT ON WATER PRICING POLICY,
Peat, Marwick, Mitchell and Co., San Diego, Calif.
Herbert L. Beckett.
Proceedings: Water Pricing Policy Conference, California University at Los Angeles, pp 51-57, March 19, 1968. 7 p.

Descriptors: *Water rates, *Pricing, Public utilities, Utilities, Cost allocation, Costs, Water policy.
Identifiers: Accounting.

The accountant is involved with water pricing policies when rendering a service to management in connection with the initial financing of water projects, the long range financial planning and the annual budgeting of anticipated revenues and expenditures. The first element of water pricing policy is the determination of the total costs of the public water agency. Then there must be a determination of the total costs which should be recovered from the water users. Costs must be allocated to many different classes of water users. The costs of providing water to each class of users is the basic guide to water pricing. However, the benefits received by each user, his ability to pay and the overall public interest must also be considered. The final decisions on water pricing policy are generally made by public officials. (Winn-Rutgers)
W69-05494

THE CONSUMER'S VIEWPOINT AND POLICY DECISIONS,
California Univ., Los Angeles.
Hans H. Doe.
Proceedings: Water Pricing Policy Conference, California University at Los Angeles, pp 74-8, March 19, 1968. 9 p.

Descriptors: *Pricing, *Water rates, Californi, Costs, Benefits, Cost allocation.

Water pricing decisions determine who shall pa the water agency costs. Water boards should recoy nize and follow the principle that the beneficiar should be required to repay the agency for the co of his benefits. The specific rules required to impl ment the principle will vary with the type of agenc and existing conditions, but recognition of the prir ciple makes easier the formulation of rules that wi result in a rate structure that is at least as fair as cir cumstances permit. The basic rules to implemer the principle are: (1) identify each benefit cor ferred by the agency, (2) determine the cost c each benefit, (3) identify the beneficiaries, and (4 apportion each group its share of the cost of th benefit. (Winn-Rutgers)
W69-05495

STATEMENT,
University of Southern California, Los Angeles.
J. Morley English.
Proceedings: Water Pricing Policy Conference California University at Los Angeles, pp 86-91 March 19, 1968. 6 p, 1 fig, 6 ref.

Descriptors: *Pricing, *Water rates, Marginal cost Legal aspects, Investments, Marginal benefit Economics, Taxes.
Identifiers: *Marginal cost pricing, Accounting Pareto optimal price.

It should be a relatively simple matter to establish appropriate laws once the fundamental principles for pricing water are determined. The economist's model for a marginal cost basis for pricing is irrefutable. The difficulty is to impute a valid price based on a correct evaluation of all the benefits. Furthermore, the determination of costs is not easy. The economist's model implicitly assume that the marginal cost function is continuous. In reality, introduction of new facilities introduces discontinuities. To develop a marginal cost curve without discontinuities, some basis must be provided for the allocation of capital costs over time. A Pareto price is an optimal price, given a state of wealth for each consumer. For a different wealth distribution a different optimum price will result. Thus, there is no one price for water which is optimal in an economic system in which wealth distribution can change. (Winn-Rutgers)
W69-05497

CAPITAL FORMATION AND GOVERNMENT CAPITAL POLICY IN DEVELOPING ECONOMIES,
Tel Aviv Univ. (Israel).
Haim Ben-Shahar.
The Journal of Development Studies, Vol 4, No 1, pp 86-96, Oct 1967. 11 p, 1 fig.

Descriptors: *Capital, *Loans, Financing, Investment, Governments, Risks, Foreign countries, Resource allocation.
Identifiers: *Underdeveloped countries, *Capital formation, Neutral loan policy, Selective loan policy, Discriminatory loan policy.

In many developing countries governments intervene in the capital market in order to encourage savings and investments. It is often claimed that by this intervention the governments distort resource allocation. The purpose of this paper is to suggest a rationale for such intervention. The main justification for government activity is to utilize potential economies of scale and net benefits of a developed finance system. This can be achieved where the government acts as a neutral financial intermediary. Additional social gain can be achieved where the government intervenes in the process of capital allocation through an active loan policy. As long as the social and private considerations concerning

optimum rate of economic growth and real in-
ne allocation between successive generations
incompatible, the intervention may increase
l welfare. This article is relevant to policy
kers who must decide to what extent water
urce development should be left to private en-
rise.
9-05518

**NOTE ON THE DUAL PRICES OF INTEGER
OGRAMS,**
nceton Univ., N. J.
er E. Alcaly, and Alvin Y. Klevorick.
nometrica, Vol 34, No 1, pp 206-214, January
6. 9 p, 1 fig.

criptors: *Linear programming, Prices, Con-
ints, Costs, Profit.
tifiers: *Dual prices, *Integer programs, Bau-
-Gomory method, *Free goods, Nonzero
es, Optimal solution, Output, Subsidy.

n earlier article Baumol and Gomory consider
problems created by the dual prices of an in-
r programming problem. They present a
hod for recomputing these dual prices so as to
edy some of these defects. This paper proposes
lternative view of the Baumol-Gomory recom-
ation process, which enables a reconciliation of
integer and linear programming properties.
reover, the authors propose a further alteration
ne Baumal-Gomory method that can be applied
ases in which nonzero prices are imputed the
goods in order to remove this property. The
ors also show that even this method may not be
rely satisfactory in coping with the free goods
lem. This method may be helpful when in-
igating the public good nature of water and in
mpting to assign implicit values and prices for
r in certain of its uses.
9-05523

. Water Demand

**FUNDAMENTAL ROLE OF WATER IN
'CASSA PER IL MEZZOGIORNO'
ELOPMENT PROGRAMS FOR SOUTHERN
LY,**
a per il Mezzogiorno (Italy).
entice d'Accadia.
the 8 Vol Proc, see Vol 2, No 9, Field 06B and
9-03305. Int Conf on Water for Peace, Wash, D
ol 6, pp 181-191, 1968. 11 p, 2 fig, 2 tab.

criptors: *Water management (Applied),
ltiple-purpose projects, *Water resources
lopment, Developed waters, Project purposes,
mum development plans, River basin develop-
t, Water supply, Evapotranspiration.
tifiers: Italy, Cassa per il Mezzogiorno.

Italian government in 1950 established the
sa per il Mezzogiorno' an agency for the
lopment of the South and the Islands of Italy
ut 43% of Italy) with its main objective the
ion of water supply problems. Only 15% of the
all occurs in the summer, loss by evapotrans-
ion is high, short independent river courses, do
ave large basins, and impermeable and steep
areas cause rapid runoff to the sea. Surface-
r development by 1966 included 26 storage
s constructed or underway with 1,500 million
storage capacity' 27 others with 2,000 million
n were in the planning or study stage. The
ndwater program included study of 1,650,000
electrical and seismic study of more than
000 ha, census of 15,000 wells, drilling of 531
wells with total footage of 45,872 m, and
ping tests on 335 wells. Between 1953 and
, 115,000 measurements were made on 9,000
gs, with 1,177 springs measured periodically.
Cassa per il Mezzogiorno has in the past 15 yr
ght 620,000 ha under irrigation, furnished
r for more than 15 million people, provided
r supply needs for 40 industrial areas, and
to supply about 400 cu m per person per year
980. (Vorhis-USGS)
-05216

WATER ALLOCATION: SUPPLY AND DEMAND RELATIONSHIPS,
Iowa State Univ., Ames.
For primary bibliographic entry see Field 06B.
W69-05483

DISCUSSION OF WATER ALLOCATION: SUPPLY AND DEMAND RELATIONSHIPS,
South Dakota State Univ., Brookings.
For primary bibliographic entry see Field 06B.
W69-05485

INCREASING OR DECREASING RETURNS TO SCALE IN THE CONSTANT ELASTICITY OF SUBSTITUTION PRODUCTION FUNCTION,
Technical Univ. of Budapest (Hungary).
Gyorgy Szakolczai, and Janos Stahl.
Rev Econ and Stat, Vol 21, No 1, pp 84-90, February 1969. 7 p, 5 tab, 17 ref.

Descriptors: Homogeneity, Capital, Labor, Return to scale.
Identifiers: *Increasing returns to scale, *Decreasing returns to scale, *CES production function, Cobb-Douglas production function, Marginal rate of substitution.

An attempt has been made to develop an increasing or decreasing returns to scale CES production function, and to measure the degree of homogeneity, the marginal rate of substitution and the elasticity of substitution and capital and labor embodied as well as disembodied technical progress. The best results have been obtained with a labor series uncorrected for quality changes. With these labor data, the rate of returns to scale is 1.5, the rate of capital-embodied, and disembodied technical change 5 and 1.4 per cent yearly, respectively, and for the elasticity and the 1930 value of the marginal rate of substitution 0.8 and 12, respectively. A closer scrutiny of the findings revealed, however, that the results obtained for the rate of returns to scale depend on the method employed to correct for cyclical changes. It seems impossible to obtain a reliable measure for this parameter without having an independent estimate for changes in the actual utilization of the capital stock. Production functions of this nature might be helpful in evaluating the production of water and similar estimation and theoretical problems apply to analyses of water production functions. (Loeb-Rutgers)
W69-05505

EFFECT OF THE LENGTH OF THE TIME PERIOD ON SERIAL CORRELATION,
Canterbury Univ., Christchurch (New Zealand).
A. C. Rayner.
Rev Econ and Stat, Vol LI, No 1, pp 107-108, February 1969. 2 p, 1 tab.

Descriptors:
Identifiers: *Time period, *Serial correlation, Error term, Misspecification, Random factors, Biased estimates, Lagged error term, Autocorrelation.

There has been an increase recently in the use of econometric models based on periods of less than one year. Part of this is the result of the belief that the short period model more correctly describes economic behavior. With the use of short period models, there is often a tendency for the estimated serial correlation of the error terms to be positive. However, while the use of short period data may give rise to serial correlation of the errors this can be overcome by conventional serial correlation correction methods on the model being estimated. Suppose that due to a lack of the necessary observations, a model which is thought to apply in the short period has to be estimated using long period data. This procedure is likely to mask any short period serial correlation there might be so that the form of the model cannot be corrected as suggested above. To the extent that the estimated model does not include the lagged error term, it is an incorrect representation of short period economic behavior. This article has relevance to time series studies of water demand and also to simulation models of water flow generated from a time series stochastic process. (Loeb-Rutgers)
W69-05506

THE ECONOMICS OF WATER ALLOCATION IN UTAH,
Utah Univ., Salt Lake City.
Iver E. Bradley, and J. P. Gardner.
The Economics of Water Allocation in Utah, Salt Lake City, Utah University, December 1968. 81 p, 13 tab, 1 chart, 16 ref, append. OWRR 14-01-0001-827.

Descriptors: *Input-output analysis, *Utah, *Water allocation, *Income, Welfare economics, Marginal income, Economics, Mathematical models, Resource allocation, Water demand, Water policy, Employment, Social impact, Agriculture, Industries, Governments, State government.
Identifiers: Multiplier, Marginal value, Marginal analysis.

This study on the economics of water allocation in Utah using input-output analysis has generated two sets of estimates: (1) estimates of the (joint) marginal value (in terms of income and employment) of water, and (2) estimates of the increase in the demand for water intake for the state as a whole and for its individual sectors. The methodology behind these estimates was to treat the state as an integrated, homogeneous economic entity whose function is to maximize welfare (measured preferably in terms of household income) by the appropriate allocation of resources. The state's job is to sense the profile of future demand that is preferred by the market system, and then to allocate the water resources in a way that ensures that the gap between actual final demand and the anticipated final demand is as small as possible. According to this study, the marginal income value of water to the state is lowest for the agricultural sectors. The relative values of water in different industry sectors are considered. (Winn-Rutgers)
W69-05507

THE INTERINDUSTRY FACTOR-CONTEXT MATRIX: AN APPLICATION FOR THE ANALYSIS AND PROJECTION OF REGIONAL WATER REQUIREMENTS,
California Univ., Berkeley.
For primary bibliographic entry see Field 06B.
W69-05509

AN ALTERNATIVE PROOF OF HANNAN'S THEOREM ON CANONICAL CORRELATION AND MULTIPLE EQUATION SYSTEMS,
Thomas J. Watson Research Center, Yorktown Heights, N. Y.; and Ohio State Univ., Columbus.
Gregory C. Chow, and D. K. Ray-Chaudhuri.
Econometrica, Vol 35, No 1, pp 139-142, January 1967. 4 p, 6 ref.

Descriptors: Regression analysis.
Identifiers: *Hannan's Theorem, *Canonical correlation, *Multiple equation systems, Simultaneous equations, Maximum likelihood, Generalized variance ratio.

This proof of a theorem of E J Hannan on the estimation of parameters in simultaneous stochastic equations emphasizes the equivalence between maximum likelihood and generalized variance ratio. It includes a proof of a theorem on maximizing the ratio of two determinants det ANA/det AMA with respect to A, and develops the restrictive assumption of Hannan's theorem in relating a simultaneous equations system and canonical correlation theory. This article would be relevant for attempts to develop a stochastic simultaneous model for water demand and use.
W69-05511

USE OF THE DURBIN-WATSON STATISTIC IN INAPPROPRIATE SITUATIONS,
Stanford Univ., Palo Alto, Calif.

Marc Nerlove, and Kenneth F. Wallis.
Econometrica, Vol 34, No 1, pp 235-238, January 1966. 4 p, 1 tab, 5 ref.

Descriptors:
Identifiers: *Durbin-Watson statistic, *Serial correlation, Lagged endogenous variables, Autoregressive scheme, Asymptotic bias, Autocorrelation.

In recent years the Durbin-Watson statistic has been used uncritically to test for serial correlation in the residuals of relationships containing lagged endogenous variables which are estimated by single or simultaneous equations methods. When lagged endogenous variables are included in an equation estimated by ordinary least squares, however, the Durbin-Watson statistic is asymptotically biased towards 2 (the value which it should have if no serial correlation is in fact present). It is doubtful, therefore, that the statistic should be used either to test for serial correlation in the residuals or to provide any indication of the extent of such correlation when the estimated equation contains lagged values of any endogenous variable. This property should be known when econometric methods are applied to water problems where the estimating equation contains lagged endogenous variables. This may occur in empirical analyses of water demand.
W69-05516

THE TYPICAL SPECTRAL SHAPE OF AN ECONOMIC VARIABLE,
Nottingham Univ. (England); and Stanford Univ., Palo Alto, Calif.
C. W. J. Granger.
Econometrica, Vol 34, No 1, pp 150-161, January 1966. 12 p, 5 fig, 11 ref.

Descriptors: Stability, Control, Frequency.
Identifiers: *Spectral shape, *Spectral analysis, *Economic variable, *Power spectra, Business cycles, Model building, Trend, Covariance stationary.

In recent years, a fairly large number of power spectra have been estimated using economic data. The almost unanimous result of these investigations is that the vast majority of economic variables, after removed of any trend in mean and seasonal components, have similarly shaped power spectra. It is the purpose of this paper to illustrate this result and to discuss briefly its implications both for economic theory in general and for economic model building in particular. Spectral methods are based upon the idea of the decomposition of a stochastic process into a number of orthogonal components, each of which is associated with a 'frequency.' Such a decomposition is always possible for processes that are 'covariance stationary.' The power spectrum records the contribution of the components belonging to a given frequency band to the total variance of the process. If a band contributes a large portion of the total variance it may be considered to be important compared to a band which contributes a smaller amount to the variance. The spectral method can potentially be quite useful to the researcher when applying econometric techniques to water problems, and in particular to empirical studies of water demand. (Loeb-Rutgers)
W69-05522

6E. Water Law and Institutions

A STATE VIEWPOINT ON RIVER BASIN PLANNING,
New York State Dept. of Conservation, Albany. Div. of Water Resources.
For primary bibliographic entry see Field 06B.
W69-05209

THE ORGANIZATION OF VENEZUELA FOR THE UTILIZATION OF ITS WATER RESOURCES (SPANISH),
Ministry of Public Works (Venezuela). Dept. of Hydraulic Works.
Francisco G. Aguerrevere.
For the 8 Volume Proceedings, see Vol 2, No 9, Field 06B and W69-03305. Int Conf on Water for Peace, Wash, D C, Vol 1, pp 369-382, 1968. 14 p.

Descriptors: *Water resources development, *Optimum development plans, *Governments, Water requirements, Water resources, Legislation, Planning, Irrigation, Water utilization.
Identifiers: Venezuela.

Venezuela's institutional structure for utilization of the country's water resources is characterized by the multiplicity of organizations having a part in it. At the national level, there are several Ministries and independent agencies, each with its varied internal organization, which in many cases makes it difficult to coordinate activities toward a possible common action in a given region. There has been a great deal of concern over finding a solution to the problem of institutional organization. It appears from the study of these conditions that there is no single solution for all cases and that each country must seek its own. In the case of Venezuela, some partial progress has been achieved, above all in the use of water resources for farming purposes, this being the field where the utilization of such resources is most complex and where, therefore, the highest relative gains have been made since 1960, when the Venezuelan Agrarian Reform Law was enacted. However, from the national standpoint the organization continues to be the same as before, with separate offices for each use. In order to be able to improve the institutional organization, it is necessary to revise and modernize the laws under which it operates. In Venezuela this problem has been deferred far too long. Legislation in this field is scattered and in many cases contradictory, which calls for a coherent body of laws befitting the needs of the country and the realities of the 20th century. (Knapp-USGS)
W69-05220

A LAWYER LOOKS AT WATER RESOURCE ECONOMICS,
Missouri Univ., Columbia.
Donald R. Levi.
American Journal of Agr. Econ., Vol 51, No 1, pp 182-183, Feb 1969. 2 p.

Descriptors: *Institutional constraints, *Water law.

The legal constraints on allocation and use of water resources make letter-perfect case studies which may result in the creation of policy. Thus, the water resource economist is in a position to help shape future policies in regard to water resources. Two roles exist for the economist interested in systems of water law: (1) to identify legal constraints; and (2) to eliminate such constraints. Several reasons exist why water resource economists have not successfully fulfilled such roles. They are the tendency to criticize without accompanied constructive alternatives; selecting a forum for research that is not read by legislators; the tendency to ignore political feasibility; and the failure to bridge the communications gap. (Grossman-Rutgers)
W69-05292

ROLE OF STATE GOVERNMENTS IN U. S. WATER MANAGEMENT,
Dwight F. Metzler.
For eight volume Proceedings see Vol 2, No 9, W69-03305. International Conference on Water for Peace, 1967, Washington: U. S. Gov't. Printing Office, Vol 5, pp 402-406, 1968. 5 p.

Descriptors: *Administration, *State governments.

The basic responsibility for managing water is carried by the state. These responsibilities of the state are for making water available to support the maximum economic development, for preventing water pollution, for protecting rights to water, and for allocating water among competing uses. A survey of the participation by various states in water management show that some states have programs in (1) basic data collection, (2) public education, (3) implementing legislation, (4) planning, and (5) policy development. The progressive states attemp carry out their responsibilities through c cooperation between the legislative and execu departments of state government. (Grossman-gers)
W69-05293

WATER RESOURCES POLICY AND POL CAL INSTITUTIONS.
Federal Council for Science and Technol Washington, D. C.
For primary bibliographic entry see Field 06B.
W69-05295

WATER LAW, POLITICS, AND ECONOM OUR COMPLEX WATER LAWS AND WA USE CUSTOMS,
Oregon State Univ., Corvallis. Water Resou Research Inst.
Chapin D. Clark.
Oregon State University, Seminar proceedi July 1965, pp 5-20. 16 p.

Descriptors: *Riparian rights, *Appropriat *History, Judicial decisions, Legislation, lands, Water supply, Water users, Water util tion, Droughts, Administration, Oregon.

The report summarizes the water law which r lates private rights to the use of surface wate describes the riparian doctrine, which is a bod principles of common law developed in the wa abundant eastern United States. Two basic theo of the doctrine are identified. The doctrine is il trated with a hypothetical court case. Final ob vations about the riparian doctrine include its definiteness, its recognition of only two conflic parties rather than needs of all water users, pro tion of investments, waste of particular water s plies, and arbitrary discrimination against cert uses. Many eastern states adhere to the ripa doctrine, but severe droughts cause many to er other legislation. The water-short West needec establish certainty of water rights. Much of its tory concerns modification or rejection established riparian principles. The 'California d trine' is extensively described. 'California doctri states recognize both riparian and appropri rights in varying degrees. 'Colorado doctrine' st rejected riparian rights and recognize only propriation rights. Elements of an appropriat right, and characteristics and administrat aspects of the appropriation doctrine described. Progressive modification of the ripar doctrine in Oregon is discussed extensively, incl ing Oregon's Supreme Court decisions and 'Wa Code' of 1909. (Gossen-Chicago)
W69-05296

WATER LAW, POLITICS, AND ECONOMI FEDERAL CONTROL OF WAT RESOURCES,
Oregon State Univ., Corvallis. Water Resour Research Inst.
Chapin D. Clark.
Oregon State University, Seminar proceedin July 1965, pp 21-41. 21 p.

Descriptors: *Federal jurisdiction, *Judicial de sions, *Water resources, Legal aspects, Naviga waters, Non-navigable waters, Proprietary pow State jurisdiction, Federal-state water rights c flicts.
Identifiers: *Federal constitution, Federal-priv claimant water rights conflicts.

The report discusses the constitutional sources the federal government's authority to develop, u ize, and conserve water resources and certain lar mark decisions of the U. S. Supreme Court. Pow over the nation's water resources is founded up the general powers expressly delegated to C gress, e.g., under the Commerce Clause and t Property Clause of the Constitution. The report lates the history of Congress' commerce pow Constitutional dictates and Supreme Court ca

used to extensively discuss federal control of igable and non-navigable waters, the expanding ncept of navigability, the effect of exercising nmerce power upon non-federal interests, and proprietary power of Congress. Constitutional rces of authority for water legislation other than Commerce and Property clauses include the r Power, Treaty-making Power, and the General lfare Clause. The discussion reveals a 19th cen- legacy of navigation servitude of private in- sts to the nation and state laws governing ate water rights. It illustrates 20th century eral-state conflicts and federal-private claimant flicts, as the federal government becomes in- singly active in resource matters. he report nts to the fact that our legal structure is in- quate for today's problems. (Gossen-Chicago) 9-05297

OCEEDINGS-SYMPOSIUM ON BETTER TER AND SEWER SERVICES FOR SMALL MMUNITIES IN NORTH CAROLINA.
th Carolina Univ., Chapel Hill. Water ources Research Inst.
primary bibliographic entry see Field 03D.
9-05312

E ORIGIN AND DEVELOPMENT OF THE TERWAYS POLICY OF THE UNITED TES,
onal Waterways Conference, Inc., Washing- D. C.
primary bibliographic entry see Field 04A.
9-05338

GAL ASPECTS OF THE SMALL TERSHED PROGRAM IN IOWA,
a Univ., Iowa City. Agricultural Law Center.
primary bibliographic entry see Field 04D.
9-05339

'SHORE PROSPECTING AND MINING VS OF THE UNITED STATES,
ie J. Goodier.
ng Engineering, Vol 20, No 7, pp 152-153, 1968. 2 p, 1 tab, 1 chart.

criptors: *Continental shelf, *Mining, nerals, *Boundaries, International law, Oceans, ed States, Federal government, Tariffs, physics, Core sampling, Oil, Submerged land State governments, Leases, Financing, Legal cts.
tifiers: Subaqueous land, Territorial sea.

International Law of the Continental Shelf ex- s the boundary of coastal nations to the edge of ontinental shelf. The outer boundary now ex- s to any depth that can be mined by advanced ng technology. Minerals mined beyond the inental shelf of the United States are con- ed 'imported' and subject to tariffs if brought into the country. The federal government rols all underwater land from the outer boun- of the territorial sea to the edge of the con- tal shelf. Permits will be difficult to obtain if g equipment or explosives are used. After a pecting survey has been completed, a request n offshore land lease must be submitted. The ng is competitive, and the original prospector d be outbid. Separate leases are issued for gas, nd minerals, so the same land could be leased veral organizations. The government is now ing the sea floor into 5,760 acre lots. These o be leased, with rent payable in advance. The nerged Land Act of 1933 grants to the coastal the right to manage the lands and natural rces of the sea floor up to three statute miles the coast. (Shevin-Fla)
-05340

SMAN-DRAKE V TOWBOAT M/V HUGH C KE, BARGE CHEM 2 (ACTION FOR AGES CAUSED BY A TOWBOAT CAST ADRIFT BY A HURRICANE).

289 F Supp 700-707 (E D La 1968).

Descriptors: *United States, *Hurricanes, *Vessels, *Cofferdams, Judicial decisions, Damages, Rivers, Ships, Navigation, Transportation, Legal aspects.
Identifiers: Acts of God, Proximate cause.

Plaintiffs allege that their cofferdam, a fixed object, was struck and damaged by the tug Blaske and one of the barges in tow as they floated down the river and that the collision was caused entirely by the fault of the tug Blaske and her crew. The defense was on the grounds of laches, unavoidable accident, act of God, and lack of negligence. The lines securing the tug and her tow to the shore had been separated when struck by other barges. These barges had themselves been separated from the shore by a hurricane. The court concluded that the evidence required the conclusion that the damage to the cofferdam was the result of an act of God over which the captain of the vessel had no control since it appeared that the captain, in securing his vessel, took all precautions commensurate with the information at hand or available. Verdict was for the defendant. (Childs-Fla)
W69-05341

DELAWARE RIVER BASIN COMPACT.
For primary bibliographic entry see Field 04A.
W69-05342

DELAWARE RIVER BASIN COMPACT.
For primary bibliographic entry see Field 04A.
W69-05343

DELAWARE RIVER BASIN COMPACT.
For primary bibliographic entry see Field 04A.
W69-05344

DELAWARE RIVER BASIN COMPACT.
For primary bibliographic entry see Field 04D.
W69-05345

RIPARIAN LANDS.

N J Stat Ann secs 12:3-1, 12:3-71 (1968).

Descriptors: *Riparian lands, *Beds under water, *Ownership of beds, *New Jersey, Riparian rights, Legislation, State governments, Tidal waters, Land tenure, Land usage, Landfills, Piers, Bulkhead lines, Docks, Hudson River, Real property, Local governments, Investigations, Surveys, Rights-of-way.
Identifiers: *Commerce and Navigation Board, Dept of Conserv and Economic Development, New York Bay, Kill von Kull, Raritan Bay, Newark Bay, Palisades.

The New Jersey Legislature has given the Commerce and Navigation Board authority over all submerged lands within certain exterior bulkhead and pier lines bounding the tidewaters adjacent to the New Jersey coastline. The Board now has the power to make surveys, leases and grants of submerged lands controlled by the state. Navigable waters beyond the exterior lines are protected. Grants of submerged lands may be made by the Board to political subdivisions within the state. Confirmatory leases and grants may be made to riparian owners claiming title under prior authority. The state may re-enter land held by a delinquent lessee as provided in the act. Mooring of boats to riparian lands is restricted and violations may be acted upon by the Board. The state may acquire riparian lands and submerged lands under the tidewater. The state, through the Commerce and Navigation Board, may lease these lands for purposes of commercial enterprises. (Kelly-Fla)
W69-05346

ESTABLISHMENT OF STATE CONTROL OVER SUBMERGED LANDS.

N J Stat Ann secs 12:3-1 to 12:3-4 (1968).

Descriptors: *Riparian rights, *Navigable waters, *Beds under water, *New Jersey, Hudson River, Legislation, Delaware River, Water law, Coasts, Land tenure, Ownership of beds, Tidal waters, Riparian land, State governments, Landfills, Pier, Bulkhead lines.
Identifiers: New York Bay, Kill von Kull, Raritan Bay, Newark Bay, Department of Conserv and Econ Development.

Sections 12:3-1 to 12:3-4 provide for examination of the limits of the state's control over land under tidal waters, and for fixing certain limitations on private use. Section 12:3-1 provides for appointment of a board of commissioners to survey the land under New York Bay, the Hudson River, Kill von Kull, Newark Bay, Arthur Kill, Raritan Bay and parts of the Delaware River; to ascertain the rights of the state thereto; and to fix exterior limits for permanent obstructions. Section 12:3-2 authorizes the establishment of exterior bulkhead and pier lines in Hudson River tidewaters, New York Bay, and Kill von Kull as reported by the commission, subject to section 12:3-13 or a subsequent act. Section 12:3-3 prohibits filling or building beyond established bulkhead lines. Piers must be built according to size limits, allowing free water passage. Section 12:3-4 repeals the Wharf Act of 1851, restoring, however, no alleged right to fill land. Only the Department of Conservation and Economic Development may allow reclaimation of, and building on, land under tidewaters, unless the right was granted before 1891. Later grants are revocable. (Kelly-Fla)
W69-05347

CONVEYANCES OF LANDS BY LEGISLATIVE AUTHORITY.

N J Stat Ann secs 12:3-5 to 12:3-7.1 (1968).

Descriptors: *Land tenure, *Ownership of beds, *Tidal waters, *New Jersey, High water mark, Landfills, Boundaries, Land reclamation, Legislation, Riparian rights, Beds under water, Water law.
Identifiers: Department of Conserv and Econ Development.

Sections 12:3-5 to 12:3-7.1 pertain generally to conveyances or leases of land under tidal waters. Section 12:3-5 allows a grantee or licenses by authority of a prior act to secure written proof of the conveyance, whether the land is presently under water or not. Reasonable rental or purchase price may be required by the state. Any lessee so desiring may afterward convert his lease into a conveyance upon payment of a reasonable purchase price. Purchasers have the right to fill to the bulkhead line or otherwise improve submerged land. Under section 12:3-6 no grant extending below the high water mark will be in force prior to payment or offer of security. According to section 12:3-7, unimproved submerged land may be granted or leased to the limits of exterior lines. The grantee may reclaim or improve the land. Grants are available to riparian owners only, unless six months have passed following notice of application by a non-riparian owner. Sections 12:3-7.1 allows applicants who are unable to give adequate notice to file with the Department of Conservation; and the Department may act to allow the grant. (Kelly-Fla)
W69-05348

TREPASS ON LANDS OF STATE UNDERWATER AND CONVEYANCES BY COMMERCE AND NAVIGATION.

N J Stat Ann secs 12:3-8 to 12:3-12 (1968).

Descriptors: *New Jersey, *Riparian rights, *Riparian lands, *Tidal waters, Legislation, Beds under water, Ownership of beds, State governments, Landfills, Land reclamation, Navigable waters, Land tenure, Water law.

Identifiers: Commerce and Navigation Board, Kill von Kull, Department of Conserv and Econ Development.

Section 12:3-8 states that the Department of Conservation and Economic Development may institute civil actions against trespasses who unlawfully use or occupy submerged land or land heretofor under water. The Attorney General must prosecute such actions. Section 12:3-9 prohibits a non-riparian grantee from filling or improving land until the rights and interests of the riparian owner have been extinguished by the Department or through court action. Section 12:3-10 allows a riparian owner to apply to the Commerce and Navigation Board for a lease or grant of land under adjacent tidewaters. The Board has discretionary power to void any grant so made, with reversion of title to the state. Section 12:3-11 holds section 12:3-10 inapplicable to other prior sections dealing with New York Bay or Kill von Kull, east of Enyard's dock. Section 12:3-12 allows the Board, with the governor and attorney general, to include additional covenants and conditions in grants of land covered within 12:3-2 to 12:3-9, whether or not the land is presently underwater. (Kelly-Fla)
W69-05349

SURVEY OPERATIONS AND CONTROLS BY THE BOARD OVER SUBMERGED LANDS.

N J Stat Ann secs 12:3-13 to 12:3-20 (1968).

Descriptors: *New Jersey, *Ownership of beds, *Land tenure, *Rights-of-way, Legislation, Tidal waters, Islands, Shoals, Reefs, Navigable waters, Bulkhead lines, Docks, River basins, Basins, Riparian rights, Hudson River, Water law, Surveys.
Identifiers: *Commerce and Navigation Board, New York Bay.

Sections 12:3-13 to 12:3-20 concern state control of basins, rights-of-way, surveying and setting prices for submerged lands. Section 12:3-13 permits the Commerce and Navigation Board to alter pier lines, basins, or lines of solid filling in New York Bay or the Hudson River. Changes shall be filed with the secretary of state. Section 12:3-15 states that the Board may sell to riparian owners rights to use basins for docking, reserving the basins as public. Section 12:3-16 provides for the fixing of prices for land, now or formerly submerged. Section 12:3-17 permits the Board's extension of its surveys to all state tidewaters, as requested by riparian owners. Under section 12:3-18, where a right-of-way separates the upland of a riparian owner from the tidewater, he shall still be a riparian owner for purposes of state grants. Section 12:3-19 permits the Board to establish exterior lines around islands, reefs, and shoals in tidal waters, prohibiting obstructions beyond them. No grant prior to 1891 is affected. Section 12:3-20 allows submerged lands around islands, reefs, or shoals to be sold by the Board with the governor's consent. (Kelly-Fla)
W69-05350

USAGE OF SUBMERGED LAND; LEASE AND GRANT CONDITIONS AND PROCEDURE.

N J Stat Ann secs 12:3-21 to 12:3-28 (1968).

Descriptors: *New Jersey, *Legislation, *Riparian rights, *Reclamation, Dredging, High water mark, Riparian lands, Land tenure, Property boundaries, Basins, Tidal waters, Bridges, Pipelines, State government, Beds under water, Ownership of beds.
Identifiers: *Commerce and Navigation Board.

Section 12:3-21 prohibits removal or dredging of land under tidewaters without a license. However, a grantee or leasee of the state may make improvements by removal or dredging of sand or other material within the lines of, or in front of, such grant or lease. Section 12:3-22 allows the Commerce and Navigation Board and governor to grant licenses for dredging and digging under tidewaters. Section 12:3-23 allows the Board, with the governor's approval, to lease or grant land under the high water mark to non-riparian owners, provided proper notice is given. Section 12:3-24 states that the board need not execute leases which are convertible to grants (Section 12:3-5), but may sell or let under conditions deemed proper. Section 12:3-25 permits the Board and governor to provide for lease renewal and annual rentals. Laying pipes under the state's tidal waters without written permission from the government and Board is prohibited under section 12:3-26. Section 12:3-27 enables the Board to enlarge or reduce the area of any public basin, and may grant or lease reclaimed or filled land, provided adjacent riparian owners consent. Section 12:3-28 declares that the Board must approve plans by other agencies to build or alter bridges over tidal waters. (Kelly-Fla)
W69-05351

PROTECTION OF THE PALISADES.

N J Stat Ann secs 12:3-29 to 12:3-32 (1968).

Descriptors: *New Jersey, *Beds under water, *Real property, Legislation, Hudson River, High water mark, Tidal waters, Land use, Land tenure, Ownership of beds, Riparian rights, Riparian lands.
Identifiers: *Palisades.

Section 12:3-29 provides that any lease or grant of submerged land beneath the Hudson River adjacent to the Palisades must contain terms preserving the uniformity and continuity of the Palisades. Section 12:3-30 allows blasting and the removal of rock or similar operations between the Palisades and the highwater mark, when done for improvement purposes. Section 12:3-31 defines the boundaries of the Palisades by metes and bounds. Section 12:3-32 states that grants made south of the Palisades or before 1898 are not affected by section 12:3-29. (Kelly-Fla)
W69-05352

GRANTS OF SUBMERGED LANDS TO THE STATE, MUNICIPALITIES, AND OTHER SUBDIVISIONS.

N J Stat Ann secs 12:3-33 to 12:3-37 (1968).

Descriptors: *New Jersey, *Riparian rights, *Local governments, Legislation, State governments, Ownership of beds, Beds under water, Riparian lands, Navigable waters, Tidal waters, Water law, Bridges.
Identifiers: *Board of Commerce and Navigation.

Section 12:3-33 allows the Board of Commerce and Navigation to grant land under tidewaters to municipalities or other subdivisions upon application, where the latter creates a public park, street or highway on riparian land. Section 12:3-34 states that the grant (12:3-33) may be conditioned upon the maintenance of the riparian land as a public facility. Section 12:3-35 allows the Board to provide for construction of bridge by private corporations for municipalities or other subdivisions for extensions of streets over lands granted. Section 12:3-36 provides that if the applicant under section 12:3-33 is unable or unwilling to pay the price fixed, the Board may grant a revocable lease, charging a nonimal fee, until it decides upon reasonable compensation for the applicant (or a new grantee) to pay. Section 12:3-37 saves listed acts from repeal. Included are prior acts relating to leases and grants of riparian lands to municipalities for streets, highways, parks, and other public purposes. (Kelly-Fla)
W69-05353

CONFIRMATORY LEASES AND GRANTS OF SUBMERGED LAND.

N J Stat Ann secs 12:3-38 to 12:3-44 (1968).

Descriptors: *Ownership of beds, *Beds under water, *Land tenure, *Riparian rights, High water mark, Riparian lands, State governments, New
sey, Equitable apportionment, Navigable wate
Identifiers: *Commerce and Navigation Board

Section 12:3-38 allows the Commerce and Na
tion Board, upon request, to make confirm
grants of submerged land to riparian owners
claim such land under prior grants. Section 12
permits the Board to execute conclusive conf
tory grants after an investigation. Further pay
may be required. Section 12:3-40 states that a
tioner's request under 12:3-38 may include
tional underwater lands adjacent to land
covered in any confirmatory lease. Under sec
12:3-41 and 12:3-42, lands now, or formerly,
tidewaters are covered by this title. Any ne
confirmatory grants may be based on original
water marks. Listed factors are to be consider
the Board; original consideration, apportion
by other agencies, equitable apportionment
irregular boundaries to provide reasonable
water access, and petitioner's present righ
riparian lands. Section 12:3-43 prohibits gra
anyone who is not a riparian owner. Section
44 states that sections 12:3-38 to 12:3-43 app
all riparian owners. (Kelly-Fla)
W69-05354

**ERRONEOUS GRANTS OF SUBMER
LAND.**

N J Stat Ann secs 12:3-45 to 12:3-47 (1968).

Descriptors: *New Jersey, *Land tenure, *Rip
rights, Legislation, Land use, Riparian lands,
waters, State governments, Water law.
Identifiers: Commerce and Navigation Board.

Section 12:3-45 provides that a riparian o
must assert his pre-emptive rights within five
of an erroneous grant of submerged lands, adja
to his property, made to a non-riparian owne
suming the latter records his grant and make
provements. Section 12:3-46 permits the C
merce and Navigation Board to convey the la
absolute fee to the grantee in error, if the affe
riparian owner fails to object. Section 12:3-4
lows the Board to require additional reason
compensation in making a grant under se
12:3-46. (E Kelly-Fla)
W69-05355

**DELINQUENT RIPARIAN LEASES; RE-EN
BY THE STATE.**

N J Stat Ann secs 12:3-48 to 12:3-47 (1968).

Descriptors: *New Jersey, *Beds under w
*Riparian rights, *Land tenure, Legisla
Ownership of beds, Real property, Land use,
governments, Administrative decisions.
Identifiers: *Riparian lessor, Commerce
Navigation Board.

Section 12:3-48 requires annual lists of
delinquent riparian leases to be submitted to
Commerce and Navigation Board. Sections
49 allow the Board to re-enter lands listed in
48 if the grant contains a covenant to that ef
Section 12:3-50 defines re-entry. Section 12:
declares that notice by service or publication
pre-requisite to re-entry, and section 12:3-52
forth contents of the notice. Section 12:
requires the Board to report to the state treas
that notice was given. Section 12:3-54 provide
delivery of the original lease by the treasurer to
Board. Section 12:3-55 requires a certificate o
entry for repossession. Section 12:3-56 decl
that state rights to unpaid rentals are unaffe
by re-entry, and section 12:3-57 releases treas
from responsibility for the lease. (E Kelly-Fla)
W69-05356

**MOORING AND FASTENING BOATS UP
RIPARIAN LANDS.**

N J Stat Ann secs 12:3-58 to 12:3-63 (1968).

scriptors: *Riparian lands, *Riparian rights, ew Jersey, Legislation, State governments, Beds ler water, Boats, Land usage.
ntifiers: *Mooring, Commerce and Navigation ard.

tion 12:3-58 provides that mooring, grounding, fastening a boat, barge, or raft to, or upon, rian lands for a ten day period constitutes a ance. Such action also constitutes a demeanor under section 12:3-59. Section 12:3- uthorizes the Commerce and Navigation Board emove the boat, barge, or raft after giving 48 rs notice, and to charge the owner with removal s by placing a lien upon the vessel. Section -61 permits the Board to enforce the lien 3-60) by sale of the boat. Section 12:3-62 pro- s that proceeds of the sale to pay costs are to be arded to the state treasurer. Section 12:3-63 s that nothing in this article will apply to ripari- nds devoted to public parks. (E Kelly-Fla)
-05357

TE ACQUISITION OF RIPARIAN LANDS; SE FOR COMMERCIAL ENTERPRISES.

Stat Ann secs 12:3-64 to 12:3-71 (1968).

criptors: *New Jersey, *Land tenure, *Riparian s, *Land usage, Legislation, State govern- ts, Beds under water, Ownership of beds, rian rights, Condemnation, Legal aspects.

ion 12:3-64 allows the Department of nomic Development to acquire riparian lands purchase, devise, or condemnation. Section -65 permits the Commerce and Navigation d to lease or grant land taken under 12:3-64 ot longer than sixty years. Riparian lands must ranted only together with adjacent submerged s. Section 12:3-66 permits the Board's con- nce of the use of riparian land to the original r for improvement by him, in consideration of transfer to the state. Section 12:3-67 allows the e under section 12:3-66 to operate a commer- enterprise under the Board's supervision. Sec- 12:3-68 permits the Board to require a per- ge of the income of the enterprise in lieu of rent. Section 12:3-69 states that moneys ved shall be treated as rents under applicable Section 12:3-70 requires that all improve- s and title with goodwill of the business to t to the state when the lease expires. Section 71 states that grants under this statute are sub- o applicable existing law. (E Kelly-Fla)
-05358

RIS CANAL AND BANKING COMPANY.

tat Ann secs 13:12-1 to 13:12-13 (1968).

riptors: *New Jersey, *Diversion, *Water- es, *Easements, Legislation, Water levels, eation, Local governments, Canals, Lakes, s, Streams, Railroads, Highways regulation, ts, Cities, Sewers, Sewer pipes, Legal aspects.
ifiers: Morris Canal and Banking Company.

corporate existence of the Morris Canal and ng Company is continued. The Morris Canal ned by this section. Title to property vested in nal and banking company is held in trust for ate. The rights vested in the company to im- d and divert waters of lakes, ponds, and ns and the rights in certain specified lakes are ated to the public use of conserving the public s and recreation. In operating dams and slu- the rights of riparian owners shall be con- d. Title to shares of stock of the canal and ng company is transferred to the Department nservation and Economic Development. All rty, title which is vested in the canal and ng company, shall continue to be managed ontrolled by that company. Grants may be to municipalities to lay and maintain sewer under and along the canal right of way. Canal rty may be sold to railroad companies to possible the construction of additional main . Abandoned portions of canal property are ated as public highways. (Childs-Fla)
W69-05359

MORRIS CANAL AND BANKING COMPANY.

N J Stat Ann secs 13:12-14 to 13:12-24 (1968).

Descriptors: *New Jersey, *Diversion, *Bridges, *Operation and maintenance, Legislation, Water supply, Cities, Dams, Sluice gates, Regulation, Port of New York Authority, Legal aspects, Canals, Roads, Drainage.
Identifiers: Morris Canal and Banking Company.

The diversion, for the purpose of municipal water supply, of waters of the canal may be permitted. Canal property may be sold for road purposes. The canal and banking company may also sell canal property in municipalities to such municipalities or to the Port of New York Authority. Property outside municipalities may be sold to municipalities or at public or private sale. A municipality may subsequently resell any property acquired from the canal and banking company. As soon as the water has been drained off, bridges are to be removed and the beds filled by the company. All dams and sluice gates are to be maintained in a safe condition, obstructions to highways or watercourses are to be prevented, and proper drainage of the canal must be provided. A canal fund is established. Injuries to or destruction of canal property are punished by fine. (Childs-Fla)
W69-05360

DELAWARE AND RARITAN CANAL.
For primary bibliographic entry see Field 04A.
W69-05361

DRAINAGE AND FLOWAGE OF LANDS.
For primary bibliographic entry see Field 04A.
W69-05362

BEACH FRONTS AND WATERWAYS.
For primary bibliographic entry see Field 04A.
W69-05363

WATERWAYS AND WATER FRONTS.
For primary bibliographic entry see Field 04A.
W69-05364

PUBLIC PARKS - PLAYGROUNDS; SALE OF RECLAIMED LANDS ABUTTING PARK LANDS.

N J Stat Ann sec 40:61-22.2 (1967).

Descriptors: *New Jersey, *Land reclamation, *Cities, *Beds, Parks, Land use, Land classification, Land fills, Land ownership, Land management, Land appraisal, City planning, Legislation, Legal aspects, Bulkheads.

Whenever a municipality has reclaimed lands under water fronting or abutting park lands and such reclaimed lands have been bulkheaded and filled and are now used for park purposes, the municipality may sell and part or parts, parcel or parcels of parklands not so reclaimed whether contiguous or not contiguous to such reclaimed park lands; provided, that the total area of park land so sold shall not exceed in area the area of such reclaimed lands. (Carruthers-Fla)
W69-05365

WETLANDS (CONTROL AND REGULATION IN MAINE).
Me Rev Stat Ann tit 12, secs 4701-4709 (1968-69 Supp).

Descriptors: *Coastal marshes, *Permits, *Maine, Legislation, Legal aspects, Surface drainage, Dredging, Sewage, Cities, Wetlands, Bogs, Swamps, Regulations, Public benefits, Competing uses, Riparian rights, Water utilization, Railroads, Roads.
Identifiers: Railroad beds.

Parties seeking to dredge or drain sewage into, or otherwise alter any swamp, bog, marsh, beach or other wetland bordering coastal waters must file written notice with the affected municipality and with the state's controlling agency. Permits will then be issued subject to protection of public interest, and the interests of adjoining owners. Appeal from a denial or an issuance of a permit may be had in the superior court. The Wetlands Control Board is the controlling state agency and its composition is provided for in the act. Emergency action is allowed without a permit, provided notice is given. The Board may waive procedural requirements or exempt certain activities where such action is not inconsistent with the purposes of the act. Maintenance and repair of existing roads or railroad beds are not affected by the act, provided no watercourse is substantially altered. Willful violations of the permit requirement provisions may result in fines and injunctive restraint of continued violation by the superior court. (E Kelly-Fla)
W69-05366

UNPROTECTED WELLS.

Me Rev Stat Ann tit 17, secs 3901, 3902 (1965).

Descriptors: *Maine, *Wells, *Well regulations, *Barriers, Legislation, Legal aspects, Water supply, State governments.
Identifiers: Penalties (Criminal).

A 'well' is defined as a deep, narrow pit in the earth, usually walled, and used for the purpose of obtaining a supply of water. All open wells shall be surrounded by a substantial fence or other enclosing barrier. Coverings which can be securely fastened may also be used. Violation of this section carries a fine or not more than $50 or imprisonment for not more than 30 days, or both. (Logan-Fla)
W69-05367

REMOVAL OF BUSHES, TREES, AND STUMPS FROM FLOWED AREA.
For primary bibliographic entry see Field 04A.
W69-05368

NUISANCES-MILLS AND DAMS; FENCES AND BUILDINGS ON PUBLIC WAYS.
For primary bibliographic entry see Field 04A.
W69-05369

DUMPING OF OIL.
For primary bibliographic entry see Field 05G.
W69-05370

DAMAGE TO ICE.

Me Rev Stat Ann tit 17, sec 2500 (1965).

Descriptors: *Maine, *Legislation, *Ice, Legal aspects, State governments, Ponds, Lakes, Damages.

Whoever will fully or maliciously cuts, injures, or otherwise damages ice upon waters from which ice is or may be taken as an article of merchandise, shall be punished by a fine of not more than $500 or imprisonment for not more than 11 months. (Logan-Fla)
W69-05371

TAKING OF WATERCRAFT, AIRCRAFT OR DRAFT ANIMALS; INJURING OR CUTTING LOOSE BOOMS, RAFTS, VESSELS OR BOATS; CIVIL ACTION FOR DAMAGES.
Me Rev Stat Ann tit 17, secs 2498, 2499 (1965).

Descriptors: *Maine, *State governments, *Boats, *Lumbering, Legislation, Legal aspects, Aircraft.
Identifiers: Double damages, Penalties (Criminal), Penalties (Civil).

Whoever willfully and mischievously takes or uses any boat, vehicle, or airplane which is the property of another, without the consent of the owner, shall be fined not more than $300 or imprisoned for not more than 11 months. Whoever, not being the owner, willfully and maliciously cuts away, lets loose, injures, or destroys any raft, boom, logs or other lumber, or any vessel, gondola, scow or other boat shall be fined not more than $500 and imprisoned not exceeding 1 year. The wrongdoer shall also be civilly liable for double damages. (Logan-Fla)
W69-05372

MOORING WATERCRAFT TO BUOYS OR BEACONS.

Me Rev Stat Ann tit 17, sec 2497 (1965).

Descriptors: *Legislation, *Buoys, *Boats, *Navigable waters, Maine, Legal aspects, State governments, Federal government, Navigation, Warning systems.
Identifiers: *Beacons, Mooring, Penalties (Criminal).

Made illegal is the mooring of any vessel, boat, scow or raft to any buoy or beacon placed by the United States or by the State of Maine in any of Maine's navigable waters. Punishment for violation of this provision is a fine of $50. Willful destruction of any such buoy or beacon results in a forfeiture of $100 and imprisonment for 3 months. (Logan-Fla)
W69-05373

MALICIOUS MISCHIEFS-PUBLIC UTILITIES.
For primary bibliographic entry see Field 04C.
W69-05374

NOTICE OF PETITIONS FOR SPECIAL LEGISLATION PERTAINING TO FISH AND GAME.

Me Re State Ann tit 3, sec 125 (1965).

Descriptors: *Maine, *Wildlife, *Fish, *Game birds, Legislation, State governments, Legal aspects.
Identifiers: *Notice, Petitions, Special legislation.

Notice of petitions, bills, or resolves for special legislation, regarding or pertaining to fish or game, with full description of the territory or waters affected by such legislation is required. Furthermore, such notice shall run for 8 consecutive weeks in some weekly publication nearest the locality affected by the proposed legislation. The last notice shall not be less than one nor more than three weeks before the assembling of the legislature. (Logan-Fla)
W69-05375

UNWHOLESOME PREMISES; REMOVAL AND REHABILITATION AT OWNER'S EXPENSE.
For primary bibliographic entry see Field 05B.
W69-05376

HARBORS, WHARVES, AND HARBOR MASTERS.
For primary bibliographic entry see Field 04A.
W69-05377

HIGHWAYS.
For primary bibliographic entry see Field 04C.
W69-05378

HIGHWAYS.
For primary bibliographic entry see Field 04C.
W69-05379

PENN CENTRAL CO V BUCKLEY AND CO (BRIDGE COLLISIONS SUIT).

293 F Supp 653-660 (D N J 1968).

Descriptors: *New Jersey, *Judicial decisions, *Bridges, *Accidents, Railroads, Navigable rivers, Damages, Ships, Channels, Navigation.

Plaintiffs owned and maintained a railroad drawbridge across a navigable river. Defendant operated tows hauling scows which passed beneath the bridge regularly in its normal course of operations. On several occasions defendant's tows, while hauling more than one scow, struck the bridge fenders inflicting considerable damage. Plaintiffs sought an injunction to restrain the defendant from operating tows with more than one scow. In denying relief, the court stated that plaintiffs had an adequate remedy at law. As a matter of law the evidence was not sufficient to show that only one-scow tows could safely cross beneath the bridge. The plaintiffs did not show that irreparable damage will result if the injuction is not granted. (Molica-Fla)
W69-05380

POIRE V SERRA (PROPRIETY OF LAND FILL BY RIPARIAN OWNER).
For primary bibliographic entry see Field 04A.
W69-05381

JOHNSON V RAY (RIGHT TO CONSTRUCT RETAINING WALL)
For primary bibliographic entry see Field 04A.
W69-05382

WATERS OF WHITE LAKE INC V FRICKE (OWNERSHIP OF LAKE BEDS).
282 App Div 333 123 NYS 2d 400-410 (1953).

Descriptors: *New York, *Ownership of beds, *Boundaries (Property), *Riparian rights, Ponds, Reasonable use, Public benefits, Easements, Judicial decisions, Legal aspects, Lakes, Real property, Beds, Riparian lands, Remedies.
Identifiers: Rebutable presumptions, Injunctions (Mandatory).

laintiff sought to enjoin use of a summer resort lake under which he owned a substantial portion of the bed. The court recognized that a very strong presumption exists in New York that a conveyance of land bounded by a small inland lake carries title to the center of the lake unless an intention to the contrary is expressly manifested in the instrument of conveyance. In the present case, the language concerning the extent of defendant's grant was somewhat ambiguous, but the court required the plaintiff to demonstrate that his title to the lake bed was sufficient to support the relief sought. The plaintiff could only demonstrate title to a substantial portion of the lake bed, and the court recognized that the portion so held was intersected by four triangular sections of bed held by third parties. This fragmentation of the plaintiff's interest made injunctive relief impracticable and unworkable. Therefore, plaintiff's request was denied. (Katz-Fla)
W69-05383

CITY OF HARDIN V NORBORNE LAND DRAINAGE DISTRICT (STATUTORY RIGHTS TO MAINTAIN EXISTING LEVEES).
For primary bibliographic entry see Field 04A.
W69-05384

REYNOLDS METAL CO V BALL (SUIT TO RECOVER DAMAGES FOR ALLEGED DEPOSIT OF SEDIMENT CONTAINING POISONOUS SUBSTANCES).
For primary bibliographic entry see Field 05C.
W69-05385

TENNESSEE VALLEY SAND AND GRAVEL V PILLING (LIABILITY FOR SEDIM DUMPING WHICH MAKES CREEK BED SH LOWER, WHICH CAUSES MORE FLOODI
For primary bibliographic entry see Field 05G.
W69-05386

GARGAC V SMITH-ROWLAND CO (PO TION OF LAKE BY INDUSTRIAL WASTES
For primary bibliographic entry see Field 05C.
W69-05387

TRUSTEES OF FREEHOLDERS AND C MONALTY V MORRISEY (TITLE TO F UNDER TIDAL WATERS).

191 Misc 920, 83 N Y S 2d 681-686 (S C 1947).

Descriptors: *New York, *Tidal waters, * under water, *Ownership of beds, Judicial sions, Legal aspects, Water law, Fishing, Shel Bays, Patents, Allotments, Boundaries (Prope Beds.
Identifiers: *Long Island, Penny Pond, Shinne Bay, Ejectment.

Plaintiffs brought an ejectment action agains fendant, seeking to recover possession of under the waters of Penny Pond, an eight acre of water on the north side of Shinnecock Plaintiffs' chain of title originated in certain En patents issued in 1676 and 1686. Defen claimed title by virtue of an allotment by trustees in 1738 which described the property in general terms. Furthermore, no individual asserted ownership for more than 200 years fo ing the allotment. The court held that plai were entitled to judgment. The representativ the trustees had never intended to deed t dividuals any lands under water. The histor other Long Island towns indicated that tidew were for the use and benefit of all the residen the various towns. The fact that defendant's depended upon a general description of the and that no claim had been made by an indiv for over 200 years merely gave additional cred to plaintiffs' claim. (Holt-Fla)
W69-05388

GREEN V MCCLOUD (ACTION TO ENJ SEWAGE FLOW).
For primary bibliographic entry see Field 05G.
W69-05389

ENDERSON V KELEHAN (UPL DRAINAGE OF SURFACE WATERS).
For primary bibliographic entry see Field 04A.
W69-05390

BURT V MUNGER (EROSION CONTROL LANDFILL BY RIPARIAN OWNER).
For primary bibliographic entry see Field 04A.
W69-05391

TURNER V SMITH (RESERVOIR OBSTRU ING LAND DRAINAGE).
For primary bibliographic entry see Field 04A.
W69-05392

DODD V BLEZEK (DETERMINATION DOMINANT ESTATE AND DRAINAGE RIG IN NATURAL STREAM).
For primary bibliographic entry see Field 04A.
W69-05393

JOHNSON V CITY OF WINSTON-SALEM TION FOR DAMAGES CAUSED BY AN STRUCTED DRAIN PIPE).
For primary bibliographic entry see Field 04A.
W69-05394

)AT V VAN VEEN (INTERFERENCE WITH ATER FLOW).
r primary bibliographic entry see Field 04A.
69-05395

CONTE V SHOCKLEY (RUNOFF JISANCE).
r primary bibliographic entry see Field 04A.
69-05396

'CAS V FORD (EASEMENT - SURFACE 'ATER DRAINAGE).
r primary bibliographic entry see Field 04A.
69-05397

)LDA V PITTSBURGH FORGINGS CO (ANDFILLS AND OWNERSHIP OF BEDS).

5 Mich 682, 39 NW 2d 221-226 (1949).

Escriptors: *Michigan, *Ownership of beds, oundaries (Property), *Ponds, Landfills, Riparian land, Riparian rights, Reasonable use, Legal ects, Judicial decisions, Banks, Mill dams, Prescriptive rights, Beds.
Identifiers: Ejectment.

Plaintiffs sought to eject defendant from certain fd land abutting on plaintiffs' property and exding into a mill pond which constituted a boundy of the plaintiffs' property. The fill operation conducted by the plaintiffs, and they claimed to such fill-land by virtue of riparian ownerp. The defendant contends that plaintiffs' deed not convey riparian rights to the plaintiffs since to the mill pond remained at all times in the ntiffs' grantor, the successor in title of the defdant. The court examined the plaintiffs' title and ermined that plaintiffs were not riparian owners. court also recognized the fact that even if ntiffs had demonstrated ownership of the pond , their claim that the right to fill such bed was an dent of riparian ownership would undoubtedly e been disallowed. (Katz-Fla)
69-05398

KISSON V STARR (TITLE TO ACCRETION).

SW 2d 956-960 (Ark 1953).

Descriptors: *Riparian rights, *Boundaries (Proky), *Accretion (Legal aspects), *Arkansas, k erosion, Avulsion, Legal aspects, Judicial sions, State jurisdiction, Erosion, Streams, ks, Riparian land, Remedies.

Joining riparian landowners brought suit to oba division of land that was formed by accretion e channel of the Arkansas River gradually ed westward. The chancellor below divided the land by extending the common boundary due across the area in controversy. The appellants, ndants below, contend that all the disputed age became their property by accretion or, if then they have acquired title by adverse poson. The appellant claims that a shift in the se of a creek, on the appellee's land, in such a ner as to parallel the Arkansas River rather empty directly into it, had the effect of cutting ppellee, and his rights, off from the accreted The court found that an argument identical to ppellant's had previously been rejected in Aras, and the court adhered to this precedent. appellant's claim to adverse possession was ded on the appellee's failure to exercise nion over the land. However, the appellant's f was found to be insufficient to support his to ownership. The judgment of the court v in favor of the appellee was affirmed. (Katz-

-05399

COUNTY COMMISSIONERS OF BALTIMORE COUNTY V HUNTER (DRAINAGE EASEMENT NUISANCE).
For primary bibliographic entry see Field 04A.
W69-05400

WATER SUPPLY PROBLEMS IN DEVELOPING COUNTRIES,
International Bank for Reconstruction and Development, Washington, D. C.
For primary bibliographic entry see Field 03D.
W69-05513

CAPITAL FORMATION AND GOVERNMENT CAPITAL POLICY IN DEVELOPING ECONOMIES,
Tel Aviv Univ. (Israel).
For primary bibliographic entry see Field 06C.
W69-05518

WATER RESOURCES LAW IN VIRGINIA.
William R. Walker, and William E. Cox.
Water Resources Law in Virginia, Bulletin 9, Aug 1968. 181 p, 412 ref, 1 fig.

Descriptors: *Natural streams, *Percolating water, *Surface runoff, *Tidal waters, Confined waters, Virginia, Publications, Water law, Legal aspects, Water sources, Riparian rights, Diversion, Pollution, Obstruction to flow, Dams, Ownership of beds, Navigation, Eminent domain, Underground streams, Tidal waters, Ponds, Lakes, Water works, Sewage systems, Remedies.

This is a compilation of the water resources laws of Virginia. It covers the state constitution, the Code of Virginia, the reports of the Virginia Supreme Court of Appeals, and other literature. The purpose of this summary is to provide a comprehensive look at the existing legal rules relating to water resources. It is hoped that this work may serve as a basis for determining what future adjustments might be made in an effort to resolve existing problems. Water rights, as they now exist, are dealt with in five spearate sections. The first four sections of the report deal with water in its natural state. Separate bodies of law are presented for natural watercourses, percolating ground water, and diffused surface water. Underground watercourses, tidal waters, lakes, and springs are all considered in the same section because the law applicable to each is basically similar to one or a combination of the three major doctrines. The law applicable to water subjected to various conditions of artificial confinement is presented separately because the rights in such water vary from those pertaining to water in its natural state. (Childs-Fla)
W69-05533

WATER RESOURCES LAWS IN VIRGINIA (NATURAL SURFACE WATERCOURSES).
William R. Walker, and William E. Cox.
Water Resources Law in Virginia, Bulletin 9, Aug 1968, 181 p, 412 ref, 1 fig.

Descriptors: *Natural streams, *Riparian rights, *Natural flow doctrine, *Ownership of beds, Virginia, Publications, Water law, Legal aspects, Water sources, Water rights, Reasonable use, Riparian land, Diversion, Pollution, Water quality, Public rights, Standards, Sewage, Industrial wastes, Obstruction to flow, Flood protection, Docks, Ownership of beds, Navigation, Eminent domain.

Under the Virginia statutes, 'watercourse' means a natural channel having a well defined bed and banks and in which water flows when it normally does flow. The riparian doctrine, with statutory modifications, governs the use of Virginia's watercourses. Generally, a riparian owner may divert water for any reasonable purpose not inconsistent with the reasonable use of other riparian owners. Both the riparian doctrine and statutory law control the preservation of the quality and purity of the state's watercourses. A combination of common law and statutory enactments control obstructions in watercourses; the applicability of a particular legal principle is dependent upon the type of obstruction and the nature of the watercourse involved. The right to use the bed of a stream depends upon the navigability of the stream and the ownership of the bed. Navigation rights are public rights and are paramount. Riparian rights generally pass with title to the riparian land, however, they may be conveyed separately. There are two exceptions to the riparian doctrine: (1) under the mill dam acts, the first locator on a stream has the superior right; (2) certain waters of the James River. (Childs-Fla)
W69-05534

WATER RESOURCES LAWS IN VIRGINIA (PERCOLATING GROUNDWATER - DIFFUSED SURFACE WATER).
William R. Walker, and William E. Cox.
Water Resources Law in Virginia, Bulletin 9, Aug 1968, 181 p, 412 ref, 1 fig.

Descriptors: *Percolating water, *Underground streams, *Surface waters, *Impounded waters, Surface runoff, Virginia, Publications, Water law, Legal aspects, Water sources, Water rights, Riparian rights, Reasonable use, Obstruction to flow, Railroads.

Percolating groundwater is all groundwater which does not flow in a known and defined channel. This definition includes all underground waters. There are two accepted doctrines governing rights to percolating waters: (1) absolute ownership; (2) reasonable use. At present, the only generally accepted legal principle concerning the use of percolating water is that any reasonable, legitimate use of one's land which interferes with the flow of percolating waters to another's land produces no liability. However, the modern trend is toward acceptance of the reasonable use doctrine. Diffused surface water normally means water which spreads over the surface of the ground without confinement in a bed or banks. Virginia purports to follow the 'common enemy' doctrine which permits each landowner to fight off surface waters as best as he can. However, there are certain exceptions to this doctrine. The legal principles applicable to underground watercourses are almost identical to those which apply to surface watercourses. The primary difference concerns the requirements for establishing the existence and location of an underground watercourse. (Childs-Fla)
W69-05535

WATER RESOURCES LAW IN VIRGINIA (OTHER WATER SOURCES).
William R. Walker, and William E. Cox.
Water Resources Law in Virginia, Bulletin 9, Aug 1968, 181 p, 412 ref, 1 fig.

Descriptors: *Water sources, *Riparian rights, *Tidal waters, *Pollution, Ownership of beds, Virginia, Publications, Water law, Legal aspects, Water rights, Consumptive use, Navigation, regulation, Fisheries, Beds, Shellfish, Harbors, Lakes, Springs.

Rights in tidal waters are governed by the same legal principles applicable to water rights in publicly owned watercourses. However, in the case of tidal waters the emphasis is on nonconsumptive uses. The pollution of tidal waters is controlled by the State Water Control Board. Principles of common law which protect private reights from injury by pollution differ from those relating to pollution of watercourses. The right of fishery in the tidal waters is subject to absolute control and regulation by the legislature. As in the case of public watercourses, the private ownership of property and the exclusive rights of use which depend on ownership extend to the low water mark for tidal waters. Jurisdiction over the ports of the state is vested in the Virginia State Ports Authority. The definition of a lake is similar to that of a watercourse, and the applicable legal principles are generally the same.

Because of the physical nature of springs, the law applicable thereto is a combination of both surface and groundwater doctrines. (Childs-Fla)
W69-05536

WATER RESOURCES LAW IN VIRGINIA (ARTIFICALLY CONFINED WATER).
For primary bibliographic entry see Field 02H.
W69-05537

WATER RESOURCES LAWS IN VIRGINIA (REMEDIES FOR INFRINGEMENT OF WATER RIGHTS).
William R. Walker, and William E. Cox.
Water Resources Law in Virginia, Bulletin 9, Aug 1968, 181 p, 412 ref, 1 fig.

Descriptors: *Remedies, *Hydrologic cycle, *Permits, *Inter-basin transfers, Ownership of beds, Virginia, Publications, Legal aspects, Water sources, Water rights, Riparian rights, Damages, Regulation, Groundwater, Planning, Legislation.
Identifiers: Statute of limitations.

The recommendations point out deficiencies in the area of water rights and their adjudication. Feasible alternatives proposed are general in nature and are not designed as an outline for specific legislation. (1) The law should recognize the interrelationships between water in the different phases of the hydrologic cycle. (2) There is need for a state agency to administer water rights. (3) A permit system would greatly facilitate the administration of water rights. (4) The rights concerning inter-basin transfers of water should be determined. (5) The ownership of the beds of the waters of the state and of certain lands bordering these waters should be defined. (6) Rights in groundwater should be developed more fully. (7) The over-all effect of any proposed water resource legislation on the total body of water law should be considered before such legislation is enacted. (Childs-Fla)
W69-05538

COMPLETION OF THE FAIRFAX COUNTY WATER AUTHORITY ACQUISITION PROGRAM.
Fairfax County Water Authority, Annandale, Va.
For primary bibliographic entry see Field 03D.
W69-05539

UNITED STATES V STATE OF LOUISIANA (STATE OWNERSHIP OF SUBMERGED, CONTIGUOUS LANDS).

U S, 89 S Ct 768-773, L Ed 2d (1969).

Descriptors: *Texas, *Submerged Lands Act, *Coastlines, *Boundary disputes, Property boundaries, Legislation, Accretion, Bank erosion, Mineral industry, Gulf of Mexico, Jetties, Leases, Submerged lands, Ownership of beds, Judicial decisions, Legal aspects, State governments, United States, Federal government.

Plaintiff brought action against several states bordering on the Gulf of Mexico to determine the correct boundary lines of contiguous, submerged lands. The 1953 Submerged Lands Act granted to Texas a nine mile belt of submerged lands in the Gulf of Mexico. Texas measured these nine miles from its coastal boundaries as those boundaries which existed in 1845, the year Texas was admitted to the Union. Plaintiff contends that the nine mile strip should be measured from the Texas coastline as it exists today. The adoption of this method of measurement would play havoc with underwater mineral leases because erosion has considerably altered the coastline from what it was in 1845. Nevertheless, the court, after a careful reading of the Act and complimentary legislative enactments, held for the plaintiff and required Texas to use its modern-day coastline as the measuring boundary. (Stewart-Fla)
W69-05540

TENNESSEE GAS TRANSMISSION CO V GREATER LAFOURCHE PORT COMMISSION (DAMAGE FOR FORCED LOWERING OF PIPELINE ACROSS NAVIGABLE STREAM).
293 F Supp 1019-1025 (E D La 1968).

Descriptors: *Louisiana, *Compensation, *Navigable waters, *Eminent domain, Channels, Permits, Dredging, Right-of-way, Open channels, Pipelines, Easements, Legal aspects, Judicial decisions, Relative rights, Land tenure, Prescriptive rights.

Plaintiff gas company brought this action against defendant port commission, charging that the commission had forced plaintiff to incur the expense in lowering plaintiff's pipeline. The pipeline extended across a navigable watercourse. Defendant had not compensated plaintiff for this expenditure. Plaintiff had purchased a right-of-way from the State of Louisiana and the right to construct a pipeline across the watercourse from a private land company. Defendant, a Louisiana state commission, later decided to deepen and widen the watercourse and directed plaintiff to lower its pipeline accordingly. Plaintiff admitted liability under a prior argument for the expense of lowering that part of the pipeline which was in the main channel, but contended that defendant should pay for the relocation of that part outside the channel. The court found, however, that the lowering of the pipeline within the channel necessitated the adjustment of the rest of the pipeline, and that the two expenditures were inseparable. Plaintiff, therefore, was responsible for the entire amount, and the forced expenditures did not constitute a 'taking' without compensation. (Kelly-Fla)
W69-05541

MEYER V CITY OF OAKLAND (VALIDITY OF SPECIAL ASSESSMENTS TO LAND FOR SEWER IMPROVEMENTS).
219 So 2d 417-420 (Fla 1969).

Descriptors: *Florida, *Assessments, *Legal aspects, *Cost-benefit ratio, Sewerage, Real benefits, Estimated benefits, Cities, Local governments, Judicial decisions, Remedies, Land tenure, Public benefits, Public health, Construction costs.
Identifiers: *Square footage assessment.

The city of Oakland Park resolved to construct a sewer project to promote health and welfare. Of the total cost, $500,000 was to be obtained by special assessment against benefitting properties. Assessments were made on a square footage basis under the applicable state statute (Fla Stat sec 170.02). Certain large tract owners sought invalidation of the assessment certificates on the ground no increase in value of their lands would result from the improvements. The circuit court validated the certificates. The Supreme Court of Florida held on appeal that if square footage assessment approximately coincides with benefit apportionment it should be sustained. The court held benefit was a result of factors such as increase in market or utility value of property; benefit to the locality as a whole; and desirability of land for commercial or residential improvement. Benefit may include actual or future enhancement of value. The presumption is that the city and trial judge were correct in finding benefit. The presumption must be overcome by clear evidence to the contrary. The court held the landowners had not overcome the presumption of benefit, and the validation was affirmed. (Harris-Fla)
W69-05542

DESTEFANO V MEGLIO (DAMAGES FOR OBSTRUCTION OF A DRAIN).

64 Pa D AND C 599-609 (C P Pa 1948).

Descriptors: *Prescriptive rights, *Runoff, *Obstruction to flow, *Drains, Flood damage, Pennsylvania, Judicial decisions, Rain water, Easements, Barriers, Pipes, Real property, Legal aspects.
Identifiers: Rainspout, Flumen, Equity, Injunctions (Prohibitory).

Plaintiff sought to enjoin defendants, from bloc or obstructing the rain water drainage from her cony to their roof, and asked for damages for ries already sustained from such blockage. question was whether or not the palintiff ha easement by prescription which enabled he discharge rain water through a pipe from her cony onto her neighbor's roof, despite any dan which might be caused thereby. The court held plaintiff had obtained an easement. A rains which is open to the air and the operation of w is continuous and notorious in every rain become an apparent easement, and, if used ad sely for over 21 years, its use thereafter canno interfered with. Defendant's obstruction of drain was enjoined, and damages were awarde plaintiff. (Childs-Fla)
W69-05543

RAU V WILDEN ACRES, INC (ACCUMU TION-RIDDANCE).
For primary bibliographic entry see Field 04A.
W69-05544

NEWTON V LYONS (COMMON ENEMY CEPTION).

90 NE 2d 917-920 (Ind Ct App 1950).

Descriptors: *Indiana, *Riddance (Legal aspec *Runoff, *Repulsion (Legal aspect), Precipita excess, Drainage water, Surface waters, Surf drainage, Overland flow, Rain water, Ditc Pipes, Tiles, Culverts, Roads, Highways, R banks, Graded, Judicial decisions, Legal aspe Flooding, Easements, Remedies, Backwater.

The plaintiff brought this action for an injunc to restrain defendant, Newton, from maintainin alleged nuisance--the obstruction of a cul under a roadbed. The parties had an agreem whereby a tile drainage system was constructe mutual expense to carry off in a regular man the surface and drainage waters naturally flow from the plaintiff's land. This program facilitated by the intersection of the parties pro ty by a state highway, the roadbed of which was tersected by a 24 inch culvert allowing the surf waters to collect and pass through the defenda property. The defendant reduced the culvert op ing to 12 inches on his side of the highway caus subsequent water backup into the palintiff's b ment. The defendant contended that his cond was lawful in that surface water, as a common e my, may be repelled by a lower proprietor. court found the defendant's conduct to have lated a qualification of the common enemy d trine in that he had artificially accumulated waters cast onto plaintiff's land. (Katz-Fla)
W69-05545

LAWRENCE V EASTERN AIRLINES (DIVI SION OF NATURAL FLOW).
For primary bibliographic entry see Field 04A.
W69-05546

DROGMILLER V OLSON (OBSTRUCTION NATURAL COURSE OF DRAINAGE).
For primary bibliographic entry see Field 04A.
W69-05547

LOCH SHELDRAKE ASSOCIATES V EVA (RESTRICTIVE CLAUSE ON THE USES WATER).
280 App Div 51, 111 NYS 2d 365-371 (1952).

Descriptors: *New York, *Water rights, *Ea ments, *Water utilization, Judicial decisions, C sumptive use, Reasonable use, Lakes, Powerplar Riparian rights, Natural use, Non-consumptive u Hydroelectric power.
Identifiers: Restrictive covenants, Equitable s vitudes.

aintiff brought suit to determine the right of the efendant to use water from a lake owned by the aintiff. The trial court held that the defendant uld use the water solely for purposes of generat- g power. However, the appellate court reversed, inting out that the terms of a grant for the use of ater will in all doubtful cases be construed as a nitation on quantity rather than a restriction as to e. No restriction as to use will be implied unless e circumstances clearly indicate such to have en the intent of the parties. The court looked to e construction of a reservation which the plaintiff t in a deed to a purchaser several years before e defendant took title. That restriction was nilar to the one presently imposed on the defen- nt. The prior restriction was construed to be a nitation upon quantity, not a restriction on use d the prior purchases were allowed to use the ter for general purposes as well as for power. e court interpreted the restriction imposed on fendant as carrying similar burdens. (Stewart- a)
69-05548

WN OF VIENNA V STATE (PRESCRIPTIVE GHTS DOCTRINE AS APPLIED TO PUBLIC OPERTY).
r primary bibliographic entry see Field 04A.
69-05549

DA V STATE (ARTIFICIAL CONTROL OF RFACE WATERS).
r primary bibliographic entry see Field 04A.
69-05550

BO V YOUNG (ARTIFICIAL DRAINAGE OF RFACE WATERS AND NATURAL FLOW).
r primary bibliographic entry see Field 04A.
69-05551

TERSON V WISCONSIN RIVER POWER CO ROPERTY ENCROACHMENT BY IM- UNDED WATERS).
primary bibliographic entry see Field 04A.
69-05552

SONITE CORPORATION V GUY (FISH- L: EFFECTS OF WATER POLLUTION).
primary bibliographic entry see Field 05C.
69-05553

ATES V UNITED STATES (TAKING OF OPERTY FOR PUBLIC PURPOSE WITHOUT T COMPENSATION).
primary bibliographic entry see Field 04A.
9-05554

TE SQUIRE V CITY OF CLEVELAND L LAND AND HIGHWAY USE AS TO LIT- RAL RIGHTS).
primary bibliographic entry see Field 04C.
9-05555

O V ATHOL HOUSING AUTHORITY MAGE FROM WATER DISCHARGE).
primary bibliographic entry see Field 04C.
9-05556

INN V MYERS (SUIT TO REMOVE OB- UCTION TO NATURAL WATERCOURSE).
primary bibliographic entry see Field 04A.
9-05557

PASO WATER IMPROV DIST NO 1 V CITY EL PASO (RIGHT OF REMOVAL UNDER TER SUPPLY CONTRACT).

F 2d 927-934 (5th Cir 1957).

Descriptors: *Water rights, *Cities, *River basin commissions, *Contracts, Federal government, Judicial decisions, Navigable rivers, Municipal water, Relative rights, Benefits, Legal aspects, Permits, Rio Grande, Right of way, Effluents.

Plaintiff, joined by the United States, sued defendant city in an effort to determine their respective rights in the waters of the Rio Grande River. The defendant city had sometime previously deeded all its right, title, interest, and right of way along an adjacent canal. This canal was contiguous to the Rio Grande and became part of the land managed by the plaintiff water improvement district. The plaintiff district and the defendant had entered into a contract which gave the city the right to take water from the river in excess of the district's needs. The defendant dumped salvageable effluent back into the river; the controversy centered about the ownership of this effluent. The city had no equitable basis to support its view that it was entitled to remove as much water from the river as it added (effluent) to it. Since the city accepted the contract and had accepted its benefits, it now could not contend that it was entitled to more water than provided therein or that the contract was a nullity. (Blunt-Fla)
W69-05558

W B RODDENBERY CO INC V CARTER (DAMAGES FOR POLLUTION OF STREAM).
For primary bibliographic entry see Field 05B.
W69-05559

REESE V STATE (DAMAGE TO LAND DUE TO DIVERSION OF STREAM).
For primary bibliographic entry see Field 04A.
W69-05560

CLARK V GIFFORD-HILL AND CO (WATER POLLUTION BY MINING).
For primary bibliographic entry see Field 05G.
W69-05561

CORNETT V HEBERT (OBSTRUCTION TO FLOW OF SURFACE WATER).
For primary bibliographic entry see Field 04A.
W69-05562

BRAY V CITY OF WINTER GARDEN (SURFACE WATERS CAST ON LOWER PROPERTY).
For primary bibliographic entry see Field 04A.
W69-05563

NAVIGABLE STREAMS, PERMISSION TO BRIDGE OR DAM; PUBLIC SERVICE FACILITIES; NATURAL RESOURCES.
Mich Const art 7, sec 12; art 7, sec 24; art 4, sec 52.

Descriptors: *Michigan, *Conservation, *Navigable waters, *Utilities, Dams, Bridges, Pollution, Water supply, Sewage disposal, Natural resources, Water policy, Water resources, Water resources development.
Identifiers: *Constitutions.

The conservation and development of the state's natural resources is declared to be of paramount public concern, and the legislature shall provide for protection of all natural resources from pollution, impairment and destruction. Navigable streams shall not be bridged or dammed without permission of the county board of supervisors in the interests of the county. Any city or village may operate and own water, sewage disposal, or any other public service facility within or without its corporate limits, and may sell and deliver such service outside its corporate limits. (Harris-Fla)
W69-05564

SALT WATER ISLANDS.

Me Rev Stat Ann tit 14, sec 7556 (1965).

Descriptors: *Maine, *Hunting, *Wildlife, *Islands, Legislation, State governments, Birds, Game birds, Saline water, Civil law, Damages, Legal aspects.
Identifiers: Penalties (Civil).

Whoever, after having notice, trespasses upon any island within salt waters, for the purpose of shooting or hunting thereon, is liable to the owner, occupant, or lessee of the island. Exemplary damages shall be not less than $20 nor more than $50 in addition to all actual damages sustained; $5 shall be assessed for every bird of any kind shot, caught, taken or killed. (Logan-Fla)
W69-05565

TRESPASS - IMPROVED LANDS AND FISH PONDS.

Me Rev Stat Ann tit 17, sec 3852 (Supp 1968-69).

Descriptors: *Maine, *State governments, *Fish, *Game birds, Legislation, Legal aspects, Fish stocking, Ponds, Pastures, Vegetation.
Identifiers: Penalties (Criminal).

Whoever commits a trespass upon any garden, pasture, orchard, or pond used for the lawful cultivation of fish or as a commercial shooting area, with intent to take, carry away, or destroy flowers, plants, grain, fish, quail, pheasants, or Chukar partridge, shall be punished by fine of not more than $100 and by imprisonment for not more than 90 days. (Logan-Fla)
W69-05566

MORRIS V WINTERS (ACTION TO REMOVE AN OBSTRUCTION TO WATER FLOW).
For primary bibliographic entry see Field 04A.
W69-05567

LEIPER V HEYWOOD-HALL CONSTR CO (CLAIM OF ARTIFICIALLY INCREASED DRAINAGE ON PART OF UPPER LANDOWNER).

381 Pa 317, 113 A 2d 148-150 (1955).

Descriptors: *Pennsylvania, *Reasonable use, *Drainage, *Artificial use, Surface waters, Surface runoff, Slopes, Drainage practices, Water conveyance, Relative rights, Judicial decisions, Legal aspects, Alteration of flow, Natural flow, Discharge, Channel flow.

Plaintiff, a lower landowner, contended that defendant construction company had, in the course of building a housing subdivision on higher land adjacent to plaintiff's property, collected surface water and artificially channeled it onto plaintiff's land in substantially increased volume. In Pennsylvania, an upper landowner has the right to have surface waters discharged from his land through a natural watercourse or via natural drainage onto lower land. He may make reasonable use of his land even if the quantity or quality of the water is somewhat changed thereby. The supreme court found, however, that water may not be diverted from its natural channel or changed substantially in quantity or quality by the upper landowner to the detriment of the servient owner. Negligence on the part of the upper landowner in collection and discharge of surface water will also give rise to liability. The court stated that the degree of alteration of surface water drainage is an evidentiary problem to be decided at trial. Here the chancellor below had decided that defendant's actions constituted reasonable land use with insignificant detriment to plaintiff. (E Kelly-Fla)
W69-05568

BIBERMAN V FUNKHOUSER (UPPER LANDOWNER'S RIGHT TO HAVE SURFACE WATER DRAIN UPON LOWER LANDOWNER).
58 A 2d 668-672 (Md 1948).

Descriptors: *Maryland, *Riddance (Legal aspects), *Surface runoff, *Natural flow, Surface waters, Judicial decisions, Water law, Grading, Ditches, Land, Surface drainage, Legal aspects, Drainage water, Topography, Ditches.
Identifiers: Artificial change of elevation, Reversal of flow, Injunctions (Mandatory), Dominant estate, Servient estate.

Plaintiff sought to enjoin defendant from permitting water on his property to flow over and upon complainant's lands. Prior to any artificial changes of elevation, defendant's property was the upper and dominant estate. After plaintiff filled in his property, the natural flow of water was reversed, it was made to flow from plaintiff's to defendant's property. Subsequently, defendant graded his lots so as to again reverse the flow to its original course, with the exception of a few small erosion ditches. It was from the consequences of this latter reversal that plaintiff sought relief. Injunctive relief was denied. The court based its decision on the rule that upper landowners are entitled to have surface water flow naturally over the land of the lower landowner. The direction of the original natural flow determines the dominant and servient estates, regardless of subsequent regradings which reverse the levels of the properties. Similarly, trivial changes caused by regrading will not give rise to an action by the lower landowner; the above doctrine will control. The defendant was, however, required to close the ditches through which water flowed as a result of defendant's grading. (Holt-Fla)
W69-05570

TANEY COUNTY V EMPIRE DIST ELECTRIC CO (FLOOD DAMAGE AND CLAIM SETTLEMENT FOR FUTURE DAMAGES).

235 SW 2d 271-173 (Mo 1951).

Descriptors: *Missouri, *Contracts, *Bridge construction, *Flood damage, Legal aspects, Compensation, Dams, Bridges, Bridge design, Claims, Relative rights, Judicial decisions, Local governments.
Identifiers: *White River, Mandamus.

Appellant county filed for a writ of mandamus to compel respondent electric company to revuild a bridge which had been destroyed by flood. The circuit court denied the writ. Appellant claims respondent's duty arises under a contract entered into between appellant and respondent's predecessor whereby respondent was to construct the bridge in question in accordance with certain specifications. Subsequent to the contract, respondent's predecessor paid $10,600 in satisfaction of all claims which would arise out of construction of a dam under congressional authority. Specifications required that the bridge be of sufficient height to be safe at all levels to which the river might reasonably be expected to rise. Appellant alleged that respondent's duty arose under this clause. The Supreme Court of Missouri held that the specific language took precedence over the general and that, since the bridge was 715 feet high, the requirements of the contract were met. The court further ruled that the $10,600 payment for inundation of roads and 'any other claims arising between the parties' was a complete bar to this action since the requirement of compensation may be fulfilled by judicial order or by an agreement between the parties. (Harris-Fla)
W69-05571

UNITED STATES V KANSAS CITY LIFE INSURANCE CO (FLOODING, UNDERFLOWING).
For primary bibliographic entry see Field 04A.
W69-05572

DILLENBECK V STATE (COMPENSATION FOR PERPETUAL EASEMENT TO FLOOD LAND).

83 NYS 2d 308-318 (Ct Cl 1948).

Descriptors: *New York, *Easements, *Compensation, *Overflow, Eminent domain, Legal aspects, Dams, Reservoir operation, Flood control, Land tenure, Relative rights, Judicial decisions, State governments, Peat.
Identifiers: *Fair market value.

Claimants brought this action for compensation from the state for appropriation of a perpetual easement to flood a parcel of land owned by them. The easement would have facilitated operation of a dam and reservoir (Whitney Point) and was to include the right to enter and remove any structures or obstructions detrimental to its operation. Claimants bought the land for $100 and intended to use it as a peat bog. It was contended that the fair market value of the bog was $40,000 based on projected earnings on peat sales. The state claimed fair market value of $100 based on the purchase price. The Court of Claims held that the easement was so exclusive as to render claimant's estate totally subservient to the state. The court determined claimants were entitled to the fair market value of the land for its highest and best available use. However, the alleged increase in value had to be proved and not based on mere speculation. Fair market value is that sum which a willing purchaser, under no compulsion to buy, will pay and which a willing seller, under no compulsion to sell, will accept. Claimants offered no proof of enhanced value based on actual sales of peat so as to sustain the alleged increase in fair market value above the $100 purchase price. The court found that reasonable compensation in these circumstances was $98. (Harris-Fla)
W69-05573

UNITED STATES V WILLIS (ARBITRARINESS IN LAND CONDEMNATION).

211 F 2d 1-4 (8th Cir 1954).

Descriptors: *Federal government, *Project purposes, *Condemnation, *Reservoir operation, Legal aspects, Dams, Land tenure, Relative rights, Compensation, Judicial decisions, Flooding, Eminent domain, Appeals, United States, Project planning, Project benefits, Federal project policy.
Identifiers: *Contour lines.

The owner of an 80.9 acre tract of land petitioned the United States District Court for an order setting aside a judgment of condemnation. The Corps of Engineers determined that it was necessary to condemn the tract as part of a dam and reservoir project because it extended into the heart of the reservoir and was accessable only on one side through another state. The government felt that if such tract remained in private hands, operation of the reservoir would be jeopardized. The District Court set aside the judgment below, ruling that condemnation of land higher in elevation than the contour line (700 feet above sea level), which would never be inundated, was an arbitrary action. The United States appealed. The Court of Appeals held that it was not legally possible to call the judgement of the Corps of Engineers arbitrary since the tract was relatively small and provided a vantage point for reservoir control. The land was susceptible of being used productively to only a limited extent, and the tract was inaccessible from within the state of Arkansas. The court found that just compensation for this plot was $1800. (Harris-Fla)
W69-05574

AMERICAN CYANAMID CO V COMMONWEALTH (POLLUTION ABATEMENT).
For primary bibliographic entry see Field 05G.
W69-05575

STATE V BOLLENBACK (NAVIGABILIT LAKE).

63 NW 2d 278-291 (Minn 1954).

Descriptors: *Minnesota, *Non-navigable w *Lakes, *Eminent domain, Public rights, Ju decisions, Right-of-way, Recreation, Boating, ing, Hunting, State governments, Federal go ment, Relative rights, Riparian rights, Rip land, Bodies of water, Ownership of beds, demnation, Easements, Legal aspects, Navi waters, Patents.
Identifiers: Swales.

The attorney general attacked issuance of an denying a new trial in a condemnation proce commenced upon the request of the Commiss of Conservation to acquire an easement private property to establish a public right of w a lake owned by defendant. The defendant tended that the alleged statutory requiremen not exist because the lake was not a navig public body of water. Evidence disclosed tha lake did not permanently connect with any body of water. Although used for hunting and ing, the lake was not used for commercial na tion, and there was never any settlement arou The court held that the lake was not navigable. title to beds of bodies of water not navigable a time of Minnesota's admission to statehood, not previously patented, remained in the Un States. Title to these beds pass by subseq patent to the purchaser of the riparian upl Travel on a body of water for purposes of hun and fishing is not commerce and provides no for a finding that such waters are navigable u the federal test which requires a useful capacit a public highway of transportation. (Heckerl Fla)
W69-05576

OSTLUND V STEARNS COUNTY (ARTIFICI ACCUMULATION OF SURFACE WATERS).

22 NW 2d 173-174 (Minn 1946).

Descriptors: *Minnesota, *Surface runoff, *R design, *Surface drainage, Land drainage, verts, Ditches, Riparian land, Legal aspe Damages, Remedies, Judicial decisions, Emin domain, Drainage water, Roads, Local gove ments, Road construction, Obstruction to fl Rivers, Channel flow.
Identifiers: Injunctions (Prohibitory).

Plaintiffs brought suit to enjoin the county fr discharging surface waters on plaintiffs' lands a to recover damages for injury to their estat Plaintiffs' lands lie between a road and the Mis sippi River. The land slopes gradually toward river. Before any road was built, much of the s face water would evaporate, and the excess wo run off into the river. As long as the surface of road was dirt, there was no real drainage proble however, when the county rebuilt the road, th made certain changes, including raising the ro bed one and one half feet. Because of the chang surface water could no longer flow over the ro The flow of water was channeled through an adequate culvert onto plaintiffs' lands causi damage. Evidence showed that the surface wa could be disposed of at minimal cost. The co upheld the trial court's damage award a sustained the injunctive order prohibiting the cou ty from discharging the water on plaintif premises. When one party collects surface water artificial means and casts it upon the premises another in increased and injurious quantities, he liable for damages incurred. (Heckerling-Fla)
W69-05577

EARLY V SOUTH CAROLINA PUBLIC SE VICE AUTHORITY (CONSTRUCTION OF DA AND DIVERSION OF RIVER).
For primary bibliographic entry see Field 04A.
W69-05578

RINE AIR WAYS, INC V STATE (INTER-RENCE WITH NAVIGATION).

NYS 2d 964-970 (Ct Cl 1951).

criptors: *New York, *Navigation, *Barriers, parian rights, Right of way, Bridges, Navigable ers, Legal aspects, Judicial decisions, Relative ts, Public rights, Compensation, Legislation, ts, Ships, Access routes, Construction, Eminent ain.
tifiers: *Bridge clearance, Standing.

mant maintained a shipyard on a navigable rway for service to all types of boats. He ght suit for damages on grounds that defen- impaired his riparian rights by constructing a nanent highway bridge, the height of which ef-vely excluded from his shipyard all except s requiring less than 50 feet clearance. The t of claims held that the claim was based on nution of business caused by interference with gation'. The court distinguished a 'navigation' from an 'access' right. The former right is a ic right, the infringement of which is not ac-ible by individuals; the latter right is a private ian right the infringement of which gives rise right of action by private riparian owners. The t held that although private riparian rights d not be taken for public use without just com-ation, the bridge in question interferred only public navigation. Since this was so, any com-ation must be statutory since the legislature nterfere with one public right in advancement other. The court held that plaintiff had been ged but not wronged. Plaintiff's claim was issed. Harris-Fla)
-05579

NCE V STATE (DAMAGES FOR AP-PRIATION OF RIPARIAN RIGHTS BY THE TE).

NYS 2d 479-481 (Ct Cl 1954).

riptors: *New York, *Easements, *Con-nation, *Right of way, Legal aspects, Riparian s, Land tenure, Compensation, Landfills, Em-ments, Bridges, Navigation, State govern-s, Judicial decisions, Public rights, Road con-tion, Eminent domain, Lakes, Highways, ages.
ifiers: *Lake Seneca.

iants were upland owners with a right of ac-o Seneca Lake. They alleged damage caused e building of a highway over the lake and el to the shoreline of their property. Con-ion of the highway involved filling the area een the highway and the shore and elevating oad to a level 50 feet above the water. This ruction completely cut off access to the lake. court of claims held that riparian owners are rvient to the state's power to construct off- improvements in furtherance of navigation commerce--the public good out-weighs the e interest. The court reasoned, however, that oad construction was not an exercise of the eign's reserve power over waterways. The further held that appropriation of riparian to facilitate commerce is subject to the s obligation to give compensation, unless such priation is in furtherance of navigation im-ment, and that damages equal to the dif-ce in value of the land with easements and ut easements should be awarded. The court ed $10,000 damages to claimant. (Harris-

05580

E SITE FOR HUNTS POINT SEWAGE TMENT WORKS, BOROUGH OF BRONX, OF NEW YORK (OWNERSHIP OF LAND R WATER).

pp Div 315, 119 NYS 2d 391-409 (Sup Ct

Descriptors: *New York, *Ownership of beds, *Boundaries (Property), *High water mark, Navigable waters, Local governments, Judicial decisions, Seashores, Beds under water, Relative rights, Riparian rights, Public lands, Land tenure, Cities, Condemnation, Legal aspects, Rivers, Bays.
Identifiers: Coves.

Appeal was taken from a condemnation proceeding in which it was determined that the City of New York and not the claimant had title to certain lands under water on the shore front of the East River. The land was located beyond the high water mark. The decision depended largely on the construction of various colonial patents of predecessors in title of the claimant and the former Town of Westchester. The City succeeded to the former interests of Westchester. Grants of more recent date by the State of New York affecting the land were also involved. The court discussed the wording of the historical grants in attempting to determine what the word 'sound' was intended to describe and what land was actually conveyed by the grants. The court held that crown patents were to be strictly construed in favor of the crown and against patentees. The fact that appurtenance clauses, which included rivers, creeks, and harbors, used in the grant to Westchester were broader than those in grants to private patentees, which overlapped the grant to Westchester, would not warrant a finding that titles to bays or coves were in the city, as successor of the town, and not in successors of private patentees. (Heckerling-Fla)
W69-05581

MUENCH V PUBLIC SERVICE COMMISSION (PUBLIC RIGHTS IN NAVIGABLE RIVER).

53 NW 2d 514-525 (Wis 1952).

Descriptors: *Wisconsin, *Navigable waters, *Adjudication procedure, *Public rights, Judicial decisions, Remedies, Local governments, Administrative agencies, Public benefits, Dams, Rivers, Hydroelectric power, Recreation, Navigable rivers, State governments, Legislation, Legal aspects, Administrative decisions, Relative rights, Navigation.
Identifiers: Standing, Delegation doctrine.

A certain hydro company filed an application with defendant commission to construct and operate a hydroelectric dam. The Conservation Commission objected to such construction on the ground that it would violate public rights. Defendant issued findings under a statute which gave it power to determine whether the dam would in fact obstruct navigation or violate other public rights. The defendant's findings upheld the company's right to construct the dam. Plaintiff, a private citizen, and the Conservation Commission filed motions for rehearing which were denied. The Circuit court held: (1) that the granting or withholding of a statutory water permit was not subject to judicial review since such action was, in effect, the conference of a 'privilege' by the legislature; and (2) that plaintiff was not a party 'aggrieved' by the defendant's action. The court directed dismissal of the action, concluding that the statute under which defendant made its findings was unconstitutional as an excessive delegation of legislative authority. Further, the court held that plaintiff did have standing since his right to use the navigable stream would be substantially impaired by the construction of the dam. (Heckerling-Fla)
W69-05582

COHASSET WATER CO V TOWN OF COHASSET (CONVEYANCE OF WATER WORKS TO TOWN).

72 NE 2d 3-10 (Mass 1947).

Descriptors: *Massachusetts, *Water works, *Contract administration, *Public utilities, Legislation, Cities, Local governments, Negotiations, Performance, Specifications, Property values, Water supply, Judicial decisions, Legal aspects, Permits.
Identifiers: Declaratory relief.

A water company brought suit in equity seeking a declaratory judgment concerning a town's vote to purchase the franchise and corporate property of the water company pursuant to the company's charter. The court held that, although the vote was effective as an exercise of the town's option to purchase, title would pass only upon execution of the power instruments and payment of a price which would be fixed at the time of the vote, not at the time of the conveyance. The court resolved the question as to how the company was to be operated in the interval between the balloting and the acquisition of title and possession by the town, stating that the company, as vendor under the contract to convey, would remain in possession until conveyance was made and would operate the water works for its own account, not as agent or trustee of the town. While the company retained possession, it would be liable for the exercise of 'good husbandry.' Finally, the court ruled that the town, having decided to exercise its option to purchase, had become contractually bound and could not rescind without the company's consent. (Reed-Fla)
W69-05583

PEOPLE V VILLAGE OF BERKELEY (STATUTORY DUTIES UNDER WATER SUPPLY CONTRACTS).

94 N E 2d 550-554 (Ill App 1950), Aff'd 98 N E 2d 743-746 (Ill 1951).

Descriptors: *Illinois, *Supply contracts, *Water supply, *Administrative agencies, Legislation, Cities, Water resources development, Operation and maintenance, Financing, Pipes, Water distribution (Applied), Water sources, Judicial decisions, Legal aspects, Public utilities.
Identifiers: Mandamus.

Plaintiffs sought a writ of mandamus to compel the duly elected officers of a village to enter into a contract with the Hillside-Berkeley Water Commission to supply water to the villages of Hillside and Berkeley. Subsequently, an amended complaint was filed requesting supplemental relief in the form of a declaratory judgment as to the rights and liabilities of the parties. The court held that where, pursuant to statutory authority, two villages pass reciprocal ordinances providing for joint acquisition and operation of a common source of water supply, and a Water Commission is created to effectuate that purpose, if one village enters into contract with the Commission, for water supply, the other village has a statutory duty to so contract. The defendant village was not allowed to disclaim any right, duty, or obligation in connection with the continued functioning of the Commission. (Katz-Fla)
W69-05584

DICKSON V BOARD OF COMM'RS OF CADDO LEVEE (EXPROPRIATION OF RIPARIAN LAND BY THE STATE).

26 So 2d 474-481 (La 1946).

Descriptors: *Louisiana, *Eminent domain, *Riparian land, *Levees, Judicial decisions, Legal aspects, Remedies, Water law, Rivers, State jurisdiction, Compensation, River regulation, Erosion, Appropriation, Relative rights, Public benefits, Public rights.
Identifiers: *Expropriation, Servitudes.

Plaintiff, a riparian owner, sued to recover for lands allegedly appropriated by a levee district. The construction of a levee resulted in the destruction of plaintiff's land and crops by reason of increased erosion caused by the artificial current created in the river. Plaintiff's claim was based upon the 5th Amendment of the Federal Constitution and upon a similar state provision which required just compensation for the taking of private property. Relief was denied. The court summarized the historical treatment of riparian owners and recognized their duty to provide for levees. The property of a riparian owner is subject to the public's right to construct

a levee. The early land grants reserved to the state the right to enter riparian land and construct levees. The court held that these lands were still subject to the levee servitude. To qualify for any compensation, the landowner would have to comply with the gratuitous provision of Article XVI of the Louisiana Constitution which requires him to plead the assessed value of the property for the preceeding year. Plaintiff failed to comply with this provision. (Holt-Fla)
W69-05585

STATE V GLIDDEN CO (CONSTITUTIONALITY OF WATER POLLUTIONS CONTROL STATUTE).
For primary bibliographic entry see Field 05G.
W69-05586

EAVES V CITY OF OTTUMWA (LIABILITY FOR FLOOD DAMAGE).

38 NW 2d 761-770 (Iowa 1949).

Descriptors: *Iowa, *Diversion structures, *Overflow, *Flood damage, Flood gates, Channels, Hydroelectric plants, Dams, Levees, River regulation, Rivers, Floods, Damages, Remedies, Judicial decisions, Legal aspects, Cities, Local governments, Operation and maintenance.
Identifiers: Res ipsa loquitor, Proximate cause, Des Moines River.

Plaintiffs sought to recover damages for flooding allegedly caused by defendant's negligence. Defendant city controlled a hydroelectric plant and a diversion channel on the Des Moines River. Plaintiffs alleged that defendant's negligent failure to open the flood gates astride the diversion channel caused river water to overflow the channel levees causing damage to plaintiff's property. The jury found for the plaintiffs and defendant appealed. This court reversed, holding that an instruction to the jury that the doctrine of res ipsa loquitor was applicable in this case was erroneous since the city did not have exclusive control of the flood water, one of the instrumentalities causing damage, and since the true cause of the injury was no more accessible to defendant than to plaintiffs. The court observed that the jury could find for the plaintiff if they felt that the alleged negligence was the proximate cause of plaintiffs' damage. The defendant owed a duty of exercising reasonable care in operating its facilities, and this was so regardless of whether the land would have been overflowed in its natural state. (Gabrielson-Fla)
W69-05587

CARLSON V A AND P CORRUGATED BOX CORP (FLOODING CAUSED BY NEGLIGENT MAINTENANCE OF DAM).
For primary bibliographic entry see Field 04A.
W69-05588

IODICE V STATE (DUTIES OF DAM OWNERS).

102 NYS 2d 742-750 (App Div 1951).

Descriptors: *New York, *Overflow, *Flood damage, *Dams, Alteration of flow, Spillways, Floods, Flood control, Rivers, Riparian rights, Reservoirs, Damages, Remedies, Judicial decisions, Legal aspects, Natural flow.

Plaintiffs sought to recover for damages caused by overflow from defendant's dam. Plaintiffs alleged that defendant's employees were negligent in failing to maintain the waters impounded behind the dam at a level suffiently below the spillways so that additional water coming into the reservoir because of excessive rain could be contained. A verdict was entered for the plaintiff, and defendant appealed. This court reversed and dismissed the claim, finding that the dam was authorized for the purpose of creating a storage reservoir and not for flood control. Therefore, no duty existed to minimize or eliminate the flooding of the land below to a greater extent than if the river flowed naturally. A dam owner may permit dam overflow where the volume cast into the channel below does not exceed the volume coming in above the dam. Actually, less water flowed through the spillways than came in above the dam. In effect then defendant's actions reduced the extent of plaintiffs' damages. Since the natural flow of the river was not exceeded through defendant's negligence, the defendant was not liable. (Gabrielson-Fla)
W69-05589

GOLDEN V AMORY (LIABILITY FOR FLOODING).
109 NE 2d 131-133 (Mass 1952).

Descriptors: *Dikes, *Overflow, *Flood damage, *Massachusetts, Floods, Dam failure, Damages, Remedies, Flood protection, Judicial decisions, Legal aspects, Excessive precipitation, Rainfall, Intensity, Legislation, Highways, Rivers, Local governments, Inspection.
Identifiers: Proximate cause, Act of God, Nuisance.

As a result of a hurricane a certain river overflowed damaging the real estate of several plaintiffs. Plaintiffs alleged that defendants' dike on the river constituted a nuisance since it had not been approved or inspected by the county commissioners as required by statute. Plaintiffs also alleged negligence in the maintenance of the dike. The judge directed verdicts for the defendants on the second allegation after a verdict for the plaintiffs. Plaintiffs excepted. The court on appeal held that since the dike was primarily a highway and only incidently a dike, the statute requiring approval and inspection was inapplicable. Furthermore, no causal relationship existed between the alleged violation of statute and the flooding as no negligence was shown in the maintenance of the dike. Since the rains which caused the flooding were totally without precedent in the region and of an intensity beyond anyone's anticipation, the court found them to be clearly an act of God. (Gabrielson-Fla)
W69-05590

BLACK RIVER REGULATING DIST. V ADIRONDACK LEAGUE CLUB (CONDEMNATION PROCEEDINGS).

307 N Y 475, 121 NE 2d 428-434 (1954).

Descriptors: *New York, *Eminent domain, *Reservoir construction, *Riverflow, Judicial decisions, Legislation, Reservoir operations, Flood control, Floods, River regulation, Administrative agencies, State governments, Public health, Safety, Public benefits, Public rights, Condemnation, Legal aspects.
Identifiers: Constitutionality.

The plaintiff initiated a condemnation proceeding to obtain defendant's land for construction of a reservoir. Plaintiff intends to construct reservoirs in order to control streamflow in the interests of public health and safety. Defendant contends that plaintiff is prohibited by statute from bringing condemnation proceedings. The statute in question provides that reservoirs may be constructed only for the purpose of furnishing a municipal water supply. Plaintiff challenged the act as unconstitutional. The court found for the defendant, holding a state administrative agency depends upon the legislature for its powers and authority. Inherent in a grant of legislative power is the plenary power reserved to the legislature to alter or revoke such grant. The statute was an alteration of the power conferred upon the plaintiff and was constitutional. (Stewart-Fla)
W69-05591

TAYLOR V STATE (PRESCRIPTIVE RIGHT TO FLOOD LAND).

302 NY 177, 96 NE 2d 765-770 (1951).

Descriptors: *New York, *New York State Ba
Canal, *Flood damage, *Prescriptive rights,
pounded waters, Judicial decisions, Check st
tures, Floodgates, Diversion structures, Overfl
Dam construction, Floodwater, Water spread
Rainfall intensity, Lakes, Floods.
Identifiers: Estoppel by judgment.

Plaintiffs brought proceedings against the state
recover damages for flooding of their lands by
waters of a lake which constituted part of
state's barge-canal system. Plaintiffs alleged
the flood damage was caused by the state's wro
ful maintenance of a dam which impounded
lake's waters at a level so high that, in times
heavy rainfall, plaintiffs' lands were flooded.
state conceded fault as to the building of the dam
an improper level but asserted that it had, by la
of time, acquired an easement to maintain the d
at such a height and, incidentally, to flood pla
tiffs' properties. The court declared that a prescr
tive right to continue the dam at a certain hei
and to divert the resulting floodwaters o
neighboring lands could only be established b
showing that over an appropriate period there
an uninterrupted user of that claimed right by s
cessive floodings of the lands in question. It was
the height of the dam but the frequency and du
tion of the floods which determined whether
prescriptive right had been acquired. The co
concluded that the evidence sustained a findi
that the state was liable to plaintiffs. (Reed-Fla)
W69-05592

NIXON V WELCH (SURFACE DRAINAG EASEMENTS).
For primary bibliographic entry see Field 04A.
W69-05593

JONES V LUCAS (SURFACE DRAINAGE).
For primary bibliographic entry see Field 04A.
W69-05594

SCHEELER V DEWERD (EASEMENT TO TAK WELL WATER).

256 Wis, 41 NW 2d 635-637 (1950).

Descriptors: *Wisconsin, *Easements, *Wat
wells, *Water rights, Judicial decisions, Wat
supply, Watercourses, Water pumping, Deep-w
pumping, Groundwater mining, Pipes, Pumpi
plants, Water delivery, Piping systems, Leg
aspects, Relative rights.
Identifiers: Implied rights, covenants.

Plaintiffs brought suit to restrain interference wi
their right to take water from a well located on d
fendant's property. The water was supplied to th
plaintiffs through a pressure system which was al
located on defendant's property. The plaintiffs ha
paid their proportionate share for the electr
pump and pressure system. Upon purchase of th
property, plaintiffs received warranty deeds whic
recited that each was entitled to obtain a supply
water from the well. Plaintiffs' grantor then co
veyed the tract upon which the well was located
the defendant, who had constructive notice of th
rights of adjoining land owners. After a disagre
ment, defendant shut off the plaintiffs' wat
supply. The court held that the plaintiffs ha
acquired an easement to draw water. Furthermor
since the grant of an easement impliedly confer
upon the grantee those additional rights reasonabl
necessary for full enjoyment of it, the plaintiffs als
had the right to use the pressure system. (Stewar
Fla)
W69-05595

STATE ROADS COMMISSION V BERRY (CON DEMNATION AWARDS).

118 A 2d 649-653 (Md 1955).

Descriptors: *Maryland, *Condemnation value
*Easements, *Dairy industry, Judicial decisions

ndemnation, Legal aspects, Compensation, nomic impact, Farms, Streams, Stock water, uting, Diversion.

ntiff condemned a portion of defendant's dairy n for use in construction of an expressway. A am, which was used by defendant to water his k, flowed across the tract. Plaintiff condemned ut 13 acres of the land and also acquired an ement in more than 1 acre for certain stream e charges and facilities. The area taken by ntiff included nearly all of the stream bed. A e was placed around the easement area. Plain- appealed the condemnation award. In affirming award, the court held that the judge's question- of expert witnesses as to the value of the land n was not reversible error since no ruling was e on the objection. There was also no error in exclusion of the testimony of the plaintiff's stant Right of Way Engineer as to the purpose e fence around the easement area since the ex- of the taking is determined by the petition, , and the jury's inquisition, not by the un- tanding of plaintiff's employees. (Molica-Fla) -05596

BOT V KERN (SERVITUDES OF INAGE).
o 2d 548-551 (La 1953).

riptors: *Louisiana, *Easements, *Surface nage, *Obstruction to flow, Judicial decisions, nage water, Riddance (Legal aspects), nage, Canals, Surface runoff, Legal aspects, lsion (Legal aspects), Relative rights, Ditches. ifiers: Injunctions (Mandatory), Injunctions hibitory), Equitable servitudes, Restrictive nants, Partition, Necessary parties.

tiffs' tracts of land were separated by land ed by defendant. All these tracts were nally part of a plantation which had been parti- d. The partition agreement granted to the ctive owners rights of drainage and passage s adjacent tracts. Plaintiffs sought an injunc- to restrain defendant from interfering with right of passage to their land and to compel dant to remove from cross ditches on his tract in dams which prevented proper drainage of tiffs' lands. The court issued the requested in- ion. The other owners of the partitioned plan- were not necessary parties to the suit se the rights granted in the partition agree- were independent. The servitudes created by act of partition were real servitudes, and, se of continual usage, they were not extin- ed by non-use for the prescriptive period. ica-Fla) 05597

WN V BLANKENSHIP (SUBSERVIENT NAGE).

2d 496-498 (La 1946).

iptors: *Louisiana, *Drainage water, *Repul- Legal aspects), *Obstruction to flow, Judicial ons, Surface runoff, Legal aspects, Drainage, ce drainage, Channels, Culverts, Channel Natural flow.
fiers: Injunctions (Mandatory).

iff's land was adjacent to defendant's land t a slightly higher elevation. The surface s from plaintiff's land drained across a natural el partly on defendant's land. Defendant's cessor in title kept the natural drain open, y reason of defendant's neglect, the drain had e obstructed by an accumulation of vegeta- This condition impeded surface drainage and d damage to plaintiff's crops. The court en- a decree ordering defendant to remove the ctions and vegetation. The fact that plaintiff deepen a different channel to obtain the d drainage was not so uncontroverted as to e a different decision. (Molica-Fla) 05598

HUTCHESON V SUMRALL (WATER SUPPLY EASEMENT).

72 So 2d 225-229 (Miss 1954).

Descriptors: *Mississippi, *Easements, *Water supply, *Artesian wells, Judicial decisions, Legal aspects, Federal government, Water rights, Adjudication procedure, Preferences (Water rights), Competing uses, Relative rights.
Identifiers: Equitable servitudes, Covenants, Injunctions (Mandatory).

Plaintiffs purchased land and appurtenances from the federal government. These lands were served with water from artesian wells situated on a parcel of land subsequently conveyed to defendant. Defendant cut off the flow of water, and plaintiffs sought an injunction requiring restoration of the flow to its original volume. At the time of their purchase, defendant knew of the existence of the wells but made no inquiry as to their use. The court held that the requested injunction should issue. The term 'appurtenances' in plaintiffs' deed conveyed any easements existing at the time of the grant. Since the wells were situated on defendant's land, defendant had a paramount right to make use of them. But, as long as the supply of water exceeded the bonafide needs of defendant, plaintiffs were entitled to a share of the excess for their bonafide needs. (Molica-Fla)
W69-05599

LEWALLEN V DAVENPORT (DAMAGE FROM BACKING SURFACE RUNOFF).
For primary bibliographic entry see Field 04A.
W69-05600

6F. Nonstructural Alternatives

EAST FORK DUCK CREEK WATERSHED; NOBLE AND WASHINGTON COUNTIES, OHIO.
Soil Conservation Service, Washington, D. C.
For primary bibliographic entry see Field 06B.
W69-05329

07. RESOURCES DATA

7A. Network Design

PROBLEMS OF THE METHODS AND ACCURACY OF HYDROLOGIC OBSERVATIONS (RUSSIAN),
State Hydrological Inst., Leningrad (USSR).
I. F. Karasen, and A. N. Chizhov.
Transl by V. Gabriel. Proc of the State Hydrol Inst, No 150, 1968. 16 p, 2 fig, 1 tab, 18 ref. Trudy Gos Gidrol Inst, No 150, 1968.

Descriptors: *Mathematical studies, *Mathematical models, *Methodology, *Reservoir storage, Discharge (Water), Stage-discharge relations, Water level fluctuations, Discharge coefficients, Slopes, Measurement, Mechanical equipment, Theoretical analysis, Hydroelectric power, Hydrograph analysis.
Identifiers: *Hydraulic observations, USSR.

On the basis of earlier analytical and experimental studies by Troitsky (1935), Brillyum (1960), Pavlov (1964) and others, an analytical analysis is presented of the optimal accuracy of water level measurements necessary for reliable evaluation of reservoir and river parameters. An assumption is made that errors present in water discharge measurements are a function of water level (stage) observations. These errors can be minimized by calculating the maximum water level amplitudes, the excess of mean early level of discharge variations over a zero level, and by taking into consideration the form of daily discharge-stage curves. The criteria for minimizing the errors in stage measurements, using a water surface slope method, were also analyzed. The study shows that (1) the stage-discharge curve can be applied in most cases, (2) measurements recorded at gaging stations should consider the discharge variations form of the stage-discharge curves and the mean annual water stages, (3) water discharged for hydroelectric use should be considered in evaluating reservoir capacity, (4) a hydraulic method using water surface slope, is more suitable at gaging stations characterized by wide discharge variations, and (5) the development of water slope instruments using pressure differences is considered very desirable. (Gabriel-USGS)
W69-05210

SYNTHETIC HYDROGRAPHS; EFFECTS OF NETWORK GEOMETRY,
Thomas J. Watson Research Center, Yorktown Heights, N. Y.
For primary bibliographic entry see Field 02A.
W69-05432

7B. Data Acquisition

TIME-OF-TRAVEL MEASUREMENTS AND OTHER APPLICATIONS OF DYE TRACING,
Geological Survey, Cheyenne, Wyo. Water Resources Division.
James F. Wilson, Jr.
Int Ass Sci Hydrol Pub No 76, Symp on Hydrol Aspects of Util of Water, Bern, Sept 25-Oct 7, 1967, pp 252-265, 1968. 14 p, 8 fig, 15 ref.

Descriptors: *Tracers, *Tracking techniques, *Dye releases, Indicators, Sampling, Streamflow, Groundwater movement, Fluorometry, Dispersion, Pesticide drift, Path of pollutants, Missouri River.
Identifiers: Rhodamine dyes, Travel time, Dye dilution techniques.

Fluorescent dyes of the rhodamine family are popular hydrologic tracers because of the simplicity and sensitivity of fluorometric procedures. The U.S. Geological Survey uses dyes for time-of-travel measurements, dispersion studies, and streamflow measurements. 'Time-of-travel' is a general term used to describe the downstream movement of water or water-borne materials with time. In the largest measurement to date, a single injection of 1800 kg of 40% dye solution was used to measure a 200 km reach of the Mississippi River, at a discharge of 6700 cu m/sec. A 1300 km reach of the Missouri River was measured twice using simultaneous injections of dye in 10 sub-reaches, at discharges of 550 and 1000 cu m/sec. The above examples and several others are described, to illustrate the following: (1) there is no apparent limit to the size or length of stream which may be studied by dye tracing; (2) time of travel observed by tracing often differs significantly from that computed from channel geometry and streamflow data; (3) excellent longitudinal dispersion information is gained by using tracers; (4) neither pools behind low dams nor heavy industrial and municipal contamination have seriously threatened the success of a measurement by dye tracing; and (5) travel time is a function of streamflow, facilitating interpolation and extrapolation of tracing data. The versatility of dye tracing is illustrated by examples of several other applications, including streamflow measurements, estuarine dispersion studies, herbicide tracing, and groundwater studies. (Knapp-USGS)
W69-05228

IMPROVED DYES FOR WATER TRACING,
Geological Survey, Washington, D. C.
James F. Wilson, Jr.
Geol Surv Water-Supply Pap 1892, Selec Tech in Water Resources Invest, 1966-67, pp 5-8, 1968. 4 p, 1 tab.

Descriptors: *Tracers, *Dye releases, *Fluorescence, Fluorometry, Specific gravity, Filters, Analytical techniques.
Identifiers: Dyes, Rhodamine-B, Rhodamine-WT, Fluorescein, Pontacyl Brilliant Pink B.

The dyes available for water tracing are described, their properties tabulated, and their uses and performance discussed. Dye manufacturers are beginning to tailor the properties of certain fluorescent dyes for water-tracing purposes. Various solutions of rhodamine B are now available with specific gravities in the range 1.00 to 1. Rhodamine WT, a new dye, exhibits low sorptive tendency and is proving to be an excellent tracer, especially for discharge measurements. Selection of fluorometer filters appropriate to the particular dye used is a critical factor in instrument sensitivity. (USGS)
W69-05235

NOMOGRAPHS FOR DETERMINING AMOUNT OF RHODAMINE B DYE FOR TIME-OF-TRAVEL STUDIES,
Geological Survey, Washington, D. C.
Bernard Dunn.
Geol Surv Water-Supply Pap 1892, Selec Tech in Water Resources Invest, 1966-67, pp 9-14, 1968. 6 p, 2 fig, 1 ref.

Descriptors: *Tracers, *Dye releases, *Estimating equations, Estimating costs, Fluorometry, Dispersion.
Identifiers: Nomographs, Dye requirements, Rhodamine-B.

Concentrations of dye are measured at a known distance below the point of injection to calculate the time of travel of a stream. The amount of dye required for injection into a stream needs to be computed in order to hold the level of concentration within desired limits and to minimize the cost of dye. Nomographs that permit rapid determination of the amount of dye required have been prepared for two of the formulas commonly used in dye studies. (USGS)
W69-05236

CONSTANT-RATE-INJECTION EQUIPMENT FOR DYE-DILUTION DISCHARGE MEASUREMENTS,
U S Geological Survey, Washington, D. C.
Ernest D. Cobb.
Geol Surv Water-Supply Pap 1892, Selec Tech in Water Resources Invest, 1966-67, pp 15-22, 1968. 8 p, 5 fig.

Descriptors: *Dye releases, *Tracers, *Discharge measurement, *Equipment, Uniform flow, Flowmeters, Pumps, Flow rates.
Identifiers: Constant-rate dye-injection, Flow regulators, Constant-head injection equipment.

The measurement of stream discharge by the constant-rate-injection dye-dilution method requires accurate injection equipment. Several units that use different principles and have different advantages have been developed. Constant flow rates of dye solution can be maintained by (1) a mariotte unit that maintains a constant head on the discharge orifice, (2) a spring-diaphragm unit that has an automatically adjusted spring-diaphragm-valve mechanism, (3) a floating siphon that maintains a fixed head on the orifice, (4) a constant-level reservoir that stores any solution above a given elevation, and (5) a constant-rate pump that uses a uniform power supply. The mariotte tank is easily and cheaply made and is very reliable, the spring-diaphragm unit is more versatile but also more expensive; and the floating siphon, the constant-level reservoir, and the constant-rate pump all have the advantage that additional solution can be added to the supply reservoir without disrupting the flow rate. (USGS)
W69-05237

SELECTION OF DYE-INJECTION AND MEASURING SITES FOR TIME-OF-TRAVEL STUDIES,
Geological Survey, Washington, D. C.
M. R. Collings.
Geol Surv Water-Supply Pap 1892, Selec Tech in Water Resources Invest, 1966-67, pp 23-29, 1968. 7 p, 1 fig, 2 ref.

Descriptors: *Tracers, *Dye releases, *Sites, Water utilization, Tracking techniques, Streamflow, Fluorometry, Estimating.
Identifiers: Time-of-travel studies, Single injection method, Multiple injection method.

Studies using fluorescent dyes for estimating time of travel in streams may be made by either a single-injection method for the entire study reach or a multiple-injection method whereby the study reach is divided into subreaches. The method used is governed by the specific prerequisites of the study, time and personnel limitations, and other factors. The optimum success of a study depends upon proper selection of dye-injection and measuring sites. Site selection should be made after a comprehensive inventory of the study reach. Factors to be evaluated include channel characteristics of the stream, potential loss of dye, municipal demands, tributary inflow, and stream discharge. (USGS)
W69-05238

COMPARISON OF RESULTS USING THREE SAMPLING TECHNIQUES FOR A FLUOMETRIC DYE STUDY IN A STREAM,
Geological Survey, Washington, D. C.
J. D. Stoner.
Geol Surv Water-Supply Pap 1892, Selec Tech in Water Resources Invest, pp 30-33, 1968. 4 p, 1 fig.

Descriptors: *Dye releases, *Tracers, *Sampling, Monitoring, Fluorometry, Reliability, Dispersion, Pumping.
Identifiers: Grab samples, Pumped samples, Stream traveltime.

Three sampling techniques--grab samples and two different pumping systems--were tested concurrently at a single point in a stream. The means and variances computed for the three sampling methods are shifted from the true means and variances by various time increments. Generally, sampling points along a stream in a time-of-travel or dispersion study are far enough apart to make the error shift insignificant, so that results from different sampling methods are directly comparable. However, some studies require that correction factors be applied to the means and variances. (USGS)
W69-05239

DYE-CLOUD PHOTOGRAPHY,
Geological Survey, Washington, D. C.
James F. Wilson, Jr.
Geol Surv Water-Supply Pap 1892, Selec Tech in Water Resources Invest, 1966-67, pp 37-43, 1968. 7 p, 4 fig, 6 ref.

Descriptors: *Dye releases, *Tracers, *Photography, Aerial photography, Films, Monitoring, Filters.
Identifiers: Dye-cloud photography.

For some time after a fluorescent dye is injected into a water body, the dye cloud is visible and may be photographed to supplement surface sampling qualitatively and quantitatively. Both vertical and oblique aerial photographs provide synotpic views of the surface distribution of the dye, which facilitates monitoring the spatial distrubution of the dye over periods of time. Color photographs are useful for exhibition purposes; black-and-white photographs taken with appropriate filters cost less to publish in reports and are best for quantitative analysis by such techniques as photodensitometry. (USGS)
W69-05241

A MICROKIT FOR DISSOLVED OXYGEN DETERMINATION,
Geological Survey, Washington, D. C.
Keith V. Slack.
Geol Surv Water-Supply Pap 1892, Selec Tech in Water Resources Invest, 1966-67, pp 44-51, 1968. 8 p, 3 fig, 4 ref.

Descriptors: *Analytical techniques, *Dissol oxygen, Test procedures, Chemical analysis, site tests, On-site laboratories, Equipment
Identifiers: Dissolved oxygen analysis

Methods are described for determining dissol oxygen in a water sample contained in a 10 hypodermic syringe. Precision is better than part ppm. The equipment and supplies are stand items that cost less than $15, exclusive of reage A 3- by 5-in. card file box will contain all mater needed for up to 50 dissolved oxygen determi tions. Reagents for the azide modification of Winkler method are either drawn into the 10 syringe or injected through the tip into the syri barrel. The sample can be titrated in a small fl or in the 10-ml syringe. (USGS)
W69-05242

FIELD KIT FOR DETERMINING ALKALINI
Geological Survey, Washington, D. C.
J. L. Kunkler.
Geol Surv Water-Supply Pap 1892, Selec Tech Water Resources Invest, 1966-67, pp 52-54, 19 3 p, 1 fig, 1 ref.

Descriptors: *Analytical techniques, *Alkalini Test procedures, Chemical analysis, On-site te On-site laboratories, Bicarbonates, Carbonat Travertine.
Identifiers: Alkalinity analysis (Field), Titration.

Accurate field determinations of alkalinity possible with the described field kit because t temperatures of the standard buffer solutions a the samples are maintained within 2 deg C of t temperature of the sampling source. Field det minations of standard solutions indicate that resu deviate less than 1% from the correct valu (USGS)
W69-05243

RAPID FIELD FILTRATION OF WATER SA PLES,
Geological Survey, Washington, D. C.
Charles F. Berkstresser, Jr.
Geol Surv Water-Supply Pap 1892, Selec Tech Water Resources Invest, 1966-67, pp 55-59, 196 5 p, 2 fig, 2 tab, 3 ref.

Descriptors: *Filtration, *Filters, *Sampling, O site laboratories, Equipment, Nitrogen.

Equipment for the rapid filtration of water sampl in the field at the time of collection is describe Water samples should be filtered to reduce chem cal change in storage. The equipment describe uses bottled nitrogen to drive the sample through high-pressure filter. (Knapp-USGS)
W69-05244

FIELD MONITORING OF THE QUALITY O WATER DURING THE DRILLING OF WELLS,
Geological Survey, Washington, D. C.
Jack Rawson.
Geol Surv Water-Supply Pap 1892, Selec Tech i Water Resources Invest, 1966-67, pp 60-66, 196 7 p, 1 fig, 2 tab, 3 ref.

Descriptors: *Analytical techniques, *Tes procedures, *Chemical analysis, On-site tests, On site laboratories, Chlorides, Sulfates, Hardness Monitoring.
Identifiers: Water quality monitoring.

Simple, rapid, and accurate visual methods of anal ysis for chloride, sulfate, and hardness ar described for use in conjunction with field conduc tivity measurements to provide more detailed an reliable information on chemical composition o well water sampled and tested during drilling. Dur ing the drilling of wells, aquifers that yield water o different chemical composition may be penetrated Fluid-conductivity logging provides an indicatio of total dissolved solids content of the waters, bu does not indicate types and concentrations of in dividual ions. (Knapp-USGS)

W69-05245

SAMPLING APPARATUS TO MINIMIZE AERATION OF WATER FOR THE DETERMINATION OF DISSOLVED GASES,
Geological Survey, Washington, D. C.
J. F. Joyner.
Geol Surv Water-Supply Pap 1892, Selec Tech in Water Resources Invest, 1966-67, pp 67-68, 1968. 2 p, 1 fig.

Descriptors: *Sampling, *Water analysis, *Chemical analysis, *Aeration, On-site data collections, Equipment.
Identifiers: Water samplers, Non-aerating water sampler, Dissolved gases.

A sampling apparatus for collecting nonaerated water from shallow depths for the determination of dissolved gases can be assembled from materials available in any chemical laboratory. The device can be used in water only 1 in. deep; conventional samplers for the same purpose cannot be used in water less than 18 in. deep. (USGS)
W69-05246

USE OF CARBON DIOXIDE IN BUBBLE GAGES TO PREVENT PRECIPITATION OF CALCIUM CARBONATE,
Geological Survey, Washington, D. C.
Wallace D. Robbins, and Leon S. Hughes.
Geol Surv Water-Supply Pap 1892, Selec Tech in Water Resources Invest, 1966-67, pp 69-71, 1968. 3 p, 1 fig, 2 ref.

Descriptors: *Stream gages, *Operation and maintenance, Equipment, Calcium carbonate, Reliability, Carbon dioxide, Nitrogen.
Identifiers: Bubble gages, Equipment modifications, Carbona dioxide bubble gages, Clogging prevention.

The tube mouth of the gas-purge system of a bubble gage may become blocked over a period of time by precipitation of calcium carbonate when nitrogen gas is bubbled through the tube into water containing high concentrations of calcium and bicarbonate in solution. Carbon dioxide substituted for nitrogen has proved successful in preventing the precipitation of calcium carbonate at the bubble-gage orifice. The described conversion from nitrogen to carbon dioxide is inexpensive, and thereafter, operation and maintenance costs of the bubble gage are reduced substantially. (USGS)
W69-05247

POLYETHYLENE OIL TUBES FOR STILLING WELLS,
Geological Survey, Washington, D. C.
Robert L. Stewart.
Geol Surv Water-Supply Pap 1892, Selec Tech in Water Resources Invest, 1966-67, pp 72-74, 1968. 3 p, 2 fig.

Descriptors: *Stream gages, *Equipment, *Operation and maintenance, Antifreeze, Tubes.
Identifiers: Stream gage oil tubes, Freezing prevention, Polyethylene sheet tubing.

An inexpensive, economical oil tube to be used in stilling wells of gaging stations for freeze prevention may be made of tubular sheet polyethylene suspended from a steel hoop. The tube can be installed and removed without disturbing the gaging station structure and its instruments. Complete instructions for the construction, installation, and operation of the tubes are given. (Knapp-USGS)
W69-05248

WATER-MANOMETER-AIR-LINE ASSEMBLY FOR DETERMINING DEPTH TO WATER IN WELLS,
Geological Survey, Washington, D. C.
O. Loeltz.
Geol Surv Water-Supply Pap 1892, Selec Tech in Water Resources Invest 1966-67, pp 75-82, 1968. 8 p, 1 fig, 1 ref.

Descriptors: *Manometers, *Instrumentation, *Water levels, *Water wells, Water level fluctuations, Measurement.
Identifiers: *Pumping tests, Aquifer tests, Airline manometers, Bubble gages.

An air-line and water-column manometer to be used to measure rapidly and accurately the changes of water level during pumping tests is described, and details of its construction and operation are given. An air-line already installed in a well or one temporarily installed for the duration of testing may be used. Measurements are made by purging the submerged end of the air-line of water and reading the manometer column height at purge pressure. In successive readings, the manometer height differences are equal to well water-level differences. (Knapp-USGS)
W69-05249

MINIMUM AND MAXIMUM WATER-LEVEL RECORDING DEVICES,
Geological Survey, Washington, D. C.
T. E. Kelly.
Geol Surv Water-Supply Pap 1892, Selec Tech in Water Resources Invest 1966-67, pp 83-86, 1968. 4 p, 2 fig.

Descriptors: *Instrumentation, *Observation wells, *Water levels, *High water mark, *Low water mark, Measurement, Equipment, Hydrograph.
Identifiers: Recorders, Minimum water levels, Maximum water levels, Crest-stage recording, Periodic observation.

To supplement periodic water-level measurements in observation wells, two inexpensive devices were constructed to determine the minimum and maximum water levels between visits to a well site. The minimum water level is determined by use of a float, and the maximum water-level device is a modification of a crest-stage station and uses a tube with powdered cork. The devices measure to an accuracy of 0.1 foot. (USGS)
W69-05250

SERVOPSYCHROMETER,
Geological Survey, Washington, D. C.
Woodrow L. Yonts, Jr.
Geol Surv Water-Supply Pap 1892, Selec Tech in Water Resources Invest, 1966-67, pp 87-90, 1968. 4 p, 1 fig.

Descriptors: *Instrumentation, *Calibrations, *Hygrometry, Humidity, Thermometers, Measurement, Analytical techniques.
Identifiers: Sling psychrometers, Servopsychrometers, Wet-bulb thermometers.

A description is given for a servopsychrometer for use inside instrument shelters, where sling psychrometers cannot be used, to check the operation of recording hygrothermographs. The instrument consists of the wet and dry bulb thermometers from a sling psychrometer and a battery-powered electric fan to blow air over the bulbs. Reading of the fan psychrometer and the recording hygrothermograph differ by less than 2% when taken in the same shelter. (Knapp-USGS)
W69-05251

RAFT FOR EVAPORATION-MEASUREMENT EQUIPMENT,
Geological Survey, Washington, D. C.
Richard U. Grozier.
Geol Surv Water-Supply Pap 1892, Selec Tech in Water Resources Invest, 1966-67, pp 91-93, 1968. 3 p 2 fig, 1 ref.

Descriptors: *Instrumentation, *Evaporation, Lakes, Anemometers, Operation and maintenance, Reservoirs.
Identifiers: Instrument raft.

Deterioration of steel barrels in rafts used to support equipment for determining evaporation on reservoirs was eliminated by using plastic foam instead of steel barrels for raft buoyancy. Special frames were devised to hold the plastic foam and the frames were fastened together in a design that made the new raft both safe and sturdy. (USGS)
W69-05252

WATER-STAGE AND RAINFALL DUAL RECORDER,
Geological Survey, Washington, D. C.
George F. Smoot, and Thomas J. Buchanan.
Geol Surv Water-Supply Pap, Selec Tech in Water Resources Invest, 1966-67, pp 94-101, 1968. 8 p, 3 fig.

Descriptors: *Stream gages, *Rain gages, *Instrumentation, Floods, Water measurement.
Identifiers: Rain-stage dual recorder, Recorders.

An instrument is described that records both cumulative rainfall and flood stages on streams with small drainage basins to help define flood frequencies. The stilling well and stage-recording mechanism are installed so that 5-, 10-, or 20-ft ranges of a stage above a predetermined gage height can be recorded during 24 hr; more than 24 hr of flood record on one chart may be difficult to read. Record automatically begins after water stage reaches the predetermined height. The rainfall recorder can register any number of inches of rain because of a siphon system attached to the rainfall-measuring reservoir. After 5 inches of rain have fallen, the siphon empties the reservoir and a new recording cycle is begun. Rainfall record is continuous between service visits to an instrument, which may be 6 to 8 weeks apart if no flood occurs. Both cumulative rainfall and water stage are recorded on one polar coordinate chart with the time of day (but not the date) of an event defined. Rainfall is recorded with an accuracy of plus or minus 0.025 in; different stage ranges are recorded with different accuracies of from plus or minus 0.025 ft for a 5-ft range to plus or minus 0.10 ft for a 20-ft range. (USGS)
W69-05253

POLAR COORDINATE CHART READER FOR STAGE-RAINFALL RECORDER,
Geological Survey, Washington, D. C.
V. B. Sauer.
Geol Surv Water-Supply Pap 1892, Selec Tech in Water Resources Invest, 1966-67, pp 102-108, 1968. 7 p, 5 fig.

Descriptors: *Instrumentation, Rain gages, Stream gages, Water measurement, Hydrograph, Charts.
Identifiers: Polar coordinate chart reader, Recorders, Stage recorders, Rainfall recorders.

The river-stage and rainfall dual recorder makes graphs on a polar coordinate chart that may be difficult and time consuming to read if done by inspection or with scales. The polar coordinate chart reader determines the coordinates of any point on the chart simply, accurately, and consistently. The chart reader consists of a time mechanism and a stage mechanism arranged so that simultaneous readings of time and stage (or cumulative rainfall) can be obtained with one setting of a stylus. Time intervals read can be as small as 10 min, and they can be estimated to 5 min. Stage can be read to 0.01 ft and rainfall to 0.01 in. However, the accuracy of such readings depends on the accuracy of the original chart. (USGS)
W69-05254

CORRECTING RIVER VELOCITIES MEASURED FROM AN UNANCHORED SHIP,
Geological Survey, Washington, D. C.
Luther C. Davis, Jr.
Geol Surv Water-Supply Pap 1892, Selec Tech in Water Resources Invest, 1966-67, pp 109-113, 1968. 5 p, 4 fig.

Descriptors: *Velocity, *Streamflow, *Rivers, *Drifting (Aquatic), *Ships, Stream gages, Measurement, Current meter.

Identifiers: Amazon River, Stream velocity measurements, Drift rate (Ships).

The problem of correcting observed Amazon River velocities that were measured from a nonstationary ship was solved by measuring the distance the unanchored vessel drifted during the 40- and 50-second velocity measurement period. By applying the rate of drift, in feet per second, to the observed velocity reading obtained by current meter, a corrected river-velocity reading was computed. (USGS)
W69-05255

PATTERNS OF BACKWATER AND DISCHARGE ON SMALL ICE-AFFECTED STREAMS,
Geological Survey, Washington, D. C.
R. Elton Cook, and Edwin E. Cerny.
Geol Surv Water-Supply Pap 1892, Selec Tech in Water Resources Invest, 1966-67, pp 114-125, 1968. 12 p, 9 fig.

Descriptors: *Stream gages, *Stage-discharge relations, *Ice, Backwater, Storage, Hydrographs, Discharge (Water).
Identifiers: Stream gaging, Ice effects, Ice storage.

A temporary stream-gaging station was built on an ice-free reach to determine the winter discharge patterns on an ice-affected stream in northern New Mexico. Records from a nearby ice-affected gaging station were compared to records of the temporary station to determine the local daily backwater pattern. The methods used in the study can be applied to improve winter discharge records and the interpretation of winter records of gage height on ice-affected streams. (USGS)
W69-05256

VARIABLE-SPEED POWER EQUIPMENT FOR DEPTH-INTEGRATION SEDIMENT SAMPLING,
Geological Survey, Washington, D. C.
Clarence T. Welborn, and John V. Skinner.
Geol Surv Water-Supply Pap 1892, Selec Tech in Water Resources Invest, 1966-67, pp 126-137, 1968. 12 p, 4 fig, 1 tab.

Descriptors: *Sampling, *Sediments, *Equipment, *Electric motors, Hoisting machinery, Measurement, Instrumentation.
Identifiers: Integrating sediment samplers, Variable speed electric motors, Series-wound motors, Shunt-wound motors.

Power equipment developed for use with sediment samplers used by the U. S. Geological Survey is described. The power units used in collecting depth-integrated suspended-sediment samples must be capable of lowering and raising a sediment sampler at a constant speed and must operate over a range of speeds. Two different power units were built and tested in an attempt to develop an efficient method of controlling transit rates. Power equipment with a series-wound motor was developed by the U. S. Geological Survey and equipment with a shunt-wound motor was developed by the Federal Inter-Agency Sedimentation Project. Both units proved successful. They differ primarily in the type of motor used and in the general method of motor-speed control. A comparison of the series-wound and the shunt-wound power units reveals that the 2 units differ with respect to complexity, efficiency, maintenance, degree of control, and initial cost. The shunt-wound unit affords a greater degree of control and efficiency but at the expense of greater complexity, cost and maintenance. The series-wound unit, because of the smaller number of parts, has a lower initial cost, is more rugged, and requires less maintenance. (USGS)
W69-05257

ELECTRIC CONTROL SYSTEM FOR DUAL OPERATION OF CURRENT METER AND SUSPENDED-SEDIMENT SAMPLER,
Geological Survey, Washington, D. C.
Herbert H. Stevens, Jr., and Robert E. Sommer, Jr.

Geol Surv Water-Supply Pap 1892, Selec Tech in Water Resources Invest, 1966-67, pp 138-141, 1968. 4 p, 2 fig, 1 ref.

Descriptors: *Control systems, *Current meters, *Sampling, Suspended load, Electrical equipment, Monitoring, Velocity.
Identifiers: Suspended-sediment samplers, Diode signal-selectors.

An electric control system for monitoring a current meter and operating a U. S. P-61 suspended sediment sampler on the same 2-conductor cable is described. The system uses diodes to select and send the proper electrical signal to each device, and reduces the time required for observing velocity and sediment concentration on major streams. (Knapp-USGS)
W69-05258

CHARACTERISTICS OF LOGARITHMIC RATING CURVES,
Geological Survey, Washington, D. C.
S. E. Rantz.
Geol Surv Water-Supply Pap 1892, Selec Tech in Water Resources Invest, 1966-67, pp 142-152, 1968. 11 p, 4 fig, 1 tab, 1 ref.

Descriptors: *Stage-discharge relations, Channels, Channel morphology, Discharge coefficients, Back-water, Cross-sections, Equations.
Identifiers: *Rating curves, Logarithmic rating curves, Stage-discharge controls.

An understanding of the shapes of logarithmic rating curves is requisite for analyzing the stage-discharge relation of a stream. The principles that govern the shapes of rating curves are demonstrated. As a general rule, linear logarithmic rating curves for section control have slopes greater than 2; linear logarithmic curves for channel control have slopes less than 2. (USGS)
W69-05259

INTERPRETATION OF FLOOD-FREQUENCY DATA,
Geological Survey, Washington, D. C.
J. R. Crippen, and S. E. Rantz.
Geol Surv Water-Supply Pap 1892, Selec Tech in Water Resources Invest, 1966-67, pp 153-157, 1968. 5 p, 2 fig, 3 ref.

Descriptors: *Floods, *Flood forecasting, Probability, Frequency analysis, Equations, Statistical methods.
Identifiers: Flood frequencies, Flood-frequency curves.

The conventional flood-frequency curve is an excellent tool for studying the economics of planned flood-control measures, but the curve presents an incomplete picture of flood risk. That is, the flood-frequency curve shows the probability of an annual peak discharge being exceeded in any one year, but does not show the probability for a sequence of years. A family of curves is presented that overcomes the deficiency. These curves have universal use in studies of flood risk because they are based on fundamental probability principles and are independent of both the flood data and the statistical distribution represented by the conventional flood-frequency curve. (USGS)
W69-05260

AN OUTLINE OF GEOPHYSICAL LOGGING METHODS AND THEIR USES IN HYDROLOGIC STUDIES,
Geological Survey, Washington, D. C.
A. I. Johnson.

Geol Surv Water-Supply Pap 1892, Selec Tech Water Resources Invest, 1966-67, pp 158-1 1968. 7 p, 1 tab, 12 ref.

Descriptors: *Borehold geophysics, *Logg (Recording), Electrical well logging, Radioac well logging, Radioactivity, Resistivity, Tempe ture, Aquifers.
Identifiers: Geophysical well logging, Resisti logging, Sonic logging, SP logging, Gamma-logging, Caliper logging, Magnetic logging.

Information on the depth, thickness, extent, structure of an aquifer may be obtained for use the hydrologist by judicious choice of the pro geophysical logging methods. To assist in mak this choice, the various methods of boreh logging, the uses that may be made of each log, a the recommended borehold conditions are su marized. However, proper use of borehold l requires some knowledge of the geology of the a and considerable experience in log interpretati (USGS)
W69-05261

ISOPIESTIC TECHNIQUE FOR MEASURIN LEAF WATER POTENTIALS WITH A THE MOCOUPLE PSYCHROMETER,
Duke Univ., Durham, N. C. Dept. of Botany.
For primary bibliographic entry see Field 02I.
W69-05286

AN ACCURATE SMALL ORIFICE RAIN GAG
Volcani Inst. of Agricultural Research, Bet Dag (Israel); and Israel Meteorological Service, B Dagan.
J. D. Kalma, J. Lomas, M. Thaller, and Y. Shashoua.
Water Resources Res, Vol 5, No 1, pp 300-30 Feb 1969. 6 p, 3 fig, 1 tab, 11 ref.

Descriptors: *Rain gages, *Instrumentatio Precipitation gages, Research and developmen Gaging stations, Rain, Rainfall, Measuremen Water measurement.
Identifiers: Small orifice rain gage, Victor ra gages.

An accurate, inexpensive, small-orifice rain gag (modified Victor-rain gage) with an orifice diame ter of 29.2 mm was developed for use in rainfa networks and in agrometeorological and hydrolog cal studies. It has a large capacity and can be in stalled and read easily. Comparison with standar rain gages showed good agreement under variou conditions of exposure and with different observa tion techniques. Small amounts of rainfall are likel to be overestimated, owing to a film of water adher ing to the glass water container of the gage whereas hail tends to be underestimated. If th gage is intended for storage, the funnel tube has t reach nearly to the bottom of the inner vessel. (K napp-USGS)
W69-05404

EVALUATION OF SOME GEOPHYSICAL TECHNIQUES APPLIED TO THE ENVIRON MENT OF A MAUI WELL,
Hawaii Inst. of Geophysics, Honolulu.
For primary bibliographic entry see Field 02F.
W69-05418

7C. Evaluation, Processing and Publication

WRITING A WATER QUALITY REPORT,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Biological and Chemical Section.
For primary bibliographic entry see Field 10.
W69-05212

MPUTERIZED SYSTEM FOR WYOMING RFACE WATER RECORDS,
oming Univ., Laramie. Water Resources earch Inst.
primary bibliographic entry see Field 02E.
-05326

WEATHER BUREAU AND WATER NAGEMENT.
ther Bureau, Silver Spring, Md.

A Report PI 680010, 1968. 16 p, 3 fig.

criptors: Hydrologic cycle, *Hydrology, ds, Probable maximum precipitation, River lation, Rivers, *Streamflow forecasting, Warn- systems, Water management, Flood control, er conservation, Water demand, Water urces, Water supply, Water pollution, Water ty, Water utilization, River forecasting, od forecasting, River flow.

ldition to protecting life and property in time ood, the hydrologic services of the Weather au also help conserve the Nation's vital water urces. This brochure describes the functions are performed by the Weather Bureau's Office ydrology. Areas described range from the mea- nent and collection of river and rainfall data to ast preparation and dissemination.
-05336

PARATION OF CO-ORDINATED CIPITATION, RUNOFF AND EVAPORA- N MAPS,
d Meteorological Organization, Geneva (Swit- nd).
rimary bibliographic entry see Field 02A.
-05337

DICTION OF SEDIMENT PROFILES IN N CHANNEL FLOW BY TURBULENT DIF- ON THEORY,
ucky Univ., Lexington; and Texas A and M , College Station. Water Resources Inst.
rimary bibliographic entry see Field 02J.
-05403

PUTER METHODS FOR TRANSIENT LYSIS OF WATER-TABLE AQUIFERS,
ornia Univ., Davis; and Ohio State Univ., nbus.
ge S. Taylor, and James N. Luthin.
r Resources Res, Vol 5, No 1, pp 144-152, 969. 9 p, 4 fig, 11 ref. OWR Project W-109.

riptors: *Drawdown, *Mathematical models, tal computers, Groundwater movement, Satu- flow, Unsaturated flow, Water level fluctua- Theis equation, Thiems equation, Dupuit- heimer theory.
fiers: Pumping tests, Aquifer tests, Draw- analysis.

uter methods for calculating drawdown in nfined aquifers are discussed. Solutions for the ted and unsaturated flow of water to wells be obtained simultaneously. The method the basic flow equations with given boundary tions, taking into account the properties of saturated zone and the contribution of verti- ow. The basic equations are listed and ex- d in cylindrical coordinates. The steps to be in computer solution by numerical analysis ted and discussed. (Knapp-USGS)
05435

LYZING STEADY-STATE FLOW IN AN INED SOIL SLAB WITH AN ELECTRIC LOG,
ultural Research Service, Phoenix, Ariz. Conservation Lab.
imary bibliographic entry see Field 02G.
05440

COMPUTER EXPERIMENTS WITH FRACTIONAL GAUSSIAN NOISES, PARTS 1, 2, AND 3,
Thomas J. Watson Research Center, Yorktown Heights, N. Y.
Benoit B. Mandelbrot, and James R. Wallis.
Water Resources Res, Vol 5, No 1, pp 228-267, Feb 1969. Total 39 p, 22 fig, 1 tab, 20 ref.

Descriptors: *Mathematical models, *Probability, Hydrologic data, Simulation analysis, Synthetic hydrology, Statistical models, Stochastic processes, Mathematical studies.
Identifiers: Gaussian noise.

Fractional Gaussian noises are a family of random processes such that the interdependence between values of the process at instants of time very distant from each other is small but nonnegligible. It is shown by mathematical analysis that such interdependence has precisely the intensity required for a good mathematical model of long run hydrological and geophysical records. The analysis is illustrated, extended, and made practically usable with the help of computer simulations. The shape of the sample functions and the relations between past and future averages are stressed. (Knapp-USGS)
W69-05453

FREQUENCY CURVES FOR ANNUAL FLOOD SERIES WITH SOME ZERO EVENTS OR INCOMPLETE DATA,
Geological Survey, Washington, D. C.
M. E. Jennings, and M. A. Benson.
Water Resources Res, Vol 5, No 1, pp 276-280, Feb 1969. 5 p, 4 fig, 4 tab, 4 ref.

Descriptors: *Statistical models, *Flood forecasting, *Probability, Hydrograph analysis, Duration curves, Non-perennial streams, Streamflow forecasting.
Identifiers: Flood frequencies, Log-Pearson distributions, Curve fitting.

In fitting a theoretical frequency distribution to a set of data, a problem arises if the series contains a number of zero values, as may occur in annual flood peak data for small, arid-region streams. The problem is twofold: first, commonly used distributions do not fit such a set of data; second, if a logarithmic transformation of the data is being used, logarithms of zero flows are not usable in a computation. To overcome the difficulties, a theorem of conditional probability is used. The probability of occurrence of a nonzero peak is combined with the conditional probability of exceeding a given flood magnitude, given that a nonzero peak has occurred. The method has been found useful also for fitting flood series in which information of peak annual floods below a specific stage is lacking. (Knapp-USGS)
W69-05455

A CONTINUOUS SIZE SPECTRUM FOR PARTICULATE MATTER IN THE SEA,
Fisheries Research Board, Nanaimo (British Columbia). Pacific Oceanographic Group.
R. W. Sheldon, and T. R. Parsons.
J Fish Res Board Can, Vol 24, No 5, pp 909-915, 1967. 5 fig, 12 ref.

Descriptors: *Particle size, *Seston, *Biomass, Carbon, Copepods, Correlation analysis, Diatoms, Estimating equations, Nannoplankton, Nitrogen, Oceanography, Phytoplankton, Plankton, Productivity, Zooplankton, Analytical techniques.
Identifiers: *Particulate matter, *Coulter Counter, Macroplankton, Microplankton, Saanich Inlet, British Columbia, Chaetoceros socialis, Dhaetoceros debilis, Pseudocalanus minutus, Skelotonema costatum.

A plot of total particle volume versus logarithm of particle diameter seems an informative method for presenting size spectra of particulate matter in seawater and is suited to classical divisions of nanno-, micro-, and macro-plankton. In a typical example, delineation of spectrum of sizes from 3 microns to 1 millimeter for particulate matter of single sample drawn from Saanich Inlet, British Columbia, June 1966, discriminated three peaks due to mixed populations of diatoms Chaetoceros socialis and C debilis, to copepod eggs, and to copepod Pseudocalanus minutus. Authors could realistically determine total biomass of irregularly shaped particles, such as phytoplankton chains, using a Coulter Counter. Particle volume measurements agreed well with estimates based upon determination of particle diameter. Where P = particle concentration in ppm by volume estimated with Coulter Counter, C = particulate carbon in ppm by weight, and N = particulate nitrogen in ppm weight, plots of P versus C and N were well described by linear relationships, P = 19C - 3.56, with correlation coefficient of 0.88; and P = 107N - 1.4, with correlation coefficient of 0.52. Correlation coefficients are significant, with probability due to chance less than 0.01. Intercepts of such plots estimate particulate matter not measured by Coulter Counter. (Eichhorn-Wis)
W69-05529

08. ENGINEERING WORKS

8A. Structures

KOYNA EARTHQUAKE OF DECEMBER 11, 1967,
For primary bibliographic entry see Field 08E.
W69-05419

8B. Hydraulics

UNSTEADY FLOW PARAMETERS IN HYDRAULIC DESIGN,
Kansas Univ., Lawrence.
Yun-Sheng Yu, and Mack H. Gray, III.
Contrib No 25, Kans Water Resources Res Inst Proj Completion Rep, Aug 1968. 38 p, 10 fig, 4 tab, 12 ref. OWRR Project A-017-KAN.

Descriptors: *Unsteady flow, *Closed conduit flow, *Pipe flow, Hydraulic transients, Surges, Valves, Fluid mechanics, Hydraulics, Kinetics, Velocity, Hydraulic engineering.
Identifiers: Reservoir-pipe flow systems, Inertial effects.

An experimental and theoretical study was made of the unsteady flow in a reservoir-conduit system caused by the sudden opening of a valve at the end of the conduit. A one-dimensional model which includes resistance and inertial effects is developed to determine the instantaneous average displacement, velocity, and acceleration of fluid in the conduit and the instaneous water depth in the reservoir. The calculations were checked by experiments using a circular reservoir with horizontal circular-section pipes of various diameters with and without streamlined inlets. The dimensionless initial acceleration in linearly related to dimensionless initial water depth for reservoir diameter to pipe diameter ratios (B/D) larger than about 15, and the lumped inertial effects of pipe and reservoir are constant. At smaller B/D, predicted initial accelerations are much higher than actual values if the effects of reservoir inertia are neglected. Reservoir-conduit systems in actual use, however, generally have B/D larger than 90 and the inertial effects of the reservoir are negligible. (Knapp-USGS)
W69-05408

8C. Hydraulic Machinery

PROBLEMS OF THE METHODS AND ACCURACY OF HYDROLOGIC OBSERVATIONS (RUSSIAN),
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 07A.
W69-05210

8D. Soil Mechanics

HYDROLOGY OF A SLIDE-PRONE GLACIAL TILL SOIL IN SOUTHEAST ALASKA,
Forest Service (USDA) Juneau, Alaska. Pacific Northwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 02G.
W69-05406

8E. Rock Mechanics and Geology

KOYNA EARTHQUAKE OF DECEMBER 11, 1967,
K. L. Rao, S. Bhagavantam, D. N. Wadia, M. S. Krishnan, and N. G. K. Murthi.
J Indian Geophys Union, Vol 5, No 1, Jan 1968. 52 p, 10 fig.

Descriptors: *Earthquakes, Hydrologic aspects, Dams, Faults (Geology), Land subsidence, Seismology, Earthquake engineering.
Identifiers: Koyna (India).

The earthquake at Koyna, India, on December 11, 1967, occurred in an area which had no previous recorded seismic activity. Because the epicenter was under the newly filled Koyna dam and reservoir, the possibility of a causal relation was investigated. Because small shocks were felt early in the filling of the reservoir, 2 seismographs, 2 accelerographs, and 2 tiltgraphs were installed in the dam, and an array of seismographs 20-40 miles from the dam. Bores near the dam revealed no major near-surface faults in the nearly horizontal Deccan basalts and volcanic rocks of the area. The early tremors were mild, shallow, centered upstream, and are thought to be evidence of crustal adjustments caused by filling the reservoir. The major shocks are deeper and stronger. The body of the dam was accelerated at 0.42 g along its axis, 0.39 g across the long axis, and 0.34 g vertically. The epicenter was 30 km deep, just downstream from the dam. Slippage probably occurred along the Malabar fault on India's west coast. It is concluded that the major shocks are of tectonic origin and that major structural design for the Deccan Plateau should take the possibility of future earthquakes of large magnitudes into account. (Knapp-USGS)
W69-05419

09. MANPOWER, GRANTS AND FACILITIES

9D. Grants, Contracts, and Research Act Allotments

FOURTH ANNUAL REPORT OF THE STATE OF WASHINGTON WATER RESEARCH CENTER, 1968.
Washington Univ., Seattle; Washington State Univ., Pullman.
John S. Gladwell.
Wash Water Res Center Report, September 1968. 136 p, 5 fig, 4 tab. OWRR Project A-999-WASH.

Descriptors: Birds, Flow, Freshwater, Bacteria, Water pollution, Control, Ground water geology, Drainage basins, Impoundments, Pollution, Economics, Aquatic environment, Legal aspects.
Identifiers: Waterbirds, Streamflow, Aquatic life, Water treatment, Aquifers, Forestry, Pollutants, Lake, Water.

The following major areas of the Annual Report, State of Washington, are reported. Federally Supported Projects Allotment Grant: Waterfowl, Hydrology, Aquatic Bacteria, Water Quality Control, Hydro-geology, Watersheds, Reservoirs, Water Pollution, Agricultural Economics. Matching Grants Program: Subjects--Pollution, Limnology, Ecology, Water Law. Regionally Supported Projects: (1) Water Resources of Washington (2) Weather Modification. Educational Aspects of the Program: Two Hydrology Seminars, Multi-Resources Development Seminar with Federal Government Officials, Seminar Series on the 'Continental Use of Arctic-Flowing Rivers,'. New Course Offering in the General Field of Water Resources, Students Working on all Center Projects, Names and Support, Publications by Water Research Center Personnel, References.
W69-05322

10. SCIENTIFIC AND TECHNICAL INFORMATION

WRITING A WATER QUALITY REPORT,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Biological and Chemical Sect
K. N. Mackenthun.
J Water Pollut Contr Fed, Vol 41, No 1, pp 82
Jan 1969. 7 p, 1 fig, 2 ref.

Descriptors: *Technical writing, *Publicati
Editing, Abstracts, Documentation, Reviews, I
collections, Investigations.
Identifiers: Water quality report writing.

Report writing is discussed in terms of content
organization, with special emphasis on the con
and difficulties of water quality reports. Con
interpretive writing and clear graphics help rea
to comprehend a report's conclusions and fac
information. The use of outlines to organize rep
is stressed. A report should be planned and
lined in preliminary form at the time of plan
the study, but the outline must be flexible to
commodate unexpected results. The audience
report determines both style and content; rep
for specialists, non-specialists, laymen, or law
should have different form and emphasis. G
style and proper use of words are important
clarity. Commonly misused words and phrases
their correct equivalents are listed. Revision
review are necessary to make sure that the repo
accurate, readable, directed to the proper
dience, and unambiguous. (Knapp-USGS)
W69-05212

DETERMINATION OF ORGANOCHLORI INSECTICIDES IN SOILS AND WATERS,
Wisconsin Univ., Madison. Dept. of Soils; Agri
tural Research Service, Washington, D. C.
For primary bibliographic entry see Field 05A.
W69-05325

DATA SYSTEMS AND INFORMATI RETRIEVAL ADAPTABLE TO WAT RESOURCES,
Department of Agriculture, Washington, D. C.
For primary bibliographic entry see Field 06B.
W69-05490

A DISCUSSION OF DATA SYSTEMS AND FORMATION RETRIEVAL ADAPTABLE WATER RESOURCES,
Pennsylvania State Univ., University Park.
For primary bibliographic entry see Field 06B.
W69-05491

SUBJECT INDEX

CCESS ROUTES
STATE SQUIRE V CITY OF CLEVELAND (FILL LAND AND HIGHWAY USE AS TO LITTORAL RIGHTS).
W69-05555 04C

CCIDENTS
PENN CENTRAL CO V BUCKLEY AND CO (BRIDGE COLLISIONS SUIT).
W69-05380 06E

CCRETION(LEGAL ASPECTS)
ADKISSON V STARR (TITLE TO ACCRETION).
W69-05399 06E

CID MICROFLORA
THE MICROBIAL FLORA OF ACID MINE WATER AND ITS RELATIONSHIP TO FORMATION AND REMOVAL OF ACID,
W69-05314 05G

CID MINE WATER
SOURCES OF COAL MINE DRAINAGE POLLUTION, WHEELING CREEK WATERSHED, OHIO.
W69-05202 05B

THE MICROBIAL FLORA OF ACID MINE WATER AND ITS RELATIONSHIP TO FORMATION AND REMOVAL OF ACID,
W69-05314 05G

DEVELOPMENT OF BIOLOGICAL INDICES TO POLLUTION LEVELS IN STREAMS AFFECTED BY ACID MINE DRAINAGE AND OIL FIELD BRINE WASTES,
W69-05407 05A

A LIMNOLOGICAL RECONNAISSANCE OF AN IMPOUNDMENT RECEIVING HEAVY METALS WITH EMPHASIS OF DIATOMS AND FISH,
W69-05465 02H

CTIVATED ALUMINA
A PILOT PLANT STUDY FOR REMOVAL OF SOLUBLE SILICA FROM ROSWELL, NEW MEXICO WATER. PHASE 1. INITIAL CONSTRUCTION AND OPERATION,
W69-05335 03A

CTS-OF-GOD
CARLSON V A AND P CORRUGATED BOX CORP (FLOODING CAUSED BY NEGLIGENT MAINTENANCE OF DAM).
W69-05588 04A

JUDICATION PROCEDURE
MUENCH V PUBLIC SERVICE COMMISSION (PUBLIC RIGHTS IN NAVIGABLE RIVER).
W69-05582 06E

MINISTRATION
ROLE OF STATE GOVERNMENTS IN U. S. WATER MANAGEMENT,
W69-05293 06E

REGIONAL RESEARCH IN WATER IN THE NORTH CENTRAL REGION,
W69-05478 06B

MINISTRATIVE AGENCIES
COMPLETION OF THE FAIRFAX COUNTY WATER AUTHORITY ACQUISITION PROGRAM.
W69-05539 03D

AMERICAN CYANAMID CO V COMMONWEALTH (POLLUTION ABATEMENT).
W69-05575 05G

PEOPLE V VILLAGE OF BERKELEY (STATUTORY DUTIES UNDER WATER SUPPLY CONTRACTS).
W69-05584 06E

RATION
SAMPLING APPARATUS TO MINIMIZE AERATION OF WATER FOR THE DETERMINATION OF DISSOLVED GASES,
W69-05246 07B

ROBIC TREATMENT
WATER QUALITY CHANGES IN CONFINED HOG-WASTE TREATMENT,
W69-05417 05D

ABAMA
TENNESSEE VALLEY SAND AND GRAVEL CO V PILLING (LIABILITY FOR SEDIMENT DUMPING WHICH MAKES CREEK BED SHALLOWER, WHICH CAUSES MORE FLOODING).
W69-05386 05G

DOBO V YOUNG (ARTIFICIAL DRAINAGE OF SURFACE WATERS AND NATURAL FLOW).
W69-05551 04A

GAL TOXINS MEMBRANE
DEMONSTRATION OF A TOXIN FROM APHANIZOMENON FLOS-AQUAE (L.) RALFS,
W69-05306 05C

ALINITY
FIELD KIT FOR DETERMINING ALKALINITY,
W69-05243 07B

ERATION OF FLOW
OAT V VAN VEEN (INTERFERENCE WITH WATER FLOW).
W69-05395 04A

REESE V STATE (DAMAGE TO LAND DUE TO DIVERSION OF STREAM).
W69-05560 04A

RAY V CITY OF WINTER GARDEN (SURFACE WATERS CAST ON LOWER PROPERTY).
W69-05563 04A

EARLY V SOUTH CAROLINA PUBLIC SERVICE AUTHORITY (CONSTRUCTION OF DAM AND DIVERSION OF RIVER).
W69-05578 04A

ANAEROBIC CONDITIONS
WATER QUALITY IN IMPOUNDMENTS AND MODIFICATIONS FROM DESTRATIFICATION,
W69-05467 02H

ANALOG MODELS
ANALYZING STEADY-STATE FLOW IN AN INCLINED SOIL SLAB WITH AN ELECTRIC ANALOG,
W69-05440 02G

ANALYTICAL TECHNIQUES
A MICROKIT FOR DISSOLVED OXYGEN DETERMINATION,
W69-05242 07B

FIELD KIT FOR DETERMINING ALKALINITY,
W69-05243 07B

FIELD MONITORING OF THE QUALITY OF WATER DURING THE DRILLING OF WELLS,
W69-05245 07B

DETERMINATION OF ORGANOCHLORINE INSECTICIDES IN SOILS AND WATERS,
W69-05325 05A

IDENTIFICATION AND DIFFERENTIATION OF HEAVY RESIDUAL OIL AND ASPHALT POLLUTANTS IN SURFACE WATERS BY COMPARATIVE RATIOS OF INFRARED ABSORBANCES,
W69-05421 05A

USING ANALYTICAL METHODS TO DEVELOP A SURFACE-RUNOFF MODEL,
W69-05431 02A

APPLICATION METHODS
VARIABLE ROW SPACING OF IRRIGATED COTTON AS A MEANS FOR REDUCING PRODUCTION COSTS AND CONSERVING WATER,
W69-05277 03F

DETERMINATION OF ORGANOCHLORINE INSECTICIDES IN SOILS AND WATERS,
W69-05325 05A

SOIL OR FOLIAR FERTILIZATION OF WELL-DRAINED AND FLOODED SLASH PINE,
W69-05332 02G

APPROPRIATION
WATER LAW, POLITICS, AND ECONOMICS OUR COMPLEX WATER LAWS AND WATER USE CUSTOMS,
W69-05296 06E

APPROXIMATION METHOD
RATIONAL DISTRIBUTED LAG FUNCTIONS,
W69-05515 06B

AQUATIC PLA
COMMON AQ . EEDS,
W69-05446 02I

AQUEDUCTS
BUDA V STATE (ARTIFICIAL CONTROL OF SURFACE WATERS).
W69-05550 04A

AQUIFERS
IDENTIFICATION OF NONLINEAR PARAMETERS OF GROUND WATER BASINS BY HYBRID COMPUTATION,
W69-05271 02F

MEASUREMENT OF SMALL SURFACE DISPLACEMENTS INDUCED BY FLUID FLOW,
W69-05433 02F

DETERMINATION OF FRESH WATERS IN THE CALCAREOUS MASSIF OF 'COSTA BRAVA', SPAIN (FRENCH),
W69-05474 02F

ARID LANDS
THE ASSESSMENT OF SURFACE RUNOFF FROM RAINFALL DATA FOR AN ARID REGION OF WEST PAKISTAN,
W69-05232 02E

ARIZONA
ASSESSING IMPACTS OF DECLINING WATER QUALITY ON GROSS VALUE OUTPUT OF AGRICULTURE, A CASE STUDY,
W69-05273 03C

WATER MANAGEMENT OF FALL-PLANTED SUGAR BEETS IN SALT RIVER VALLEY OF ARIZONA,
W69-05279 03F

ARKANSAS
COMPREHENSIVE BASIN STUDY ON WHITE RIVER BASIN, ARKANSAS AND MISSOURI.
W69-05201 06B

REYNOLDS METAL CO V BALL (SUIT TO RECOVER DAMAGES FOR ALLEGED DEPOSIT OF SEDIMENT CONTAINING POISONOUS SUBSTANCES).
W69-05385 05C

TURNER V SMITH (RESERVOIR OBSTRUCTING LAND DRAINAGE).
W69-05392 04A

ADKISSON V STARR (TITLE TO ACCRETION).
W69-05399 06E

ARTESIAN WELLS
HUTCHESON V SUMRALL (WATER SUPPLY EASEMENT).
W69-05599 06E

ARTIFICIAL USE
LEIPER V HEYWOOD-HALL CONSTR CO (CLAIM OF ARTIFICIALLY INCREASED DRAINAGE ON PART OF UPPER LANDOWNER).
W69-05568 06E

ASPHALT
IDENTIFICATION AND DIFFERENTIATION OF HEAVY RESIDUAL OIL AND ASPHALT POLLUTANTS IN SURFACE WATERS BY COMPARATIVE RATIOS OF INFRARED ABSORBANCES,
W69-05421 05A

ASSESSMENTS
MEYER V CITY OF OAKLAND (VALIDITY OF SPECIAL ASSESSMENTS TO LAND FOR SEWER IMPROVEMENTS).
W69-05542 06E

AUSTRALIA
TISSUE WATER RELATIONS FOR BRIGALOW AND MULGA,
W69-05281 02I

AUTOCORRELATION
AUTOCORRELATION BETWEEN FIRST DIFFERENCES OF MID-RANGES,
W69-05520 06B

AUTUMN
WATER MANAGEMENT OF FALL-PLANTED SUGAR BEETS IN SALT RIVER VALLEY OF ARIZONA,
W69-05279 03F

BARLEY
EFFECTS OF MOISTURE AND FERTILIZER ON YIELDS OF SPRING WHEAT AND BARLEY,
W69-05263 02I

BARRIERS
UNPROTECTED WELLS.
W69-05367 06E

MARINE AIR WAYS, INC V STATE (INTERFERENCE WITH NAVIGATION).
W69-05579 06E

BEACONS
MOORING WATERCRAFT TO BUOYS OR BEACONS.
W69-05373 06E

BEDS
PUBLIC PARKS - PLAYGROUNDS SALE OF RECLAIMED LANDS ABUTTING PARK LANDS.
W69-05365 06E

BEDS UNDER WATER
RIPARIAN LANDS.
W69-05346 06E

ESTABLISHMENT OF STATE CONTROL OVER SUBMERGED LANDS.
W69-05347 06E

PROTECTION OF THE PALISADES.
W69-05352 06E

CONFIRMATORY LEASES AND GRANTS OF SUBMERGED LAND.
W69-05354 06E

DELINQUENT RIPARIAN LEASES RE-ENTRY BY THE STATE.
W69-05356 06E

REMOVAL OF BUSHES, TREES, AND STUMPS FROM FLOWED AREA.
W69-05368 04A

TRUSTEES OF FREEHOLDERS AND COMMONALTY V MORRISEY (TITLE TO BEDS UNDER TIDAL WATERS).
W69-05388 06E

BIOINDICATORS
DEVELOPMENT OF BIOLOGICAL INDICES TO POLLUTION LEVELS IN STREAMS AFFECTED BY ACID MINE DRAINAGE AND OIL FIELD BRINE WASTES,
W69-05407 05A

BIOMASS
A CONTINUOUS SIZE SPECTRUM FOR PARTICULATE MATTER IN THE SEA,
W69-05529 07C

BLANEY-CRIDDLE FORMULA
EFFECT OF MOISTURE REGIMES AND HARVESTS ON EFFICIENCY OF WATER USE BY TEN FORAGE CROPS,
W69-05268 02I

BOARD OF COMMERCE AND NAVIGATION
GRANTS OF SUBMERGED LANDS TO THE STATE, MUNICIPALITIES, AND OTHER SUBDIVISIONS.
W69-05353 06E

BOATS
TAKING OF WATERCRAFT, AIRCRAFT OR DRAFT ANIMALS INJURING OR CUTTING LOOSE BOOMS, RAFTS, VESSELS OR BOATS CIVIL ACTION FOR DAMAGES.
W69-05372 06E

MOORING WATERCRAFT TO BUOYS OR BEACONS.
W69-05373 06E

BOGS
EVAPORATION FROM BOGS IN THE EUROPEAN TERRITORY OF THE USSR
W69-05214 02D

BOREHOLD GEOPHYSICS
AN OUTLINE OF GEOPHYSICAL LOGGING METHODS AND THEIR USES IN HYDROLOGIC STUDIES,
W69-05261 07B

BOREHOLE GEOPHYSICS
EVALUATION OF SOME GEOPHYSICAL TECHNIQUES APPLIED TO THE ENVIRONMENT OF A MAUI WELL,
W69-05418 02F

BOUNDARIES
OFFSHORE PROSPECTING AND MINING LAWS OF THE UNITED STATES,
W69-05340 06E

BOUNDARIES(PROPERTY)
WATERS OF WHITE LAKE INC V PRICKE (OWNERSHIP OF LAKE BEDS).
W69-05383 06E

HOLDA V PITTSBURGH FORGINGS CO (LANDFILLS AND OWNERSHIP OF BEDS).
W69-05398 06E

ADKISSON V STARR (TITLE TO ACCRETION).
W69-05399 06E

IN RE SITE FOR HUNTS POINT SEWAGE TREATMENT WORKS, BOROUGH OF BRONX, CITY OF NEW YORK (OWNERSHIP OF LAND UNDER WATER).
W69-05581 06E

BOUNDARY DISPUTES
UNITED STATES V STATE OF LOUISIANA (STATE OWNERSHIP OF SUBMERGED, CONTIGUOUS LANDS).
W69-05540 06E

BRACKISH WATER
A PILOT PLANT STUDY FOR REMOVAL OF SOLUBLE SILICA FROM ROSWELL, NEW MEXICO WATER. PHASE 1. INITIAL CONSTRUCTION AND OPERATION,
W69-05335 03A

WATER SUPPLY IN THE BRACKISH-WATER REGIONS OF SOUTH VIETNAM.
W69-05457 02L

BRANCHING MULTISTAGE SYSTEMS
A COMMENT ON OPTIMIZATION METHODS FOR BRANCHING MULTISTAGE WATER RESOURCE SYSTEMS,
W69-05499 06A

BRANCHING WATER SYSTEMS
OPTIMIZATION METHODS FOR BRANCHING MULTISTAGE WATER RESOURCE SYSTEMS--A REPLY TO A COMMENT BY E. P. BRATER,
W69-05501 06A

BRIDGE CLEARANCE
MARINE AIR WAYS, INC V STATE (INTERFERENCE WITH NAVIGATION).
W69-05579 06E

BRIDGE CONSTRUCTION
TANEY COUNTY V EMPIRE DIST ELECTRIC CO (FLOOD DAMAGE AND CLAIM SETTLEMENT FOR FUTURE DAMAGES).
W69-05571 06E

BRIDGES
MORRIS CANAL AND BANKING COMPANY.
W69-05360 06E

PENN CENTRAL CO V BUCKLEY AND CO (BRIDGE COLLISIONS SUIT).
W69-05380 06E

BRIGALOW
TISSUE WATER RELATIONS FOR BRIGALOW AND MULGA,
W69-05281 02I

BRINES
VARIATION IN THE COMPOSITION OF BRINE FROM THE SYLVANIA FORMATION NEAR MIDLAND, MICHIGAN,
W69-05401 02F

DEVELOPMENT OF BIOLOGICAL INDICES TO POLLUTION LEVELS IN STREAMS AFFECTED BY ACID MINE DRAINAGE AND OIL FIELD BRINE WASTES,
W69-05407 05A

BUOYS
MOORING WATERCRAFT TO BUOYS OR BEACONS.
W69-05373 06E

BY-PASS PIPING
WATER POLLUTION CONTROL USING BY-PASS PIPING,
W69-05503 05G

CALCIUM SULFATE
BASIC STUDIES OF SCALE CONTROL,
W69-05334 03A

CALIBRATIONS
SERVOPSYCHROMETER,
W69-05251 07B

CALIFORNIA
ECONOMIC ALTERNATIVES,
W69-05528 05G

CANALS
DELAWARE AND RARITAN CANAL.

W69-05361 04A

ANONICAL CORRELATION
AN ALTERNATIVE PROOF OF HANNAN'S THEOREM ON CANONICAL CORRELATION AND MULTIPLE EQUATION SYSTEMS,
W69-05511 [illegible]

APITAL
CAPITAL FORMATION AND GOVERNMENT CAPITAL POLICY IN DEVELOPING ECONOMIES,
W69-05518 06C

APITAL FORMATION
CAPITAL FORMATION AND GOVERNMENT CAPITAL POLICY IN DEVELOPING ECONOMIES,
W69-05518 06C

RBON DIOXIDE
STOMATAL OPENING IN ISOLATED EPIDERMAL STRIPS OF VICIA FABA. I. RESPONSE TO LIGHT AND TO CO2-FREE AIR,
W69-05278 02I

LL DIVISION
EFFECTS OF PHOSPHATE CONCENTRATION ON CELL DIVISION RATES AND YIELD OF A TROPICAL OCEANIC DIATOM,
W69-05530 05C

NTRAL U S
REGIONAL RESEARCH IN WATER IN THE NORTH CENTRAL REGION,
W69-05478 06B

DISCUSSION OF REGIONAL RESEARCH IN THE NORTH CENTRAL REGION,
W69-05479 06B

S PRODUCTION FUNCTION
INCREASING OR DECREASING RETURNS TO SCALE IN THE CONSTANT ELASTICITY OF SUBSTITUTION PRODUCTION FUNCTION,
W69-05505 06D

ANNEL IMPROVEMENT
WATERWAYS AND WATER FRONTS.
W69-05364 04A

REESE V STATE (DAMAGE TO LAND DUE TO DIVERSION OF STREAM).
W69-05560 04A

ANNELS
FLAT CHANNEL TERRACES,
W69-05282 02J

VATER WAVES OVER A RECTANGULAR CHANNEL THROUGH A REEF,
W69-05448 02L

PARRAL
OISTURE-RETENTION CAPACITY OF LITTER UNDER TWO ARIZONA CHAPARRAL COMMUNITIES,
W69-05267 02G

RITY
HE UTILITY OF DISASTERS,
69-05288 06B

CK STRUCTURES
NGINEERING TECHNIQUES AND PRINCIPLES APPLIED TO SOIL EROSION CONTROL,
69-05333 04D

ROGMILLER V OLSON (OBSTRUCTION TO NATURAL COURSE OF DRAINAGE).
69-05547 04A

MICAL ANALYSIS
IELD MONITORING OF THE QUALITY OF WATER DURING THE DRILLING F WELLS,
69-05245 07B

AMPLING APPARATUS TO MINIMIZE AERATION OF WATER FOR THE ETERMINATION OF DISSOLVED GASES,
69-05246 07B

MISTRY
NAMICS OF PHYSICOCHEMISTRY IN A LARGE RESERVOIR,
69-05466 02H

STER COUNTY(PENNSYLVANIA)
HE PLAN AND PROGRAM FOR THE BRANDYWINE.
69-05299 06B

CULAR SERIAL CORRELATION
ESTING FOR SERIAL CORRELATION AFTER LEAST SQUARES EGRESSION,
69-05289 06B

IES
UBLIC PARKS - PLAYGROUNDS SALE OF RECLAIMED LANDS ABUTTING ARK LANDS.
69-05365 06E

. PASO WATER IMPROV DIST NO 1 V CITY OF EL PASO (RIGHT OF EMOVAL UNDER WATER SUPPLY CONTRACT).
69-05558 06E

IATOLOGY
OMPARATIVE STUDY OF SNOW TYPE HYDROLOGY OF NORTHEASTERN ANADA AND OF PLAINS OF RUSSIA AND SIBERIA,
69-05225 02E

ED CONDUIT FLOW
STEADY FLOW PARAMETERS IN HYDRAULIC DESIGN,
9-05408 08B

COAL MINES
SOURCES OF COAL MINE DRAINAGE POLLUTION, WHEELING CREEK WATERSHED, OHIO.
W69-05202 05B

COASTAL ENGINEERING
BEACH FRONTS AND WATERWAYS.
W69-05363 04A

COASTAL MARSHES
WETLANDS (CONTROL AND REGULATION IN MAINE).
W69-05366 06E

COASTLINES
UNITED STATES V STATE OF LOUISIANA (STATE OWNERSHIP OF SUBMERGED, CONTIGUOUS LANDS).
W69-05540 06E

COBB-DOUGLAS PRODUCTION FUNCTION
THE ESTIMATION OF MARGINAL PRODUCT FROM A COBB-DOUGLAS PRODUCTION FUNCTION,
W69-05521 06B

COFFERDAMS
MASSMAN-LAKE V TOWBOAT M/V HUGH C BLASKE, BARGE CHEM 2 (ACTION FOR DAMAGES CAUSED BY A TOWBOAT CAST ADRIFT BY A HURRICANE).
W69-05341 06E

COLD REGIONS
COMPARATIVE STUDY OF SNOW TYPE HYDROLOGY OF NORTHEASTERN CANADA AND OF PLAINS OF RUSSIA AND SIBERIA,
W69-05225 02E

COLORADO RIVER BASIN
NUCLEAR POWER AND WATER DESALTING PLANTS FOR SOUTHWEST UNITED STATES AND NORTHWEST MEXICO.
W69-052[illegible] 03A

COMMERCE AND NAVIGATION BOARD
RIPARIAN LANDS.
W69-05346 06E

SURVEY OPERATIONS AND CONTROLS BY THE BOARD OVER SUBMERGED LANDS.
W69-05350 06E

USAGE OF SUBMERGED LAND LEASE AND GRANT CONDITIONS AND PROCEDURE.
W69-05351 06E

CONFIRMATORY LEASES AND GRANTS OF SUBMERGED LAND.
W69-05354 06E

COMPARATIVE DAMAGES
MASONITE CORPORATION V GUY (FISHKILL EFFECTS OF WATER POLLUTION).
W69-05553 05C

COMPENSATION
TENNESSEE GAS TRANSMISSION CO V GREATER LAFOURCHE PORT COMMISSION (DAMAGE FOR FORCED LOWERING OF PIPELINE ACROSS NAVIGABLE STREAM).
W69-05541 06E

DILLENBECK V STATE (COMPENSATION FOR PERPETUAL EASEMENT TO FLOOD LAND).
W69-05573 06E

COMPUTER MODELS
IDENTIFICATION OF NONLINEAR PARAMETERS OF GROUND WATER BASINS BY HYBRID COMPUTATION,
W69-05271 02F

RAINFALL-RUNOFF MODEL FOR SMALL BASIN FLOOD HYDROGRAPH SIMULATION,
W69-05420 02A

COMPUTER PROGRAMS
COMPUTERIZED SYSTEM FOR WYOMING SURFACE WATER RECORDS,
W69-05326 02E

CONDEMNATION
UNITED STATES V WILLIS (ARBITRARINESS IN LAND CONDEMNATION).
W69-05574 06E

CRANCE V STATE (DAMAGES FOR APPROPRIATION OF RIPARIAN RIGHTS BY THE STATE).
W69-05580 06E

CONDEMNATION VALUE
STATE ROADS COMMISSION V BERRY (CONDEMNATION AWARDS).
W69-05596 06E

CONFINED WATER
WATER RESOURCES LAW IN VIRGINIA (ARTIFICALLY CONFINED WATER).
W69-05537 02H

CONIFEROUS TREES
THE INTERCEPTION-TRANSPIRATION RELATIONSHIP OF WHITE SPRUCE AND WHITE PINE,
W69-05274 02D

CONSERVATION
NAVIGABLE STREAMS, PERMISSION TO BRIDGE OR DAM PUBLIC SERVICE FACILITIES NATURAL RESOURCES.
W69-05564 06E

CONSTITUTIONS
NAVIGABLE STREAMS, PERMISSION TO BRIDGE OR DAM PUBLIC

SERVICE FACILITIES NATURAL RESOURCES.
W69-05564 06E

CONTINENTAL SHELF
OFFSHORE PROSPECTING AND MINING LAWS OF THE UNITED STATES,
W69-05340 06E

CONTOUR LINES
UNITED STATES V WILLIS (ARBITRARINESS IN LAND CONDEMNATION)
W69-05574 06E

CONTRACT ADMINISTRATION
COHASSET WATER CO V TOWN OF COHASSET (CONVEYANCE OF WATER WORKS TO TOWN).
W69-05583 06E

CONTRACTS
EL PASO WATER IMPROV DIST NO 1 V CITY OF EL PASO (RIGHT OF REMOVAL UNDER WATER SUPPLY CONTRACT).
W69-05578 06E

TANEY COUNTY V EMPIRE DIST ELECTRIC CO (FLOOD DAMAGE AND CLAIM SETTLEMENT FOR FUTURE DAMAGES).
W69-05571 06E

CONTROL SYSTEMS
ELECTRIC CONTROL SYSTEM FOR DUAL OPERATION OF CURRENT METER AND SUSPENDED-SEDIMENT SAMPLER,
W69-05258 07B

COORDINATION
DISCUSSION OF REGIONAL RESEARCH IN THE NORTH CENTRAL REGION,
W69-05479 06B

CORN BELT
TILLAGE METHODS TO REDUCE RUNOFF AND EROSION IN THE CORN BELT,
W69-05330 03F

CORRELATION ANALYSIS
TESTING FOR SERIAL CORRELATION AFTER LEAST SQUARES REGRESSION,
W69-05289 06B

COSTA RICA
PORTABLE WATER PURIFIERS FOR COSTA RICA,
W69-05456 05D

COSTS
ECONOMICS AND FINANCING OF IRRIGATION PROJECTS,
W69-05221 06C

ECONOMIC ANALYSIS OF PUBLIC WATER SUPPLY IN THE PISCATAQUA RIVER WATERSHED,
W69-05510 03E

COST-BENEFIT ANALYSIS
THE INTERINDUSTRY FACTOR-CONTEXT MATRIX AN APPLICATION FOR THE ANALYSIS AND PROJECTION OF REGIONAL WATER REQUIREMENTS,
W69-05509 06B

COST-BENEFIT RATIO
EAST FORK DUCK CREEK WATERSHED NOBLE AND WASHINGTON COUNTIES, OHIO.
W69-05329 06B

MEYER V CITY OF OAKLAND (VALIDITY OF SPECIAL ASSESSMENTS TO LAND FOR SEWER IMPROVEMENTS).
W69-05542 06E

COTTON
VARIABLE ROW SPACING OF IRRIGATED COTTON AS A MEANS FOR REDUCING PRODUCTION COSTS AND CONSERVING WATER,
W69-05277 03F

COULTER COUNTER
A CONTINUOUS SIZE SPECTRUM FOR PARTICULATE MATTER IN THE SEA,
W69-05529 07C

CRANBERRIES
JONES V LUCAS (SURFACE DRAINAGE).
W69-05594 04A

CRITERIA
WELFARE ECONOMICS, ECONOMIC GROWTH AND THE CHOICE OF TECHNIQUES,
W69-05500 06B

CROP PRODUCTION
ASSESSING IMPACTS OF DECLINING WATER QUALITY ON GROSS VALUE OUTPUT OF AGRICULTURE, A CASE STUDY,
W69-05273 03C

RUNOFF WATER-SPREADING ON LEVELED CROPLAND,
W69-05275 04A

EFFECT OF EARLY-SUMMER SEEDING OF WINTER WHEAT ON YIELD, SOIL MOISTURE, AND SOIL NITRATE,
W69-05280 03F

RELATIONSHIP OF PALMER DROUGHT VARIABLES TO YIELD OF WINTER WHEAT,
W69-05283 03F

STUDIES ON WATER USE IN PEA (PISUM SATIVUM L.),
W69-05287 03F

SOIL OR FOLIAR FERTILIZATION OF WELL-DRAINED AND FLOODED SLASH PINE,
W69-05332 02G

CROP RESPONSE
EFFECTS OF MOISTURE AND FERTILIZER ON YIELDS OF SPRING WHE AND BARLEY,
W69-05263 02I

MEASUREMENT OF DROUGHT RESISTANCE IN CROP PLANTS,
W69-05265 02G

CURRENT METERS
ELECTRIC CONTROL SYSTEM FOR DUAL OPERATION OF CURRENT METE AND SUSPENDED-SEDIMENT SAMPLER,
W69-05258 07B

CURRENTS(WATER)
EQUILIBRIUM FLOW AREAS OF INLETS ON SANDY COASTS,
W69-05447 02L

DAIRY INDUSTRY
STATE ROADS COMMISSION V BERRY (CONDEMNATION AWARDS).
W69-05596 06E

DAM FAILURE
CARLSON V A AND P CORRUGATED BOX CORP (FLOODING CAUSED BY NEGLIGENT MAINTENANCE OF DAM).
W69-05588 04A

DAMAGES
PETERSON V WISCONSIN RIVER POWER CO (PROPERTY ENCROACHMENT BY IMPOUNDED WATERS).
W69-05552 04A

W B RODDENBERY CO INC V CARTER (DAMAGES FOR POLLUTION OF STREAM).
W69-05559 05B

DAMS
REMOVAL OF BUSHES, TREES, AND STUMPS FROM FLOWED AREA.
W69-05368 04A

TOWN OF VIENNA V STATE (PRESCRIPTIVE RIGHTS DOCTRINE AS APPLIED TO PUBLIC PROPERTY).
W69-05549 04A

BOBO V YOUNG (ARTIFICIAL DRAINAGE OF SURFACE WATERS AND NATURAL FLOW).
W69-05551 04A

PETERSON V WISCONSIN RIVER POWER CO (PROPERTY ENCROACHMENT BY IMPOUNDED WATERS).
W69-05552 04A

CORNETT V HEBERT (OBSTRUCTION TO FLOW OF SURFACE WATER).
W69-05562 04A

CARLSON V A AND P CORRUGATED BOX CORP (FLOODING CAUSED BY NEGLIGENT MAINTENANCE OF DAM).
W69-05588 04A

IODICE V STATE (DUTIES OF DAM OWNERS).
W69-05589 06E

DATA COLLECTIONS
FLOODS IN VIRGINIA - MAGNITUDE AND FREQUENCY,
W69-05415 02E

WATER QUALITY INVESTIGATION, PART 1 - BASIC DATA, FORT LOUDOUN RESERVOIR, APRIL 1966 - JUNE 1968,
W69-05416 05A

DATA PROCESSING
COMPUTERIZED SYSTEM FOR WYOMING SURFACE WATER RECORDS,
W69-05326 02E

DATA STORAGE AND RETRIEVAL
COMPUTERIZED SYSTEM FOR WYOMING SURFACE WATER RECORDS,
W69-05326 02E

DATA SYSTEMS AND INFORMATION RETRIEVAL ADAPTABLE TO WATER RESOURCES,
W69-05490 06B

A DISCUSSION OF DATA SYSTEMS AND INFORMATION RETRIEVAL ADAPTABLE TO WATER RESOURCES
W69-05491 06B

DATA SYSTEMS
DATA SYSTEMS AND INFORMATION RETRIEVAL ADAPTABLE TO WATER RESOURCES,
W69-05490 06B

DECREASING RETURNS TO SCALE
INCREASING OR DECREASING RETURNS TO SCALE IN THE CONSTANT ELASTICITY OF SUBSTITUTION PRODUCTION FUNCTION,
W69-05505 06D

DELAWARE
CICONTE V SHOCKLEY (RUNOFF NUISANCE).
W69-05396 04A

DELAWARE ESTUARY
THE LONGITUDINAL DIFFUSION COEFFICIENT IN THE DELAWARE RIVE ESTUARY AS DETERMINED FROM A STEADY-STATE MODEL,
W69-05428 02L

WATER POLLUTION CONTROL USING BY-PASS PIPING,
W69-05503 05G

DELAWARE RIVER BASIN COMPACT
DELAWARE RIVER BASIN COMPACT.
W69-05342 04A

69-05343 04A

69-05344 04A

ONSTRATION WATERSHEDS
N DEFENSE OF EXPERIMENTAL WATERSHEDS,
69-05405 02A

ITIFICATION
ITROGEN CYCLE IN SURFACE AND SUBSURFACE WATERS,
69-05323 05B

SITY CURRENTS
YNAMICS OF PHYSICOCHEMISTRY IN A LARGE RESERVOIR,
69-05466 02H

OSITION(SEDIMENTS)
OALES V UNITED STATES (TAKING OF PROPERTY FOR PUBLIC
URPOSE WITHOUT JUST COMPENSATION).
69-05554 04A

ALINATION
UCLEAR POWER AND WATER DESALTING PLANTS FOR SOUTHWEST
NITED STATES AND NORTHWEST MEXICO.
69-05208 03A

ASIC STUDIES OF SCALE CONTROL,
69-05334 03A

TOMS
LIMNOLOGICAL RECONNAISSANCE OF AN IMPOUNDMENT RECEIVING
EAVY METALS WITH EMPHASIS OF DIATOMS AND FISH,
69-05465 02H

FFECTS OF PHOSPHATE CONCENTRATION ON CELL DIVISION RATES
ND YIELD OF A TROPICAL OCEANIC DIATOM,
69-05530 05C

FUSION
HE LONGITUDINAL DIFFUSION COEFFICIENT IN THE DELAWARE RIVER
STUARY AS DETERMINED FROM A STEADY-STATE MODEL,
69-05428 02L

YDRODYNAMIC DISPERSION IN A SATURATED HOMOGENEOUS POROUS
EDIUM AT LOW PECLET NUMBERS AND NONHOMOGENEOUS SOLUTION,
69-05434 01B

TAL COMPUTERS
OMPUTER METHODS FOR TRANSIENT ANALYSIS OF WATER-TABLE
QUIFERS,
69-05435 07C

S
OGMILLER V OLSON (OBSTRUCTION TO NATURAL COURSE OF
AINAGE).
9-05547 04A

LDEN V AMORY (LIABILITY FOR FLOODING).
9-05590 06E

STERS
E UTILITY OF DISASTERS,
9-05288 06B

RTABLE WATER PURIFIERS FOR COSTA RICA,
9-05456 05D

HARGE MEASUREMENT
NSTANT-RATE-INJECTION EQUIPMENT FOR DYE-DILUTION DISCHARGE
EASUREMENTS,
9-05237 07B

ERSION
DRODYNAMIC DISPERSION IN A SATURATED HOMOGENEOUS POROUS
DIUM AT LOW PECLET NUMBERS AND NONHOMOGENEOUS SOLUTION,
9-05434 01B

OLVED OXYGEN
MICROKIT FOR DISSOLVED OXYGEN DETERMINATION,
9-05242 07B

TER QUALITY IN IMPOUNDMENTS AND MODIFICATIONS FROM
STRATIFICATION,
9-05467 02H

RIBUTED LAG FUNCTIONS
TIONAL DISTRIBUTED LAG FUNCTIONS,
9-05515 06B

RIBUTED LAGS
STRIBUTED LAGS A SURVEY,
9-05514 06B

RIBUTION PATTERNS
EDICTING FIELD DISTRIBUTIONS OF SPRINKLER SYSTEMS,
9-05285 03F

HES
UNTY COMMISSIONERS OF BALTIMORE COUNTY V HUNTER (DRAINAGE
SEMENT NUISANCE).
9-05400 04A

OGMILLER V OLSON (OBSTRUCTION TO NATURAL COURSE OF
AINAGE).
9-05547 04A

ION V WELCH (SURFACE DRAINAGE EASEMENTS).
9-05593 04A

AL

SEASONAL AND DIURNAL VARIATION IN POCOSIN SHRUB MOISTURE
CONTENT,
W69-05331 02I

DIVERSION
MORRIS CANAL AND BANKING COMPANY.
W69-05359 06E

W69-05360 06E

POIRE V SERRA (PROPRIETY OF LAND FILL BY RIPARIAN OWNER).
W69-05381 04A

LAWRENCE V EASTERN AIRLINES (DIVERSION OF NATURAL FLOW).
W69-05546 04A

REESE V STATE (DAMAGE TO LAND DUE TO DIVERSION OF STREAM).
W69-05560 04A

DIVERSION DAMS
EARLY V SOUTH CAROLINA PUBLIC SERVICE AUTHORITY
(CONSTRUCTION OF DAM AND DIVERSION OF RIVER).
W69-05578 04A

DIVERSION STRUCTURES
ENDERSON V KELEHAN (UPLAND DRAINAGE OF SURFACE WATERS).
W69-05390 04A

EAVES V CITY OF OTTUMWA (LIABILITY FOR FLOOD DAMAGE).
W69-05587 06E

DOMESTIC ANIMALS
NITROGEN CYCLE IN SURFACE AND SUBSURFACE WATERS,
W69-05323 05B

DOMESTIC WASTES
GREEN V MCCLOUD (ACTION TO ENJOIN SEWAGE FLOW).
W69-05389 05G

DOMESTIC WATER
THE COMPETITION FOR WATER QUALITY DOMESTIC USE,
W69-05527 05G

DRAINAGE
DRAINAGE AND FLOWAGE OF LANDS.
W69-05362 04A

CORNETT V HEBERT (OBSTRUCTION TO FLOW OF SURFACE WATER).
W69-05562 04A

BRAY V CITY OF WINTER GARDEN (SURFACE WATERS CAST ON LOWER
PROPERTY).
W69-05563 04A

LEIPER V HEYWOOD-HALL CONSTR CO (CLAIM OF ARTIFICIALLY
INCREASED DRAINAGE ON PART OF UPPER LANDOWNER).
W69-05568 06E

DRAINAGE EFFECTS
SOIL OR FOLIAR FERTILIZATION OF WELL-DRAINED AND FLOODED
SLASH PINE,
W69-05332 02G

DRAINAGE WATER
DEYO V ATHOL HOUSING AUTHORITY (DAMAGE FROM WATER
DISCHARGE).
W69-05556 04C

BROWN V BLANKENSHIP (SUBSERVIENT DRAINAGE).
W69-05598 06E

DRAINS
DESTEFANO V MEGLIO (DAMAGES FOR OBSTRUCTION OF A DRAIN).
W69-05543 06E

DRAWDOWN
COMPUTER METHODS FOR TRANSIENT ANALYSIS OF WATER-TABLE
AQUIFERS,
W69-05435 07C

DRIFTING(AQUATIC)
CORRECTING RIVER VELOCITIES MEASURED FROM AN UNANCHORED
SHIP,
W69-05255 07B

DROUGHT RESISTANCE
DROUGHT AND PHOSPHORUS AFFECT GROWTH OF ANNUAL FORAGE
LEGUMES,
W69-05264 02I

MEASUREMENT OF DROUGHT RESISTANCE IN CROP PLANTS,
W69-05265 02G

TISSUE WATER RELATIONS FOR BRIGALOW AND MULGA,
W69-05281 02I

DROUGHTS
RELATIONSHIP OF PALMER DROUGHT VARIABLES TO YIELD OF WINTER
WHEAT,
W69-05283 03F

HYDROLOGIC EFFECTS OF THE 1962-66 DROUGHT ON LONG ISLAND, N.
Y.,
W69-05411 02A

DRY FARMING
MEASUREMENT OF DROUGHT RESISTANCE IN CROP PLANTS,
W69-05265 02G

DUAL PRICES
A NOTE ON THE DUAL PRICES OF INTEGER PROGRAMS,

W69-05523 06C

DUNES
SOIL PROBLEMS IN RESEEDING A GREASEWOOD-RABBITBRUSH RANGE SITE,
W69-05269 02G

DURBIN-WATSON STATISTIC
USE OF THE DURBIN-WATSON STATISTIC IN INAPPROPRIATE SITUATIONS,
W69-05516 06D

DYE RELEASES
TIME-OF-TRAVEL MEASUREMENTS AND OTHER APPLICATIONS OF DYE TRACING,
W69-05228 07B

IMPROVED DYES FOR WATER TRACING,
W69-05235 07B

NOMOGRAPHS FOR DETERMINING AMOUNT OF RHODAMINE B DYE FOR TIME-OF-TRAVEL STUDIES,
W69-05236 07B

CONSTANT-RATE-INJECTION EQUIPMENT FOR DYE-DILUTION DISCHARGE MEASUREMENTS,
W69-05237 07B

SELECTION OF DYE-INJECTION AND MEASURING SITES FOR TIME-OF-TRAVEL STUDIES,
W69-05238 07B

COMPARISON OF RESULTS USING THREE SAMPLING TECHNIQUES FOR A FLUOMETRIC DYE STUDY IN A STREAM,
W69-05239 07B

DYE-CLOUD PHOTOGRAPHY,
W69-05241 07B

DYNAMIC PROGRAMMING
A COMMENT ON OPTIMIZATION METHODS FOR BRANCHING MULTISTAGE WATER RESOURCE SYSTEMS,
W69-05499 06A

OPTIMIZATION METHODS FOR BRANCHING MULTISTAGE WATER RESOURCE SYSTEMS--A REPLY TO A COMMENT BY E. F. BRATER,
W69-05501 06A

DYSTROPHY
RESERVOIR EUTROPHICATION AND DYSTROPHICATION FOLLOWING IMPOUNDMENT,
W69-05471 02H

EARLY PLANTING
EFFECT OF EARLY-SUMMER SEEDING OF WINTER WHEAT ON YIELD, SOIL MOISTURE, AND SOIL NITRATE,
W69-05280 03F

EARTHQUAKES
KOYNA EARTHQUAKE OF DECEMBER 11, 1967,
W69-05419 08E

EASEMENTS
THE PLAN AND PROGRAM FOR THE BRANDYWINE.
W69-05299 06B

MORRIS CANAL AND BANKING COMPANY.
W69-05359 06E

DELAWARE AND RARITAN CANAL.
W69-05361 04A

LOCH SHELDRAKE ASSOCIATES V EVANS (RESTRICTIVE CLAUSE ON THE USES OF WATER).
W69-05548 06E

CORNETT V HEBERT (OBSTRUCTION TO FLOW OF SURFACE WATER).
W69-05562 04A

MORRIS V WINTERS (ACTION TO REMOVE AN OBSTRUCTION TO WATER FLOW).
W69-05567 04A

DILLENBECK V STATE (COMPENSATION FOR PERPETUAL EASEMENT TO FLOOD LAND).
W69-05573 06E

CRANCE V STATE (DAMAGES FOR APPROPRIATION OF RIPARIAN RIGHTS BY THE STATE).
W69-05580 06E

NIXON V WELCH (SURFACE DRAINAGE EASEMENTS).
W69-05593 04A

SCHEPLER V DEWERD (EASEMENT TO TAKE WELL WATER).
W69-05595 06E

STATE ROADS COMMISSION V BERRY (CONDEMNATION AWARDS).
W69-05596 06E

TALBOT V KERN (SERVITUDES OF DRAINAGE).
W69-05597 06E

HUTCHESON V SUMRALL (WATER SUPPLY EASEMENT).
W69-05599 06E

EAST FORK DUCK CREEK WATERSHED
EAST FORK DUCK CREEK WATERSHED NOBLE AND WASHINGTON COUNTIES, OHIO.
W69-05329 06B

ECONOMIC FEASIBILITY
VARIABLE ROW SPACING OF IRRIGATED COTTON AS A MEANS FOR REDUCING PRODUCTION COSTS AND CONSERVING WATER,
W69-05277 03F

ECONOMIC IMPACT
ASSESSING IMPACTS OF DECLINING WATER QUALITY ON GROSS VALUE OUTPUT OF AGRICULTURE, A CASE STUDY,
W69-05273 03C

BROAD SCOPE OF NAVIGATION'S ECONOMIC IMPACT,
W69-05449 06B

ECONOMIC STABILITY
MONEY, MULTIPLIER ACCELERATOR INTERACTION AND THE BUSINESS CYCLE,
W69-05291 06B

ECONOMIC VARIABLE
THE TYPICAL SPECTRAL SHAPE OF AN ECONOMIC VARIABLE,
W69-05522 06D

ECONOMICS
ECONOMICS AND FINANCING OF IRRIGATION PROJECTS,
W69-05221 06C

WELFARE ECONOMICS, ECONOMIC GROWTH AND THE CHOICE OF TECHNIQUES,
W69-05500 06B

ELECTRIC MOTORS
VARIABLE-SPEED POWER EQUIPMENT FOR DEPTH-INTEGRATION SEDIMENT SAMPLING,
W69-05257 07B

ELECTRICAL RESISTANCE
EVALUATION OF SOME GEOPHYSICAL TECHNIQUES APPLIED TO THE ENVIRONMENT OF A MAUI WELL,
W69-05418 02F

ELECTRICITY
MALICIOUS MISCHIEFS-PUBLIC UTILITIES.
W69-05374 04C

EMINENT DOMAIN
TENNESSEE GAS TRANSMISSION CO V GREATER LAFOURCHE PORT COMMISSION (DAMAGE FOR FORCED LOWERING OF PIPELINE ACROSS NAVIGABLE STREAM).
W69-05541 06E

COATES V UNITED STATES (TAKING OF PROPERTY FOR PUBLIC PURPOSE WITHOUT JUST COMPENSATION).
W69-05554 04A

STATE V BOLLENBACK (NAVIGABILITY OF LAKE).
W69-05576 06E

DICKSON V BOARD OF COMM'RS OF CADDO LEVEE (EXPROPRIATION OF RIPARIAN LAND BY THE STATE).
W69-05585 06E

BLACK RIVER REGULATING DIST. V ADIRONDACK LEAGUE CLUB (CONDEMNATION PROCEEDINGS).
W69-05591 06E

ENCROACHMENT
BEACH FRONTS AND WATERWAYS.
W69-05363 04A

ENERGY BUDGET
SNOW ACCUMULATION AS RELATED TO METEOROLOGICAL, TOPOGRAPHIC AND FOREST VARIABLES IN CENTRAL SIERRA NEVADA, CALIFORNIA,
W69-05226 02C

ENGINEERING
BUDA V STATE (ARTIFICIAL CONTROL OF SURFACE WATERS).
W69-05550 04A

ENUMERATION
OPTIMIZATION METHODS FOR BRANCHING MULTISTAGE WATER RESOURCE SYSTEMS--A REPLY TO A COMMENT BY E. F. BRATER,
W69-05501 06A

EPIDERMIS
STOMATAL OPENING IN ISOLATED EPIDERMAL STRIPS OF VICIA FABA I. RESPONSE TO LIGHT AND TO CO2-FREE AIR,
W69-05278 02I

EQUIPMENT
CONSTANT-RATE-INJECTION EQUIPMENT FOR DYE-DILUTION DISCHARGE MEASUREMENTS,
W69-05237 07B

POLYETHYLENE OIL TUBES FOR STILLING WELLS,
W69-05248 07B

VARIABLE-SPEED POWER EQUIPMENT FOR DEPTH-INTEGRATION SEDIMENT SAMPLING,
W69-05257 07B

EROSION
GRANITES, GRUSSES, AND THE SHERMAN EROSION SURFACE, SOUTHERN LARAMIE RANGE, COLORADO-WYOMING,
W69-05211 02J

BEACH FRONTS AND WATERWAYS.
W69-05363 04A

EROSION CONTROL
FLAT CHANNEL TERRACES,
W69-05282 02J

NGINEERING TECHNIQUES AND PRINCIPLES APPLIED TO SOIL
ROSION CONTROL,
69-05333 04D

ATERWAYS AND WATER FRONTS.
69-05364 04A

ENTIAL NUTRIENTS
ITROGEN CYCLE IN SURFACE AND SUBSURFACE WATERS,
69-05323 05B

MATING EQUATIONS
OMOGRAPHS FOR DETERMINING AMOUNT OF RHODAMINE B DYE FOR
ME-OF-TRAVEL STUDIES,
9-05236 07B

PPEL
BO V YOUNG (ARTIFICIAL DRAINAGE OF SURFACE WATERS AND
TURAL FLOW).
9-05551 04A

ARIES
THE REPRESENTATION OF THE REYNOLDS STRESS IN A TIDAL
TUARY,
9-05213 02L

E LONGITUDINAL DIFFUSION COEFFICIENT IN THE DELAWARE RIVER
TUARY AS DETERMINED FROM A STEADY-STATE MODEL,
9-05428 02L

OPHICATION
OLOGICAL ASPECTS OF EUTROPHICATION IN LAKES MENDOTA,
YSTAL, TROUT AND GREEN,
9-05324 02H

SERVOIR MANAGEMENT PROBLEMS CREATED BY INCREASED
OSPHORUS LEVELS OF SURFACE WATERS,
9-05470 02H

SERVOIR EUTROPHICATION AND DYSTROPHICATION FOLLOWING
POUNDMENT,
9-05471 02H

ORATION
APORATION FROM BOGS IN THE EUROPEAN TERRITORY OF THE USSR,
9-05214 02D

FT FOR EVAPORATION-MEASUREMENT EQUIPMENT,
9-05252 07B

EPARATION OF CO-ORDINATED PRECIPITATION, RUNOFF AND
APORATION MAPS,
9-05337 02A

ORATION CONTROL
FECT OF FATTY ALCOHOL ON CHANGE IN SOIL WATER DURING THE
MMER FALLOW PERIOD
9-05284 02G

OTRANSPIRATION
METHOD OF DETERMINING EVAPOTRANSPIRATION IN SOIL
NOLITHS,
9-05270 02D

SIVE SOILS
DRAULIC CONDUCTIVITY R[illegible]TED TO POROSITY AND SWELLING OF
IL,
9-05443 02G

DITURES
ONOMICS AND FINANCING OF IRRIGATION PROJECTS.
9-05221 06C

PRIATION
KSON V BOARD OF COMM'RS OF CADDO LEVEL (EXPROPRIATION OF
ARIAN LAND BY THE STATE).
9-05585 06E

R ANALYSIS
TOR ANALYSIS AND REGRESSION,
-05517 06B

MARKET VALUE
LENBECK V STATE (COMPENSATION FOR PERPETUAL EASEMENT TO
OD LAND).
-05573 06E

MANAGEMENT
ES V LUCAS (SURFACE DRAINAGE).
-05594 04A

WASTE
ROGEN CYCLE IN SURFACE AND SUBSURFACE WATERS,
-05323 05B

WASTES
ER QUALITY CHANGES IN CONFINED HOG WASTE TREATMENT,
-05417 05D

AL CONSTITUTION
ER LAW, POLITICS, AND ECONOMICS FEDERAL CONTROL OF
ER RESOURCES,
-05297 06E

AL GOVERNMENT
TED STATES V WILLIS (ARBITRARINESS IN LAND CONDEMNATION).
-05574 06E

AL JURISDICTION
ER LAW, POLITICS, AND ECONOMICS FEDERAL CONTROL OF
WATER RESOURCES,
W69-05297 06E

FIELD CAPACITY
MOISTURE-RETENTION CAPACITY OF LITTER UNDER TWO ARIZONA
CHAPARRAL COMMUNITIES,
W69-05267 02G

FILTERS
RAPID FIELD FILTRATION OF WATER SAMPLES,
W69-05244 07B

FILTRATION
RAPID FIELD FILTRATION OF WATER SAMPLES,
W69-05244 07B

FINANCING
DELAWARE RIVER BASIN COMPACT.
W69-05345 04D

FIRST DIFFERENCES
AUTOCORRELATION BETWEEN FIRST DIFFERENCES OF MID-RANGES,
W69-05520 06B

FISH
NOTICE OF PETITIONS FOR SPECIAL LEGISLATION PERTAINING TO
FISH AND GAME.
W69-05375 06E

TRESPASS - IMPROVED LANDS AND FISH PONDS.
W69-05566 06E

FISH MANAGEMENT
RESERVOIR FISHERY RESOURCES,
W69-05463 02H

FISHKILL
A LIMNOLOGICAL RECONNAISSANCE OF AN IMPOUNDMENT RECEIVING
HEAVY METALS WITH EMPHASIS OF DIATOMS AND FISH,
W69-05465 02H

MASONITE CORPORATION V GUY (FISHKILL EFFECTS OF WATER
POLLUTION).
W69-05553 05C

FLASH FLOODS
CARLSON V A AND P CORRUGATED BOX CORP (FLOODING CAUSED BY
NEGLIGENT MAINTENANCE OF DAM).
W69-05588 04A

FLOC FORMATION
IDENTIFICATION OF ZOOGLOEA SPECIES AND THE RELATIONSHIP TO
ZOOGLOEAL MATRIX AND FLOC FORMATION,
W69-05313 05C

FLOOD CONTROL
FLAT CHANNEL TERRACES,
W69-05282 02J

FLOOD DAMAGE
FLOOD PLAIN INFORMATION, SOUTHWEST BRANCH, PRINCE GEORGES
COUNTY, MARYLAND.
W69-05203 04A

FLOOD PLAIN INFORMATION (ANACOSTIA RIVER), PRINCE GEORGES
COUNTY, MARYLAND.
W69-05204 04A

FLOOD PLAIN INFORMATION, INTRENCHMENT, SUGAR, DOOLITTLE AND
DOLESS CREEKS.
W69-05205 04A

FLOOD PLAIN INFORMATION OF PROCTOR CREEK, METROPOLITAN
ATLANTA, GEORGIA.
W69-05206 04A

FLOOD PLAIN INFORMATION ON HEADWATERS SOUTH RIVER,
METROPOLITAN ATLANTA, GEORGIA.
W69-05207 04A

EAST FORK DUCK CREEK WATERSHED NOBLE AND WASHINGTON
COUNTIES, OHIO.
W69-05329 06B

JOHNSON V CITY OF WINSTON-SALEM (ACTION FOR DAMAGES CAUSED
BY AN OBSTRUCTED DRAIN PIPE).
W69-05394 04A

FLOOD PLAIN INFORMATION OF ELLICOTT CREEK IN CITY OF
TONAWANDA AND VICINITY, ERIE COUNTY, NEW YORK.
W69-05458 02E

FLOOD PLAIN INFORMATION OF DUCK CREEK, GARLAND, TEXAS.
W69-05459 02E

FLOOD PLAIN INFORMATION, SOUTH MESQUITE CREEK, MESQUITE,
TEXAS.
W69-05460 02E

FLOOD PLAIN INFORMATION, TENMILE CREEK, DALLAS COUNTY,
TEXAS.
W69-05461 02E

FLOOD PLAIN INFORMATION OF CATTARAUGUS CREEK, ARCADE,
WYOMING COUNTY, NEW YORK.
W69-05462 02E

TOWN OF VIENNA V STATE (PRESCRIPTIVE RIGHTS DOCTRINE AS
APPLIED TO PUBLIC PROPERTY).
W69-05549 04A

TANEY COUNTY V EMPIRE DIST ELECTRIC CO (FLOOD DAMAGE AND CLAIM SETTLEMENT FOR FUTURE DAMAGES).
W69-05571 06E

EAVES V CITY OF OTTUMWA (LIABILITY FOR FLOOD DAMAGE).
W69-05587 06E

IODICE V STATE (DUTIES OF DAM OWNERS).
W69-05589 06E

GOLDEN V AMORY (LIABILITY FOR FLOODING).
W69-05590 06E

TAYLOR V STATE (PRESCRIPTIVE RIGHT TO FLOOD LAND).
W69-05592 06E

FLOOD FORECASTING
THE ASSESSMENT OF SURFACE RUNOFF FROM RAINFALL DATA FOR AN ARID REGION OF WEST PAKISTAN,
W69-05232 02E

COMPARISON OF FLOOD-WAVE AND WATER-PARTICLE TRAVELTIMES,
W69-05240 02E

INTERPRETATION OF FLOOD-FREQUENCY DATA,
W69-05260 07B

THE WEATHER BUREAU AND WATER MANAGEMENT.
W69-05336 07C

FREQUENCY CURVES FOR ANNUAL FLOOD SERIES WITH SOME ZERO EVENTS OR INCOMPLETE DATA,
W69-05455 07C

FLOOD PLAIN ZONING
THE PLAN AND PROGRAM FOR THE BRANDYWINE.
W69-05299 06B

FLOOD PLAINS
FLOOD PLAIN INFORMATION, SOUTHWEST BRANCH, PRINCE GEORGES COUNTY, MARYLAND.
W69-05203 04A

FLOOD PLAIN INFORMATION (ANACOSTIA RIVER), PRINCE GEORGES COUNTY, MARYLAND.
W69-05204 04A

FLOOD PROTECTION
EAST FORK DUCK CREEK WATERSHED NOBLE AND WASHINGTON COUNTIES, OHIO.
W69-05329 06B

FLOOD ROUTING
MOUNTAIN RIVER FLOOD RUNOFF THEORY, MEANS OF ITS INVESTIGATION AND CALCULATION,
W69-05230 02A

FLOOD WATERS
BUDA V STATE (ARTIFICIAL CONTROL OF SURFACE WATERS).
W69-05550 04A

FLOODS
FLOOD PLAIN INFORMATION, SOUTHWEST BRANCH, PRINCE GEORGES COUNTY, MARYLAND.
W69-05203 04A

FLOOD PLAIN INFORMATION (ANACOSTIA RIVER), PRINCE GEORGES COUNTY, MARYLAND.
W69-05204 04A

FLOOD PLAIN INFORMATION, INTRENCHMENT, SUGAR, DOOLITTLE AND DOLESS CREEKS.
W69-05205 04A

FLOOD PLAIN INFORMATION OF PROCTOR CREEK, METROPOLITAN ATLANTA, GEORGIA.
W69-05206 04A

FLOOD PLAIN INFORMATION ON HEADWATERS SOUTH RIVER, METROPOLITAN ATLANTA, GEORGIA.
W69-05207 04A

STUDIES OF RUNOFF FORMATION UNDER CONDITION OF HIGH-ANGLE ATTITUDE OF THE IMPERVIOUS BED,
W69-05229 02E

COMPARISON OF FLOOD-WAVE AND WATER-PARTICLE TRAVELTIMES,
W69-05240 02E

INTERPRETATION OF FLOOD-FREQUENCY DATA,
W69-05260 07B

FLOODS IN VIRGINIA - MAGNITUDE AND FREQUENCY,
W69-05415 02E

FLOOD PLAIN INFORMATION OF ELLICOTT CREEK IN CITY OF TONAWANDA AND VICINITY, ERIE COUNTY, NEW YORK.
W69-05458 02E

FLOOD PLAIN INFORMATION OF DUCK CREEK, GARLAND, TEXAS.
W69-05459 02E

FLOOD PLAIN INFORMATION, SOUTH MESQUITE CREEK, MESQUITE, TEXAS.
W69-05460 02E

FLOOD PLAIN INFORMATION, TENMILE CREEK, DALLAS COUNTY, TEXAS.
W69-05461 02E

FLOOD PLAIN INFORMATION OF CATTARAUGUS CREEK, ARCADE, WYOMING COUNTY, NEW YORK.
W69-05462 02E

FLORIDA
TECHNIQUES OF WATER MANAGEMENT OF LAKE OKEECHOBEE AND THE FLORIDA EVERGLADES,
W69-05223 04A

MEYER V CITY OF OAKLAND (VALIDITY OF SPECIAL ASSESSMENTS LAND FOR SEWER IMPROVEMENTS).
W69-05542 06E

LAWRENCE V EASTERN AIRLINES (DIVERSION OF NATURAL FLOW).
W69-05546 04A

BRAY V CITY OF WINTER GARDEN (SURFACE WATERS CAST ON LOWER PROPERTY).
W69-05563 04A

FLOW NETS
FLUID FLOW IN THE WESTERN CANADA SEDIMENTARY BASIN - 1. EFFECT OF TOPOGRAPHY,
W69-05451 02F

FLUCTUATION
PESTICIDE LEVELS AND FLUCTUATION IN SOIL BACTERIA IN AN IRRIGATED FIELD AND A POND OF SOUTHWEST TEXAS,
W69-05272 05C

FLUIDIZED BED SEEDING
BASIC STUDIES OF SCALE CONTROL,
W69-05334 03A

W69-05334 03A

FLUORESCENCE
IMPROVED DYES FOR WATER TRACING,
W69-05235 07B

FOLIAR APPLICATION
SOIL OR FOLIAR FERTILIZATION OF WELL-DRAINED AND FLOODED SLASH PINE,
W69-05332 02G

FOODS
PESTICIDES NOT ENOUGH KNOWN.
W69-05215 05G

FORAGE GRASSES
EFFECT OF MOISTURE REGIMES AND HARVESTS ON EFFICIENCY OF WATER USE BY TEN FORAGE CROPS,
W69-05268 02I

FORAGE LEGUMES
EFFECT OF MOISTURE REGIMES AND HARVESTS ON EFFICIENCY OF WATER USE BY TEN FORAGE CROPS,
W69-05268 02I

FORECASTING
PREDICTING FIELD DISTRIBUTIONS OF SPRINKLER SYSTEMS,
W69-05285 03F

EVALUATION OF PRE-IMPOUNDMENT CONDITIONS FOR PREDICTION OF STORED WATER QUALITY,
W69-05468 02H

FORT LOUDOUN RESERVOIR(TENN)
WATER QUALITY INVESTIGATION, PART 1 - BASIC DATA, FORT LOUDOUN RESERVOIR, APRIL 1966 - JUNE 1968,
W69-05416 05A

FREE GOODS
A NOTE ON THE DUAL PRICES OF INTEGER PROGRAMS,
W69-05523 06C

FRESH WATER
DETERMINATION OF FRESH WATERS IN THE CALCAREOUS MASSIF OF 'COSTA BRAVA', SPAIN (FRENCH),
W69-05474 02F

GAME BIRDS
NOTICE OF PETITIONS FOR SPECIAL LEGISLATION PERTAINING TO FISH AND GAME.
W69-05375 06E

TRESPASS - IMPROVED LANDS AND FISH PONDS.
W69-05566 06E

GEOLOGY
SALT-WATER ENCROACHMENT OF TERTIARY LIMESTONE ALONG COASTAL SOUTH CAROLINA,
W69-05473 02L

GEORGIA
W B RODDENBERY CO INC V CARTER (DAMAGES FOR POLLUTION OF STREAM).
W69-05559 05B

GLACIAL SOILS
HYDROLOGY OF A SLIDE-PRONE GLACIAL TILL SOIL IN SOUTHEAST ALASKA,
W69-05406 02G

GOVERNMENTS
THE ORGANIZATION OF VENEZUELA FOR THE UTILIZATION OF ITS WATER RESOURCES (SPANISH),
W69-05220 06E

ECONOMIC ALTERNATIVES,
W69-05528 05G

NITES
RANITES, GRUSSES, AND THE SHERMAN EROSION SURFACE, SOUTHERN
ARAMIE RANGE, COLORADO-WYOMING,
69-05211 02J

SSED WATERWAYS
NGINEERING TECHNIQUES AND PRINCIPLES APPLIED TO SOIL
ROSION CONTROL,
69-05333 04D

SSES
OIL MOISTURE CONDITIONS UNDER PASTURES OF COOL-SEASON AND
ARM-SEASON GRASSES,
69-05266 02G

OIL PROBLEMS IN RESEEDING A GREASEWOOD-RABBITBRUSH RANGE
ITE,
69-05269 02G

FLS
ENNESSEE VALLEY SAND AND GRAVEL CO V PILLING (LIABILITY FOR
EDIMENT DUMPING WHICH MAKES CREEK BED SHALLOWER, WHICH
USES MORE FLOODING).
69-05386 05G

ING
OIL MOISTURE CONDITIONS UNDER PASTURES OF COOL-SEASON AND
ARM-SEASON GRASSES,
69-05266 02G

SEWOOD
OIL PROBLEMS IN RESEEDING A GREASEWOOD-RABBITBRUSH RANGE
TE,
69-05269 02G

T LAKES
DROMETEOROLOGICAL STUDIES IN SUPPORT OF THE INTERNATIONAL
ELD YEAR FOR THE GREAT LAKES,
69-05222 02B

CE
LT WATER ENCROACHMENT IN KARST AQUIFERS, ISLAND OF
PHALLINIA, (IONIAN),
69-05472 02L

ND WATER RECHARGE
TING WASTE WATER TO BENEFICIAL USE - THE FLUSHING MEADOWS
OJECT,
69-05327 05D

TURNING WASTES TO THE LAND, A NEW ROLE FOR AGRICULTURE,
69-05328 05D

NDWATER
RIATION IN THE COMPOSITION OF BRINE FROM THE SYLVANIA
EMATION NEAR MIDLAND, MICHIGAN,
69-05401 02F

TER-RESOURCES APPRAISAL OF THE SNAKE RIVER BASIN IN
WADA,
69-05414 02E

ALUATION OF SOME GEOPHYSICAL TECHNIQUES APPLIED TO THE
VIRONMENT OF A MAUI WELL,
69-05418 02F

ER RESOURCES OF THE BURNETT REGION,
69-05423 02E

ER SUPPLY IN THE BRACKISH-WATER REGIONS OF SOUTH VIETNAM.
69-05457 02L

DWATER BASINS
NTIFICATION OF NONLINEAR PARAMETERS OF GROUND WATER
INS BY HYBRID COMPUTATION,
-05271 02F

DWATER MOVEMENT
NSIENT FLOW OF GROUND WATER TO WELLS IN MULTIPLE-AQUIFER
TEMS,
-05413 02F

SUREMENT OF SMALL SURFACE DISPLACEMENTS INDUCED BY FLUID
W,
-05433 02F

ID FLOW IN THE WESTERN CANADA SEDIMENTARY BASIN - 1.
ECT OF TOPOGRAPHY,
-05451 02F

ERMINING THE RATIO OF HORIZONTAL TO VERTICAL PERMEABILITY
AQUIFER-TEST ANALYSIS,
-05452 02F

ES
NITES, GRUSSES, AND THE SHERMAN EROSION SURFACE, SOUTHERN
AMIE RANGE, COLORADO-WYOMING,
-05211 02J

N'S THEOREM
ALTERNATIVE PROOF OF HANNAN'S THEOREM ON CANONICAL
RELATION AND MULTIPLE EQUATION SYSTEMS,
-05511 06D

R MASTERS
BORS, WHARVES, AND HARBOR MASTERS.
-05377 04A

RS
BOR DEVELOPMENT PORT OF PORTLAND, MAINE.
-05298 06B

HARBORS, WHARVES, AND HARBOR MASTERS.
W69-05377 04A

EQUILIBRIUM FLOW AREAS OF INLETS ON SANDY COASTS,
W69-05447 02L

HARMONIC REGRESSION
LONG SWINGS,
W69-05498 06B

HARVESTING
EFFECT OF MOISTURE REGIMES AND HARVESTS ON EFFICIENCY OF
WATER USE BY TEN FORAGE CROPS,
W69-05268 02I

HAWAII
EVALUATION OF SOME GEOPHYSICAL TECHNIQUES APPLIED TO THE
ENVIRONMENT OF A MAUI WELL,
W69-05418 02F

HEAT BUDGET
PREDICTING TEMPERATURES OF SMALL STREAMS,
W69-05427 02E

HIGH WATER MARK
MINIMUM AND MAXIMUM WATER-LEVEL RECORDING DEVICES,
W69-05250 07B

IN RE SITE FOR HUNTS POINT SEWAGE TREATMENT WORKS, BOROUGH
OF BRONX, CITY OF NEW YORK (OWNERSHIP OF LAND UNDER WATER).
W69-05581 06E

HIGHWAYS
HIGHWAYS.
W69-05378 04C

W69-05379 04C

HISTORY
WATER LAW, POLITICS, AND ECONOMICS OUR COMPLEX WATER LAWS
AND WATER USE CUSTOMS,
W69-05296 06E

HOGS
WATER QUALITY CHANGES IN CONFINED HOG WASTE TREATMENT,
W69-05417 05D

HUMAN RESOURCES
INTERGRATING HUMAN-SOCIAL RESOURCES INTO THE WATER RESOURCE
DEVELOPMENT PROJECT,
W69-05217 06B

HUNTING
SALT WATER ISLANDS.
W69-05565 06E

HURRICANES
MASSMAN-DRAKE V TOWBOAT M/V HUGH C BLASKE, BARGE CHEM 2
(ACTION FOR DAMAGES CAUSED BY A TOWBOAT CAST ADRIFT BY A
HURRICANE).
W69-05341 06E

HYBRID COMPUTERS
IDENTIFICATION OF NONLINEAR PARAMETERS OF GROUND WATER
BASINS BY HYBRID COMPUTATION,
W69-05271 02F

HYDRAULIC CONDUCTIVITY
HYDRAULIC CONDUCTIVITY RELATED TO POROSITY AND SWELLING OF
SOIL,
W69-05443 02G

HYDRAULIC ENGINEERING
ENGINEERING TECHNIQUES AND PRINCIPLES APPLIED TO SOIL
EROSION CONTROL,
W69-05333 04D

HYDRAULIC MODELS
DESIGN CRITERIA FOR LABORATORY CATCHMENT EXPERIMENTS, WITH
PARTICULAR REFERENCE TO RAINFALL SIMULATION,
W69-05234 02A

PREDICTION OF SEDIMENT PROFILES IN OPEN CHANNEL FLOW BY
TURBULENT DIFFUSION THEORY,
W69-05403 02J

SHOALING OF SOLITARY WAVES ON SMALL SLOPES,
W69-05450 02H

HYDRAULIC OBSERVATIONS
PROBLEMS OF THE METHODS AND ACCURACY OF HYDROLOGIC
OBSERVATIONS (RUSSIAN),
W69-05210 07A

HYDROELECTRIC POWER
DELAWARE RIVER BASIN COMPACT.
W69-05345 04D

HYDROGRAPH ANALYSIS
COMPARATIVE STUDY OF SNOW TYPE HYDROLOGY OF NORTHEASTERN
CANADA AND OF PLAINS OF RUSSIA AND SIBERIA,
W69-05225 02E

HYDROGRAPHS
COMPARATIVE STUDY OF SNOW TYPE HYDROLOGY OF NORTHEASTERN
CANADA AND OF PLAINS OF RUSSIA AND SIBERIA,
W69-05225 02E

SYNTHETIC HYDROGRAPHS EFFECTS OF NETWORK GEOMETRY,
W69-05432 02A

RUNOFF HYDROGRAPH AS A FUNCTION OF RAINFALL EXCESS,
W69-05438 02A

HYDROLOGIC ASPECTS
HYDROLOGY OF A SLIDE-PRONE GLACIAL TILL SOIL IN SOUTHEAST ALASKA,
W69-05406 02G

HYDROLOGIC EFFECTS OF THE 1962-66 DROUGHT ON LONG ISLAND, N. Y.,
W69-05411 02A

HYDROLOGIC CYCLE
WATER RESOURCES LAWS IN VIRGINIA (REMEDIES FOR INFRINGEMENT OF WATER RIGHTS).
W69-05538 06E

HYDROLOGIC PROPERTIES
DETERMINATION OF FRESH WATERS IN THE CALCAREOUS MASSIF OF 'COSTA BRAVA', SPAIN (FRENCH),
W69-05474 02F

HYDROLOGY
THE WEATHER BUREAU AND WATER MANAGEMENT.
W69-05336 07C

HYGROMETRY
SERVOPSYCHROMETER,
W69-05251 07B

ISOPIESTIC TECHNIQUE FOR MEASURING LEAF WATER POTENTIALS WITH A THERMOCOUPLE PSYCHROMETER,
W69-05286 02I

HYPOLIMNION
EFFECT OF IMPOUNDMENTS ON PRODUCTIVITY, WATER CHEMISTRY, AND HEAT BUDGETS OF RIVERS,
W69-05469 02H

ILLINOIS
PEOPLE V VILLAGE OF BERKELEY (STATUTORY DUTIES UNDER WATER SUPPLY CONTRACTS).
W69-05584 06E

IMPAIRED WATER QUALITY
QUALITY WATER'S FOURTH DIMENSION,
W69-05524 05G

THE COMPETITION FOR WATER QUALITY AGRICULTURE,
W69-05525 05G

IMPLEMENTATION TECHNIQUES
WATER RESOURCES POLICY AND POLITICAL INSTITUTIONS.
W69-05295 06B

IMPOUNDED WATERS
WATER RESOURCES LAWS IN VIRGINIA (PERCOLATING GROUNDWATER - DIFFUSED SURFACE WATER).
W69-05535 06E

IMPOUNDMENTS
WATER QUALITY IN IMPOUNDMENTS AND MODIFICATIONS FROM DESTRATIFICATION,
W69-05467 02H

INCOME
AN INCOME-NET WORTH APPROACH TO MEASURING ECONOMIC WELFARE,
W69-05290 06B

THE ECONOMICS OF WATER ALLOCATION IN UTAH,
W69-05507 06D

INCREASING RETURNS TO SCALE
INCREASING OR DECREASING RETURNS TO SCALE IN THE CONSTANT ELASTICITY OF SUBSTITUTION PRODUCTION FUNCTION,
W69-05505 06D

INDIA
ECONOMICS AND FINANCING OF IRRIGATION PROJECTS,
W69-05221 06C

MEASUREMENT OF DROUGHT RESISTANCE IN CROP PLANTS,
W69-05265 02G

INDIANA
NEWTON V LYONS (COMMON ENEMY EXCEPTION).
W69-05545 06E

GWINN V MYERS (SUIT TO REMOVE OBSTRUCTION TO NATURAL WATERCOURSE).
W69-05557 04A

INDUSTRIAL PLANTS
W B RODDENBERY CO INC V CARTER (DAMAGES FOR POLLUTION OF STREAM).
W69-05559 05B

INDUSTRIAL WASTES
GARGAC V SMITH-ROWLAND CO (POLLUTION OF LAKE BY INDUSTRIAL WASTES).
W69-05387 05C

TREATING COKE PLANT WASTE,
W69-05422 05D

INDUSTRIES
THE COMPETITION FOR WATER QUALITY INDUSTRY,
W69-05526 05G

INFILTRATION
SOIL PROBLEMS IN RESEEDING A GREASEWOOD-RABBITBRUSH RANG SITE,
W69-05269 02G

THE MECHANISM OF NATURAL GROUND-WATER RECHARGE AND DISCH 1. ONE-DIMENSIONAL, VERTICAL, UNSTEADY, UNSATURATED FLOW ABOVE A RECHARGING OR DISCHARGING GROUND-WATER FLOW SYST
W69-05436 02F

INFORMATION RETRIEVAL
DATA SYSTEMS AND INFORMATION RETRIEVAL ADAPTABLE TO WATE RESOURCES,
W69-05490 06B

A DISCUSSION OF DATA SYSTEMS AND INFORMATION RETRIEVAL ADAPTABLE TO WATER RESOURCES,
W69-05491 06B

INLAND WATERWAYS
THE ORIGIN AND DEVELOPMENT OF THE WATERWAYS POLICY OF TH UNITED STATES,
W69-05338 04A

INLETS
WATERWAYS AND WATER FRONTS.
W69-05364 04A

INPUT-OUTPUT ANALYSIS
THE ECONOMICS OF WATER ALLOCATION IN UTAH,
W69-05507 06D

THE INTERINDUSTRY FACTOR-CONTEXT MATRIX AN APPLICATION THE ANALYSIS AND PROJECTION OF REGIONAL WATER REQUIREMEN
W69-05509 06B

INSTITUTIONAL CONSTRAINTS
A LAWYER LOOKS AT WATER RESOURCE ECONOMICS,
W69-05292 06E

WATER RESOURCES POLICY AND POLITICAL INSTITUTIONS.
W69-05295 06B

INSTRUMENTATION
WATER-MANOMETER-AIR-LINE ASSEMBLY FOR DETERMINING DEPTH WATER IN WELLS,
W69-05249 07B

MINIMUM AND MAXIMUM WATER-LEVEL RECORDING DEVICES,
W69-05250 07B

SERVOPSYCHROMETER,
W69-05251 07B

RAFT FOR EVAPORATION-MEASUREMENT EQUIPMENT,
W69-05252 07B

WATER-STAGE AND RAINFALL DUAL RECORDER,
W69-05253 07B

POLAR COORDINATE CHART READER FOR STAGE-RAINFALL RECORDER
W69-05254 07B

AN ACCURATE SMALL ORIFICE RAIN GAGE,
W69-05404 07B

INTEGER PROGRAMS
A NOTE ON THE DUAL PRICES OF INTEGER PROGRAMS,
W69-05523 06C

INTERCEPTION
THE INTERCEPTION-TRANSPIRATION RELATIONSHIP OF WHITE SPRU AND WHITE PINE,
W69-05274 02D

INTERDISCIPLINARY RESEARCH
CONCEPTUAL ISSUES IN THE CONDUCT OF REGIONAL RESEARCH ON ECONOMICS OF WATER,
W69-05480 06B

INTERNATIONAL HYDROLOGICAL DECADE
HYDROMETEOROLOGICAL STUDIES IN SUPPORT OF THE INTERNATION FIELD YEAR FOR THE GREAT LAKES,
W69-05222 02B

INTERSTATE COMPACTS
DELAWARE RIVER BASIN COMPACT.
W69-05342 04A

W69-05343 04A

W69-05344 04A

INTERSTATE RIVERS
THE ORIGIN AND DEVELOPMENT OF THE WATERWAYS POLICY OF THE UNITED STATES,
W69-05338 04A

INTER-BASIN TRANSFERS
WATER RESOURCES LAWS IN VIRGINIA (REMEDIES FOR INFRINGEME OF WATER RIGHTS).
W69-05538 06E

INVESTMENT
WATER RESOURCE DEVELOPMENT PUBLIC AND PRIVATE INVESTMEN
W69-05486 06B

DISCUSSION OF WATER RESOURCE DEVELOPMENT PUBLIC AND PRIVATE INVESTMENT,
W69-05487 06B

IOWA

EGAL ASPECTS OF THE SMALL WATERSHED PROGRAM IN IOWA,
W69-05339 04D

ODD V BLEZEK (DETERMINATION OF DOMINANT ESTATE AND DRAINAGE
IGHTS IN NATURAL STREAM).
W69-05393 04A

OAT V VAN VEEN (INTERFERENCE WITH WATER FLOW).
W69-05395 04A

ROGMILLER V OLSON (OBSTRUCTION TO NATURAL COURSE OF
RAINAGE).
W69-05547 04A

AVES V CITY OF OTTUMWA (LIABILITY FOR FLOOD DAMAGE).
W69-05587 06E

IXON V WELCH (SURFACE DRAINAGE EASEMENTS).
W69-05593 04A

IGATED LAND
ESTICIDE LEVELS AND FLUCTUATION IN SOIL BACTERIA IN AN
RRIGATED FIELD AND A POND OF SOUTHWEST TEXAS,
69-05272 05C

IGATION
CONOMICS AND FINANCING OF IRRIGATION PROJECTS,
69-05221 06C

ATER RESOURCES OF THE BURNETT REGION,
69-05423 02E

IGATION CAPITAL
CONOMICS AND FINANCING OF IRRIGATION PROJECTS,
69-05221 06C

IGATION EFFICIENCY
ARIABLE ROW SPACING OF IRRIGATED COTTON AS A MEANS FOR
EDUCING PRODUCTION COSTS AND CONSERVING WATER,
69-05277 03F

ATER MANAGEMENT OF FALL-PLANTED SUGAR BEETS IN SALT RIVER
ALLEY OF ARIZONA,
69-05279 03F

ETERMINATION OF OPTIMUM CAPACITY OF A STORAGE RESERVOIR FOR
RRIGATION PURPOSES AS A BASIS FOR ALLOCATING COSTS IN
ULTIPLE-PURPOSE PROJECTS,
9-05294 03F

GATION POTENTIAL
CONOMICS AND FINANCING OF IRRIGATION PROJECTS,
9-05221 06C

GATION PRACTICES
UDIES ON WATER USE IN PEA (PISUM SATIVUM L.),
9-05287 03F

GATION SYSTEMS
EDICTING FIELD DISTRIBUTIONS OF SPRINKLER SYSTEMS,
9-05285 03F

GATION WATER
E COMPETITION FOR WATER QUALITY AGRICULTURE,
9-05525 05G

NDS
LT WATER ISLANDS.
9-05565 06E

IESTIC
OPIESTIC TECHNIQUE FOR MEASURING LEAF WATER POTENTIALS
TH A THERMOCOUPLE PSYCHROMETER,
9-05286 02I

IAN HYDRAULIC RECLAMATION
GINEERING TECHNIQUES AND PRINCIPLES APPLIED TO SOIL
OSION CONTROL,
9-05333 04D

ATION
COMMENT ON OPTIMIZATION METHODS FOR BRANCHING MULTISTAGE
TER RESOURCE SYSTEMS,
9-05499 06A

TIMIZATION METHODS FOR BRANCHING MULTISTAGE WATER RESOURCE
STEMS--A REPLY TO A COMMENT BY E. F. BRATER,
9-05501 06A

CIAL DECISIONS
TER LAW, POLITICS, AND ECONOMICS FEDERAL CONTROL OF
TER RESOURCES,
9-05297 06E

N CENTRAL CO V BUCKLEY AND CO (BRIDGE COLLISIONS SUIT).
9-05380 06E

LT WATER ENCROACHMENT IN KARST AQUIFERS, ISLAND OF
PHALLINIA, (IONIAN),
9-05472 02L

ICKY
INSON V RAY (RIGHT TO CONSTRUCT RETAINING WALL)
9-05382 04A

EN V MCCLOUD (ACTION TO ENJOIN SEWAGE FLOW).
9-05389 05G

ALLEN V DAVENPORT (DAMAGE FROM BACKING SURFACE RUNOFF).
9-05600 04A

LABORATORY CATCHMENT EXPERIMENTS
DESIGN CRITERIA FOR LABORATORY CATCHMENT EXPERIMENTS, WITH PARTICULAR REFERENCE TO RAINFALL SIMULATION,
W69-05234 02A

LABORATORY TESTS
DESIGN CRITERIA FOR LABORATORY CATCHMENT EXPERIMENTS, WITH PARTICULAR REFERENCE TO RAINFALL SIMULATION,
W69-05234 02A

LAKE SENECA
CRANCE V STATE (DAMAGES FOR APPROPRIATION OF RIPARIAN RIGHTS BY THE STATE).
W69-05580 06E

LAKES
TECHNIQUES OF WATER MANAGEMENT OF LAKE OKEECHOBEE AND THE FLORIDA EVERGLADES,
W69-05223 04A

STATE V BOLLENBACK (NAVIGABILITY OF LAKE).
W69-05576 06E

LAND RECLAMATION
PUBLIC PARKS - PLAYGROUNDS SALE OF RECLAIMED LANDS ABUTTING PARK LANDS.
W69-05365 06E

LAND TENURE
CONVEYANCES OF LANDS BY LEGISLATIVE AUTHORITY.
W69-05348 06E

SURVEY OPERATIONS AND CONTROLS BY THE BOARD OVER SUBMERGED LANDS.
W69-05350 06E

CONFIRMATORY LEASES AND GRANTS OF SUBMERGED LAND.
W69-05354 06E

ERRONEOUS GRANTS OF SUBMERGED LAND.
W69-05355 06E

DELINQUENT RIPARIAN LEASES RE-ENTRY BY THE STATE.
W69-05356 06E

STATE ACQUISITION OF RIPARIAN LANDS LEASE FOR COMMERCIAL ENTERPRISES.
W69-05358 06E

LAND USAGE
STATE ACQUISITION OF RIPARIAN LANDS LEASE FOR COMMERCIAL ENTERPRISES.
W69-05358 06E

LAND USE
HARBOR DEVELOPMENT PORT OF PORTLAND, MAINE.
W69-05298 06B

THE PLAN AND PROGRAM FOR THE BRANDYWINE.
W69-05299 06B

LANDFILLS
POIRE V SERRA (PROPRIETY OF LAND FILL BY RIPARIAN OWNER).
W69-05381 04A

LANDSLIDES
HYDROLOGY OF A SLIDE-PRONE GLACIAL TILL SOIL IN SOUTHEAST ALASKA,
W69-05406 02G

LEAVES
TISSUE WATER RELATIONS FOR BRIGALOW AND MULGA,
W69-05281 02I

ISOPIESTIC TECHNIQUE FOR MEASURING LEAF WATER POTENTIALS WITH A THERMOCOUPLE PSYCHROMETER,
W69-05286 02I

SEASONAL AND DIURNAL VARIATION IN POCOSIN SHRUB MOISTURE CONTENT,
W69-05331 02I

LEGAL ASPECTS
LEGAL CONSTRAINTS IN WATER PRICING POLICY,
W69-05493 06C

MEYER V CITY OF OAKLAND (VALIDITY OF SPECIAL ASSESSMENTS TO LAND FOR SEWER IMPROVEMENTS).
W69-05542 06E

LEGISLATION
USAGE OF SUBMERGED LAND LEASE AND GRANT CONDITIONS AND PROCEDURE.
W69-05351 06E

DAMAGE TO ICE.
W69-05371 06E

MOORING WATERCRAFT TO BUOYS OR BEACONS.
W69-05373 06E

UNWHOLESOME PREMISES REMOVAL AND REHABILITATION AT OWNER'S EXPENSE.
W69-05376 05B

HARBORS, WHARVES, AND HARBOR MASTERS.
W69-05377 04A

HIGHWAYS.
W69-05378 04C

W69-05379 04C

COMPLETION OF THE FAIRFAX COUNTY WATER AUTHORITY ACQUISITION PROGRAM.
W69-05539 03D

LEGUMES
DROUGHT AND PHOSPHORUS AFFECT GROWTH OF ANNUAL FORAGE LEGUMES,
W69-05264 02I

LEVEES
CITY OF HARDIN V NORBORNE LAND DRAINAGE DISTRICT (STATUTORY RIGHTS TO MAINTAIN EXISTING LEVEES).
W69-05384 04A

BOAT V VAN VEEN (INTERFERENCE WITH WATER FLOW).
W69-05395 04A

DICKSON V BOARD OF COMM'RS OF CADDO LEVEE (EXPROPRIATION OF RIPARIAN LAND BY THE STATE).
W69-05585 06E

LEVEL PANS
RUNOFF WATER-SPREADING ON LEVELED CROPLAND,
W69-05275 04A

LIGHT
STOMATAL OPENING IN ISOLATED EPIDERMAL STRIPS OF VICIA FABA. I. RESPONSE TO LIGHT AND TO CO2-FREE AIR,
W69-05278 02I

LIMESTONES
SALT-WATER ENCROACHMENT OF TERTIARY LIMESTONE ALONG COASTAL SOUTH CAROLINA,
W69-05473 02L

DETERMINATION OF FRESH WATERS IN THE CALCAREOUS MASSIF OF 'COSTA BRAVA', SPAIN (FRENCH),
W69-05474 02F

LINEAR PROGRAMMING
WATER POLLUTION CONTROL USING BY-PASS PIPING,
W69-05503 05G

A NOTE ON THE DUAL PRICES OF INTEGER PROGRAMS,
W69-05523 06C

LITTER LAYER
MOISTURE-RETENTION CAPACITY OF LITTER UNDER TWO ARIZONA CHAPARRAL COMMUNITIES,
W69-05267 02G

LOANS
CAPITAL FORMATION AND GOVERNMENT CAPITAL POLICY IN DEVELOPING ECONOMIES,
W69-05518 06C

LOCAL GOVERNMENTS
GRANTS OF SUBMERGED LANDS TO THE STATE, MUNICIPALITIES, AND OTHER SUBDIVISIONS.
W69-05353 06E

UNWHOLESOME PREMISES REMOVAL AND REHABILITATION AT OWNER'S EXPENSE.
W69-05376 05B

HIGHWAYS.
W69-05378 04C

W69-05379 04C

DEYO V ATHOL HOUSING AUTHORITY (DAMAGE FROM WATER DISCHARGE).
W69-05556 04C

LOGGING(RECORDING)
AN OUTLINE OF GEOPHYSICAL LOGGING METHODS AND THEIR USES IN HYDROLOGIC STUDIES,
W69-05261 07B

LONG CYCLES
LONG SWINGS,
W69-05498 06B

LONG ISLAND
TRUSTEES OF FREEHOLDERS AND COMMONALTY V MORRISEY (TITLE TO BEDS UNDER TIDAL WATERS).
W69-05388 06E

LONG SWINGS
LONG SWINGS,
W69-05498 06B

LOUISIANA
TENNESSEE GAS TRANSMISSION CO V GREATER LAFOURCHE PORT COMMISSION (DAMAGE FOR FORCED LOWERING OF PIPELINE ACROSS NAVIGABLE STREAM).
W69-05541 06E

CLARK V GIFFORD-HILL AND CO (WATER POLLUTION BY MINING).
W69-05561 05G

CORNETT V HEBERT (OBSTRUCTION TO FLOW OF SURFACE WATER).
W69-05562 04A

DICKSON V BOARD OF COMM'RS OF CADDO LEVEE (EXPROPRIATION OF RIPARIAN LAND BY THE STATE).
W69-05585 06E

TALBOT V KERN (SERVITUDES OF DRAINAGE).
W69-05597 06E

BROWN V BLANKENSHIP (SUBSERVIENT DRAINAGE).
W69-05598 06E

LOW WATER MARK
MINIMUM AND MAXIMUM WATER-LEVEL RECORDING DEVICES,
W69-05250 07B

LUMBERING
TAKING OF WATERCRAFT, AIRCRAFT OR DRAFT ANIMALS INJURING CUTTING LOOSE BOOMS, RAFTS, VESSELS OR BOATS CIVIL ACTIO FOR DAMAGES.
W69-05372 06E

LUSTRUMENTATION
STUDIES ON METHODS OF SOIL WATER DETERMINATION,
W69-05304 02G

MAINE
WETLANDS (CONTROL AND REGULATION IN MAINE).
W69-05366 06E

UNPROTECTED WELLS.
W69-05367 06E

REMOVAL OF BUSHES, TREES, AND STUMPS FROM FLOWED AREA.
W69-05368 04A

NUISANCES-MILLS AND DAMS FENCES AND BUILDINGS ON PUBLIC WAYS.
W69-05369 04A

DUMPING OF OIL.
W69-05370 05G

DAMAGE TO ICE.
W69-05371 06E

TAKING OF WATERCRAFT, AIRCRAFT OR DRAFT ANIMALS INJURING CUTTING LOOSE BOOMS, RAFTS, VESSELS OR BOATS CIVIL ACTIO FOR DAMAGES.
W69-05372 06E

MALICIOUS MISCHIEFS-PUBLIC UTILITIES.
W69-05374 04C

NOTICE OF PETITIONS FOR SPECIAL LEGISLATION PERTAINING TO FISH AND GAME.
W69-05375 06E

SALT WATER ISLANDS.
W69-05565 06E

TRESPASS - IMPROVED LANDS AND FISH PONDS.
W69-05566 06E

MANOMETERS
WATER-MANOMETER-AIR-LINE ASSEMBLY FOR DETERMINING DEPTH T WATER IN WELLS,
W69-05249 07B

MARGINAL COST PRICING
STATEMENT,
W69-05497 06C

MARGINAL PRODUCT
THE ESTIMATION OF MARGINAL PRODUCT FROM A COBB-DOUGLAS PRODUCTION FUNCTION,
W69-05521 06B

MARGINAL PRODUCTIVITY
THE ESTIMATION OF MARGINAL PRODUCT FROM A COBB-DOUGLAS PRODUCTION FUNCTION,
W69-05521 06B

MARKOV PROCESSES
RECURRENCE INTERVALS BETWEEN EXCEEDANCES OF SELECTED RIVER LEVELS. 2. ALTERNATIVES TO A MARKOV MODEL,
W69-05454 02E

MARYLAND
COUNTY COMMISSIONERS OF BALTIMORE COUNTY V HUNTER (DRAINAG EASEMENT NUISANCE).
W69-05400 04A

BIBERMAN V FUNKHOUSER (UPPER LANDOWNER'S RIGHT TO HAVE SURFACE WATER DRAIN UPON LOWER LANDOWNER).
W69-05570 06E

STATE ROADS COMMISSION V BERRY (CONDEMNATION AWARDS).
W69-05596 06E

MASSACHUSETTS
COHASSET WATER CO V TOWN OF COHASSET (CONVEYANCE OF WATER WORKS TO TOWN).
W69-05583 06E

GOLDEN V AMORY (LIABILITY FOR FLOODING).
W69-05590 06E

MATHEMATICAL MODELS
PROBLEMS OF THE METHODS AND ACCURACY OF HYDROLOGIC OBSERVATIONS (RUSSIAN),
W69-05210 07A

PREDICTION OF SEDIMENT PROFILES IN OPEN CHANNEL FLOW BY TURBULENT DIFFUSION THEORY,
W69-05403 02J

TRANSIENT FLOW OF GROUND WATER TO WELLS IN MULTIPLE-AQUIFER SYSTEMS,
W69-05413 02F

RAINFALL-RUNOFF MODEL FOR SMALL BASIN FLOOD HYDROGRAPH SIMULATION,
W69-05420 02A

COMPUTER METHODS FOR TRANSIENT ANALYSIS OF WATER-TABLE AQUIFERS,
W69-05435 07C

RUNOFF HYDROGRAPH AS A FUNCTION OF RAINFALL EXCESS,
W69-05438 02A

COMPUTER EXPERIMENTS WITH FRACTIONAL GAUSSIAN NOISES, PARTS 1, 2, AND 3,
W69-05453 07C

RECURRENCE INTERVALS BETWEEN EXCEEDANCES OF SELECTED RIVER LEVELS. 2. ALTERNATIVES TO A MARKOV MODEL,
W69-05454 02E

THEMATICAL STUDIES
PROBLEMS OF THE METHODS AND ACCURACY OF HYDROLOGIC OBSERVATIONS (RUSSIAN),
W69-05210 07A

TRANSIENT FLOW OF GROUND WATER TO WELLS IN MULTIPLE-AQUIFER SYSTEMS,
W69-05413 02F

ASUREMENT
ISOPIESTIC TECHNIQUE FOR MEASURING LEAF WATER POTENTIALS WITH A THERMOCOUPLE PSYCHROMETER,
W69-05286 02I

THODOLOGY
PROBLEMS OF THE METHODS AND ACCURACY OF HYDROLOGIC OBSERVATIONS (RUSSIAN),
W69-05210 07A

CONCEPTUAL ISSUES IN THE CONDUCT OF REGIONAL RESEARCH ON THE ECONOMICS OF WATER,
W69-05480 06B

EGIONAL AND NATIONAL PLANNING OF AGRICULTURAL RESEARCH,
W69-05482 06B

ICO
UCLEAR POWER AND WATER DESALTING PLANTS FOR SOUTHWEST NITED STATES AND NORTHWEST MEXICO.
69-05208 03A

HIGAN
NWHOLESOME PREMISES REMOVAL AND REHABILITATION AT OWNER'S XPENSE.
69-05376 05B

ARBORS, WHARVES, AND HARBOR MASTERS.
69-05377 04A

IGHWAYS.
69-05378 04C

69-05379 04C

URT V MUNGER (EROSION CONTROL AND LANDFILL BY RIPARIAN WNER).
69-05391 04A

OLDA V PITTSBURGH FORGINGS CO (LANDFILLS AND OWNERSHIP OF EDS).
69-05398 06E

AVIGABLE STREAMS, PERMISSION TO BRIDGE OR DAM PUBLIC ERVICE FACILITIES NATURAL RESOURCES.
69-05564 06E

ONES V LUCAS (SURFACE DRAINAGE).
69-05594 04A

OORGANISMS
HE MICROBIAL FLORA OF ACID MINE WATER AND ITS RELATIONSHIP O FORMATION AND REMOVAL OF ACID,
69-05314 05G

ROCRUSTACEANS
IMNOLOGICAL STUDIES OF LENTIC WATERS,
69-05302 02H

-RANGES
NTOCORRELATION BETWEEN FIRST DIFFERENCES OF MID-RANGES,
9-05520 06B

, DAMS
ISANCES-MILLS AND DAMS FENCES AND BUILDINGS ON PUBLIC YS.
9-05369 04A

ERALS
FSHORE PROSPECTING AND MINING LAWS OF THE UNITED STATES,
9-05340 06E

NG
FSHORE PROSPECTING AND MINING LAWS OF THE UNITED STATES,
9-05340 06E

ARK V GIFFORD-HILL AND CO (WATER POLLUTION BY MINING).
9-05561 05G

MINNESOTA
ENDERSON V KELEHAN (UPLAND DRAINAGE OF SURFACE WATERS).
W69-05390 04A

STATE V BOLLENBACK (NAVIGABILITY OF LAKE).
W69-05576 06E

OSTLUND V STEARNS COUNTY (ARTIFICIAL ACCUMULATION OF SURFACE WATERS).
W69-05577 06E

MISSISSIPPI
MASONITE CORPORATION V GUY (FISHKILL EFFECTS OF WATER POLLUTION).
W69-05553 05C

HUTCHESON V SUMRALL (WATER SUPPLY EASEMENT).
W69-05599 06E

MISSISSIPPI RIVER
UNITED STATES V KANSAS CITY LIFE INSURANCE CO (FLOODING, UNDERFLOWING).
W69-05572 04A

MISSOURI
COMPREHENSIVE BASIN STUDY ON WHITE RIVER BASIN, ARKANSAS AND MISSOURI.
W69-05201 06B

CITY OF HARDIN V NORBORNE LAND DRAINAGE DISTRICT (STATUTORY RIGHTS TO MAINTAIN EXISTING LEVEES).
W69-05384 04A

TANEY COUNTY V EMPIRE DIST ELECTRIC CO (FLOOD DAMAGE AND CLAIM SETTLEMENT FOR FUTURE DAMAGES).
W69-05571 06E

UNITED STATES V KANSAS CITY LIFE INSURANCE CO (FLOODING, UNDERFLOWING).
W69-05572 04A

MIXING
ARTIFICIAL MIXING OF DENSITY-STRATIFIED FLUIDS A LABORATORY INVESTIGATION,
W69-05412 02H

MODEL STUDIES
DESIGN CRITERIA FOR LABORATORY CATCHMENT EXPERIMENTS, WITH PARTICULAR REFERENCE TO RAINFALL SIMULATION,
W69-05234 02A

A METHOD OF DETERMINING EVAPOTRANSPIRATION IN SOIL MONOLITHS,
W69-05270 02D

MOISTURE CONTENT
SOIL MOISTURE CONDITIONS UNDER PASTURES OF COOL-SEASON AND WARM-SEASON GRASSES,
W69-05266 02G

MOISTURE-RETENTION CAPACITY OF LITTER UNDER TWO ARIZONA CHAPARRAL COMMUNITIES,
W69-05267 02G

TISSUE WATER RELATIONS FOR BRIGALOW AND MULGA,
W69-05281 02I

STUDIES ON METHODS OF SOIL WATER DETERMINATION,
W69-05304 02G

SEASONAL AND DIURNAL VARIATION IN POCOSIN SHRUB MOISTURE CONTENT,
W69-05331 02I

MOISTURE DEFICIT
EFFECT OF MOISTURE REGIMES AND HARVESTS ON EFFICIENCY OF WATER USE BY TEN FORAGE CROPS,
W69-05268 02I

MOISTURE STRESS
DROUGHT AND PHOSPHORUS AFFECT GROWTH OF ANNUAL FORAGE LEGUMES,
W69-05264 02I

MEASUREMENT OF DROUGHT RESISTANCE IN CROP PLANTS,
W69-05265 02G

MONEY
MONEY, MULTIPLIER ACCELERATOR INTERACTION AND THE BUSINESS CYCLE,
W69-05291 06B

MONOLITHS
A METHOD OF DETERMINING EVAPOTRANSPIRATION IN SOIL MONOLITHS,
W69-05270 02D

MONSOONS
MEASUREMENT OF DROUGHT RESISTANCE IN CROP PLANTS,
W69-05265 02G

MOORING
MOORING AND FASTENING BOATS UPON RIPARIAN LANDS.
W69-05357 06E

MOUNTAIN LAKES
LIMNOLOGICAL STUDIES OF LENTIC WATERS,
W69-05302 02H

MOUNTAINS
MOUNTAIN RIVER FLOOD RUNOFF THEORY, MEANS OF ITS

INVESTIGATION AND CALCULATION,
W69-05230 02A

NUMERICAL FORECASTING OF MOUNTAIN RIVER FLOOD RUNOFF ON THE BASIS OF ESTABLISHING TERRITORIALLY - GENERALIZED RELATIONSHIPS,
W69-05211 02A

THE ASSESSMENT OF RUNOFF FROM A MOUNTAINOUS AND SEMI-ARID AREA IN WESTERN IRAN,
W69-05213 02E

MULGA
TISSUE WATER RELATIONS FOR BRIGALOW AND MULGA,
W69-05281 02I

MULTICOLLINEARITY
FACTOR ANALYSIS AND REGRESSION,
W69-05517 06B

MULTIDISCIPLINARY RESEARCH
CONCEPTUAL ISSUES IN THE CONDUCT OF REGIONAL RESEARCH ON THE ECONOMICS OF WATER,
W69-05480 06B

MULTIPLE EQUATION SYSTEMS
AN ALTERNATIVE PROOF OF HANNAN'S THEOREM ON CANONICAL CORRELATION AND MULTIPLE EQUATION SYSTEMS,
W69-05511 06D

MULTIPLE-PURPOSE PROJECTS
COMPREHENSIVE BASIN STUDY ON WHITE RIVER BASIN, ARKANSAS AND MISSOURI.
W69-05201 06B

THE FUNDAMENTAL ROLE OF WATER IN THE 'CASSA PER IL MEZZOGIORNO' DEVELOPMENT PROGRAMS FOR SOUTHERN ITALY,
W69-05216 06D

MUNICIPAL WASTES
PROCEEDINGS-SYMPOSIUM ON BETTER WATER AND SEWER SERVICES FOR SMALL COMMUNITIES IN NORTH CAROLINA.
W69-05312 03D

MUNICIPAL WATER
PROCEEDINGS-SYMPOSIUM ON BETTER WATER AND SEWER SERVICES FOR SMALL COMMUNITIES IN NORTH CAROLINA.
W69-05312 03D

NATURAL FLOW
LAWRENCE V EASTERN AIRLINES (DIVERSION OF NATURAL FLOW).
W69-05546 04A

BOB V YOUNG (ARTIFICIAL DRAINAGE OF SURFACE WATERS AND NATURAL FLOW).
W69-05551 04A

BIBERMAN V FUNKHOUSER (UPPER LANDOWNER'S RIGHT TO HAVE SURFACE WATER DRAIN UPON LOWER LANDOWNER).
W69-05570 06E

LEWALLEN V DAVENPORT (DAMAGE FROM BACKING SURFACE RUNOFF).
W69-05600 04A

NATURAL FLOW DOCTRINE
BOAT V VAN VEEN (INTERFERENCE WITH WATER FLOW).
W69-05395 04A

WATER RESOURCES LAWS IN VIRGINIA (NATURAL SURFACE WATERCOURSES).
W69-05534 06E

NATURAL SEAWATER
BASIC STUDIES OF SCALE CONTROL,
W69-05334 03A

NATURAL STREAMS
TURNER V SMITH (RESERVOIR OBSTRUCTING LAND DRAINAGE).
W69-05542 04A

DODD V BLEZEK (DETERMINATION OF DOMINANT ESTATE AND DRAINAGE RIGHTS IN NATURAL STREAM).
W69-05393 04A

WATER RESOURCES LAW IN VIRGINIA.
W69-05533 06E

WATER RESOURCES LAWS IN VIRGINIA (NATURAL SURFACE WATERCOURSES).
W69-05534 06E

GWINN V MYERS (SUIT TO REMOVE OBSTRUCTION TO NATURAL WATERCOURSE).
W69-05567 04A

NAVIGABLE WATERS
ESTABLISHMENT OF STATE CONTROL OVER SUBMERGED LANDS.
W69-05347 06E

MOORING WATERCRAFT TO BUOYS OR BEACONS.
W69-05373 06E

TENNESSEE GAS TRANSMISSION CO V GREATER LAFOURCHE PORT COMMISSION (DAMAGE FOR FORCED LOWERING OF PIPELINE ACROSS NAVIGABLE STREAM).
W69-05541 06E

NAVIGABLE STREAMS, PERMISSION TO BRIDGE OR DAM PUBLIC SERVICE FACILITIES NATURAL RESOURCES.
W69-05564 06E

MUENCH V PUBLIC SERVICE COMMISSION (PUBLIC RIGHTS IN NAVIGABLE RIVER).
W69-05582 06E

NAVIGATION
REMOVAL OF BUSHES, TREES, AND STUMPS FROM FLOWED AREA.
W69-05368 04A

BROAD SCOPE OF NAVIGATION'S ECONOMIC IMPACT,
W69-05449 06B

MARINE AIR WAYS, INC V STATE (INTERFERENCE WITH NAVIGATION
W69-05579 06E

NEGLIGENCE
COATES V UNITED STATES (TAKING OF PROPERTY FOR PUBLIC PURPOSE WITHOUT JUST COMPENSATION).
W69-05554 04A

NET WORTH
AN INCOME-NET WORTH APPROACH TO MEASURING ECONOMIC WELFARE
W69-05290 06B

NEVADA
WATER-RESOURCES APPRAISAL OF THE SNAKE RIVER BASIN IN NEVADA,
W69-05414 02E

NEW HAMPSHIRE
POIRE V SERRA (PROPRIETY OF LAND FILL BY RIPARIAN OWNER).
W69-05381 04A

NEW JERSEY
RIPARIAN LANDS.
W69-05346 06E

ESTABLISHMENT OF STATE CONTROL OVER SUBMERGED LANDS.
W69-05347 06E

CONVEYANCES OF LANDS BY LEGISLATIVE AUTHORITY.
W69-05348 06E

TRESPASS ON LANDS OF STATE UNDERWATER AND CONVEYANCES BY COMMERCE AND NAVIGATION.
W69-05349 06E

SURVEY OPERATIONS AND CONTROLS BY THE BOARD OVER SUBMERGED LANDS.
W69-05350 06E

USAGE OF SUBMERGED LAND LEASE AND GRANT CONDITIONS AND PROCEDURE.
W69-05351 06E

PROTECTION OF THE PALISADES.
W69-05352 06E

GRANTS OF SUBMERGED LANDS TO THE STATE, MUNICIPALITIES, AND OTHER SUBDIVISIONS.
W69-05353 06E

ERRONEOUS GRANTS OF SUBMERGED LAND.
W69-05355 06E

DELINQUENT RIPARIAN LEASES RE-ENTRY BY THE STATE.
W69-05356 06E

MOORING AND FASTENING BOATS UPON RIPARIAN LANDS.
W69-05357 06E

STATE ACQUISITION OF RIPARIAN LANDS LEASE FOR COMMERCIAL ENTERPRISES.
W69-05358 06E

MORRIS CANAL AND BANKING COMPANY.
W69-05359 06E

W69-05360 06E

DELAWARE AND RARITAN CANAL.
W69-05361 04A

DRAINAGE AND FLOWAGE OF LANDS.
W69-05362 04A

WATERWAYS AND WATER FRONTS.
W69-05364 04A

PUBLIC PARKS - PLAYGROUNDS SALE OF RECLAIMED LANDS ABUTTIN PARK LANDS.
W69-05365 06E

PENN CENTRAL CO V BUCKLEY AND CO (BRIDGE COLLISIONS SUIT).
W69-05380 06E

NEW YORK
WATERS OF WHITE LAKE INC V FRICKE (OWNERSHIP OF LAKE BEDS).
W69-05383 06E

TRUSTEES OF FREEHOLDERS,AND COMMONALTY V MORRISEY (TITLE TO BEDS UNDER TIDAL WATERS).
W69-05388 06E

LOCH SHELDRAKE ASSOCIATES V EVANS (RESTRICTIVE CLAUSE ON THE USES OF WATER).
W69-05548 06E

TOWN OF VIENNA V STATE (PRESCRIPTIVE RIGHTS DOCTRINE AS APPLIED TO PUBLIC PROPERTY).
W69-05549 04A

REESE V STATE (DAMAGE TO LAND DUE TO DIVERSION OF STREAM).
W69-05560 04A

DILLENBECK V STATE (COMPENSATION FOR PERPETUAL EASEMENT TO FLOOD LAND).
W69-05573 06E

MARINE AIR WAYS, INC V STATE (INTERFERENCE WITH NAVIGATION).
W69-05579 06E

CRANCE V STATE (DAMAGES FOR APPROPRIATION OF RIPARIAN RIGHTS BY THE STATE).
W69-05580 06E

IN RE SITE FOR HUNTS POINT SEWAGE TREATMENT WORKS, BOROUGH OF BRONX, CITY OF NEW YORK (OWNERSHIP OF LAND UNDER WATER).
W69-05581 06E

IODICE V STATE (DUTIES OF DAM OWNERS).
W69-05589 06E

BLACK RIVER REGULATING DIST. V ADIRONDACK LEAGUE CLUB (CONDEMNATION PROCEEDINGS).
W69-05591 06E

TAYLOR V STATE (PRESCRIPTIVE RIGHT TO FLOOD LAND).
W69-05592 06E

W YORK STATE BARGE CANAL
TAYLOR V STATE (PRESCRIPTIVE RIGHT TO FLOOD LAND).
W69-05592 06E

TRATES
EFFECT OF EARLY-SUMMER SEEDING OF WINTER WHEAT ON YIELD, SOIL MOISTURE, AND SOIL NITRATE,
W69-05280 03F

NITROGEN CYCLE IN SURFACE AND SUBSURFACE WATERS,
W69-05323 05B

TRIFICATION
NITROGEN CYCLE IN SURFACE AND SUBSURFACE WATERS,
W69-05323 05B

TROGEN
EFFECTS OF MOISTURE AND FERTILIZER ON YIELDS OF SPRING WHEAT AND BARLEY,
W69-05263 02I

TROGEN CYCLE
NITROGEN CYCLE IN SURFACE AND SUBSURFACE WATERS,
W69-05323 05B

NMARGINAL ECONOMICS
WATER RESOURCE DEVELOPMENT PUBLIC AND PRIVATE INVESTMENT,
W69-05486 06B

N-NAVIGABLE WATERS
NUISANCES-MILLS AND DAMS FENCES AND BUILDINGS ON PUBLIC WAYS.
W69-05369 04A

STATE V BOLLENBACK (NAVIGABILITY OF LAKE).
W69-05576 06E

TH CAROLINA
PROCEEDINGS-SYMPOSIUM ON BETTER WATER AND SEWER SERVICES FOR SMALL COMMUNITIES IN NORTH CAROLINA.
W69-05312 03D

JOHNSON V CITY OF WINSTON-SALEM (ACTION FOR DAMAGES CAUSED BY AN OBSTRUCTED DRAIN PIPE).
W69-05394 04A

STATE V GLIDDEN CO (CONSTITUTIONALITY OF WATER POLLUTIONS CONTROL STATUTE).
W69-05586 05G

TH CENTRAL REGION RESEARCH PROJECT NC-57
REGIONAL RESEARCH IN WATER IN THE NORTH CENTRAL REGION,
W69-05478 06B

THEASTERN TROPICAL PACIFIC
EFFECTS OF PHOSPHATE CONCENTRATION ON CELL DIVISION RATES AND YIELD OF A TROPICAL OCEANIC DIATOM,
W69-05530 05C

ICE
NOTICE OF PETITIONS FOR SPECIAL LEGISLATION PERTAINING TO FISH AND GAME.
W69-05375 06E

LEAR POWERPLANTS
NUCLEAR POWER AND WATER DESALTING PLANTS FOR SOUTHWEST UNITED STATES AND NORTHWEST MEXICO.
W69-05208 03A

SANCE
LAWRENCE V EASTERN AIRLINES (DIVERSION OF NATURAL FLOW).
W69-05546 04A

ERVATION WELLS
MINIMUM AND MAXIMUM WATER-LEVEL RECORDING DEVICES,
W69-05250 07B

TRUCTION TO FLOW
TURNER V SMITH (RESERVOIR OBSTRUCTING LAND DRAINAGE).
W69-05392 04A

ODD V BLEZEK (DETERMINATION OF DOMINANT ESTATE AND DRAINAGE RIGHTS IN NATURAL STREAM).
W69-05393 04A

JOHNSON V CITY OF WINSTON-SALEM (ACTION FOR DAMAGES CAUSED BY AN OBSTRUCTED DRAIN PIPE).
W69-05394 04A

DESTEFANO V MEGLIO (DAMAGES FOR OBSTRUCTION OF A DRAIN).
W69-05543 06E

MORRIS V WINTERS (ACTION TO REMOVE AN OBSTRUCTION TO WATER FLOW).
W69-05567 04A

TALBOT V KERN (SERVITUDES OF DRAINAGE).
W69-05597 06E

BROWN V BLANKENSHIP (SUBSERVIENT DRAINAGE).
W69-05598 06E

OCTADECANOL
EFFECT OF FATTY ALCOHOL ON CHANGE IN SOIL WATER DURING THE SUMMER FALLOW PERIOD,
W69-05284 02G

OHIO
SOURCES OF COAL MINE DRAINAGE POLLUTION, WHEELING CREEK WATERSHED, OHIO.
W69-05202 05B

STATE SQUIRE V CITY OF CLEVELAND (FILL LAND AND HIGHWAY USE AS TO LITTORAL RIGHTS).
W69-05555 04C

OIL SPILLS
OIL SPILLAGE STUDY, LITERATURE SEARCH, AND CRITICAL EVALUATION FOR SELECTION OF PROMISING TECHNIQUES TO CONTROL AND PREVENT DAMAGE,
W69-05262 05G

OIL WASTES
DUMPING OF OIL.
W69-05370 05G

OILY WATER
OIL SPILLAGE STUDY, LITERATURE SEARCH, AND CRITICAL EVALUATION FOR SELECTION OF PROMISING TECHNIQUES TO CONTROL AND PREVENT DAMAGE,
W69-05262 05G

IDENTIFICATION AND DIFFERENTIATION OF HEAVY RESIDUAL OIL AND ASPHALT POLLUTANTS IN SURFACE WATERS BY COMPARATIVE RATIOS OF INFRARED ABSORBANCES,
W69-05421 05A

OLIGOTROPHY
LIMNOLOGICAL STUDIES OF LENTIC WATERS,
W69-05302 02H

OPERATION AND MAINTENANCE
USE OF CARBON DIOXIDE IN BUBBLE GAGES TO PREVENT PRECIPITATION OF CALCIUM CARBONATE,
W69-05247 07B

POLYETHYLENE OIL TUBES FOR STILLING WELLS,
W69-05248 07B

MORRIS CANAL AND BANKING COMPANY.
W69-05360 06E

OPPORTUNITY COSTS
WATER ALLOCATION SUPPLY AND DEMAND RELATIONSHIPS,
W69-05483 06B

OPTIMIZATION METHODS
A COMMENT ON OPTIMIZATION METHODS FOR BRANCHING MULTISTAGE WATER RESOURCE SYSTEMS,
W69-05499 06A

OPTIMIZATION METHODS FOR BRANCHING MULTISTAGE WATER RESOURCE SYSTEMS--A REPLY TO A COMMENT BY E. F. BRATER,
W69-05501 06A

OPTIMUM DEVELOPMENT PLANS
THE ORGANIZATION OF VENEZUELA FOR THE UTILIZATION OF ITS WATER RESOURCES (SPANISH),
W69-05220 06E

WATER RESOURCES OF THE BURNETT REGION,
W69-05423 02E

ORGANOCHLORIDE INSECTICIDES
DETERMINATION OF ORGANOCHLORINE INSECTICIDES IN SOILS AND WATERS,
W69-05325 05A

OSMOTIC PRESSURE
MOVEMENT OF WATER AND SALT THROUGH A CLAY-WATER SYSTEM EXPERIMENTAL VERIFICATION OF ONSAGER RECIPROCAL RELATION,
W69-05441 02G

THE EFFECT OF OSMOTIC PRESSURE GRADIENTS ON WATER MOVEMENT IN UNSATURATED SOIL,
W69-05442 02G

OVERFLOW
GARGAC V SMITH-ROWLAND CO (POLLUTION OF LAKE BY INDUSTRIAL WASTES).
W69-05387 05C

CLARK V GIFFORD-HILL AND CO (WATER POLLUTION BY MINING).
W69-05561 05G

DILLENBECK V STATE (COMPENSATION FOR PERPETUAL EASEMENT TO FLOOD LAND).
W69-05573 06E

EAVES V CITY OF OTTUMWA (LIABILITY FOR FLOOD DAMAGE).
W69-05587 06E

IODICE V STATE (DUTIES OF DAM OWNERS).
W69-05589 06E

GOLDEN V AMORY (LIABILITY FOR FLOODING).
W69-05590 06E

OVERLAND FLOW
ENDERSON V KELEHAN (UPLAND DRAINAGE OF SURFACE WATERS).
W69-05390 04A

OWNERSHIP OF BEDS
RIPARIAN LANDS.
W69-05346 06E

CONVEYANCES OF LANDS BY LEGISLATIVE AUTHORITY.
W69-05348 06E

SURVEY OPERATIONS AND CONTROLS BY THE BOARD OVER SUBMERGED LANDS.
W69-05350 06E

CONFIRMATORY LEASES AND GRANTS OF SUBMERGED LAND.
W69-05354 06E

WATERS OF WHITE LAKE INC V FRICKE (OWNERSHIP OF LAKE BEDS).
W69-05383 06E

TRUSTEES OF FREEHOLDERS AND COMMONALTY V MORRISEY (TITLE TO BEDS UNDER TIDAL WATERS).
W69-05388 06E

PURT V MUNGER (EROSION CONTROL AND LANDFILL BY RIPARIAN OWNER).
W69-05391 04A

HOLDA V PITTSBURGH FORGINGS CO (LANDFILLS AND OWNERSHIP OF BEDS).
W69-05398 06E

WATER RESOURCES LAWS IN VIRGINIA (NATURAL SURFACE WATERCOURSES).
W69-05534 06E

IN RE SITE FOR HUNTS POINT SEWAGE TREATMENT WORKS, BOROUGH OF BRONX, CITY OF NEW YORK (OWNERSHIP OF LAND UNDER WATER).
W69-05581 06E

PALISADES
PROTECTION OF THE PALISADES.
W69-05352 06E

PALMER DROUGHT INDEX
RELATIONSHIP OF PALMER DROUGHT VARIABLES TO YIELD OF WINTER WHEAT,
W69-05283 03F

PARAMETERS
IDENTIFICATION OF NONLINEAR PARAMETERS OF GROUND WATER BASINS BY HYBRID COMPUTATION,
W69-05271 02F

PARAMETRIC HYDROLOGY
IDENTIFICATION OF NONLINEAR PARAMETERS OF GROUND WATER BASINS BY HYBRID COMPUTATION,
W69-05271 02F

PARTICLE SIZE
A CONTINUOUS SIZE SPECTRUM FOR PARTICULATE MATTER IN THE SEA,
W69-05529 07C

PARTICULATE MATTER
A CONTINUOUS SIZE SPECTRUM FOR PARTICULATE MATTER IN THE SEA,
W69-05529 07C

PASTURES
SOIL MOISTURE CONDITIONS UNDER PASTURES OF COOL-SEASON AND WARM-SEASON GRASSES,
W69-05266 02G

PATH OF POLLUTANTS
THE LONGITUDINAL DIFFUSION COEFFICIENT IN THE DELAWARE RIVER ESTUARY AS DETERMINED FROM A STEADY-STATE MODEL,
W69-05428 02L

PEAS
STUDIES ON WATER USE IN PEA (PISUM SATIVUM L.),
W69-05287 03F

PENNSYLVANIA
LUCAS V FORD (EASEMENT - SURFACE WATER DRAINAGE).
W69-05397 04A

BAU V WILDEN ACRES, INC (ACCUMULATION-RIDDANCE).
W69-05544 04A

MORRIS V WINTERS (ACTION TO REMOVE AN OBSTRUCTION TO WATER FLOW).
W69-05567 04A

LEIPER V HEYWOOD-HALL CONSTR CO (CLAIM OF ARTIFICIALLY INCREASED DRAINAGE ON PART OF UPPER LANDOWNER).
W69-05568 06E

CARLSON V A AND P CORRUGATED BOX CORP (FLOODING CAUSED B NEGLIGENT MAINTENANCE OF DAM).
W69-05588 04A

PERCOLATING WATER
WATER RESOURCES LAW IN VIRGINIA.
W69-05533 06E

WATER RESOURCES LAWS IN VIRGINIA (PERCOLATING GROUNDWATE DIFFUSED SURFACE WATER).
W69-05535 06E

PERCOLATION
UNITED STATES V KANSAS CITY LIFE INSURANCE CO (FLOODING, UNDERFLOWING).
W69-05572 04A

PERMAFROST
STUDIES OF RUNOFF FORMATION UNDER CONDITION OF HIGH-ANGL ATTITUDE OF THE IMPERVIOUS BED,
W69-05229 02E

PERMEABILITY
PORE SIZE DISTRIBUTIONS AS MEASURED BY THE MERCURY INTRU METHOD AND THEIR USE IN PREDICTING PERMEABILITY,
W69-05439 02G

DETERMINING THE RATIO OF HORIZONTAL TO VERTICAL PERMEABI BY AQUIFER-TEST ANALYSIS,
W69-05452 02F

PERMITS
WETLANDS (CONTROL AND REGULATION IN MAINE).
W69-05366 06E

WATER RESOURCES LAWS IN VIRGINIA (REMEDIES FOR INFRINGEM OF WATER RIGHTS).
W69-05538 06E

PESTICIDE RESIDUES
PESTICIDES NOT ENOUGH KNOWN.
W69-05215 05G

PESTICIDE LEVELS AND FLUCTUATION IN SOIL BACTERIA IN AN IRRIGATED FIELD AND A POND OF SOUTHWEST TEXAS,
W69-05272 05C

PESTICIDES
PESTICIDES NOT ENOUGH KNOWN.
W69-05215 05G

PETROLEUM PRODUCTS
IDENTIFICATION AND DIFFERENTIATION OF HEAVY RESIDUAL OIL ASPHALT POLLUTANTS IN SURFACE WATERS BY COMPARATIVE RATI OF INFRARED ABSORBANCES,
W69-05421 05A

PHENOLS
TREATING COKE PLANT WASTE,
W69-05422 05D

PHOSPHATES
EFFECTS OF PHOSPHATE CONCENTRATION ON CELL DIVISION RATE AND YIELD OF A TROPICAL OCEANIC DIATOM,
W69-05530 05C

PHOSPHORUS
DROUGHT AND PHOSPHORUS AFFECT GROWTH OF ANNUAL FORAGE LEGUMES,
W69-05264 02I

RESERVOIR MANAGEMENT PROBLEMS CREATED BY INCREASED PHOSPHORUS LEVELS OF SURFACE WATERS,
W69-05470 02H

PHOSPHORUS COMPOUNDS
PHOSPHORUS IN FLOWING WATERS,
W69-05445 05B

PHOSPHORUS RADIOISOTOPES
ACCUMULATION OF PHOSPHORUS-32 AND ZINC-65 BY LIVING AND KILLED PLANKTON,
W69-05531 05C

PHOTOGRAPHY
DYE-CLOUD PHOTOGRAPHY,
W69-05241 07B

PHYLLODES
TISSUE WATER RELATIONS FOR BRIGALOW AND MULGA,
W69-05281 02I

PHYSICOCHEMISTRY
DYNAMICS OF PHYSICOCHEMISTRY IN A LARGE RESERVOIR,
W69-05466 02H

PHYTOPLANKTON
BIOLOGICAL ASPECTS OF EUTROPHICATION IN LAKES MENDOTA, CRYSTAL, TROUT AND GREEN,
W69-05324 02H

PILOT PLANTS
A PILOT PLANT STUDY FOR REMOVAL OF SOLUBLE SILICA FROM ROSWELL, NEW MEXICO WATER. PHASE 1. INITIAL CONSTRUCTIO AND OPERATION,
W69-05335 03A

PIPE FLOW
UNSTEADY FLOW PARAMETERS IN HYDRAULIC DESIGN,

W69-05408 08B

SCATAQUA RIVER
ECONOMIC ANALYSIS OF PUBLIC WATER SUPPLY IN THE PISCATAQUA RIVER WATERSHED,
W69-05510 03E

ANKTON
ACCUMULATION OF PHOSPHORUS-32 AND ZINC-65 BY LIVING AND KILLED PLANKTON,
W69-05531 05C

ANNING
A STATE VIEWPOINT ON RIVER BASIN PLANNING,
69-05209 06B

ROCEEDINGS OF SYMPOSIUM ON BETTER WATER AND SEWER SERVICES ON SMALL COMMUNITIES IN NORTH CAROLINA,
69-05424 06B

CONOMIC ALTERNATIVES,
69-05528 05G

NT MANAGEMENT
ILLAGE METHODS TO REDUCE RUNOFF AND EROSION IN THE CORN ELT,
69-05330 03F

NT TISSUES
ISSUE WATER RELATIONS FOR BRIGALOW AND MULGA,
69-05281 02I

SOPIESTIC TECHNIQUE FOR MEASURING LEAF WATER POTENTIALS ITH A THERMOCOUPLE PSYCHROMETER,
9-05286 02I

TING MANAGEMENT
FECT OF EARLY-SUMMER SEEDING OF WINTER WHEAT ON YIELD, OIL MOISTURE, AND SOIL NITRATE,
9-05280 03F

AS
ALITY OF WATERS FROM PLAYAS ON THE SOUTHERN HIGH PLAINS,
9-05276 03C

SIN
ASONAL AND DIURNAL VARIATION IN POCOSIN SHRUB MOISTURE NTENT,
9-05331 02I

UTANT IDENTIFICATION
VELOPMENT OF BIOLOGICAL INDICES TO POLLUTION LEVELS IN REAMS AFFECTED BY ACID MINE DRAINAGE AND OIL FIELD BRINE STES,
9-05407 05A

DTION
TER RESOURCES LAW IN VIRGINIA (OTHER WATER SOURCES).
9-05536 06E

UTION ABATEMENT
NNESSEE VALLEY SAND AND GRAVEL CO V PILLING (LIABILITY FOR DIMENT DUMPING WHICH MAKES CREEK BED SHALLOWER, WHICH USES MORE FLOODING).
9-05386 05G

TICIDE LEVELS AND FLUCTUATION IN SOIL BACTERIA IN AN IGATED FIELD AND A POND OF SOUTHWEST TEXAS,
-05272 05C

DA V PITTSBURGH FORGINGS CO (LANDFILLS AND OWNERSHIP OF S).
-05398 06E

ITY
E SIZE DISTRIBUTIONS AS MEASURED BY THE MERCURY INTRUSION HOD AND THEIR USE IN PREDICTING PERMEABILITY,
-05439 02G

RAULIC CONDUCTIVITY RELATED TO POROSITY AND SWELLING OF L,
-05443 02G

S MEDIA
RODYNAMIC DISPERSION IN A SATURATED HOMOGENEOUS POROUS IUM AT LOW PECLET NUMBERS AND NONHOMOGENEOUS SOLUTION,
-05434 01B

E SIZE DISTRIBUTIONS AS MEASURED BY THE MERCURY INTRUSION HOD AND THEIR USE IN PREDICTING PERMEABILITY,
-05439 02G

ND(MAINE)
OR DEVELOPMENT PORT OF PORTLAND, MAINE.
-05298 06B

E WATER
ABLE WATER PURIFIERS FOR COSTA RICA,
05456 05D

CT OF FATTY ALCOHOL ON CHANGE IN SOIL WATER DURING THE ER FALLOW PERIOD,
05284 02G

SPECTRA
TYPICAL SPECTRAL SHAPE OF AN ECONOMIC VARIABLE,
05522 06D

ITATION.

PREPARATION OF CO-ORDINATED PRECIPITATION, RUNOFF AND EVAPORATION MAPS,
W69-05337 02A

PRECIPITATION EXCESS
CICONTE V SHOCKLEY (RUNOFF NUISANCE).
W69-05396 04A

PRESCRIPTIVE RIGHTS
DESTEFANO V MEGLIO (DAMAGES FOR OBSTRUCTION OF A DRAIN).
W69-05543 06E

TOWN OF VIENNA V STATE (PRESCRIPTIVE RIGHTS DOCTRINE AS APPLIED TO PUBLIC PROPERTY).
W69-05549 04A

TAYLOR V STATE (PRESCRIPTIVE RIGHT TO FLOOD LAND).
W69-05592 06E

PRICING
WATER ALLOCATION SUPPLY AND DEMAND RELATIONSHIPS,
W69-05483 06B

PROCEEDINGS WATER POLICY PRICING CONFERENCE,
W69-05492 06C

LEGAL CONSTRAINTS IN WATER PRICING POLICY,
W69-05493 06C

THE ACCOUNTANT'S VIEWPOINT ON WATER PRICING POLICY,
W69-05494 06C

THE CONSUMER'S VIEWPOINT AND POLICY DECISIONS,
W69-05495 06C

STATEMENT,
W69-05497 06C

ECONOMIC ANALYSIS OF PUBLIC WATER SUPPLY IN THE PISCATAQUA RIVER WATERSHED,
W69-05510 03E

PRIMARY PRODUCTIVITY
EFFECTS OF PHOSPHATE CONCENTRATION ON CELL DIVISION RATES AND YIELD OF A TROPICAL OCEANIC DIATOM,
W69-05530 05C

PROBABILITY
COMPUTER EXPERIMENTS WITH FRACTIONAL GAUSSIAN NOISES, PARTS 1, 2, AND 3,
W69-05453 07C

RECURRENCE INTERVALS BETWEEN EXCEEDANCES OF SELECTED RIVER LEVELS. 2. ALTERNATIVES TO A MARKOV MODEL,
W69-05454 02E

FREQUENCY CURVES FOR ANNUAL FLOOD SERIES WITH SOME ZERO EVENTS OR INCOMPLETE DATA,
W69-05455 07C

PRODUCTIVITY
BIOLOGICAL ASPECTS OF EUTROPHICATION IN LAKES MENDOTA, CRYSTAL, TROUT AND GREEN,
W69-05324 02H

PROJECT PLANNING
DELAWARE RIVER BASIN COMPACT.
W69-05343 04A

PROJECT PURPOSES
UNITED STATES V WILLIS (ARBITRARINESS IN LAND CONDEMNATION).
W69-05574 06E

PUBLIC BENEFITS
HARBOR DEVELOPMENT PORT OF PORTLAND, MAINE.
W69-05298 06B

PUBLIC HEALTH
WATER FOR LIVING,
W69-05219 05C

PUBLIC PURPOSES
TOWN OF VIENNA V STATE (PRESCRIPTIVE RIGHTS DOCTRINE AS APPLIED TO PUBLIC PROPERTY).
W69-05549 04A

PUBLIC RIGHTS
MUENCH V PUBLIC SERVICE COMMISSION (PUBLIC RIGHTS IN NAVIGABLE RIVER).
W69-05582 06E

PUBLIC UTILITIES
COHASSET WATER CO V TOWN OF COHASSET (CONVEYANCE OF WATER WORKS TO TOWN).
W69-05583 06E

PUBLIC WORKS
EARLY V SOUTH CAROLINA PUBLIC SERVICE AUTHORITY (CONSTRUCTION OF DAM AND DIVERSION OF RIVER).
W69-05578 04A

PUBLICATIONS
WRITING A WATER QUALITY REPORT,
W69-05212 10

PULP WASTES
COMPONENTS OF WOOD PULP BLEACH EFFLUENTS,
W69-05402 05A

PUMPING TESTS
WATER-MANOMETER-AIR-LINE ASSEMBLY FOR DETERMINING DEPTH TO

WATER IN WELLS,
W69-05249 07B

RABBITBUSH
SOIL PROBLEMS IN RESEEDING A GREASEWOOD-RABBITBRUSH RANGE SITE,
W69-05269 02G

RADIOACTIVE ACCUMULATION
ACCUMULATION OF PHOSPHORUS-32 AND ZINC-65 BY LIVING AND KILLED PLANKTON,
W69-05531 05C

RADIOACTIVE UPTAKE
ACCUMULATION OF PHOSPHORUS-32 AND ZINC-65 BY LIVING AND KILLED PLANKTON,
W69-05531 05C

RADIOECOLOGY
ACCUMULATION OF PHOSPHORUS-32 AND ZINC-65 BY LIVING AND KILLED PLANKTON,
W69-05531 05C

RAIN GAGES
WATER-STAGE AND RAINFALL DUAL RECORDER,
W69-05253 07B

AN ACCURATE SMALL ORIFICE RAIN GAGE,
W69-05404 07B

RAINFALL
EFFECTS OF MOISTURE AND FERTILIZER ON YIELDS OF SPRING WHEAT AND BARLEY,
W69-05263 02I

RAINFALL SIMULATORS
DESIGN CRITERIA FOR LABORATORY CATCHMENT EXPERIMENTS, WITH PARTICULAR REFERENCE TO RAINFALL SIMULATION,
W69-05234 02A

RAINFALL-RUNOFF RELATIONSHIPS
AN EXPERIMENTAL INVESTIGATION OF PARTIAL AREA CONTRIBUTIONS,
W69-05227 02A

STUDIES OF RUNOFF FORMATION UNDER CONDITION OF HIGH-ANGLE ATTITUDE OF THE IMPERVIOUS BED,
W69-05229 02E

MOUNTAIN RIVER FLOOD RUNOFF THEORY, MEANS OF ITS INVESTIGATION AND CALCULATION,
W69-05230 02A

NUMERICAL FORECASTING OF MOUNTAIN RIVER FLOOD RUNOFF ON THE BASIS OF ESTABLISHING TERRITORIALLY - GENERALIZED RELATIONSHIPS,
W69-05231 02A

THE ASSESSMENT OF SURFACE RUNOFF FROM RAINFALL DATA FOR AN ARID REGION OF WEST PAKISTAN,
W69-05232 02E

THE ASSESSMENT OF RUNOFF FROM A MOUNTAINOUS AND SEMI-ARID AREA IN WESTERN IRAN,
W69-05233 02E

DESIGN CRITERIA FOR LABORATORY CATCHMENT EXPERIMENTS, WITH PARTICULAR REFERENCE TO RAINFALL SIMULATION,
W69-05234 02A

RAINFALL-RUNOFF MODEL FOR SMALL BASIN FLOOD HYDROGRAPH SIMULATION,
W69-05420 02A

A PROPOSED MECHANICS FOR THE INVESTIGATION OF SURFACE RUNOFF FROM SMALL WATERSHEDS. 1, DEVELOPMENT,
W69-05425 02A

RUNOFF VOLUME PREDICTION FROM DAILY CLIMATIC DATA,
W69-05426 02A

USING ANALYTICAL METHODS TO DEVELOP A SURFACE-RUNOFF MODEL,
W69-05431 02A

RUNOFF HYDROGRAPH AS A FUNCTION OF RAINFALL EXCESS,
W69-05438 02A

RANGE MANAGEMENT
SOIL PROBLEMS IN RESEEDING A GREASEWOOD-RABBITBRUSH RANGE SITE,
W69-05269 02G

RATE LEVEL
LEGAL CONSTRAINTS IN WATER PRICING POLICY,
W69-05493 06C

RATE STRUCTURE
LEGAL CONSTRAINTS IN WATER PRICING POLICY,
W69-05493 06C

RATES OF APPLICATION
STUDIES ON WATER USE IN PEA (PISUM SATIVUM L.),
W69-05287 03F

RATING CURVES
CHARACTERISTICS OF LOGARITHMIC RATING CURVES,
W69-05259 07B

REAERATION
ARTIFICIAL MIXING OF DENSITY-STRATIFIED FLUIDS A LABORATORY INVESTIGATION,
W69-05412 02H

WATER QUALITY IN IMPOUNDMENTS AND MODIFICATIONS FROM DESTRATIFICATION,
W69-05467 02H

REAL PROPERTY
PROTECTION OF THE PALISADES.
W69-05352 06E

REASONABLE USE
BRAY V CITY OF WINTER GARDEN (SURFACE WATERS CAST ON LO PROPERTY).
W69-05563 04A

LEIPER V HEYWOOD-HALL CONSTR CO (CLAIM OF ARTIFICIALLY INCREASED DRAINAGE ON PART OF UPPER LANDOWNER).
W69-05568 06E

RECLAMATION
USAGE OF SUBMERGED LAND LEASE AND GRANT CONDITIONS AND PROCEDURE.
W69-05351 06E

REFRACTION(WATER WAVES)
WATER WAVES OVER A RECTANGULAR CHANNEL THROUGH A REEF,
W69-05448 02L

REGIONAL ANALYSIS
REGIONAL RESEARCH IN WATER IN THE NORTH CENTRAL REGION,
W69-05478 06B

DISCUSSION OF REGIONAL RESEARCH IN THE NORTH CENTRAL RE
W69-05479 06B

CONCEPTUAL ISSUES IN THE CONDUCT OF REGIONAL RESEARCH O ECONOMICS OF WATER,
W69-05480 06B

DISCUSSION OF CONCEPTUAL ISSUES IN THE CONDUCT OF REGIO RESEARCH ON THE ECONOMICS OF WATER,
W69-05481 06B

REGIONAL ECONOMIC DEVELOPMENT AND WATER,
W69-05488 06B

DISCUSSION OF REGIONAL ECONOMIC DEVELOPMENT AND WATER,
W69-05489 06B

REGIONAL GROWTH STAGES
REGIONAL ECONOMIC DEVELOPMENT AND WATER,
W69-05488 06B

REGRESSION ANALYSIS
LONG SWINGS,
W69-05498 06B

FACTOR ANALYSIS AND REGRESSION,
W69-05517 06B

REMEDIES
WATER RESOURCES LAWS IN VIRGINIA (REMEDIES FOR INFRINGE OF WATER RIGHTS).
W69-05538 06E

REPULSION(LEGAL ASPECTS)
CITY OF HARDIN V NORBORNE LAND DRAINAGE DISTRICT (STATU RIGHTS TO MAINTAIN EXISTING LEVEES).
W69-05384 04A

CICONTE V SHOCKLEY (RUNOFF NUISANCE).
W69-05396 04A

LUCAS V FORD (EASEMENT - SURFACE WATER DRAINAGE).
W69-05397 04A

COUNTY COMMISSIONERS OF BALTIMORE COUNTY V HUNTER (DRAI EASEMENT NUISANCE).
W69-05400 04A

RAU V WILDEN ACRES, INC (ACCUMULATION-RIDDANCE).
W69-05544 04A

DEYO V ATHOL HOUSING AUTHORITY (DAMAGE FROM WATER DISCHARGE).
W69-05556 04C

BROWN V BLANKENSHIP (SUBSERVIENT DRAINAGE).
W69-05598 06E

LEWALLEN V DAVENPORT (DAMAGE FROM BACKING SURFACE RUNOF
W69-05600 04A

REPULSION(LEGAL ASPECT)
NEWTON V LYONS (COMMON ENEMY EXCEPTION).
W69-05545 06E

RESEARCH AND DEVELOPMENT
WATER RESOURCES POLICY AND POLITICAL INSTITUTIONS.
W69-05295 06B

RESEARCH PROBLEMS
MAJOR RESEARCH PROBLEMS IN WATER QUALITY,
W69-05519 05G

RESERVOIR CONSTRUCTION
BLACK RIVER REGULATING DIST. V ADIRONDACK LEAGUE CLUB (CONDEMNATION PROCEEDINGS).
W69-05591 06E

RESERVOIR FISHERIES
RESERVOIR FISHERY RESOURCES

9-05463 02H

RVOIR FISHERY MANAGEMENT
SERVOIR FISHERY RESOURCES,
9-05463 02H

RVOIR OPERATION
SERVOIR MANAGEMENT PROBLEMS CREATED BY INCREASED
OSPHORUS LEVELS OF SURFACE WATERS,
9-05470 02H

ITED STATES V WILLIS (ARBITRARINESS IN LAND CONDEMNATION).
9-05574 06E

RVOIR STORAGE
OBLEMS OF THE METHODS AND ACCURACY OF HYDROLOGIC
SERVATIONS (RUSSIAN),
9-05210 07A

RVOIRS
IFICIAL MIXING OF DENSITY-STRATIFIED FLUIDS A
BORATORY INVESTIGATION,
9-05412 02H

ER QUALITY INVESTIGATION, PART 1 - BASIC DATA, FORT
DOUN RESERVOIR, APRIL 1966 - JUNE 1968,
9-05416 05A

MECHANICS OF STRATIFIED FLOW IN RESERVOIRS,
9-05464 02H

AMICS OF PHYSICOCHEMISTRY IN A LARGE RESERVOIR,
9-05466 02H

ER QUALITY IN IMPOUNDMENTS AND MODIFICATIONS FROM
TRATIFICATION,
9-05467 02H

LUATION OF PRE-IMPOUNDMENT CONDITIONS FOR PREDICTION OF
RED WATER QUALITY,
9-05468 02H

ECT OF IMPOUNDMENTS ON PRODUCTIVITY, WATER CHEMISTRY, AND
T BUDGETS OF RIVERS,
9-05469 02H

ERVOIR EUTROPHICATION AND DYSTROPHICATION FOLLOWING
OUNDMENT,
9-05471 02H

RCE ALLOCATION
ER RESOURCE DEVELOPMENT PUBLIC AND PRIVATE INVESTMENT,
9-05486 06B

RCE DEVELOPMENT
ER RESOURCE DEVELOPMENT PUBLIC AND PRIVATE INVESTMENT,
9-05486 06B

CUSSION OF WATER RESOURCE DEVELOPMENT PUBLIC AND
VATE INVESTMENT,
9-05487 06B

IONAL ECONOMIC DEVELOPMENT AND WATER,
9-05488 06B

NING WALLS
NSON V RAY (RIGHT TO CONSTRUCT RETAINING WALL)
9-05382 04A

V HUNGER (EROSION CONTROL AND LANDFILL BY RIPARIAN
ER).
9-05391 04A

ION
TURE-RETENTION CAPACITY OF LITTER UNDER TWO ARIZONA
ARRAL COMMUNITIES,
05267 02G

(MONETARY)
R RESOURCE DEVELOPMENT PUBLIC AND PRIVATE INVESTMENT,
05486 06B

ISLAND
UDY OF THE EFFECT OF TAXATION ON THE SIX PRIVATE OR
I-MUNICIPAL WATER UTILITIES IN RHODE ISLAND,
05316 06C

CE(LEGAL ASPECTS)
NTE V SHOCKLEY (RUNOFF NUISANCE).
05396 04A

S V FORD (EASEMENT - SURFACE WATER DRAINAGE).
05397 04A

V WILDEN ACRES, INC (ACCUMULATION-RIDDANCE).
05544 04A

ON V LYONS (COMMON ENEMY EXCEPTION).
05545 06E

RMAN V FUNKHOUSER (UPPER LANDOWNER'S RIGHT TO HAVE
ACE WATER DRAIN UPON LOWER LANDOWNER).
05570 06E

OF WAY
TY COMMISSIONERS OF BALTIMORE COUNTY V HUNTER (DRAINAGE
MENT NUISANCE).
05400 04A

CE V STATE (DAMAGES FOR APPROPRIATION OF RIPARIAN RIGHTS
HE STATE).

W69-05580 06E

RIGHTS-OF-WAY
SURVEY OPERATIONS AND CONTROLS BY THE BOARD OVER SUBMERGED
LANDS.
W69-05350 06E

RIPARIAN LAND
DICKSON V BOARD OF COMM'RS OF CADDO LEVEE (EXPROPRIATION OF
RIPARIAN LAND BY THE STATE).
W69-05585 06E

RIPARIAN LANDS
RIPARIAN LANDS.
W69-05346 06E

TRESPASS ON LANDS OF STATE UNDERWATER AND CONVEYANCES BY
COMMERCE AND NAVIGATION.
W69-05349 06E

MOORING AND FASTENING BOATS UPON RIPARIAN LANDS.
W69-05357 06E

STATE ACQUISITION OF RIPARIAN LANDS LEASE FOR COMMERCIAL
ENTERPRISES.
W69-05358 06E

STATE SQUIRE V CITY OF CLEVELAND (FILL LAND AND HIGHWAY USE
AS TO LITTORAL RIGHTS).
W69-05555 04C

RIPARIAN LESSOR
DELINQUENT RIPARIAN LEASES RE-ENTRY BY THE STATE.
W69-05356 06E

RIPARIAN RIGHTS
WATER LAW, POLITICS, AND ECONOMICS OUR COMPLEX WATER LAWS
AND WATER USE CUSTOMS,
W69-05296 06E

ESTABLISHMENT OF STATE CONTROL OVER SUBMERGED LANDS.
W69-05347 06E

TRESPASS ON LANDS OF STATE UNDERWATER AND CONVEYANCES BY
COMMERCE AND NAVIGATION.
W69-05349 06E

USAGE OF SUBMERGED LAND LEASE AND GRANT CONDITIONS AND
PROCEDURE.
W69-05351 06E

GRANTS OF SUBMERGED LANDS TO THE STATE, MUNICIPALITIES, AND
OTHER SUBDIVISIONS.
W69-05353 06E

CONFIRMATORY LEASES AND GRANTS OF SUBMERGED LAND.
W69-05354 06E

ERRONEOUS GRANTS OF SUBMERGED LAND.
W69-05355 06E

DELINQUENT RIPARIAN LEASES RE-ENTRY BY THE STATE.
W69-05356 06E

MOORING AND FASTENING BOATS UPON RIPARIAN LANDS.
W69-05357 06E

JOHNSON V RAY (RIGHT TO CONSTRUCT RETAINING WALL)
W69-05382 04A

WATERS OF WHITE LAKE INC V FRICKE (OWNERSHIP OF LAKE BEDS).
W69-05383 06E

BURT V HUNGER (EROSION CONTROL AND LANDFILL BY RIPARIAN
OWNER).
W69-05391 04A

ADKISSON V STARR (TITLE TO ACCRETION).
W69-05399 06E

WATER RESOURCES LAWS IN VIRGINIA (NATURAL SURFACE
WATERCOURSES).
W69-05534 06E

WATER RESOURCES LAW IN VIRGINIA (OTHER WATER SOURCES).
W69-05536 06E

STATE SQUIRE V CITY OF CLEVELAND (FILL LAND AND HIGHWAY USE
AS TO LITTORAL RIGHTS).
W69-05555 04C

MARINE AIR WAYS, INC V STATE (INTERFERENCE WITH NAVIGATION).
W69-05579 06E

RIVER BASIN COMMISSIONS
LARGE TREATMENT PLANTS OF THE EMSCHER ASSOCIATION AND THEIR
IMPORTANCE FOR IMPROVING CONDITIONS OF THE RHINE,
W69-05218 05D

EL PASO WATER IMPROV DIST NO 1 V CITY OF EL PASO (RIGHT OF
REMOVAL UNDER WATER SUPPLY CONTRACT).
W69-05558 06E

RIVER BASIN DEVELOPMENT
COMPREHENSIVE BASIN STUDY ON WHITE RIVER BASIN, ARKANSAS AND
MISSOURI.
W69-05201 06B

A STATE VIEWPOINT ON RIVER BASIN PLANNING,
W69-05209 06B

DELAWARE RIVER BASIN COMPACT.
W69-05342 04A

W69-05343 04A

W69-05344 04A

RIVER CONTROL
THE TENNESSEE VALLEY AUTHORITY ECONOMIC IMPACT OF ITS COMPREHENSIVE WATER DEVELOPMENT PROGRAM,
W69-05502 06B

RIVERFLOW
BLACK RIVER REGULATING DIST. V ADIRONDACK LEAGUE CLUB (CONDEMNATION PROCEEDINGS).
W69-05591 06E

RIVERS
LARGE TREATMENT PLANTS OF THE EMSCHER ASSOCIATION AND THEIR IMPORTANCE FOR IMPROVING CONDITIONS OF THE RHINE,
W69-05218 05D

CORRECTING RIVER VELOCITIES MEASURED FROM AN UNANCHORED SHIP,
W69-05255 07B

RIVERS AND HARBORS ACT
THE ORIGIN AND DEVELOPMENT OF THE WATERWAYS POLICY OF THE UNITED STATES,
W69-05338 04A

ROAD DESIGN
OSTLUND V STEARNS COUNTY (ARTIFICIAL ACCUMULATION OF SURFACE WATERS).
W69-05577 06E

ROSWELL PLANT
A PILOT PLANT STUDY FOR REMOVAL OF SOLUBLE SILICA FROM ROSWELL, NEW MEXICO WATER. PHASE 1. INITIAL CONSTRUCTION AND OPERATION,
W69-05335 03A

ROSWELL WATER
BASIC STUDIES OF SCALE CONTROL,
W69-05334 03A

W69-05334 03A

ROTATIONS
TILLAGE METHODS TO REDUCE RUNOFF AND EROSION IN THE CORN BELT,
W69-05330 03F

ROUTING
AN EXPERIMENTAL INVESTIGATION OF PARTIAL AREA CONTRIBUTIONS,
W69-05227 02A

NUMERICAL FORECASTING OF MOUNTAIN RIVER FLOOD RUNOFF ON THE BASIS OF ESTABLISHING TERRITORIALLY - GENERALIZED RELATIONSHIPS,
W69-05231 02A

THE ASSESSMENT OF SURFACE RUNOFF FROM RAINFALL DATA FOR AN ARID REGION OF WEST PAKISTAN,
W69-05232 02E

THE ASSESSMENT OF RUNOFF FROM A MOUNTAINOUS AND SEMI-ARID AREA IN WESTERN IRAN,
W69-05233 02E

ROW SPACING
VARIABLE ROW SPACING OF IRRIGATED COTTON AS A MEANS FOR REDUCING PRODUCTION COSTS AND CONSERVING WATER,
W69-05277 03F

RUNOFF
AN EXPERIMENTAL INVESTIGATION OF PARTIAL AREA CONTRIBUTIONS,
W69-05227 02A

RUNOFF WATER-SPREADING ON LEVELED CROPLAND,
W69-05275 04A

FLAT CHANNEL TERRACES,
W69-05282 02J

PREPARATION OF CO-ORDINATED PRECIPITATION, RUNOFF AND EVAPORATION MAPS,
W69-05337 02A

RELATION OF SOIL PROPERTIES TO ITS ERODIBILITY,
W69-05444 02J

DESTEFANO V MEGLIO (DAMAGES FOR OBSTRUCTION OF A DRAIN).
W69-05543 06E

NEWTON V LYONS (COMMON ENEMY EXCEPTION).
W69-05545 06E

RUNOFF FORECASTING
RUNOFF VOLUME PREDICTION FROM DAILY CLIMATIC DATA,
W69-05426 02A

USING ANALYTICAL METHODS TO DEVELOP A SURFACE-RUNOFF MODEL,
W69-05431 02A

RUNOFF HYDROGRAPH AS A FUNCTION OF RAINFALL EXCESS,
W69-05438 02A

RURAL AREAS
PROCEEDINGS OF SYMPOSIUM ON BETTER WATER AND SEWER SERVICES FOR SMALL COMMUNITIES IN NORTH CAROLINA,
W69-05424 06B

SALINE WATER INTRUSION
WATER SUPPLY IN THE BRACKISH-WATER REGIONS OF SOUTH VIE
W69-05457 02L

SALT WATER ENCROACHMENT IN KARST AQUIFERS, ISLAND OF KEPHALLINIA, (IONIAN),
W69-05472 02L

SALT-WATER ENCROACHMENT OF TERTIARY LIMESTONE ALONG COA SOUTH CAROLINA,
W69-05473 02L

SALINE WATER-FRESH WATER INTERFACE
SALT-WATER ENCROACHMENT OF TERTIARY LIMESTONE ALONG COA SOUTH CAROLINA,
W69-05473 02L

SALINE WATER-FRESH WATER INTERFACES
SALT WATER ENCROACHMENT IN KARST AQUIFERS, ISLAND OF KEPHALLINIA, (IONIAN),
W69-05472 02L

SALINITY
ASSESSING IMPACTS OF DECLINING WATER QUALITY ON GROSS VA OUTPUT OF AGRICULTURE, A CASE STUDY,
W69-05273 03C

SALT RIVER VALLEY
WATER MANAGEMENT OF FALL-PLANTED SUGAR BEETS IN SALT RIV VALLEY OF ARIZONA,
W69-05279 03F

SAMPLING
COMPARISON OF RESULTS USING THREE SAMPLING TECHNIQUES FO FLUOMETRIC DYE STUDY IN A STREAM,
W69-05239 07B

RAPID FIELD FILTRATION OF WATER SAMPLES,
W69-05244 07B

SAMPLING APPARATUS TO MINIMIZE AERATION OF WATER FOR THE DETERMINATION OF DISSOLVED GASES,
W69-05246 07B

VARIABLE-SPEED POWER EQUIPMENT FOR DEPTH-INTEGRATION SEDIMENT SAMPLING,
W69-05257 07B

ELECTRIC CONTROL SYSTEM FOR DUAL OPERATION OF CURRENT ME AND SUSPENDED-SEDIMENT SAMPLER,
W69-05258 07B

SATURATED FLOW
THE MECHANISM OF NATURAL GROUND-WATER RECHARGE AND DISCH 1. ONE-DIMENSIONAL, VERTICAL, UNSTEADY, UNSATURATED FLOW ABOVE A RECHARGING OR DISCHARGING GROUND-WATER FLOW SYST
W69-05436 02F

SCALE VERSUS PROCESS VARIABLES
BASIC STUDIES OF SCALE CONTROL,
W69-05334 03A

SCALING
BASIC STUDIES OF SCALE CONTROL,
W69-05334 03A

A PILOT PLANT STUDY FOR REMOVAL OF SOLUBLE SILICA FROM ROSWELL, NEW MEXICO WATER. PHASE 1. INITIAL CONSTRUCTIO AND OPERATION,
W69-05335 03A

SEASONAL
SEASONAL AND DIURNAL VARIATION IN POCOSIN SHRUB MOISTURE CONTENT,
W69-05331 02I

SEDIMENT PROFILES
PREDICTION OF SEDIMENT PROFILES IN OPEN CHANNEL FLOW BY TURBULENT DIFFUSION THEORY,
W69-05403 02J

SEDIMENT TRANSPORT
PREDICTION OF SEDIMENT PROFILES IN OPEN CHANNEL FLOW BY TURBULENT DIFFUSION THEORY,
W69-05403 02J

SEDIMENTATION
POIRE V SERRA (PROPRIETY OF LAND FILL BY RIPARIAN OWNER).
W69-05381 04A

SEDIMENTS
VARIABLE-SPEED POWER EQUIPMENT FOR DEPTH-INTEGRATION SEDIMENT SAMPLING,
W69-05257 07B

REYNOLDS METAL CO V BALL (SUIT TO RECOVER DAMAGES FOR ALLEGED DEPOSIT OF SEDIMENT CONTAINING POISONOUS SUBSTANCES).
W69-05385 05C

TENNESSEE VALLEY SAND AND GRAVEL CO V PILLING (LIABILITY SEDIMENT DUMPING WHICH MAKES CREEK BED SHALLOWER, WHICH CAUSES MORE FLOODING).
W69-05386 05G

SEEPAGE
PETERSON V WISCONSIN RIVER POWER CO (PROPERTY ENCROACHMEN BY IMPOUNDED WATERS).
W69-05552 04A

ISMIC STUDIES
EVALUATION OF SOME GEOPHYSICAL TECHNIQUES APPLIED TO THE ENVIRONMENT OF A MAUI WELL,
W69-05418 02F

RIAL CORRELATION
EFFECT OF THE LENGTH OF THE TIME PERIOD ON SERIAL CORRELATION,
W69-05506 06D

USE OF THE DURBIN-WATSON STATISTIC IN INAPPROPRIATE SITUATIONS,
W69-05516 06D

STON
A CONTINUOUS SIZE SPECTRUM FOR PARTICULATE MATTER IN THE SEA,
W69-05529 07C

AGE
PROCEEDINGS OF SYMPOSIUM ON BETTER WATER AND SEWER SERVICES FOR SMALL COMMUNITIES IN NORTH CAROLINA,
69-05424 06B

AGE EFFLUENTS
ASONITE CORPORATION V GUY (FISHKILL EFFECTS OF WATER OLLUTION).
69-05553 05C

EPAGE
ATER SUPPLY PROBLEMS IN DEVELOPING COUNTRIES,
69-05513 03D

PS
ORRECTING RIVER VELOCITIES MEASURED FROM AN UNANCHORED HIP,
69-05255 07B

RE PROTECTION
EACH FRONTS AND WATERWAYS.
69-05363 04A

NIFICANCE POINTS
ESTING FOR SERIAL CORRELATION AFTER LEAST SQUARES EGRESSION,
59-05289 06B

ICA
PILOT PLANT STUDY FOR REMOVAL OF SOLUBLE SILICA FROM OSWELL, NEW MEXICO WATER. PHASE 1. INITIAL CONSTRUCTION ND OPERATION,
59-05335 03A

ES
LECTION OF DYE-INJECTION AND MEASURING SITES FOR TIME-OF-AVEL STUDIES,
9-05238 07B

H PINE TREES
IL OR FOLIAR FERTILIZATION OF WELL-DRAINED AND FLOODED ASH PINE,
9-05332 02G

E STABILIZATION
LLAGE METHODS TO REDUCE RUNOFF AND EROSION IN THE CORN LT,
9-05330 03F

ES
OUNTAIN RIVER FLOOD RUNOFF THEORY, MEANS OF ITS VESTIGATION AND CALCULATION,
9-05230 02A

MERICAL FORECASTING OF MOUNTAIN RIVER FLOOD RUNOFF ON THE SIS OF ESTABLISHING TERRITORIALLY - GENERALIZED LATIONSHIPS,
9-05231 02A

L WATERSHEDS
PROPOSED MECHANICS FOR THE INVESTIGATION OF SURFACE RUNOFF OM SMALL WATERSHEDS. 1, DEVELOPMENT,
9-05425 02A

EDICTING TEMPERATURES OF SMALL STREAMS,
9-05427 02E

COVER
OW ACCUMULATION AS RELATED TO METEOROLOGICAL, TOPOGRAPHIC, D FOREST VARIABLES IN CENTRAL SIERRA NEVADA, CALIFORNIA,
9-05226 02C

'ALL
OW ACCUMULATION AS RELATED TO METEOROLOGICAL, TOPOGRAPHIC, D FOREST VARIABLES IN CENTRAL SIERRA NEVADA, CALIFORNIA,
9-05226 02C

AL ADJUSTMENT
ERGRATING HUMAN-SOCIAL RESOURCES INTO THE WATER RESOURCE VELOPMENT PROJECT,
-05217 06B

L ASPECTS
ERGRATING HUMAN-SOCIAL RESOURCES INTO THE WATER RESOURCE ELOPMENT PROJECT,
-05217 06B

L VALUE
FARE ECONOMICS, ECONOMIC GROWTH AND THE CHOICE OF HNIQUES,
-05500 06B

SOIL
DETERMINATION OF ORGANOCHLORINE INSECTICIDES IN SOILS AND WATERS,
W69-05325 05A

SOIL BACTERIA
PESTICIDE LEVELS AND FLUCTUATION IN SOIL BACTERIA IN AN IRRIGATED FIELD AND A POND OF SOUTHWEST TEXAS,
W69-05272 05C

SOIL CONSERVATION DISTRICT
LEGAL ASPECTS OF THE SMALL WATERSHED PROGRAM IN IOWA,
W69-05339 04D

SOIL EROSION
TILLAGE METHODS TO REDUCE RUNOFF AND EROSION IN THE CORN BELT,
W69-05330 03F

RELATION OF SOIL PROPERTIES TO ITS ERODIBILITY,
W69-05444 02J

COATES V UNITED STATES (TAKING OF PROPERTY FOR PUBLIC PURPOSE WITHOUT JUST COMPENSATION).
W69-05554 04A

SOIL MANAGEMENT
TILLAGE METHODS TO REDUCE RUNOFF AND EROSION IN THE CORN BELT,
W69-05330 03F

SOIL MOISTURE
SOIL MOISTURE CONDITIONS UNDER PASTURES OF COOL-SEASON AND WARM-SEASON GRASSES,
W69-05266 02G

MOISTURE-RETENTION CAPACITY OF LITTER UNDER TWO ARIZONA CHAPARRAL COMMUNITIES,
W69-05267 02G

A METHOD OF DETERMINING EVAPOTRANSPIRATION IN SOIL MONOLITHS,
W69-05270 02D

THE INTERCEPTION-TRANSPIRATION RELATIONSHIP OF WHITE SPRUCE AND WHITE PINE,
W69-05274 02D

EFFECT OF EARLY-SUMMER SEEDING OF WINTER WHEAT ON YIELD, SOIL MOISTURE, AND SOIL NITRATE,
W69-05280 03F

STUDIES OF METHODS OF SOIL WATER DETERMINATION,
W69-05305 02G

RUNOFF VOLUME PREDICTION FROM DAILY CLIMATIC DATA,
W69-05426 02A

SOIL PHYSICAL PROPERTIES
RELATION OF SOIL PROPERTIES TO ITS ERODIBILITY,
W69-05444 02J

SOIL PROFILES
A METHOD OF DETERMINING EVAPOTRANSPIRATION IN SOIL MONOLITHS,
W69-05270 02D

SOIL STABILIZATION
ENGINEERING TECHNIQUES AND PRINCIPLES APPLIED TO SOIL EROSION CONTROL,
W69-05333 04D

SOIL SURFACES
SOIL PROBLEMS IN RESEEDING A GREASEWOOD-RABBITBRUSH RANGE SITE,
W69-05269 02G

SOIL WASTE TREATMENT
PUTTING WASTE WATER TO BENEFICIAL USE - THE FLUSHING MEADOWS PROJECT,
W69-05327 05D

RETURNING WASTES TO THE LAND, A NEW ROLE FOR AGRICULTURE,
W69-05328 05D

SOIL WATER
EFFECT OF MOISTURE REGIMES AND HARVESTS ON EFFICIENCY OF WATER USE BY TEN FORAGE CROPS,
W69-05268 02I

EFFECT OF FATTY ALCOHOL ON CHANGE IN SOIL WATER DURING THE SUMMER FALLOW PERIOD,
W69-05284 02G

STUDIES ON METHODS OF SOIL WATER DETERMINATION,
W69-05304 02G

STUDIES OF METHODS OF SOIL WATER DETERMINATION,
W69-05305 02G

SOIL OR FOLIAR FERTILIZATION OF WELL-DRAINED AND FLOODED SLASH PINE,
W69-05332 02G

HYDROLOGY OF A SLIDE-PRONE GLACIAL TILL SOIL IN SOUTHEAST ALASKA,
W69-05406 02G

SOIL WATER MOVEMENT
HYDROLOGY OF A SLIDE-PRONE GLACIAL TILL SOIL IN SOUTHEAST

ALASKA,
W69-05406 02G

ANALYZING STEADY-STATE FLOW IN AN INCLINED SOIL SLAB WITH AN ELECTRIC ANALOG,
W69-05440 02G

MOVEMENT OF WATER AND SALT THROUGH A CLAY-WATER SYSTEM EXPERIMENTAL VERIFICATION OF ONSAGER RECIPROCAL RELATION,
W69-05441 02G

THE EFFECT OF OSMOTIC PRESSURE GRADIENTS ON WATER MOVEMENT IN UNSATURATED SOIL,
W69-05442 02G

HYDRAULIC CONDUCTIVITY RELATED TO POROSITY AND SWELLING OF SOIL,
W69-05443 02G

SOUTH CAROLINA
SALT-WATER ENCROACHMENT OF TERTIARY LIMESTONE ALONG COASTAL SOUTH CAROLINA,
W69-05473 02L

EARLY V SOUTH CAROLINA PUBLIC SERVICE AUTHORITY (CONSTRUCTION OF DAM AND DIVERSION OF RIVER).
W69-05578 04A

SPAIN
DETERMINATION OF FRESH WATERS IN THE CALCAREOUS MASSIF OF 'COSTA BRAVA', SPAIN (FRENCH),
W69-05474 02F

SPECTRAL ANALYSIS
LONG SWINGS,
W69-05498 06B

THE TYPICAL SPECTRAL SHAPE OF AN ECONOMIC VARIABLE,
W69-05522 06D

SPECTRAL DENSITY FUNCTION
TESTING FOR SERIAL CORRELATION AFTER LEAST SQUARES REGRESSION,
W69-05289 06B

SPECTRAL SHAPE
THE TYPICAL SPECTRAL SHAPE OF AN ECONOMIC VARIABLE,
W69-05522 06D

SPRINKLER IRRIGATION
PREDICTING FIELD DISTRIBUTIONS OF SPRINKLER SYSTEMS,
W69-05285 03F

SQUARE FOOTAGE ASSESSMENT
MEYER V CITY OF OAKLAND (VALIDITY OF SPECIAL ASSESSMENTS TO LAND FOR SEWER IMPROVEMENTS).
W69-05542 06E

STAGE-DISCHARGE RELATIONS
PATTERNS OF BACKWATER AND DISCHARGE ON SMALL ICE-AFFECTED STREAMS,
W69-05256 07B

CHARACTERISTICS OF LOGARITHMIC RATING CURVES,
W69-05259 07B

FLOODS IN VIRGINIA - MAGNITUDE AND FREQUENCY,
W69-05415 02E

STAGNANT WATER
UNWHOLESOME PREMISES REMOVAL AND REHABILITATION AT OWNER'S EXPENSE.
W69-05376 05B

STATE GOVERNMENTS
ROLE OF STATE GOVERNMENTS IN U. S. WATER MANAGEMENT,
W69-05293 06E

TAKING OF WATERCRAFT, AIRCRAFT OR DRAFT ANIMALS INJURING OR CUTTING LOOSE BOOMS, RAFTS, VESSELS OR BOATS CIVIL ACTION FOR DAMAGES.
W69-05372 06E

TRESPASS - IMPROVED LANDS AND FISH PONDS.
W69-05566 06E

STATISTICAL METHODS
STATISTICAL ANALYSIS OF GROUND WATER USE AND REPLENISHMENT,
W69-05475 02F

STATISTICAL MODELS
RECURRENCE INTERVALS BETWEEN EXCEEDANCES OF SELECTED RIVER LEVELS. 2. ALTERNATIVES TO A MARKOV MODEL,
W69-05454 02E

FREQUENCY CURVES FOR ANNUAL FLOOD SERIES WITH SOME ZERO EVENTS OR INCOMPLETE DATA,
W69-05455 07C

STATISTICAL ANALYSIS OF GROUND WATER USE AND REPLENISHMENT,
W69-05475 02F

STEADY FLOW
ANALYZING STEADY-STATE FLOW IN AN INCLINED SOIL SLAB WITH AN ELECTRIC ANALOG,
W69-05440 02G

STEMFLOW
SEASONAL AND DIURNAL VARIATION IN POCOSIN SHRUB MOISTURE CONTENT,
W69-05311 02I

STOCHASTIC PROCESSES
A PROPOSED MECHANICS FOR THE INVESTIGATION OF SURFACE RU FROM SMALL WATERSHEDS. 1, DEVELOPMENT,
W69-05425 02A

STOMATA
STOMATAL OPENING IN ISOLATED EPIDERMAL STRIPS OF VICIA F I. RESPONSE TO LIGHT AND TO CO2-FREE AIR,
W69-05278 02I

STRAIN
MEASUREMENT OF SMALL SURFACE DISPLACEMENTS INDUCED BY FL FLOW,
W69-05433 02F

STRATIFICATION
THE MECHANICS OF STRATIFIED FLOW IN RESERVOIRS,
W69-05464 02H

DYNAMICS OF PHYSICOCHEMISTRY IN A LARGE RESERVOIR,
W69-05466 02H

WATER QUALITY IN IMPOUNDMENTS AND MODIFICATIONS FROM DESTRATIFICATION,
W69-05467 02H

STREAM GAGES
USE OF CARBON DIOXIDE IN BUBBLE GAGES TO PREVENT PRECIPITATION OF CALCIUM CARBONATE,
W69-05247 07B

POLYETHYLENE OIL TUBES FOR STILLING WELLS,
W69-05248 07B

WATER-STAGE AND RAINFALL DUAL RECORDER,
W69-05253 07B

PATTERNS OF BACKWATER AND DISCHARGE ON SMALL ICE-AFFECTE STREAMS,
W69-05256 07B

STREAM POLLUTION
MASONITE CORPORATION V GUY (FISHKILL EFFECTS OF WATER POLLUTION).
W69-05553 05C

STREAMFLOW
CORRECTING RIVER VELOCITIES MEASURED FROM AN UNANCHORED SHIP,
W69-05255 07B

COMPUTERIZED SYSTEM FOR WYOMING SURFACE WATER RECORDS,
W69-05326 02E

JOHNSON V RAY (RIGHT TO CONSTRUCT RETAINING WALL)
W69-05382 04A

FLOODS IN VIRGINIA - MAGNITUDE AND FREQUENCY,
W69-05415 02E

PREDICTING TEMPERATURES OF SMALL STREAMS,
W69-05427 02E

STREAMFLOW FORECASTING
THE ASSESSMENT OF SURFACE RUNOFF FROM RAINFALL DATA FOR A ARID REGION OF WEST PAKISTAN,
W69-05232 02E

THE WEATHER BUREAU AND WATER MANAGEMENT.
W69-05336 07C

RUNOFF HYDROGRAPH AS A FUNCTION OF RAINFALL EXCESS,
W69-05438 02A

STREAMS
NUISANCES-MILLS AND DAMS FENCES AND BUILDINGS ON PUBLIC WAYS.
W69-05369 04A

STRUCTURES
BUDA V STATE (ARTIFICIAL CONTROL OF SURFACE WATERS).
W69-05550 04A

SUBMERGED LANDS ACT
UNITED STATES V STATE OF LOUISIANA (STATE OWNERSHIP OF SUBMERGED, CONTIGUOUS LANDS).
W69-05540 06E

SUBSURFACE DRAINAGE
JOHNSON V CITY OF WINSTON-SALEM (ACTION FOR DAMAGES CAUSE BY AN OBSTRUCTED DRAIN PIPE).
W69-05394 04A

SUGAR BEETS
WATER MANAGEMENT OF FALL-PLANTED SUGAR BEETS IN SALT RIVE VALLEY OF ARIZONA,
W69-05279 03F

SUMMER
EFFECT OF FATTY ALCOHOL ON CHANGE IN SOIL WATER DURING TH SUMMER FALLOW PERIOD,
W69-05284 02G

SUPPLY CONTRACTS
PEOPLE V VILLAGE OF BERKELEY (STATUTORY DUTIES UNDER WATE SUPPLY CONTRACTS).
W69-05584 06E

SURFACE DRAINAGE
DODD V BLEZEK (DETERMINATION OF DOMINANT ESTATE AND DRAIN

IGHTS IN NATURAL STREAM).
69-05393 04A

STLUND V STEARNS COUNTY (ARTIFICIAL ACCUMULATION OF SURFACE ATERS).
69-05577 06E

IXON V WELCH (SURFACE DRAINAGE EASEMENTS).
69-05593 04A

ONES V LUCAS (SURFACE DRAINAGE).
69-05594 04A

ALBOT V KERN (SERVITUDES OF DRAINAGE).
69-05597 06E

WALLEN V DAVENPORT (DAMAGE FROM BACKING SURFACE RUNOFF).
69-05600 04A

ACE RUNOFF
ALITY OF WATERS FROM PLAYAS ON THE SOUTHERN HIGH PLAINS,
9-05276 03C

LLAGE METHODS TO REDUCE RUNOFF AND EROSION IN THE CORN LT,
9-05330 03F

TY OF HARDIN V NORBORNE LAND DRAINAGE DISTRICT (STATUTORY GHTS TO MAINTAIN EXISTING LEVEES).
9-05384 04A

DERSON V KELEHAN (UPLAND DRAINAGE OF SURFACE WATERS).
9-05390 04A

TER RESOURCES LAW IN VIRGINIA.
9-05533 06E

INN V MYERS (SUIT TO REMOVE OBSTRUCTION TO NATURAL TERCOURSE).
9-05557 04A

BERMAN V PUNKHOUSER (UPPER LANDOWNER'S RIGHT TO HAVE RFACE WATER DRAIN UPON LOWER LANDOWNER).
9-05570 06E

TLUND V STEARNS COUNTY (ARTIFICIAL ACCUMULATION OF SURFACE TERS).
9-05577 06E

ACE WATER
ATES V UNITED STATES (TAKING OF PROPERTY FOR PUBLIC RPOSE WITHOUT JUST COMPENSATION).
9-05554 04A

RRIS V WINTERS (ACTION TO REMOVE AN OBSTRUCTION TO WATER OW).
9-05567 04A

ACE WATERS
MPUTERIZED SYSTEM FOR WYOMING SURFACE WATER RECORDS,
9-05326 02E

NER V SMITH (RESERVOIR OBSTRUCTING LAND DRAINAGE).
9-05392 04A

TER-RESOURCES APPRAISAL OF THE SNAKE RIVER BASIN IN VADA,
9-05414 02E

TER RESOURCES OF THE BURNETT REGION,
9-05423 02E

OSPHORUS IN FLOWING WATERS,
9-05445 05B

TER RESOURCES LAWS IN VIRGINIA (PERCOLATING GROUNDWATER - FFUSED SURFACE WATER).
9-05535 06E

O V YOUNG (ARTIFICIAL DRAINAGE OF SURFACE WATERS AND TURAL FLOW).
9-05551 04A

NDED LOAD
DICTION OF SEDIMENT PROFILES IN OPEN CHANNEL FLOW BY BULENT DIFFUSION THEORY,
9-05403 02J

ES
D V BLEZEK (DETERMINATION OF DOMINANT ESTATE AND DRAINAGE HTS IN NATURAL STREAM).
-05393 04A

TIC ANALYSIS
PARATIVE STUDY OF SNOW TYPE HYDROLOGY OF NORTHEASTERN ADA AND OF PLAINS OF RUSSIA AND SIBERIA,
-05225 02E

ETIC CARBONATE FREE SEAWATER
IC STUDIES OF SCALE CONTROL,
-05334 03A

-05334 03A

ETIC HYDROGRAPHS
THETIC HYDROGRAPHS EFFECTS OF NETWORK GEOMETRY,
-05432 02A

ETIC HYDROLOGY
THETIC HYDROGRAPHS EFFECTS OF NETWORK GEOMETRY,
-05432 02A

TAXATION
THE ORIGIN AND DEVELOPMENT OF THE WATERWAYS POLICY OF THE UNITED STATES,
W69-05338 04A

TAXES
A STUDY OF THE EFFECT OF TAXATION ON THE SIX PRIVATE OR QUASI-MUNICIPAL WATER UTILITIES IN RHODE ISLAND,
W69-05316 06C

HARBORS, WHARVES, AND HARBOR MASTERS.
W69-05377 04A

TECHNICAL WRITING
WRITING A WATER QUALITY REPORT,
W69-05212 10

TENNESSEE
WATER QUALITY INVESTIGATION, PART 1 - BASIC DATA, FORT LOUDOUN RESERVOIR, APRIL 1966 - JUNE 1968,
W69-05416 05A

TENNESSEE RIVER
WATER QUALITY INVESTIGATION, PART 1 - BASIC DATA, FORT LOUDOUN RESERVOIR, APRIL 1966 - JUNE 1968,
W69-05416 05A

TENNESSEE VALLEY AUTHORITY
THE TENNESSEE VALLEY AUTHORITY ECONOMIC IMPACT OF ITS COMPREHENSIVE WATER DEVELOPMENT PROGRAM,
W69-05502 06B

TERRACING
FLAT CHANNEL TERRACES,
W69-05282 02J

TEST PROCEDURES
FIELD MONITORING OF THE QUALITY OF WATER DURING THE DRILLING OF WELLS,
W69-05245 07B

TEXAS
QUALITY OF WATERS FROM PLAYAS ON THE SOUTHERN HIGH PLAINS,
W69-05276 03C

UNITED STATES V STATE OF LOUISIANA (STATE OWNERSHIP OF SUBMERGED, CONTIGUOUS LANDS).
W69-05540 06E

THERMAL STRATIFICATION
ARTIFICIAL MIXING OF DENSITY-STRATIFIED FLUIDS A LABORATORY INVESTIGATION,
W69-05412 02H

THERMOCOUPLE
ISOPIESTIC TECHNIQUE FOR MEASURING LEAF WATER POTENTIALS WITH A THERMOCOUPLE PSYCHROMETER,
W69-05286 02I

TIDAL WATERS
CONVEYANCES OF LANDS BY LEGISLATIVE AUTHORITY.
W69-05348 06E

TRESPASS ON LANDS OF STATE UNDERWATER AND CONVEYANCES BY COMMERCE AND NAVIGATION.
W69-05349 06E

TRUSTEES OF FREEHOLDERS AND COMMONALTY V MORRISEY (TITLE TO BEDS UNDER TIDAL WATERS).
W69-05388 06E

WATER RESOURCES LAW IN VIRGINIA.
W69-05533 06E

WATER RESOURCES LAW IN VIRGINIA (OTHER WATER SOURCES).
W69-05536 06E

TIDES
ON THE REPRESENTATION OF THE REYNOLDS STRESS IN A TIDAL ESTUARY,
W69-05213 02L

TIME PERIOD
EFFECT OF THE LENGTH OF THE TIME PERIOD ON SERIAL CORRELATION,
W69-05506 06D

TOPOGRAPHY
GRANITES, GRUSSES, AND THE SHERMAN EROSION SURFACE, SOUTHERN LARAMIE RANGE, COLORADO-WYOMING,
W69-05211 02J

SNOW ACCUMULATION AS RELATED TO METEOROLOGICAL, TOPOGRAPHIC, AND FOREST VARIABLES IN CENTRAL SIERRA NEVADA, CALIFORNIA,
W69-05226 02C

FLUID FLOW IN THE WESTERN CANADA SEDIMENTARY BASIN - 1. EFFECT OF TOPOGRAPHY,
W69-05451 02F

TOXICITY
DEMONSTRATION OF A TOXIN FROM APHANIZOMENON FLOS-AQUAE (L.) RALFS,
W69-05306 05C

REYNOLDS METAL CO V BALL (SUIT TO RECOVER DAMAGES FOR ALLEGED DEPOSIT OF SEDIMENT CONTAINING POISONOUS SUBSTANCES).
W69-05385 05C

TRACERS
TIME-OF-TRAVEL MEASUREMENTS AND OTHER APPLICATIONS OF DYE TRACING,
W69-05228 07B

IMPROVED DYES FOR WATER TRACING,
W69-05235 07B

NOMOGRAPHS FOR DETERMINING AMOUNT OF RHODAMINE B DYE FOR TIME-OF-TRAVEL STUDIES,
W69-05236 07B

CONSTANT-RATE-INJECTION EQUIPMENT FOR DYE-DILUTION DISCHARGE MEASUREMENTS,
W69-05237 07B

SELECTION OF DYE-INJECTION AND MEASURING SITES FOR TIME-OF-TRAVEL STUDIES,
W69-05238 07B

COMPARISON OF RESULTS USING THREE SAMPLING TECHNIQUES FOR A FLUOMETRIC DYE STUDY IN A STREAM,
W69-05239 07B

DYE-CLOUD PHOTOGRAPHY,
W69-05241 07B

TRACKING TECHNIQUES
TIME-OF-TRAVEL MEASUREMENTS AND OTHER APPLICATIONS OF DYE TRACING,
W69-05228 07B

TRANSMISSIVITY
A METHOD OF DETERMINING EVAPOTRANSPIRATION IN SOIL MONOLITHS,
W69-05270 02D

TRANSPIRATION
THE INTERCEPTION-TRANSPIRATION RELATIONSHIP OF WHITE SPRUCE AND WHITE PINE,
W69-05274 02D

TREND REMOVED DEVIATION FROM TREND
LONG SWINGS,
W69-05498 06B

TREND-SURFACE ANALYSIS
STATISTICAL ANALYSIS OF GROUND WATER USE AND REPLENISHMENT,
W69-05475 02F

TROPICAL OCEANS
EFFECTS OF PHOSPHATE CONCENTRATION ON CELL DIVISION RATES AND YIELD OF A TROPICAL OCEANIC DIATOM,
W69-05530 05C

TURBULENCE
ON THE REPRESENTATION OF THE REYNOLDS STRESS IN A TIDAL ESTUARY,
W69-05213 02L

UNACCOUNTED-FOR WATER
WATER SUPPLY PROBLEMS IN DEVELOPING COUNTRIES,
W69-05513 03D

UNDERDEVELOPED COUNTRIES
CAPITAL FORMATION AND GOVERNMENT CAPITAL POLICY IN DEVELOPING ECONOMIES,
W69-05518 06C

UNDERFLOW
UNITED STATES V KANSAS CITY LIFE INSURANCE CO (FLOODING, UNDERFLOWING).
W69-05572 04A

UNDERGROUND STREAMS
WATER RESOURCES LAWS IN VIRGINIA (PERCOLATING GROUNDWATER - DIFFUSED SURFACE WATER).
W69-05535 06E

UNITED STATES
NUCLEAR POWER AND WATER DESALTING PLANTS FOR SOUTHWEST UNITED STATES AND NORTHWEST MEXICO.
W69-05208 03A

MASSMAN-DRAKE V TOWBOAT M/V HUGH C BLASKE, BARGE CHEM 2 (ACTION FOR DAMAGES CAUSED BY A TOWBOAT CAST ADRIFT BY A HURRICANE).
W69-05341 06E

UNSATURATED FLOW
THE MECHANISM OF NATURAL GROUND-WATER RECHARGE AND DISCHARGE 1. ONE-DIMENSIONAL, VERTICAL, UNSTEADY, UNSATURATED FLOW ABOVE A RECHARGING OR DISCHARGING GROUND-WATER FLOW SYSTEM,
W69-05436 02F

THE EFFECT OF OSMOTIC PRESSURE GRADIENTS ON WATER MOVEMENT IN UNSATURATED SOIL,
W69-05442 02G

UNSTEADY FLOW
COMPARISON OF FLOOD-WAVE AND WATER-PARTICLE TRAVELTIMES,
W69-05240 02E

UNSTEADY FLOW PARAMETERS IN HYDRAULIC DESIGN,
W69-05408 08B

TRANSIENT FLOW OF GROUND WATER TO WELLS IN MULTIPLE-AQUIFER SYSTEMS,
W69-05413 02F

THE MECHANISM OF NATURAL GROUND-WATER RECHARGE AND DISCHARGE 1. ONE-DIMENSIONAL, VERTICAL, UNSTEADY, UNSATURATED FLO ABOVE A RECHARGING OR DISCHARGING GROUND-WATER FLOW SYS
W69-05436 02F

UTAH
THE ECONOMICS OF WATER ALLOCATION IN UTAH,
W69-05507 06D

UTILITIES
MALICIOUS MISCHIEFS-PUBLIC UTILITIES.
W69-05374 04C

NAVIGABLE STREAMS, PERMISSION TO BRIDGE OR DAM PUBLIC SERVICE FACILITIES NATURAL RESOURCES.
W69-05564 06E

VALUE JUDGMENTS
WELFARE ECONOMICS, ECONOMIC GROWTH AND THE CHOICE OF TECHNIQUES,
W69-05500 06B

VARIABILITY
RELATIONSHIP OF PALMER DROUGHT VARIABLES TO YIELD OF WI WHEAT,
W69-05283 03F

VELOCITY
CORRECTING RIVER VELOCITIES MEASURED FROM AN UNANCHORED SHIP,
W69-05255 07B

VESSELS
MASSMAN-DRAKE V TOWBOAT M/V HUGH C BLASKE, BARGE CHEM 2 (ACTION FOR DAMAGES CAUSED BY A TOWBOAT CAST ADRIFT BY A HURRICANE).
W69-05341 06E

VIRGINIA
GARGAC V SMITH-ROWLAND CO (POLLUTION OF LAKE BY INDUSTRI WASTES).
W69-05387 05C

WATER RESOURCES LAW IN VIRGINIA (ARTIFICALLY CONFINED WATER).
W69-05537 02H

COMPLETION OF THE FAIRFAX COUNTY WATER AUTHORITY ACQUISI PROGRAM.
W69-05539 03D

AMERICAN CYANAMID CO V COMMONWEALTH (POLLUTION ABATEMENT
W69-05575 05G

WASHOUTS
EAST FORK DUCK CREEK WATERSHED NOBLE AND WASHINGTON COUNTIES, OHIO.
W69-05329 06B

WASTE TREATMENT
WATER QUALITY CHANGES IN CONFINED HOG WASTE TREATMENT,
W69-05417 05D

WASTE WATER DISPOSAL
PUTTING WASTE WATER TO BENEFICIAL USE - THE FLUSHING MEA PROJECT,
W69-05327 05D

RETURNING WASTES TO THE LAND, A NEW ROLE FOR AGRICULTURE,
W69-05328 05D

WASTE WATER RECLAMATION
PUTTING WASTE WATER TO BENEFICIAL USE - THE FLUSHING MEA PROJECT,
W69-05327 05D

RETURNING WASTES TO THE LAND, A NEW ROLE FOR AGRICULTURE,
W69-05328 05D

WASTE WATER TREATMENT
LARGE TREATMENT PLANTS OF THE EMSCHER ASSOCIATION AND TH IMPORTANCE FOR IMPROVING CONDITIONS OF THE RHINE,
W69-05218 05D

TREATING COKE PLANT WASTE,
W69-05422 05D

WASTES
NITROGEN CYCLE IN SURFACE AND SUBSURFACE WATERS,
W69-05323 05B

WATER
DETERMINATION OF ORGANOCHLORINE INSECTICIDES IN SOILS AND WATERS,
W69-05325 05A

WATER ALLOCATION
THE ECONOMICS OF WATER ALLOCATION IN UTAH,
W69-05507 06D

WATER ALLOCATION(POLICY)
DELAWARE RIVER BASIN COMPACT.
W69-05342 04A

WATER ALLOCATION SUPPLY AND DEMAND RELATIONSHIPS,
W69-05483 06B

DISCUSSION OF WATER ALLOCATION SUPPLY AND DEMAND RELATIONSHIPS,
W69-05485 06B

WATER ANALYSIS

MPLING APPARATUS TO MINIMIZE AERATION OF WATER FOR THE TERMINATION OF DISSOLVED GASES,
9-05246 07B

R CHEMISTRY
ALITY OF WATERS FROM PLAYAS ON THE SOUTHERN HIGH PLAINS,
9-05276 03C

RIATION IN THE COMPOSITION OF BRINE FROM THE SYLVANIA MATION NEAR MIDLAND, MICHIGAN,
9-05401 02F

CONSERVATION
IABLE ROW SPACING OF IRRIGATED COTTON AS A MEANS FOR UCING PRODUCTION COSTS AND CONSERVING WATER,
-05277 03F

DISTRIBUTION(APPLIED)
DICTING FIELD DISTRIBUTIONS OF SPRINKLER SYSTEMS,
-05285 03F

DISTRICTS
PLETION OF THE FAIRFAX COUNTY WATER AUTHORITY ACQUISITION GRAM.
-05539 03D

LAW
AWYER LOOKS AT WATER RESOURCE ECONOMICS,
-05292 06E

ER RESOURCES POLICY AND POLITICAL INSTITUTIONS.
-05295 06B

LEVEL FLUCTUATIONS
ROLOGIC EFFECTS OF THE 1962-66 DROUGHT ON LONG ISLAND, N.
-05411 02A

LEVELS
ER-MANOMETER-AIR-LINE ASSEMBLY FOR DETERMINING DEPTH TO R IN WELLS,
05249 07B

MUM AND MAXIMUM WATER-LEVEL RECORDING DEVICES,
05250 07B

MANAGEMENT
WARE RIVER BASIN COMPACT.
05342 04A

05343 04A

R RESEARCH PROBLEMS IN WATER QUALITY,
05519 05G

MANAGEMENT(APPLIED)
FUNDAMENTAL ROLE OF WATER IN THE 'CASSA PER IL OGIORNO' DEVELOPMENT PROGRAMS FOR SOUTHERN ITALY,
05216 06D

NIQUES OF WATER MANAGEMENT OF LAKE OKEECHOBEE AND THE IDA EVERGLADES,
05223 04A

MANAGEMENT OF FALL-PLANTED SUGAR BEETS IN SALT RIVER Y OF ARIZONA,
05279 03F

ED WATERSHED YIELDS IMPROVED WATER HARVEST,
05410 03B

OLLUTION
ES OF COAL MINE DRAINAGE POLLUTION, WHEELING CREEK SHED, OHIO.
5202 05B

NG OF OIL.
5370 05G

V MCCLOUD (ACTION TO ENJOIN SEWAGE FLOW).
5389 05G

RESEARCH PROBLEMS IN WATER QUALITY,
5519 05G

ODDENBERY CO INC V CARTER (DAMAGES FOR POLLUTION OF M).
5559 05B

V GIFFORD-HILL AND CO (WATER POLLUTION BY MINING).
5561 05G

CAN CYANAMID CO V COMMONWEALTH (POLLUTION ABATEMENT).
5575 05G

OLLUTION CONTROL
ARE RIVER BASIN COMPACT.
5344 04A

POLLUTION CONTROL USING BY-PASS PIPING,
5503 05G

CAN CYANAMID CO V COMMONWEALTH (POLLUTION ABATEMENT).
575 05G

V GLIDDEN CO (CONSTITUTIONALITY OF WATER POLLUTIONS L STATUTE).
586 05G

LLUTION EFFECTS
V SMITH-ROWLAND CO (POLLUTION OF LAKE BY INDUSTRIAL WASTES).
W69-05387 05C

DEVELOPMENT OF BIOLOGICAL INDICES TO POLLUTION LEVELS IN STREAMS AFFECTED BY ACID MINE DRAINAGE AND OIL FIELD BRINE WASTES,
W69-05407 05A

A LIMNOLOGICAL RECONNAISSANCE OF AN IMPOUNDMENT RECEIVING HEAVY METALS WITH EMPHASIS OF DIATOMS AND FISH,
W69-05465 02H

WATER POLLUTION SOURCES
OIL SPILLAGE STUDY, LITERATURE SEARCH, AND CRITICAL EVALUATION FOR SELECTION OF PROMISING TECHNIQUES TO CONTROL AND PREVENT DAMAGE,
W69-05262 05G

NITROGEN CYCLE IN SURFACE AND SUBSURFACE WATERS,
W69-05323 05B

REYNOLDS METAL CO V BALL (SUIT TO RECOVER DAMAGES FOR ALLEGED DEPOSIT OF SEDIMENT CONTAINING POISONOUS SUBSTANCES).
W69-05385 05C

COMPONENTS OF WOOD PULP BLEACH EFFLUENTS,
W69-05402 05A

IDENTIFICATION AND DIFFERENTIATION OF HEAVY RESIDUAL OIL AND ASPHALT POLLUTANTS IN SURFACE WATERS BY COMPARATIVE RATIOS OF INFRARED ABSORBANCES,
W69-05421 05A

WATER POLLUTION TREATMENT
LARGE TREATMENT PLANTS OF THE EMSCHER ASSOCIATION AND THEIR IMPORTANCE FOR IMPROVING CONDITIONS OF THE RHINE,
W69-05218 05D

OIL SPILLAGE STUDY, LITERATURE SEARCH, AND CRITICAL EVALUATION FOR SELECTION OF PROMISING TECHNIQUES TO CONTROL AND PREVENT DAMAGE,
W69-05262 05G

WATER POTENTIAL
ISOPIESTIC TECHNIQUE FOR MEASURING LEAF WATER POTENTIALS WITH A THERMOCOUPLE PSYCHROMETER,
W69-05286 02I

WATER PURIFICATION
PORTABLE WATER PURIFIERS FOR COSTA RICA,
W69-05456 05D

WATER QUALITY
ASSESSING IMPACTS OF DECLINING WATER QUALITY ON GROSS VALUE OUTPUT OF AGRICULTURE, A CASE STUDY,
W69-05273 03C

QUALITY OF WATERS FROM PLAYAS ON THE SOUTHERN HIGH PLAINS,
W69-05276 03C

THE PLAN AND PROGRAM FOR THE BRANDYWINE.
W69-05299 06B

WATER QUALITY INVESTIGATION, PART 1 - BASIC DATA, FORT LOUDOUN RESERVOIR, APRIL 1966 - JUNE 1968,
W69-05416 05A

PREDICTING TEMPERATURES OF SMALL STREAMS,
W69-05427 02E

DYNAMICS OF PHYSICOCHEMISTRY IN A LARGE RESERVOIR,
W69-05466 02H

WATER QUALITY IN IMPOUNDMENTS AND MODIFICATIONS FROM DESTRATIFICATION,
W69-05467 02H

EVALUATION OF PRE-IMPOUNDMENT CONDITIONS FOR PREDICTION OF STORED WATER QUALITY,
W69-05468 02H

EFFECT OF IMPOUNDMENTS ON PRODUCTIVITY, WATER CHEMISTRY, AND HEAT BUDGETS OF RIVERS,
W69-05469 02H

MAJOR RESEARCH PROBLEMS IN WATER QUALITY,
W69-05519 05G

QUALITY WATER'S FOURTH DIMENSION,
W69-05524 05G

THE COMPETITION FOR WATER QUALITY AGRICULTURE,
W69-05525 05G

THE COMPETITION FOR WATER QUALITY INDUSTRY,
W69-05526 05G

THE COMPETITION FOR WATER QUALITY DOMESTIC USE,
W69-05527 05G

WATER QUALITY CONTROL
WATER POLLUTION CONTROL USING BY-PASS PIPING,
W69-05503 05G

MAJOR RESEARCH PROBLEMS IN WATER QUALITY,
W69-05519 05G

WATER QUALITY MANAGEMENT
WATER POLLUTION CONTROL USING BY-PASS PIPING,
W69-05503 05G

WATER RATES
PROCEEDINGS WATER POLICY PRICING CONFERENCE,
W69-05492 06C

LEGAL CONSTRAINTS IN WATER PRICING POLICY,
W69-05493 06C

THE ACCOUNTANT'S VIEWPOINT ON WATER PRICING POLICY,
W69-05494 06C

THE CONSUMER'S VIEWPOINT AND POLICY DECISIONS,
W69-05495 06C

STATEMENT,
W69-05497 06C

ECONOMIC ANALYSIS OF PUBLIC WATER SUPPLY IN THE PISCATAQUA RIVER WATERSHED,
W69-05510 03E

WATER REQUIREMENTS
STUDIES ON WATER USE IN PEA (PISUM SATIVUM L.),
W69-05287 03F

THE INTERINDUSTRY FACTOR-CONTEXT MATRIX AN APPLICATION FOR THE ANALYSIS AND PROJECTION OF REGIONAL WATER REQUIREMENTS,
W69-05509 06B

WATER RESOURCE DEVELOPMENT
CONCEPTUAL ISSUES IN THE CONDUCT OF REGIONAL RESEARCH ON THE ECONOMICS OF WATER,
W69-05480 06B

WATER RESOURCES
WATER LAW, POLITICS, AND ECONOMICS FEDERAL CONTROL OF WATER RESOURCES,
W69-05297 06E

WATER RESOURCES OF THE SALMON FALLS CREEK BASIN, IDAHO-NEVADA,
W69-05409 02E

WATER-RESOURCES APPRAISAL OF THE SNAKE RIVER BASIN IN NEVADA,
W69-05414 02E

WATER RESOURCES OF THE BURNETT REGION,
W69-05423 02E

WATER RESOURCES DEVELOPMENT
COMPREHENSIVE BASIN STUDY ON WHITE RIVER BASIN, ARKANSAS AND MISSOURI.
W69-05201 06B

A STATE VIEWPOINT ON RIVER BASIN PLANNING,
W69-05209 06B

THE FUNDAMENTAL ROLE OF WATER IN THE 'CASSA PER IL MEZZOGIORNO' DEVELOPMENT PROGRAMS FOR SOUTHERN ITALY,
W69-05216 06D

INTERGRATING HUMAN-SOCIAL RESOURCES INTO THE WATER RESOURCE DEVELOPMENT PROJECT,
W69-05217 06B

THE ORGANIZATION OF VENEZUELA FOR THE UTILIZATION OF ITS WATER RESOURCES (SPANISH),
W69-05220 06E

WATER RESOURCES POLICY AND POLITICAL INSTITUTIONS.
W69-05295 06B

PROCEEDINGS OF SYMPOSIUM ON BETTER WATER AND SEWER SERVICES FOR SMALL COMMUNITIES IN NORTH CAROLINA,
W69-05424 06B

WATER SUPPLY IN THE BRACKISH-WATER REGIONS OF SOUTH VIETNAM.
W69-05457 02L

STATISTICAL ANALYSIS OF GROUND WATER USE AND REPLENISHMENT,
W69-05475 02F

THE TENNESSEE VALLEY AUTHORITY ECONOMIC IMPACT OF ITS COMPREHENSIVE WATER DEVELOPMENT PROGRAM,
W69-05502 06B

WATER RESOURCES PLANNING
PROCEEDINGS-SYMPOSIUM ON BETTER WATER AND SEWER SERVICES FOR SMALL COMMUNITIES IN NORTH CAROLINA.
W69-05312 03D

WATER RESOURCES PLANNING ACT
A STATE VIEWPOINT ON RIVER BASIN PLANNING,
W69-05209 06B

WATER RESOURCES RESEARCH ACT
DISCUSSION OF REGIONAL RESEARCH IN THE NORTH CENTRAL REGION,
W69-05479 06B

WATER RIGHTS
WATER RESOURCES LAW IN VIRGINIA (ARTIFICALLY CONFINED WATER).
W69-05537 02H

LOCH SHELDRAKE ASSOCIATES V EVANS (RESTRICTIVE CLAUSE ON THE USES OF WATER).
W69-05548 06E

EL PASO WATER IMPROV DIST NO 1 V CITY OF EL PASO (RIGHT OF REMOVAL UNDER WATER SUPPLY CONTRACT).
W69-05558 06E

SCHEELER V DEWERD (EASEMENT TO TAKE WELL WATER).
W69-05595 06E

WATER SOURCES
WATER RESOURCES LAW IN VIRGINIA (OTHER WATER SOURCES).
W69-05536 06E

WATER RESOURCES LAW IN VIRGINIA (ARTIFICALLY CONFINED WATER).
W69-05537 02H

WATER SPREADING
RUNOFF WATER-SPREADING ON LEVELED CROPLAND,
W69-05275 04A

WATER STORAGE
RUNOFF WATER-SPREADING ON LEVELED CROPLAND,
W69-05275 04A

WATER SUPPLY
WATER FOR LIVING,
W69-05219 05C

DELAWARE AND RARITAN CANAL.
W69-05361 04A

ECONOMIC ANALYSIS OF PUBLIC WATER SUPPLY IN THE PISCAT RIVER WATERSHED,
W69-05510 03E

WATER SUPPLY PROBLEMS IN DEVELOPING COUNTRIES,
W69-05513 03D

PEOPLE V VILLAGE OF BERKELEY (STATUTORY DUTIES UNDER W SUPPLY CONTRACTS).
W69-05584 06E

HUTCHESON V SUMRALL (WATER SUPPLY EASEMENT).
W69-05599 06E

WATER TABLE
IDENTIFICATION OF NONLINEAR PARAMETERS OF GROUND WATER BASINS BY HYBRID COMPUTATION,
W69-05271 02F

WATER TEMPERATURE
PREDICTING TEMPERATURES OF SMALL STREAMS,
W69-05427 02E

WATER UTILITIES
A STUDY OF THE EFFECT OF TAXATION ON THE SIX PRIVATE O QUASI-MUNICIPAL WATER UTILITIES IN RHODE ISLAND,
W69-05316 06C

WATER UTILIZATION
DROUGHT AND PHOSPHORUS AFFECT GROWTH OF ANNUAL FORAGE LEGUMES,
W69-05264 02I

STUDIES ON WATER USE IN PEA (PISUM SATIVUM L.),
W69-05287 03F

ECONOMIC ANALYSIS OF PUBLIC WATER SUPPLY IN THE PISCAT RIVER WATERSHED,
W69-05510 03E

LOCH SHELDRAKE ASSOCIATES V EVANS (RESTRICTIVE CLAUSE USES OF WATER).
W69-05548 06E

WATER VAPOR
ISOPIESTIC TECHNIQUE FOR MEASURING LEAF WATER POTENTIA WITH A THERMOCOUPLE PSYCHROMETER,
W69-05286 02I

WATER WELLS
WATER-MANOMETER-AIR-LINE ASSEMBLY FOR DETERMINING DEPT WATER IN WELLS,
W69-05249 07B

SCHEELER V DEWERD (EASEMENT TO TAKE WELL WATER).
W69-05595 06E

WATER WORKS
MALICIOUS MISCHIEFS-PUBLIC UTILITIES.
W69-05374 04C

COHASSET WATER CO V TOWN OF COHASSET (CONVEYANCE OF WA WORKS TO TOWN).
W69-05583 06E

WATER YIELD IMPROVEMENT
TREATED WATERSHED YIELDS IMPROVED WATER HARVEST,
W69-05410 03B

WATERCOURSES
MORRIS CANAL AND BANKING COMPANY.
W69-05359 06E

WATERCOURSES(LEGAL)
GWINN V MYERS (SUIT TO REMOVE OBSTRUCTION TO NATURAL WATERCOURSE).
W69-05557 04A

WATERSHED MANAGEMENT
LEGAL ASPECTS OF THE SMALL WATERSHED PROGRAM IN IOWA,
W69-05339 04D

DELAWARE RIVER BASIN COMPACT.

69-05345 04D

ERSHED MANAGMENT
AST FORK DUCK CREEK WATERSHED NOBLE AND WASHINGTON OUNTIES, OHIO.
69-05329 06B

ERSHED PROTECTION AND FLOOD PREVENTION ACT
EGAL ASPECTS OF THE SMALL WATERSHED PROGRAM IN IOWA,
69-05339 04D

ERSHEDS
EGAL ASPECTS OF THE SMALL WATERSHED PROGRAM IN IOWA,
69-05339 04D

ERSHEDS(BASINS)
UNOFF WATER-SPREADING ON LEVELED CROPLAND,
69-05275 04A

ES(WATER)
ATER WAVES OVER A RECTANGULAR CHANNEL THROUGH A REEF,
69-05448 02L

HOALING OF SOLITARY WAVES ON SMALL SLOPES,
69-05450 02H

THERING
RANITES, GRUSSES, AND THE SHERMAN EROSION SURFACE, SOUTHERN ARAMIE RANGE, COLORADO-WYOMING,
69-05211 02J

FARE(ECONOMICS)
W INCOME-NET WORTH APPROACH TO MEASURING ECONOMIC WELFARE,
69-05290 06B

L REGULATIONS
NPROTECTED WELLS.
69-05367 06E

LS
NPROTECTED WELLS.
69-05367 06E

LTON-MOHAWK IRRIGATION DISTRICT
SSESSING IMPACTS OF DECLINING WATER QUALITY ON GROSS VALUE TPUT OF AGRICULTURE, A CASE STUDY,
69-05273 03C

TERN CANADA BASIN
QUID FLOW IN THE WESTERN CANADA SEDIMENTARY BASIN - 1. FFECT OF TOPOGRAPHY,
69-05451 02F

T
FFECTS OF MOISTURE AND FERTILIZER ON YIELDS OF SPRING WHEAT D BARLEY,
69-05263 02I

FFECT OF EARLY-SUMMER SEEDING OF WINTER WHEAT ON YIELD, IL MOISTURE, AND SOIL NITRATE,
69-05280 03F

LATIONSHIP OF PALMER DROUGHT VARIABLES TO YIELD OF WINTER EAT,
69-05283 03F

TGRASSES
IL PROBLEMS IN RESEEDING A GREASEWOOD-RABBITBRUSH RANGE TE,
69-05269 02G

WHITE PINE TREES
THE INTERCEPTION-TRANSPIRATION RELATIONSHIP OF WHITE SPRUCE AND WHITE PINE,
W69-05274 02D

WHITE RIVER
TANEY COUNTY V EMPIRE DIST ELECTRIC CO (FLOOD DAMAGE AND CLAIM SETTLEMENT FOR FUTURE DAMAGES).
W69-05571 06E

WHITE SPRUCE TREES
THE INTERCEPTION-TRANSPIRATION RELATIONSHIP OF WHITE SPRUCE AND WHITE PINE,
W69-05274 02D

WILDLIFE
NOTICE OF PETITIONS FOR SPECIAL LEGISLATION PERTAINING TO FISH AND GAME.
W69-05375 06E

SALT WATER ISLANDS.
W69-05565 06E

WINTER
RELATIONSHIP OF PALMER DROUGHT VARIABLES TO YIELD OF WINTER WHEAT,
W69-05283 03F

WISCONSIN
PETERSON V WISCONSIN RIVER POWER CO (PROPERTY ENCROACHMENT BY IMPOUNDED WATERS).
W69-05552 04A

MUENCH V PUBLIC SERVICE COMMISSION (PUBLIC RIGHTS IN NAVIGABLE RIVER).
W69-05582 06E

SCHEELER V DEWERD (EASEMENT TO TAKE WELL WATER).
W69-05595 06E

WORLD BANK
WATER SUPPLY PROBLEMS IN DEVELOPING COUNTRIES,
W69-05513 03D

YIELD EQUATIONS
EFFECTS OF PHOSPHATE CONCENTRATION ON CELL DIVISION RATES AND YIELD OF A TROPICAL OCEANIC DIATOM,
W69-05530 05C

ZINC RADIOISOTOPES
ACCUMULATION OF PHOSPHORUS-32 AND ZINC-65 BY LIVING AND KILLED PLANKTON,
W69-05531 05C

ZOOGLOEA BACTERIA
IDENTIFICATION OF ZOOGLOEA SPECIES AND THE RELATIONSHIP TO ZOOGLOEAL MATRIX AND FLOC FORMATION,
W69-05313 05C

ZOOGLOEAL MATRIX
IDENTIFICATION OF ZOOGLOEA SPECIES AND THE RELATIONSHIP TO ZOOGLOEAL MATRIX AND FLOC FORMATION,
W69-05313 05C

ZOOPLANKTON
LIMNOLOGICAL STUDIES OF LENTIC WATERS,
W69-05302 02H

BIOLOGICAL ASPECTS OF EUTROPHICATION IN LAKES MENDOTA, CRYSTAL, TROUT AND GREEN,
W69-05324 02H

AUTHOR INDEX

, J. M.
LUATION OF SOME GEOPHYSICAL TECHNIQUES APPLIED TO THE
IRONMENT OF A MAUI WELL,
-05418 02F

NEVERE, FRANCISCO G.
ORGANIZATION OF VENEZUELA FOR THE UTILIZATION OF ITS
ER RESOURCES (SPANISH),
-05220 06E

Y, ROGER E.
OTE ON THE DUAL PRICES OF INTEGER PROGRAMS,
-05523 06C

F, G. J.
SPILLAGE STUDY, LITERATURE SEARCH, AND CRITICAL
LUATION FOR SELECTION OF PROMISING TECHNIQUES TO CONTROL
PREVENT DAMAGE,
-05262 05G

SON, HENRY W.
ACCUMULATION AS RELATED TO METEOROLOGICAL, TOPOGRAPHIC,
FOREST VARIABLES IN CENTRAL SIERRA NEVADA, CALIFORNIA,
-05226 02C

ATE, HOWARD G.
FICIDE LEVELS AND FLUCTUATION IN SOIL BACTERIA IN AN
GATED FIELD AND A POND OF SOUTHWEST TEXAS,
05272 05C

R. D.
UREMENT OF DROUGHT RESISTANCE IN CROP PLANTS,
05265 02G

D. J.
OGEN CYCLE IN SURFACE AND SUBSURFACE WATERS,
05323 05B

T, YEHUDA
ODYNAMIC DISPERSION IN A SATURATED HOMOGENEOUS POROUS
UM AT LOW PECLET NUMBERS AND NONHOMOGENEOUS SOLUTION,
05434 01B

, F. S.
USSION OF CONCEPTUAL ISSUES IN THE CONDUCT OF REGIONAL
ARCH ON THE ECONOMICS OF WATER,
05481 06B

RALPH W.
FF VOLUME PREDICTION FROM DAILY CLIMATIC DATA,
05426 02A

E, W. C.
TED WATERSHED YIELDS IMPROVED WATER HARVEST,
05410 03B

SSA, NICHOLAS L.
TE VIEWPOINT ON RIVER BASIN PLANNING,
05209 06B

D, BILLY J.
CTION OF SEDIMENT PROFILES IN OPEN CHANNEL FLOW BY
LENT DIFFUSION THEORY,
05403 02J

J. A.
ED WATERSHED YIELDS IMPROVED WATER HARVEST,
5410 03B

A.
TS OF MOISTURE AND FERTILIZER ON YIELDS OF SPRING WHEAT
ARLEY,
5263 02I

C. D.
PILLAGE STUDY, LITERATURE SEARCH, AND CRITICAL
ATION FOR SELECTION OF PROMISING TECHNIQUES TO CONTROL
REVENT DAMAGE,
5262 05G

, HERBERT L.
CCOUNTANT'S VIEWPOINT ON WATER PRICING POLICY,
5494 06C

, PAUL
OMPETITION FOR WATER QUALITY DOMESTIC USE,
5527 05G

A. W.
AIN RIVER FLOOD RUNOFF THEORY, MEANS OF ITS
TIGATION AND CALCULATION,
5230 02A

K.
ES ON WATER USE IN PEA (PISUM SATIVUM L.),
5287 03F

ER, C. S.
IZATION METHODS FOR BRANCHING MULTISTAGE WATER RESOURCE
MS--A REPLY TO A COMMENT BY E. F. BRATER,
5501 06A

OBERT
QUALITY CHANGES IN CONFINED HOG WASTE TREATMENT,
417 05D

N. P.

NUMERICAL FORECASTING OF MOUNTAIN RIVER FLOOD RUNOFF ON THE
BASIS OF ESTABLISHING TERRITORIALLY - GENERALIZED
RELATIONSHIPS,
W69-05231 02A

BENOIT, RICHARD
A LIMNOLOGICAL RECONNAISSANCE OF AN IMPOUNDMENT RECEIVING
HEAVY METALS WITH EMPHASIS OF DIATOMS AND FISH,
W69-05465 02H

BENSON, M. A.
FREQUENCY CURVES FOR ANNUAL FLOOD SERIES WITH SOME ZERO
EVENTS OR INCOMPLETE DATA,
W69-05455 07C

BEN-SHAHAR, HAIM
CAPITAL FORMATION AND GOVERNMENT CAPITAL POLICY IN
DEVELOPING ECONOMIES,
W69-05518 06C

BERGMANN, J. M.
RAINFALL-RUNOFF MODEL FOR SMALL BASIN FLOOD HYDROGRAPH
SIMULATION,
W69-05420 02A

BERKSTRESSER, CHARLES F., JR.
RAPID FIELD FILTRATION OF WATER SAMPLES,
W69-05244 07B

BETSON, ROGER P.
USING ANALYTICAL METHODS TO DEVELOP A SURFACE-RUNOFF MODEL,
W69-05431 02A

BHAGAVANTAM, S.
KOYNA EARTHQUAKE OF DECEMBER 11, 1967,
W69-05419 08E

BLACKBURN, R. D.
COMMON AQUATIC WEEDS,
W69-05446 02I

BLACKMARR, W. H.
SEASONAL AND DIURNAL VARIATION IN POCOSIN SHRUB MOISTURE
CONTENT,
W69-05331 02I

BOERSMA, L.
PORE SIZE DISTRIBUTIONS AS MEASURED BY THE MERCURY INTRUSION
METHOD AND THEIR USE IN PREDICTING PERMEABILITY,
W69-05439 02G

BOURCIER, DONALD V.
ECONOMIC ANALYSIS OF PUBLIC WATER SUPPLY IN THE PISCATAQUA
RIVER WATERSHED,
W69-05510 03E

BOUWER, HERMAN
PUTTING WASTE WATER TO BENEFICIAL USE - THE FLUSHING MEADOWS
PROJECT,
W69-05327 05D

RETURNING WASTES TO THE LAND, A NEW ROLE FOR AGRICULTURE,
W69-05328 05D

BOYER, JOHN S.
ISOPIESTIC TECHNIQUE FOR MEASURING LEAF WATER POTENTIALS
WITH A THERMOCOUPLE PSYCHROMETER,
W69-05286 02I

BRADLEY, IVER E.
THE ECONOMICS OF WATER ALLOCATION IN UTAH,
W69-05507 06D

BRADLEY, W. C.
GRANITES, GRUSSES, AND THE SHERMAN EROSION SURFACE, SOUTHERN
LARAMIE RANGE, COLORADO-WYOMING,
W69-05211 02J

BRANSCHEID, VOLKER O.
PREDICTING FIELD DISTRIBUTIONS OF SPRINKLER SYSTEMS,
W69-05285 03F

BRATER, E. F.
A COMMENT ON OPTIMIZATION METHODS FOR BRANCHING MULTISTAGE
WATER RESOURCE SYSTEMS,
W69-05499 06A

BRAZEE, ROSS D.
A PROPOSED MECHANICS FOR THE INVESTIGATION OF SURFACE RUNOFF
FROM SMALL WATERSHEDS. 1, DEVELOPMENT,
W69-05425 02A

BRENGLE, K. G.
EFFECT OF FATTY ALCOHOL ON CHANGE IN SOIL WATER DURING THE
SUMMER FALLOW PERIOD,
W69-05284 02G

BREWER, MICHAEL F.
ECONOMIC ALTERNATIVES,
W69-05528 05G

BROBERG, D. E.
FLAT CHANNEL TERRACES,
W69-05282 02J

BROWER, STEPHEN L.
INTERGRATING HUMAN-SOCIAL RESOURCES INTO THE WATER RESOURCE

DEVELOPMENT PROJECT,
W69-05217 06B

BROWNING, GEORGE M.
REGIONAL AND NATIONAL PLANNING OF AGRICULTURAL RESEARCH,
W69-05482 06B

BROWN, GEORGE W.
PREDICTING TEMPERATURES OF SMALL STREAMS,
W69-05427 02E

BROWN, MERLE J.
RELATIONSHIP OF PALMER DROUGHT VARIABLES TO YIELD OF WINTER WHEAT,
W69-05283 03F

BROWN, T. S.
A PILOT PLANT STUDY FOR REMOVAL OF SOLUBLE SILICA FROM ROSWELL, NEW MEXICO WATER. PHASE 1. INITIAL CONSTRUCTION AND OPERATION,
W69-05335 03A

BROWZIN, BORIS S.
COMPARATIVE STUDY OF SNOW TYPE HYDROLOGY OF NORTHEASTERN CANADA AND OF PLAINS OF RUSSIA AND SIBERIA,
W69-05225 02E

BRUSH, LUCIEN M.
ARTIFICIAL MIXING OF DENSITY-STRATIFIED FLUIDS A LABORATORY INVESTIGATION,
W69-05412 02H

BRYLKA, RUDOLF
PORTABLE WATER PURIFIERS FOR COSTA RICA,
W69-05456 05D

BUCHANAN, THOMAS J.
COMPARISON OF FLOOD-WAVE AND WATER-PARTICLE TRAVELTIMES,
W69-05240 02E

WATER-STAGE AND RAINFALL DUAL RECORDER,
W69-05253 07B

BUCHTA, H. G.
FLAT CHANNEL TERRACES,
W69-05282 02J

BURWELL, R. E.
TILLAGE METHODS TO REDUCE RUNOFF AND EROSION IN THE CORN BELT,
W69-05330 03F

CAIRNS, JOHN, JR.
A LIMNOLOGICAL RECONNAISSANCE OF AN IMPOUNDMENT RECEIVING HEAVY METALS WITH EMPHASIS OF DIATOMS AND FISH,
W69-05465 02H

CAMFIELD, FREDERICK E.
SHOALING OF SOLITARY WAVES ON SMALL SLOPES,
W69-05450 02H

CAMPBELL, CHARLES
LEGAL ASPECTS OF THE SMALL WATERSHED PROGRAM IN IOWA,
W69-05339 04D

CANDAU, M. G.
WATER FOR LIVING,
W69-05219 05C

CARPENTER, T. G.
THE ASSESSMENT OF RUNOFF FROM A MOUNTAINOUS AND SEMI-ARID AREA IN WESTERN IRAN,
W69-05233 02E

CASTLE, EMERY N.
CONCEPTUAL ISSUES IN THE CONDUCT OF REGIONAL RESEARCH ON THE ECONOMICS OF WATER,
W69-05480 06B

CERNY, EDWIN E.
PATTERNS OF BACKWATER AND DISCHARGE ON SMALL ICE-AFFECTED STREAMS,
W69-05256 07B

CHAPMAN, T. G.
RECURRENCE INTERVALS BETWEEN EXCEEDANCES OF SELECTED RIVER LEVELS. 2. ALTERNATIVES TO A MARKOV MODEL,
W69-05454 02E

CHESTERS, G.
DETERMINATION OF ORGANOCHLORINE INSECTICIDES IN SOILS AND WATERS,
W69-05325 05A

CHIN, Y. KUO
ARTIFICIAL MIXING OF DENSITY-STRATIFIED FLUIDS A LABORATORY INVESTIGATION,
W69-05412 02H

CHIZHOV, A. M.
PROBLEMS OF THE METHODS AND ACCURACY OF HYDROLOGIC OBSERVATIONS (RUSSIAN),
W69-05210 07A

CHOW, GREGORY C.
AN ALTERNATIVE PROOF OF HANNAN'S THEOREM ON CANONICAL CORRELATION AND MULTIPLE EQUATION SYSTEMS,
W69-05511 06D

CLARK, CHAPIN D.
WATER LAW, POLITICS, AND ECONOMICS OUR COMPLEX WATER LAWS AND WATER USE CUSTOMS,
W69-05296 06E

WATER LAW, POLITICS, AND ECONOMICS FEDERAL CONTROL OF WATER RESOURCES,
W69-05297 06E

COBB, ERNEST D.
CONSTANT-RATE-INJECTION EQUIPMENT FOR DYE-DILUTION DISCH MEASUREMENTS,
W69-05237 07B

COHEN, PHILIP
HYDROLOGIC EFFECTS OF THE 1962-66 DROUGHT ON LONG ISLAN Y.,
W69-05411 02A

COLLINGS, M. R.
SELECTION OF DYE-INJECTION AND MEASURING SITES FOR TIME- TRAVEL STUDIES,
W69-05238 07B

COLLINS, J. W.
COMPONENTS OF WOOD PULP BLEACH EFFLUENTS,
W69-05402 05A

CONARD, E. C.
SOIL MOISTURE CONDITIONS UNDER PASTURES OF COOL-SEASON WARM-SEASON GRASSES,
W69-05266 02G

CONNOR, D. J.
TISSUE WATER RELATIONS FOR BRIGALOW AND MULGA,
W69-05281 02I

COOK, M. W.
OIL SPILLAGE STUDY, LITERATURE SEARCH, AND CRITICAL EVALUATION FOR SELECTION OF PROMISING TECHNIQUES TO CON AND PREVENT DAMAGE,
W69-05262 05G

COOK, R. ELTON
PATTERNS OF BACKWATER AND DISCHARGE ON SMALL ICE-AFFECTI STREAMS,
W69-05256 07B

CORBALIS, JAMES J., JR.
COMPLETION OF THE FAIRFAX COUNTY WATER AUTHORITY ACQUISI PROGRAM.
W69-05539 03D

COX, MAURICE B.
RUNOFF WATER-SPREADING ON LEVELED CROPLAND,
W69-05275 04A

COX, WILLIAM E.
WATER RESOURCES LAW IN VIRGINIA.
W69-05533 06E

WATER RESOURCES LAWS IN VIRGINIA (NATURAL SURFACE WATERCOURSES).
W69-05534 06E

WATER RESOURCES LAWS IN VIRGINIA (PERCOLATING GROUNDWATE DIFFUSED SURFACE WATER).
W69-05535 06E

WATER RESOURCES LAW IN VIRGINIA (OTHER WATER SOURCES).
W69-05536 06E

WATER RESOURCES LAW IN VIRGINIA (ARTIFICALLY CONFINED WATER).
W69-05537 02H

WATER RESOURCES LAWS IN VIRGINIA (REMEDIES FOR INFRINGEM OF WATER RIGHTS).
W69-05538 06E

CRABTREE, K. T.
NITROGEN CYCLE IN SURFACE AND SUBSURFACE WATERS,
W69-05323 05B

CRIPPEN, J. R.
INTERPRETATION OF FLOOD-FREQUENCY DATA,
W69-05260 07B

CROSTHWAITE, E. G.
WATER RESOURCES OF THE SALMON FALLS CREEK BASIN, IDAHO- NEVADA,
W69-05409 02E

CURRY, R. BRUCE
A PROPOSED MECHANICS FOR THE INVESTIGATION OF SURFACE RU FROM SMALL WATERSHEDS. 1, DEVELOPMENT,
W69-05425 02A

CUSHING, C. E.
ACCUMULATION OF PHOSPHORUS-32 AND ZINC-65 BY LIVING AND KILLED PLANKTON,
W69-05531 05C

DAMBACH, CHARLES A.
DEVELOPMENT OF BIOLOGICAL INDICES TO POLLUTION LEVELS IN STREAMS AFFECTED BY ACID MINE DRAINAGE AND OIL FIELD BRI WASTES,
W69-05407 05A

DANIELS, H. E.
AUTOCORRELATION BETWEEN FIRST DIFFERENCES OF MID-RANGES,
W69-05520 06B

IS, DIANA
IL SPILLAGE STUDY, LITERATURE SEARCH, AND CRITICAL
VALUATION FOR SELECTION OF PROMISING TECHNIQUES TO CONTROL
ND PREVENT DAMAGE,
69-05262 05G

IS, D. W.
PILOT PLANT STUDY FOR REMOVAL OF SOLUBLE SILICA FROM
OSWELL, NEW MEXICO WATER. PHASE 1. INITIAL CONSTRUCTION
ND OPERATION,
69-05335 03A

IS, H. CRAIG
HE INTERINDUSTRY FACTOR-CONTEXT MATRIX AN APPLICATION FOR
HE ANALYSIS AND PROJECTION OF REGIONAL WATER REQUIREMENTS,
69-05509 06B

IS, LUTHER C., JR.
ORRECTING RIVER VELOCITIES MEASURED FROM AN UNANCHORED
HIP,
69-05255 07B

IS, STANLEY N.
EASUREMENT OF SMALL SURFACE DISPLACEMENTS INDUCED BY FLUID
LOW,
69-05433 02F

DY, D. R.
AINFALL-RUNOFF MODEL FOR SMALL BASIN FLOOD HYDROGRAPH
IMULATION,
69-05420 02A

ALESSI, LOUIS
HE UTILITY OF DISASTERS,
69-05288 06B

HENRY, L.
ATER RESOURCES OF THE BURNETT REGION,
69-05423 02E

ACKER, L. W.
ORE SIZE DISTRIBUTIONS AS MEASURED BY THE MERCURY INTRUSION
ETHOD AND THEIR USE IN PREDICTING PERMEABILITY,
69-05439 02G

ONICO, J. P.
ASIC STUDIES OF SCALE CONTROL,
69-05334 03A

EY, W. G.
FFECT OF EARLY-SUMMER SEEDING OF WINTER WHEAT ON YIELD,
OIL MOISTURE, AND SOIL NITRATE,
69-05280 03F

WANIA, H. P.
OMPONENTS OF WOOD PULP BLEACH EFFLUENTS,
69-05402 05A

OSON, ANNE N.
FFECTS OF PHOSPHATE CONCENTRATION ON CELL DIVISION RATES
ND YIELD OF A TROPICAL OCEANIC DIATOM,
69-05530 05C

, HANS H.
HE CONSUMER'S VIEWPOINT AND POLICY DECISIONS,
69-05495 06C

AN, PATRICK
HE MICROBIAL FLORA OF ACID MINE WATER AND ITS RELATIONSHIP
O FORMATION AND REMOVAL OF ACID,
69-05314 05G

AN, P. R.
DENTIFICATION OF ZOOGLOEA SPECIES AND THE RELATIONSHIP TO
OOGLOEAL MATRIX AND FLOC FORMATION,
69-05313 05C

N, BERNARD
OMOGRAPHS FOR DETERMINING AMOUNT OF RHODAMINE B DYE FOR
IME-OF-TRAVEL STUDIES,
69-05236 07B

LA, A. S.
OIL PROBLEMS IN RESEEDING A GREASEWOOD-RABBITBRUSH RANGE
ITE,
69-05269 02G

ACCADIA, R. DENTICE
HE FUNDAMENTAL ROLE OF WATER IN THE 'CASSA PER IL
EZZOGIORNO' DEVELOPMENT PROGRAMS FOR SOUTHERN ITALY,
69-05216 06D

IN, THOMAS E.
ATER-RESOURCES APPRAISAL OF THE SNAKE RIVER BASIN IN
EVADA,
69-05414 02E

ERT, R. E., JR.
OIL PROBLEMS IN RESEEDING A GREASEWOOD-RABBITBRUSH RANGE
ITE,
69-05269 02G

LER, D. H.
RANITES, GRUSSES, AND THE SHERMAN EROSION SURFACE, SOUTHERN
ARAMIE RANGE, COLORADO-WYOMING,
69-05211 02J

LSON, G. C.
ARIATION IN THE COMPOSITION OF BRINE FROM THE SYLVANIA
ORMATION NEAR MIDLAND, MICHIGAN,
69-05401 02F

ELDER, R. A.
THE MECHANICS OF STRATIFIED FLOW IN RESERVOIRS,
W69-05464 02H

EMBREE, WILLIAM N.
COMPUTERIZED SYSTEM FOR WYOMING SURFACE WATER RECORDS,
W69-05326 02E

ENGLISH, J. MORLEY
STATEMENT,
W69-05497 06C

ERIE, L. J.
WATER MANAGEMENT OF FALL-PLANTED SUGAR BEETS IN SALT RIVER
VALLEY OF ARIZONA,
W69-05279 03F

ESPINOSA, MANUEL E.
DETERMINATION OF OPTIMUM CAPACITY OF A STORAGE RESERVOIR FOR
IRRIGATION PURPOSES AS A BASIS FOR ALLOCATING COSTS IN
MULTIPLE-PURPOSE PROJECTS,
W69-05294 03F

FABUSS, B. M.
BASIC STUDIES OF SCALE CONTROL,
W69-05334 03A

FIREMAN, MILTON
THE COMPETITION FOR WATER QUALITY AGRICULTURE,
W69-05525 05G

FISCHER, R. A.
STOMATAL OPENING IN ISOLATED EPIDERMAL STRIPS OF VICIA FABA.
I. RESPONSE TO LIGHT AND TO CO2-FREE AIR
W69-05278 02I

FISK, P. R.
THE ESTIMATION OF MARGINAL PRODUCT FROM A COBB-DOUGLAS
PRODUCTION FUNCTION,
W69-05521 06B

FLANNER, WILLIAM B.
SEASONAL AND DIURNAL VARIATION IN POCOSIN SHRUB MOISTURE
CONTENT,
W69-05331 02I

FLECKSTEINER, JOHN W.
TREATING COKE PLANT WASTE,
W69-05422 05D

FLEMING, J. H.
THE ASSESSMENT OF SURFACE RUNOFF FROM RAINFALL DATA FOR AN
ARID REGION OF WEST PAKISTAN,
W69-05232 02E

FORSTE, ROBERT H.
ECONOMIC ANALYSIS OF PUBLIC WATER SUPPLY IN THE PISCATAQUA
RIVER WATERSHED,
W69-05510 03E

FOSTER, MINARD I.
BROAD SCOPE OF NAVIGATION'S ECONOMIC IMPACT,
W69-05449 06B

FRANKE, O. L.
HYDROLOGIC EFFECTS OF THE 1962-66 DROUGHT ON LONG ISLAND, N.
Y.,
W69-05411 02A

FREEZE, R. ALLAN
THE MECHANISM OF NATURAL GROUND-WATER RECHARGE AND DISCHARGE
1. ONE-DIMENSIONAL, VERTICAL, UNSTEADY, UNSATURATED FLOW
ABOVE A RECHARGING OR DISCHARGING GROUND-WATER FLOW SYSTEM,
W69-05436 02F

FRENCH, O. F.
WATER MANAGEMENT OF FALL-PLANTED SUGAR BEETS IN SALT RIVER
VALLEY OF ARIZONA,
W69-05279 03F

FRERE, M. H.
HYDRAULIC CONDUCTIVITY RELATED TO POROSITY AND SWELLING OF
SOIL,
W69-05443 02G

FREY, JOHN C.
A DISCUSSION OF DATA SYSTEMS AND INFORMATION RETRIEVAL
ADAPTABLE TO WATER RESOURCES,
W69-05491 06B

FRIEDMAN, B. A.
IDENTIFICATION OF ZOOGLOEA SPECIES AND THE RELATIONSHIP TO
ZOOGLOEAL MATRIX AND FLOC FORMATION,
W69-05313 05C

GARCIA, R. M.
MOISTURE-RETENTION CAPACITY OF LITTER UNDER TWO ARIZONA
CHAPARRAL COMMUNITIES,
W69-05267 02G

GARDNER, J. P.
THE ECONOMICS OF WATER ALLOCATION IN UTAH,
W69-05507 06D

GENTILE, JOHN H.
DEMONSTRATION OF A TOXIN FROM APHANIZOMENON FLOS-AQUAE (L.)
RALFS,
W69-05306 05C

GILL, JAMES

THE COMPETITION FOR WATER QUALITY INDUSTRY,
W69-05526 05G

GLADWELL, JOHN S.
FOURTH ANNUAL REPORT OF THE STATE OF WASHINGTON WATER RESEARCH CENTER, 1968.
W69-05322 09D

GLOYNA, EARNEST F.
MAJOR RESEARCH PROBLEMS IN WATER QUALITY,
W69-05519 05G

GOODIER, LESLIE J.
OFFSHORE PROSPECTING AND MINING LAWS OF THE UNITED STATES,
W69-05340 06E

GRANGER, C. W. J.
THE TYPICAL SPECTRAL SHAPE OF AN ECONOMIC VARIABLE,
W69-05522 06D

GRAVES, G. W.
WATER POLLUTION CONTROL USING BY-PASS PIPING,
W69-05503 05G

GRAY, MACK H., III.
UNSTEADY FLOW PARAMETERS IN HYDRAULIC DESIGN,
W69-05408 08B

GRILICHES, ZVI
DISTRIBUTED LAGS A SURVEY,
W69-05514 06B

GROZIER, RICHARD U.
RAFT FOR EVAPORATION-MEASUREMENT EQUIPMENT,
W69-05252 07B

HAGEN, J. I.
STUDIES OF METHODS OF SOIL WATER DETERMINATION,
W69-05305 02G

HAIGH, F. B.
WATER RESOURCES OF THE BURNETT REGION,
W69-05423 02E

HALDERMAN, ALLAN D.
MEASUREMENT OF SMALL SURFACE DISPLACEMENTS INDUCED BY FLUID FLOW,
W69-05433 02F

HALLER, FAYE M.
USING ANALYTICAL METHODS TO DEVELOP A SURFACE-RUNOFF MODEL,
W69-05431 02A

HALL, M. J.
DESIGN CRITERIA FOR LABORATORY CATCHMENT EXPERIMENTS, WITH PARTICULAR REFERENCE TO RAINFALL SIMULATION,
W69-05234 02A

HANNAN, E. J.
TESTING FOR SERIAL CORRELATION AFTER LEAST SQUARES REGRESSION,
W69-05289 06B

HANSEN, W. LEE
AN INCOME-NET WORTH APPROACH TO MEASURING ECONOMIC WELFARE,
W69-05290 06B

HARKNESS, JON P.
LONG SWINGS,
W69-05498 06B

HARRISON, D. S.
COMMON AQUATIC WEEDS,
W69-05446 02I

HARRIS, MARSHALL
LEGAL ASPECTS OF THE SMALL WATERSHED PROGRAM IN IOWA,
W69-05339 04D

HARTMAN, MONROE A.
RUNOFF VOLUME PREDICTION FROM DAILY CLIMATIC DATA,
W69-05426 02A

HART, WILLIAM E.
PREDICTING FIELD DISTRIBUTIONS OF SPRINKLER SYSTEMS,
W69-05285 03F

HASLER, A. D.
BIOLOGICAL ASPECTS OF EUTROPHICATION IN LAKES MENDOTA, CRYSTAL, TROUT AND GREEN,
W69-05324 02H

HATFIELD, G. B.
WATER POLLUTION CONTROL USING BY-PASS PIPING,
W69-05503 05G

HAUSER, VICTOR L.
QUALITY OF WATERS FROM PLAYAS ON THE SOUTHERN HIGH PLAINS,
W69-05276 03C

HEEDE, BURCHARD H.
ENGINEERING TECHNIQUES AND PRINCIPLES APPLIED TO SOIL EROSION CONTROL,
W69-05333 04D

HEWLETT, JOHN D.
IN DEFENSE OF EXPERIMENTAL WATERSHEDS,
W69-05405 02A

HILALY, NABIL
WATER WAVES OVER A RECTANGULAR CHANNEL THROUGH A REEF,
W69-05448 02L

HILER, EDWARD A.
PREDICTION OF SEDIMENT PROFILES IN OPEN CHANNEL FLOW BY TURBULENT DIFFUSION THEORY,
W69-05403 02J

HILL, I. K.
RUNOFF HYDROGRAPH AS A FUNCTION OF RAINFALL EXCESS,
W69-05438 02A

HINES, WILLIAM W.
LEGAL ASPECTS OF THE SMALL WATERSHED PROGRAM IN IOWA,
W69-05339 04D

HITCHON, BRIAN
FLUID FLOW IN THE WESTERN CANADA SEDIMENTARY BASIN - 1. EFFECT OF TOPOGRAPHY,
W69-05451 02F

HITE, HOWARD E., JR.
STUDIES ON METHODS OF SOIL WATER DETERMINATION,
W69-05304 02G

HOLM, PAUL L.
DATA SYSTEMS AND INFORMATION RETRIEVAL ADAPTABLE TO WATER RESOURCES,
W69-05490 06B

HOWELLS, DAVID H.
PROCEEDINGS OF SYMPOSIUM ON BETTER WATER AND SEWER SERVICES FOR SMALL COMMUNITIES IN NORTH CAROLINA,
W69-05424 06B

HUGHES, LEON S.
USE OF CARBON DIOXIDE IN BUBBLE GAGES TO PREVENT PRECIPITATION OF CALCIUM CARBONATE,
W69-05247 07B

HULL, ROBERT W.
THE ORIGIN AND DEVELOPMENT OF THE WATERWAYS POLICY OF THE UNITED STATES,
W69-05338 04A

HULL, WILLIAM J.
THE ORIGIN AND DEVELOPMENT OF THE WATERWAYS POLICY OF THE UNITED STATES,
W69-05338 04A

IRWIN, WILLIAM H.
WATER QUALITY IN IMPOUNDMENTS AND MODIFICATIONS FROM DESTRATIFICATION,
W69-05467 02H

JANSMA, J. DEAN
DISCUSSION OF REGIONAL ECONOMIC DEVELOPMENT AND WATER,
W69-05489 06B

JENNINGS, M. E.
FREQUENCY CURVES FOR ANNUAL FLOOD SERIES WITH SOME ZERO EVENTS OR INCOMPLETE DATA,
W69-05455 07C

JOHNSON, A. I.
AN OUTLINE OF GEOPHYSICAL LOGGING METHODS AND THEIR USES IN HYDROLOGIC STUDIES,
W69-05261 07B

JOHNSON, E. B.
STATISTICAL ANALYSIS OF GROUND WATER USE AND REPLENISHMENT,
W69-05475 02F

JOHNS, B.
ON THE REPRESENTATION OF THE REYNOLDS STRESS IN A TIDAL ESTUARY,
W69-05213 02L

JORGENSON, DALE W.
RATIONAL DISTRIBUTED LAG FUNCTIONS,
W69-05515 06B

JOYNER, B. F.
SAMPLING APPARATUS TO MINIMIZE AERATION OF WATER FOR THE DETERMINATION OF DISSOLVED GASES,
W69-05246 07B

KALMA, J. D.
AN ACCURATE SMALL ORIFICE RAIN GAGE,
W69-05404 07B

KARASEN, I. F.
PROBLEMS OF THE METHODS AND ACCURACY OF HYDROLOGIC OBSERVATIONS (RUSSIAN),
W69-05210 07A

KARDOS, L. T.
EFFECT OF MOISTURE REGIMES AND HARVESTS ON EFFICIENCY OF WATER USE BY TEN FORAGE CROPS,
W69-05268 02I

KARPLUS, WALTER J.
IDENTIFICATION OF NONLINEAR PARAMETERS OF GROUND WATER BASINS BY HYBRID COMPUTATION,
W69-05271 02F

KAWAHARA, FRED K.
IDENTIFICATION AND DIFFERENTIATION OF HEAVY RESIDUAL OIL AND ASPHALT POLLUTANTS IN SURFACE WATERS BY COMPARATIVE RATIOS OF INFRARED ABSORBANCES,
W69-05421 05A

N, T. E.
NIMUM AND MAXIMUM WATER-LEVEL RECORDING DEVICES,
9-05250 07B

ER, W. D.
VEMENT OF WATER AND SALT THROUGH A CLAY-WATER SYSTEM
PERIMENTAL VERIFICATION OF ONSAGER RECIPROCAL RELATION,
9-05441 02G

E EFFECT OF OSMOTIC PRESSURE GRADIENTS ON WATER MOVEMENT
UNSATURATED SOIL,
9-05442 02G

, LOWELL E.
OSPHORUS IN FLOWING WATERS,
9-05445 05B

RICK, ALVIN Y.
NOTE ON THE DUAL PRICES OF INTEGER PROGRAMS,
9-05523 06C

, G. O.
E SIZE DISTRIBUTIONS AS MEASURED BY THE MERCURY INTRUSION
THOD AND THEIR USE IN PREDICTING PERMEABILITY,
9-05439 02G

ING, EDWARD B.
PIESTIC TECHNIQUE FOR MEASURING LEAF WATER POTENTIALS
H A THERMOCOUPLE PSYCHROMETER,
-05286 02I

L, WALTER G., JR.
OFF VOLUME PREDICTION FROM DAILY CLIMATIC DATA,
-05426 02A

E.
GE TREATMENT PLANTS OF THE EMSCHER ASSOCIATION AND THEIR
ORTANCE FOR IMPROVING CONDITIONS OF THE RHINE,
-05218 05D

I, ALEX
IC STUDIES OF SCALE CONTROL,
-05334 03A

NBADER, PAUL D.
ATING COKE PLANT WASTE,
-05422 05D

ETZOV, A. S.
DIES OF RUNOFF FORMATION UNDER CONDITION OF HIGH-ANGLE
ITUDE OF THE IMPERVIOUS BED,
-05229 02E

NAN, M. S.
NA EARTHQUAKE OF DECEMBER 11, 1967,
-05419 08E

ER, J. L.
LD KIT FOR DETERMINING ALKALINITY,
-05243 07B

IG, J. E.
ER RESOURCES OF THE BURNETT REGION,
-05423 02E

WERFF, J. V.
HAULIC CONDUCTIVITY RELATED TO POROSITY AND SWELLING OF
L,
-05443 02G

CHARLES, E., JR.
ERVOIR FISHERY RESOURCES,
-05463 02H

, E. E.
NITES, GRUSSES, AND THE SHERMAN EROSION SURFACE, SOUTHERN
AMIE RANGE, COLORADO-WYOMING,
-05211 02J

, F. C.
ER QUALITY INVESTIGATION, PART 1 - BASIC DATA, FORT
DOUN RESERVOIR, APRIL 1966 - JUNE 1968,
-05416 05A

, LEE W.
PUTERIZED SYSTEM FOR WYOMING SURFACE WATER RECORDS,
-05326 02E

ICE, J. M.
AMICS OF PHYSICOCHEMISTRY IN A LARGE RESERVOIR,
-05466 02H

C. E.
SPILLAGE STUDY, LITERATURE SEARCH, AND CRITICAL
LUATION FOR SELECTION OF PROMISING TECHNIQUES TO CONTROL
PREVENT DAMAGE,
05262 05G

, OLIVER R.
LITY OF WATERS FROM PLAYAS ON THE SOUTHERN HIGH PLAINS,
05276 03C

J.
MENT OF WATER AND SALT THROUGH A CLAY-WATER SYSTEM
RIMENTAL VERIFICATION OF ONSAGER RECIPROCAL RELATION,
05441 02G

EFFECT OF OSMOTIC PRESSURE GRADIENTS ON WATER MOVEMENT
NSATURATED SOIL,
05442 02G

LEVIN, A. G.
STUDIES OF RUNOFF FORMATION UNDER CONDITION OF HIGH-ANGLE
ATTITUDE OF THE IMPERVIOUS BED,
W69-05229 02E

LEVI, DONALD R.
A LAWYER LOOKS AT WATER RESOURCE ECONOMICS,
W69-05292 06E

LICHTY, R. W.
RAINFALL-RUNOFF MODEL FOR SMALL BASIN FLOOD HYDROGRAPH
SIMULATION,
W69-05420 02A

LIGGETT, F. E.
FLAT CHANNEL TERRACES,
W69-05282 02J

LOELTZ, O. J.
WATER-MANOMETER-AIR-LINE ASSEMBLY FOR DETERMINING DEPTH TO
WATER IN WELLS,
W69-05249 07B

LOFTING, EVERARD M.
THE INTERINDUSTRY FACTOR-CONTEXT MATRIX AN APPLICATION FOR
THE ANALYSIS AND PROJECTION OF REGIONAL WATER REQUIREMENTS,
W69-05509 06B

LOMAS, J.
AN ACCURATE SMALL ORIFICE RAIN GAGE,
W69-05404 07B

LONGENECKER, D. E.
VARIABLE ROW SPACING OF IRRIGATED COTTON AS A MEANS FOR
REDUCING PRODUCTION COSTS AND CONSERVING WATER,
W69-05277 03F

LORD, WILLIAM B.
DISCUSSION OF WATER RESOURCE DEVELOPMENT PUBLIC AND
PRIVATE INVESTMENT,
W69-05487 06B

LOTSPEICH, FREDERICK B.
QUALITY OF WATERS FROM PLAYAS ON THE SOUTHERN HIGH PLAINS,
W69-05276 03C

LOVELL, MICHAEL C.
MONEY, MULTIPLIER ACCELERATOR INTERACTION AND THE BUSINESS
CYCLE,
W69-05291 06B

LUECK, B. F.
COMPONENTS OF WOOD PULP BLEACH EFFLUENTS,
W69-05402 05A

LULL, HOWARD W.
IN DEFENSE OF EXPERIMENTAL WATERSHEDS,
W69-05405 02A

LUTHIN, JAMES N.
COMPUTER METHODS FOR TRANSIENT ANALYSIS OF WATER-TABLE
AQUIFERS,
W69-05435 07C

LU, CHIN H.
BASIC STUDIES OF SCALE CONTROL,
W69-05334 03A

LYERLY, P. J.
VARIABLE ROW SPACING OF IRRIGATED COTTON AS A MEANS FOR
REDUCING PRODUCTION COSTS AND CONSERVING WATER,
W69-05277 03F

MACAU VILAR, FEDERICO
DETERMINATION OF FRESH WATERS IN THE CALCAREOUS MASSIF OF
'COSTA BRAVA', SPAIN (FRENCH),
W69-05474 02F

MACKENTHUN, K. M.
WRITING A WATER QUALITY REPORT,
W69-05212 10

MACPHEE, CRAIG
A LETHAL INDEX FOR CLASSIFYING CHEMICALS WHICH AFFECT WATER
QUALITY OF AQUATIC LIFE,
W69-05303 05C

MAKI, WILBUR R.
REGIONAL ECONOMIC DEVELOPMENT AND WATER,
W69-05488 06B

MALAHOFF, A.
EVALUATION OF SOME GEOPHYSICAL TECHNIQUES APPLIED TO THE
ENVIRONMENT OF A MAUI WELL,
W69-05418 02F

MANDELBROT, BENOIT B.
COMPUTER EXPERIMENTS WITH FRACTIONAL GAUSSIAN NOISES, PARTS
1, 2, AND 3,
W69-05453 07C

MANNERING, J. V.
TILLAGE METHODS TO REDUCE RUNOFF AND EROSION IN THE CORN
BELT,
W69-05330 03F

RELATION OF SOIL PROPERTIES TO ITS ERODIBILITY,
W69-05444 02J

MANN, H. O.
EFFECT OF FATTY ALCOHOL ON CHANGE IN SOIL WATER DURING THE

SUMMER FALLOW PERIOD,
W69-05284 02G

MASSEY, DEAN T.
REGIONAL RESEARCH IN WATER IN THE NORTH CENTRAL REGION,
W69-05478 06B

MATHRANI, K. P.
ECONOMICS AND FINANCING OF IRRIGATION PROJECTS,
W69-05221 06C

MATSON, ARTHUR J.
DISCUSSION OF WATER ALLOCATION SUPPLY AND DEMAND RELATIONSHIPS,
W69-05485 06B

MCCLYMONDS, N. E.
HYDROLOGIC EFFECTS OF THE 1962-66 DROUGHT ON LONG ISLAND, N. Y.,
W69-05411 02A

MCCOY, E.
NITROGEN CYCLE IN SURFACE AND SUBSURFACE WATERS,
W69-05323 05B

MCDONOUGH, MARTIN
LEGAL CONSTRAINTS IN WATER PRICING POLICY,
W69-05493 06C

MCGAUKEY, P. H.
QUALITY WATER'S FOURTH DIMENSION,
W69-05524 05G

MCGILCHRIST, C. A.
RECURRENCE INTERVALS BETWEEN EXCEEDANCES OF SELECTED RIVER LEVELS. 2. ALTERNATIVES TO A MARKOV MODEL,
W69-05454 02E

MCKELL, C. M.
DROUGHT AND PHOSPHORUS AFFECT GROWTH OF ANNUAL FORAGE LEGUMES,
W69-05264 02I

MCKINNEY, ROSS E.
WATER QUALITY CHANGES IN CONFINED HOG WASTE TREATMENT,
W69-05417 05D

MCMICHAEL, FRANCIS C.
ARTIFICIAL MIXING OF DENSITY-STRATIFIED FLUIDS A LABORATORY INVESTIGATION,
W69-05412 02H

MEIER, W. L., JR.
OPTIMIZATION METHODS FOR BRANCHING MULTISTAGE WATER RESOURCE SYSTEMS--A REPLY TO A COMMENT BY E. F. BRATER,
W69-05501 06A

MERVA, GEORGE E.
A PROPOSED MECHANICS FOR THE INVESTIGATION OF SURFACE RUNOFF FROM SMALL WATERSHEDS. 1, DEVELOPMENT,
W69-05425 02A

METZLER, DWIGHT F.
ROLE OF STATE GOVERNMENTS IN U. S. WATER MANAGEMENT,
W69-05293 06E

MICKELSON, ROME H.
RUNOFF WATER-SPREADING ON LEVELED CROPLAND,
W69-05275 04A

MIDDLETON, T. R.
BASIC STUDIES OF SCALE CONTROL,
W69-05334 03A

MILLER, E. M.
FLOODS IN VIRGINIA - MAGNITUDE AND FREQUENCY,
W69-05415 02E

MOOLANI, M. K.
STUDIES ON WATER USE IN PEA (PISUM SATIVUM L.),
W69-05287 03F

MOORE, DONALD O.
WATER-RESOURCES APPRAISAL OF THE SNAKE RIVER BASIN IN NEVADA,
W69-05414 02E

MOURIN, V.
SALT WATER ENCROACHMENT IN KARST AQUIFERS, ISLAND OF KEPHALLINIA, (IONIAN),
W69-05472 02L

MURTHI, M. G. K.
KOYNA EARTHQUAKE OF DECEMBER 11, 1967,
W69-05419 08E

MUSICK, JACK
RUNOFF WATER-SPREADING ON LEVELED CROPLAND,
W69-05275 04A

NAKAYAMA, F. S.
HYDRAULIC CONDUCTIVITY RELATED TO POROSITY AND SWELLING OF SOIL,
W69-05443 02G

NATH, S. K.
WELFARE ECONOMICS, ECONOMIC GROWTH AND THE CHOICE OF TECHNIQUES,
W69-05500 06B

NEAL, JOE KENDALL
RESERVOIR EUTROPHICATION AND DYSTROPHICATION FOLLOWING IMPOUNDMENT,
W69-05471 02H

NERLOVE, MARC
USE OF THE DURBIN-WATSON STATISTIC IN INAPPROPRIATE SITUATIONS,
W69-05516 06D

NEUMAN, SHLOMO P.
TRANSIENT FLOW OF GROUND WATER TO WELLS IN MULTIPLE-AQUI SYSTEMS,
W69-05413 02F

NICOLSON, J. A.
THE INTERCEPTION-TRANSPIRATION RELATIONSHIP OF WHITE SPR AND WHITE PINE,
W69-05274 02D

NIELSON, LYMAN H.
EVALUATION OF PRE-IMPOUNDMENT CONDITIONS FOR PREDICTION STORED WATER QUALITY,
W69-05468 02H

NIELSON, R. P.
EFFECT OF EARLY-SUMMER SEEDING OF WINTER WHEAT ON YIELD, SOIL MOISTURE, AND SOIL NITRATE,
W69-05280 03F

NOONAN, L.
THE EFFECT OF OSMOTIC PRESSURE GRADIENTS ON WATER MOVEME IN UNSATURATED SOIL,
W69-05442 02G

NORDENSON, TOR J.
PREPARATION OF CO-ORDINATED PRECIPITATION, RUNOFF AND EVAPORATION MAPS,
W69-05337 02A

NORMAN, DENNIS
A LETHAL INDEX FOR CLASSIFYING CHEMICALS WHICH AFFECT WA QUALITY OF AQUATIC LIFE,
W69-05303 05C

OLIVE, JOHN H.
DEVELOPMENT OF BIOLOGICAL INDICES TO POLLUTION LEVELS IN STREAMS AFFECTED BY ACID MINE DRAINAGE AND OIL FIELD BRI WASTES,
W69-05407 05A

OZBUN, J. L.
EFFECTS OF MOISTURE AND FERTILIZER ON YIELDS OF SPRING W AND BARLEY,
W69-05263 02I

O'BRIEN, MORROUGH P.
EQUILIBRIUM FLOW AREAS OF INLETS ON SANDY COASTS,
W69-05447 02L

O'SHEA, J. A.
WATER RESOURCES OF THE BURNETT REGION,
W69-05423 02E

PARSONS, T. R.
A CONTINUOUS SIZE SPECTRUM FOR PARTICULATE MATTER IN THE SEA,
W69-05529 07C

PASE, C. P.
MOISTURE-RETENTION CAPACITY OF LITTER UNDER TWO ARIZONA CHAPARRAL COMMUNITIES,
W69-05267 02G

PATRIC, J. H.
HYDROLOGY OF A SLIDE-PRONE GLACIAL TILL SOIL IN SOUTHEAS ALASKA,
W69-05406 02G

PAULSON, RICHARD W.
THE LONGITUDINAL DIFFUSION COEFFICIENT IN THE DELAWARE E ESTUARY AS DETERMINED FROM A STEADY-STATE MODEL,
W69-05428 02L

PETERSON, FRANK L.
MEASUREMENT OF SMALL SURFACE DISPLACEMENTS INDUCED BY FL FLOW,
W69-05433 02F

PILLSBURY, ARTHUR F.
PROCEEDINGS WATER POLICY PRICING CONFERENCE,
W69-05492 06C

PINCOCK, M. GLADE
ASSESSING IMPACTS OF DECLINING WATER QUALITY ON GROSS VA OUTPUT OF AGRICULTURE, A CASE STUDY,
W69-05273 03C

PIONKE, H. B.
DETERMINATION OF ORGANOCHLORINE INSECTICIDES IN SOILS AN WATERS,
W69-05325 05A

PITTERMAN, MARVIN
A STUDY OF THE EFFECT OF TAXATION ON THE SIX PRIVATE OR QUASI-MUNICIPAL WATER UTILITIES IN RHODE ISLAND,
W69-05316 06C

POLKOWSKI, L. B.
NITROGEN CYCLE IN SURFACE AND SUBSURFACE WATERS,
W69-05323 05B

POWELL, R. D.
EFFECT OF MOISTURE REGIMES AND HARVESTS ON EFFICIENCY OF WATER USE BY TEN FORAGE CROPS,
W69-05268 02I

PRESCOTT, EDWARD
MONEY, MULTIPLIER ACCELERATOR INTERACTION AND THE BUSINESS CYCLE,
W69-05291 06B

PRINCE, R. G. H.
WATER RESOURCES OF THE BURNETT REGION,
W69-05423 02E

QUERIO, C. W.
VARIATION IN THE COMPOSITION OF BRINE FROM THE SYLVANIA FORMATION NEAR MIDLAND, MICHIGAN,
W69-05401 02F

RABE, FRED W.
LIMNOLOGICAL STUDIES OF LENTIC WATERS,
W69-05302 02H

RAGAN, ROBERT M.
AN EXPERIMENTAL INVESTIGATION OF PARTIAL AREA CONTRIBUTIONS,
W69-05227 02A

RANDLES, CHESTER
THE MICROBIAL FLORA OF ACID MINE WATER AND ITS RELATIONSHIP TO FORMATION AND REMOVAL OF ACID,
W69-05314 05G

RANTZ, S. E.
CHARACTERISTICS OF LOGARITHMIC RATING CURVES,
W69-05259 07B

INTERPRETATION OF FLOOD-FREQUENCY DATA,
W69-05260 07B

RAO, K. L.
KOYNA EARTHQUAKE OF DECEMBER 11, 1967,
W69-05419 08E

RAWSON, JACK
FIELD MONITORING OF THE QUALITY OF WATER DURING THE DRILLING OF WELLS,
W69-05245 07B

RAYNER, A. C.
EFFECT OF THE LENGTH OF THE TIME PERIOD ON SERIAL CORRELATION,
W69-05506 06D

RAY-CHAUDHURI, D. K.
AN ALTERNATIVE PROOF OF HANNAN'S THEOREM ON CANONICAL CORRELATION AND MULTIPLE EQUATION SYSTEMS,
W69-05511 06D

RECHARD, PAUL A.
COMPUTERIZED SYSTEM FOR WYOMING SURFACE WATER RECORDS,
W69-05326 02E

REIMER, CHARLES W.
A LIMNOLOGICAL RECONNAISSANCE OF AN IMPOUNDMENT RECEIVING HEAVY METALS WITH EMPHASIS OF DIATOMS AND FISH,
W69-05465 02H

REINHART, KENNETH G.
IN DEFENSE OF EXPERIMENTAL WATERSHEDS,
W69-05405 02A

RENNE, ROLAND R.
DISCUSSION OF REGIONAL RESEARCH IN THE NORTH CENTRAL REGION,
W69-05479 06B

RICHARDS, T. L.
HYDROMETEOROLOGICAL STUDIES IN SUPPORT OF THE INTERNATIONAL FIELD YEAR FOR THE GREAT LAKES,
W69-05222 02B

ROBBINS, WALLACE D.
USE OF CARBON DIOXIDE IN BUBBLE GAGES TO PREVENT PRECIPITATION OF CALCIUM CARBONATE,
W69-05247 07B

ROBECK, GORDON G.
WATER QUALITY IN IMPOUNDMENTS AND MODIFICATIONS FROM DESTRATIFICATION,
W69-05467 02H

ROCKAWAY, J. D.
STATISTICAL ANALYSIS OF GROUND WATER USE AND REPLENISHMENT,
W69-05475 02F

ROLLINS, M. B.
SOIL PROBLEMS IN RESEEDING A GREASEWOOD-RABBITBRUSH RANGE SITE,
W69-05269 02G

ROMANOV, V. V.
EVAPORATION FROM BOGS IN THE EUROPEAN TERRITORY OF THE USSR,
W69-05214 02D

ROSE, GORDON D.
REGIONAL RESEARCH IN WATER IN THE NORTH CENTRAL REGION,
W69-05478 06B

RASHER, JOHN J., JR.
DEMONSTRATION OF A TOXIN FROM APHANIZOMENON FLOS-AQUAE (L.) RALFS,
W69-05306 05C

SAUER, V. B.
POLAR COORDINATE CHART READER FOR STAGE-RAINFALL RECORDER,
W69-05254 07B

SAWHNEY, J. S.
STUDIES ON WATER USE IN PEA (PISUM SATIVUM L.),
W69-05287 03F

SAWYER, PHILIP J.
DEMONSTRATION OF A TOXIN FROM APHANIZOMENON FLOS-AQUAE (L.) RALFS,
W69-05306 05C

SCHMID, A. ALLAN
WATER RESOURCE DEVELOPMENT PUBLIC AND PRIVATE INVESTMENT,
W69-05486 06B

SCHULTZ, ROBERT P.
SOIL OR FOLIAR FERTILIZATION OF WELL-DRAINED AND FLOODED SLASH PINE,
W69-05332 02G

SCHWAB, GLENN O.
A PROPOSED MECHANICS FOR THE INVESTIGATION OF SURFACE RUNOFF FROM SMALL WATERSHEDS. 1, DEVELOPMENT,
W69-05425 02A

SCOTT, JOHN T., JR.
FACTOR ANALYSIS AND REGRESSION,
W69-05517 06B

SHASHOUA, Y.
AN ACCURATE SMALL ORIFICE RAIN GAGE,
W69-05404 07B

SHELDON, R. W.
A CONTINUOUS SIZE SPECTRUM FOR PARTICULATE MATTER IN THE SEA,
W69-05529 07C

SHIPMAN, HAROLD R.
WATER SUPPLY PROBLEMS IN DEVELOPING COUNTRIES,
W69-05513 03D

SIPLE, GEORGE E.
SALT-WATER ENCROACHMENT OF TERTIARY LIMESTONE ALONG COASTAL SOUTH CAROLINA,
W69-05473 02L

SKINNER, JOHN V.
VARIABLE-SPEED POWER EQUIPMENT FOR DEPTH-INTEGRATION SEDIMENT SAMPLING,
W69-05257 07B

SLACK, KEITH V.
A MICROKIT FOR DISSOLVED OXYGEN DETERMINATION,
W69-05242 07B

SMERDON, ERNEST T.
PREDICTION OF SEDIMENT PROFILES IN OPEN CHANNEL FLOW BY TURBULENT DIFFUSION THEORY,
W69-05403 02J

SMITH, STEPHEN C.
ECONOMIC ALTERNATIVES,
W69-05528 05G

SMOOT, GEORGE F.
WATER-STAGE AND RAINFALL DUAL RECORDER,
W69-05253 07B

SOMMER, ROBERT E., JR.
ELECTRIC CONTROL SYSTEM FOR DUAL OPERATION OF CURRENT METER AND SUSPENDED-SEDIMENT SAMPLER,
W69-05258 07B

STAHL, JANOS
INCREASING OR DECREASING RETURNS TO SCALE IN THE CONSTANT ELASTICITY OF SUBSTITUTION PRODUCTION FUNCTION,
W69-05505 06D

STEVENS, HERBERT H., JR.
ELECTRIC CONTROL SYSTEM FOR DUAL OPERATION OF CURRENT METER AND SUSPENDED-SEDIMENT SAMPLER,
W69-05258 07B

STEWART, ROBERT L.
POLYETHYLENE OIL TUBES FOR STILLING WELLS,
W69-05248 07B

STONER, J. D.
COMPARISON OF RESULTS USING THREE SAMPLING TECHNIQUES FOR A FLUOMETRIC DYE STUDY IN A STREAM,
W69-05239 07B

STREET, ROBERT L.
SHOALING OF SOLITARY WAVES ON SMALL SLOPES,
W69-05450 02H

SUCOFF, E. I.
THE INTERCEPTION-TRANSPIRATION RELATIONSHIP OF WHITE SPRUCE AND WHITE PINE,
W69-05274 02D

SURKAN, A. J.
SYNTHETIC HYDROGRAPHS EFFECTS OF NETWORK GEOMETRY,
W69-05432 02A

SUTCLIFFE, J. V.
THE ASSESSMENT OF RUNOFF FROM A MOUNTAINOUS AND SEMI-ARID

AREA IN WESTERN IRAN,
W69-05233 02E

SWANSTON, D. N.
HYDROLOGY OF A SLIDE-PRONE GLACIAL TILL SOIL IN SOUTHEAST ALASKA,
W69-05406 02G

SYMONS, JAMES M.
WATER QUALITY IN IMPOUNDMENTS AND MODIFICATIONS FROM DESTRATIFICATION,
W69-05467 02H

SZAKOLCZAI, GYORGY
INCREASING OR DECREASING RETURNS TO SCALE IN THE CONSTANT ELASTICITY OF SUBSTITUTION PRODUCTION FUNCTION,
W69-05505 06D

TAYLOR, GEORGE H. B.
THE TENNESSEE VALLEY AUTHORITY ECONOMIC IMPACT OF ITS COMPREHENSIVE WATER DEVELOPMENT PROGRAM,
W69-05502 06B

TAYLOR, GEORGE S.
COMPUTER METHODS FOR TRANSIENT ANALYSIS OF WATER-TABLE AQUIFERS,
W69-05435 07C

TAYLOR, ROBERT G.
PESTICIDE LEVELS AND FLUCTUATION IN SOIL BACTERIA IN AN IRRIGATED FIELD AND A POND OF SOUTHWEST TEXAS,
W69-05272 05C

TERRAGUCHI, M.
BIOLOGICAL ASPECTS OF EUTROPHICATION IN LAKES MENDOTA, CRYSTAL, TROUT AND GREEN,
W69-05324 02H

TERRELL, R. D.
TESTING FOR SERIAL CORRELATION AFTER LEAST SQUARES REGRESSION,
W69-05289 06B

THALLER, M.
AN ACCURATE SMALL ORIFICE RAIN GAGE,
W69-05404 07B

THAXTON, E. L., JR.
VARIABLE ROW SPACING OF IRRIGATED COTTON AS A MEANS FOR REDUCING PRODUCTION COSTS AND CONSERVING WATER,
W69-05277 03F

THOMAS, WILLIAM H.
EFFECTS OF PHOSPHATE CONCENTRATION ON CELL DIVISION RATES AND YIELD OF A TROPICAL OCEANIC DIATOM,
W69-05530 05C

THORUD, D. B.
THE INTERCEPTION-TRANSPIRATION RELATIONSHIP OF WHITE SPRUCE AND WHITE PINE,
W69-05274 02D

TIMMONS, JOHN F.
WATER ALLOCATION SUPPLY AND DEMAND RELATIONSHIPS,
W69-05483 06B

TUCKER, RUSSELL L.
USING ANALYTICAL METHODS TO DEVELOP A SURFACE-RUNOFF MODEL,
W69-05431 02A

TUNSTALL, B. R.
TISSUE WATER RELATIONS FOR BRIGALOW AND MULGA,
W69-05281 02I

VANDERLIP, R. L.
RELATIONSHIP OF PALMER DROUGHT VARIABLES TO YIELD OF WINTER WHEAT,
W69-05283 03F

VEMURI, VENKATESWARARAO
IDENTIFICATION OF NONLINEAR PARAMETERS OF GROUND WATER BASINS BY HYBRID COMPUTATION,
W69-05271 02F

VERDUIN, JACOB
RESERVOIR MANAGEMENT PROBLEMS CREATED BY INCREASED PHOSPHORUS LEVELS OF SURFACE WATERS,
W69-05470 02H

VISSER, W. C.
A METHOD OF DETERMINING EVAPOTRANSPIRATION IN SOIL MONOLITHS,
W69-05270 02D

WADIA, D. N.
KOYNA EARTHQUAKE OF DECEMBER 11, 1967,
W69-05419 08E

WALKER, WILLIAM H.
WATER RESOURCES LAW IN VIRGINIA.
W69-05533 06E

WATER RESOURCES LAWS IN VIRGINIA (NATURAL SURFACE WATERCOURSES).
W69-05534 06E

WATER RESOURCES LAWS IN VIRGINIA (PERCOLATING GROUNDWATER - DIFFUSED SURFACE WATER).
W69-05535 06E

WATER RESOURCES LAW IN VIRGINIA (OTHER WATER SOURCES).
W69-05536 06E

WATER RESOURCES LAW IN VIRGINIA (ARTIFICALLY CONFINED WATER).
W69-05537 02H

WATER RESOURCES LAWS IN VIRGINIA (REMEDIES FOR INFRINGEMENT OF WATER RIGHTS).
W69-05538 06E

WALKE, CLIFFORD L. B.
TECHNIQUES OF WATER MANAGEMENT OF LAKE OKEECHOBEE AND THE FLORIDA EVERGLADES,
W69-05223 04A

WALLIS, JAMES R.
COMPUTER EXPERIMENTS WITH FRACTIONAL GAUSSIAN NOISES, PARTS 1, 2, AND 3,
W69-05453 07C

WALLIS, KENNETH F.
USE OF THE DURBIN-WATSON STATISTIC IN INAPPROPRIATE SITUATIONS,
W69-05516 06D

WALL, J. P.
BIOLOGICAL ASPECTS OF EUTROPHICATION IN LAKES MENDOTA, CRYSTAL, TROUT AND GREEN,
W69-05324 02H

WATSON, D. G.
ACCUMULATION OF PHOSPHORUS-32 AND ZINC-65 BY LIVING AND KILLED PLANKTON,
W69-05531 05C

WEBB, A. A.
COMPONENTS OF WOOD PULP BLEACH EFFLUENTS,
W69-05402 05A

WEEKS, EDWIN P.
DETERMINING THE RATIO OF HORIZONTAL TO VERTICAL PERMEABILITY BY AQUIFER-TEST ANALYSIS,
W69-05452 02F

WEISBROD, BURTON A.
AN INCOME-NET WORTH APPROACH TO MEASURING ECONOMIC WELFARE,
W69-05290 06B

WELBORN, CLARENCE T.
VARIABLE-SPEED POWER EQUIPMENT FOR DEPTH-INTEGRATION SEDIMENT SAMPLING,
W69-05257 07B

WELDON, L. W.
COMMON AQUATIC WEEDS,
W69-05446 02I

WHINSTON, A.
WATER POLLUTION CONTROL USING BY-PASS PIPING,
W69-05503 05G

WHISLER, F. D.
ANALYZING STEADY-STATE FLOW IN AN INCLINED SOIL SLAB WITH AN ELECTRIC ANALOG,
W69-05440 02G

WILLIAMS, W. A.
DROUGHT AND PHOSPHORUS AFFECT GROWTH OF ANNUAL FORAGE LEGUMES,
W69-05264 02I

WILSON, A. M.
DROUGHT AND PHOSPHORUS AFFECT GROWTH OF ANNUAL FORAGE LEGUMES,
W69-05264 02I

WILSON, JAMES F., JR.
TIME-OF-TRAVEL MEASUREMENTS AND OTHER APPLICATIONS OF DYE TRACING,
W69-05228 07B

IMPROVED DYES FOR WATER TRACING,
W69-05235 07B

DYE-CLOUD PHOTOGRAPHY,
W69-05241 07B

WISCHMEIER, W. H.
RELATION OF SOIL PROPERTIES TO ITS ERODIBILITY,
W69-05444 02J

WISSMAR, ROBERT C.
LIMNOLOGICAL STUDIES OF LENTIC WATERS,
W69-05302 02H

WITHERSPOON, PAUL A.
TRANSIENT FLOW OF GROUND WATER TO WELLS IN MULTIPLE-AQUIFER SYSTEMS,
W69-05413 02F

WITZEL, S.
NITROGEN CYCLE IN SURFACE AND SUBSURFACE WATERS,
W69-05323 05B

WOLF, P. O.
DESIGN CRITERIA FOR LABORATORY CATCHMENT EXPERIMENTS, WITH PARTICULAR REFERENCE TO RAINFALL SIMULATION,
W69-05234 02A

WOODYER, K. D.
RECURRENCE INTERVALS BETWEEN EXCEEDANCES OF SELECTED RIVER

VELS. 2. ALTERNATIVES TO A MARKOV MODEL,
9-05454 02E

HT, JOHN C.
FECT OF IMPOUNDMENTS ON PRODUCTIVITY, WATER CHEMISTRY, AND
AT BUDGETS OF RIVERS,
9-05469 02H

ERLICH, W. O.
E MECHANICS OF STRATIFIED FLOW IN RESERVOIRS,
9-05464 02H

S, WOODROW L., JR.
RVOPSYCHROMETER,
9-05251 07B

SHAN, VERN E.
SOIL MOISTURE CONDITIONS UNDER PASTURES OF COOL-SEASON AND
WARM-SEASON GRASSES,
W69-05266 02G

YOUNG, R. A.
EFFECTS OF MOISTURE AND FERTILIZER ON YIELDS OF SPRING WHEAT
AND BARLEY,
W69-05263 02I

YU, YUN-SHENG
UNSTEADY FLOW PARAMETERS IN HYDRAULIC DESIGN,
W69-05408 08B

ZOETL, J.
SALT WATER ENCROACHMENT IN KARST AQUIFERS, ISLAND OF
KEPHALLINIA, (IONIAN),
W69-05472 02L

ORGANIZATIONAL INDEX

GRICULTURAL RESEARCH SERVICE, AKRON, COLO. CENTRAL GREAT LAINS FIELD STATION.
RUNOFF WATER-SPREADING ON LEVELED CROPLAND,
W69-05275 04A

GRICULTURAL RESEARCH SERVICE, BELTSVILLE, MD. SOILS LAB. ND AGRICULTURAL RESEARCH SERVICE, PHOENIX, ARIZ. WATER ONSERVATION LAB.
HYDRAULIC CONDUCTIVITY RELATED TO POROSITY AND SWELLING OF SOIL,
W69-05443 02G

GRICULTURAL RESEARCH SERVICE, BUSHLAND, TEX.
QUALITY OF WATERS FROM PLAYAS ON THE SOUTHERN HIGH PLAINS,
W69-05276 03C

GRICULTURAL RESEARCH SERVICE, GAINESVILLE, FLA. CROPS ESEARCH DIV. AND FLORIDA UNIV., GAINESVILLE.
GRICULTURAL EXTENSION SERVICE.
COMMON AQUATIC WEEDS,
W69-05446 02I

GRICULTURAL RESEARCH SERVICE, LAFAYETTE, IND. AND PURDUE NIV., LAFAYETTE, IND. DEPT. OF AGRONOMY.
RELATION OF SOIL PROPERTIES TO ITS ERODIBILITY,
W69-05444 02J

GRICULTURAL RESEARCH SERVICE, PHOENIX, ARIZ. WATER ONSERVATION LAB.
PUTTING WASTE WATER TO BENEFICIAL USE - THE FLUSHING MEADOWS PROJECT,
W69-05327 05D

RETURNING WASTES TO THE LAND, A NEW ROLE FOR AGRICULTURE,
W69-05328 05D

ANALYZING STEADY-STATE FLOW IN AN INCLINED SOIL SLAB WITH AN ELECTRIC ANALOG,
W69-05440 02G

GRICULTURAL RESEARCH SERVICE, PULLMAN, WASH. RESEARCH IV. CALIFORNIA UNIV., RIVERSIDE CALIFORNIA UNIV., DAVIS.
DROUGHT AND PHOSPHORUS AFFECT GROWTH OF ANNUAL FORAGE LEGUMES,
W69-05264 02I

GRICULTURAL RESEARCH SERVICE, RIESEL, TEX. AND GRICULTURAL RESEARCH SERVICE, CHICKASHA, OKLA.
RUNOFF VOLUME PREDICTION FROM DAILY CLIMATIC DATA,
W69-05426 02A

GRICULTURAL RESEARCH SERVICE, WASHINGTON, D. C. SOIL AND ATER RESEARCH DIV., AGRICULTURAL RESEARCH SERVICE, ASHINGTON, D. C. CROPS RESEARCH DIV.
SOIL PROBLEMS IN RESEEDING A GREASEWOOD-RABBITBRUSH RANGE SITE,
W69-05269 02G

GRICULTURE RESEARCH SERVICE, WASHINGTON, D. C. PURDUE NIV., LAFAYETTE, IND. AGRICULTURAL EXPERIMENT STATION.
TILLAGE METHODS TO REDUCE RUNOFF AND EROSION IN THE CORN BELT,
W69-05330 03F

GRICULTURE RESEARCH SERVICE, PHOENIX, ARIZ. WATER ONSERVATION LABORATORY.
WATER MANAGEMENT OF FALL-PLANTED SUGAR BEETS IN SALT RIVER VALLEY OF ARIZONA,
W69-05279 03F

MERICAN FISHERIES SOCIETY, NEW YORK.
RESERVOIR FISHERY RESOURCES,
W69-05463 02H

MERICAN WATER RESOURCES ASSOCIATION, URBANA, ILL.
PROCEEDINGS OF THE THIRD ANNUAL AMERICAN WATER RESOURCES CONFERENCE.
W69-05508 06B

UBURN UNIV., ALA. AGRICULTURAL EXPERIMENT STATION.
DYNAMICS OF PHYSICOCHEMISTRY IN A LARGE RESERVOIR,
W69-05466 02H

USTRALIAN NATIONAL UNIV., CANBERRA.
TESTING FOR SERIAL CORRELATION AFTER LEAST SQUARES REGRESSION,
W69-05289 06B

ATTELLE MEMORIAL INST., RICHLAND, WASH. PACIFIC NORTHWEST ABS.
OIL SPILLAGE STUDY, LITERATURE SEARCH, AND CRITICAL EVALUATION FOR SELECTION OF PROMISING TECHNIQUES TO CONTROL AND PREVENT DAMAGE,
W69-05262 05G

ATTELLE-NORTHWEST, RICHLAND, WASH. PACIFIC NORTHWEST LAB.
ACCUMULATION OF PHOSPHORUS-32 AND ZINC-65 BY LIVING AND KILLED PLANKTON,
W69-05531 05C

ETHLEHEM STEEL CORP., PA. HOMER RESEARCH LAB.
TREATING COKE PLANT WASTE,
W69-05422 05D

IRMINGHAM UNIV. (ENGLAND).
AUTOCORRELATION BETWEEN FIRST DIFFERENCES OF MID-RANGES,
W69-05520 06B

CALIFORNIA UNIV., BERKELEY.
TRANSIENT FLOW OF GROUND WATER TO WELLS IN MULTIPLE-AQUIFER SYSTEMS,
W69-05413 02F

THE INTERINDUSTRY FACTOR-CONTEXT MATRIX AN APPLICATION FOR THE ANALYSIS AND PROJECTION OF REGIONAL WATER REQUIREMENTS,
W69-05509 06B

RATIONAL DISTRIBUTED LAG FUNCTIONS,
W69-05515 06B

QUALITY WATER'S FOURTH DIMENSION,
W69-05524 05G

ECONOMIC ALTERNATIVES,
W69-05528 05G

CALIFORNIA UNIV., BERKELEY. COLL. OF ENGINEERING.
EQUILIBRIUM FLOW AREAS OF INLETS ON SANDY COASTS,
W69-05447 02L

CALIFORNIA UNIV., DAVIS AND OHIO STATE UNIV., COLUMBUS.
COMPUTER METHODS FOR TRANSIENT ANALYSIS OF WATER-TABLE AQUIFERS,
W69-05435 07C

CALIFORNIA UNIV., DAVIS.
THE COMPETITION FOR WATER QUALITY AGRICULTURE,
W69-05525 05G

CALIFORNIA UNIV., DAVIS. DEPT. OF WATER SCIENCE AND ENGINEERING.
PREDICTING FIELD DISTRIBUTIONS OF SPRINKLER SYSTEMS,
W69-05285 03F

CALIFORNIA UNIV., DAVIS. LAB. OF PLANT-WATER RELATIONS.
STOMATAL OPENING IN ISOLATED EPIDERMAL STRIPS OF VICIA FABA. I. RESPONSE TO LIGHT AND TO CO2-FREE AIR,
W69-05278 02I

CALIFORNIA UNIV., LOS ANGELES.
IDENTIFICATION OF NONLINEAR PARAMETERS OF GROUND WATER BASINS BY HYBRID COMPUTATION,
W69-05271 02F

PROCEEDINGS WATER POLICY PRICING CONFERENCE,
W69-05492 06C

THE CONSUMER'S VIEWPOINT AND POLICY DECISIONS,
W69-05495 06C

CALIFORNIA UNIV., LOS ANGELES. GRADUATE SCHOOL OF BUSINESS AND PURDUE UNIV., LAFAYETTE, IND. KRANNERT GRADUATE SCHOOL.
WATER POLLUTION CONTROL USING BY-PASS PIPING,
W69-05503 05G

CALIFORNIA UNIV., RIVERSIDE COLORADO STATE UNIV., FORT COLLINS AND AGRICULTURAL RESEARCH SERVICE, WASHINGTON, D. C.
MOVEMENT OF WATER AND SALT THROUGH A CLAY-WATER SYSTEM EXPERIMENTAL VERIFICATION OF ONSAGER RECIPROCAL RELATION,
W69-05441 02G

CALIFORNIA UNIV., RIVERSIDE. DEPT. OF SOIL PHYSICS, AND COLORADO STATE UNIV., FORT COLLINS.
THE EFFECT OF OSMOTIC PRESSURE GRADIENTS ON WATER MOVEMENT IN UNSATURATED SOIL,
W69-05442 02G

CAMBRIDGE UNIV. (ENGLAND).
RUNOFF HYDROGRAPH AS A FUNCTION OF RAINFALL EXCESS,
W69-05438 02A

CANTERBURY UNIV., CHRISTCHURCH (NEW ZEALAND).
EFFECT OF THE LENGTH OF THE TIME PERIOD ON SERIAL CORRELATION,
W69-05506 06D

CARNEGIE-MELLON UNIV., PITTSBURGH, PA. PENNSYLVANIA UNIV., PHILADELPHIA.
MONEY, MULTIPLIER ACCELERATOR INTERACTION AND THE BUSINESS CYCLE,
W69-05291 06B

CASSA PER IL MEZZOGIORNO (ITALY).
THE FUNDAMENTAL ROLE OF WATER IN THE 'CASSA PER IL MEZZOGIORNO' DEVELOPMENT PROGRAMS FOR SOUTHERN ITALY,
W69-05216 06D

CATHOLIC UNIV. OF AMERICA, WASHINGTON, D. C.
COMPARATIVE STUDY OF SNOW TYPE HYDROLOGY OF NORTHEASTERN CANADA AND OF PLAINS OF RUSSIA AND SIBERIA,
W69-05225 02E

CHESTER COUNTY WATER RESOURCES AUTHORITY, WEST CHESTER, PA. AND PENNSYLVANIA UNIV., PHILADELPHIA. INST. FOR ENVIRONMENTAL STUDIES.
THE PLAN AND PROGRAM FOR THE BRANDYWINE.
W69-05299 06B

CHICAGO UNIV., ILL.
DISTRIBUTED LAGS A SURVEY,
W69-05514 06B

CITY OF SAN DIEGO, CALIF.

THE COMPETITION FOR WATER QUALITY DOMESTIC USE,
W69-05527 05G

COLORADO STATE UNIV., SPRINGFIELD. SOUTHEASTERN COLORADO BRANCH STATION.
EFFECT OF FATTY ALCOHOL ON CHANGE IN SOIL WATER DURING THE SUMMER FALLOW PERIOD,
W69-05284 02G

CORPS OF ENGINEERS, BALTIMORE, MD.
FLOOD PLAIN INFORMATION, SOUTHWEST BRANCH, PRINCE GEORGES COUNTY, MARYLAND.
W69-05203 04A

FLOOD PLAIN INFORMATION (ANACOSTIA RIVER), PRINCE GEORGES COUNTY, MARYLAND.
W69-05204 04A

CORPS OF ENGINEERS, BUFFALO, N. Y.
FLOOD PLAIN INFORMATION OF ELLICOTT CREEK IN CITY OF TONAWANDA AND VICINITY, ERIE COUNTY, NEW YORK.
W69-05458 02E

FLOOD PLAIN INFORMATION OF CATTARAUGUS CREEK, ARCADE, WYOMING COUNTY, NEW YORK.
W69-05462 02E

CORPS OF ENGINEERS, FORT WORTH, TEX.
FLOOD PLAIN INFORMATION OF DUCK CREEK, GARLAND, TEXAS.
W69-05459 02E

FLOOD PLAIN INFORMATION, SOUTH MESQUITE CREEK, MESQUITE, TEXAS.
W69-05460 02E

FLOOD PLAIN INFORMATION, TENMILE CREEK, DALLAS COUNTY, TEXAS.
W69-05461 02E

CORPS OF ENGINEERS, JACKSONVILLE, FLA. SOUTH ATLANTIC DIV.
TECHNIQUES OF WATER MANAGEMENT OF LAKE OKEECHOBEE AND THE FLORIDA EVERGLADES,
W69-05223 04A

CORPS OF ENGINEERS, MOBILE, ALA.
FLOOD PLAIN INFORMATION OF PROCTOR CREEK, METROPOLITAN ATLANTA, GEORGIA.
W69-05206 04A

CORPS OF ENGINEERS, SAVANNAH, GA.
FLOOD PLAIN INFORMATION, INTRENCHMENT, SUGAR, DOOLITTLE AND DOLESS CREEKS.
W69-05205 04A

FLOOD PLAIN INFORMATION ON HEADWATERS SOUTH RIVER, METROPOLITAN ATLANTA, GEORGIA.
W69-05207 04A

DEPARTMENT OF AGRICULTURE, WASHINGTON, D. C.
DATA SYSTEMS AND INFORMATION RETRIEVAL ADAPTABLE TO WATER RESOURCES,
W69-05490 06B

DEPT. OF ENERGY, MINES AND RESOURCES, CALGARY (ALBERTA). INLAND WATERS BRANCH.
THE MECHANISM OF NATURAL GROUND-WATER RECHARGE AND DISCHARGE 1. ONE-DIMENSIONAL, VERTICAL, UNSTEADY, UNSATURATED FLOW ABOVE A RECHARGING OR DISCHARGING GROUND-WATER FLOW SYSTEM,
W69-05436 02F

DEPT. OF THE INTERIOR, WASHINGTON, D. C.
DISCUSSION OF REGIONAL RESEARCH IN THE NORTH CENTRAL REGION,
W69-05479 06B

DOW CHEMICAL CO., MIDLAND, MICH.
VARIATION IN THE COMPOSITION OF BRINE FROM THE SYLVANIA FORMATION NEAR MIDLAND, MICHIGAN,
W69-05401 02F

DUKE UNIV., DURHAM, N. C.
THE UTILITY OF DISASTERS,
W69-05288 06B

DUKE UNIV., DURHAM, N. C. DEPT. OF BOTANY.
ISOPIESTIC TECHNIQUE FOR MEASURING LEAF WATER POTENTIALS WITH A THERMOCOUPLE PSYCHROMETER,
W69-05286 02I

ECONOMIC RESEARCH SERVICE, SALT LAKE CITY, UTAH.
ASSESSING IMPACTS OF DECLINING WATER QUALITY ON GROSS VALUE OUTPUT OF AGRICULTURE, A CASE STUDY,
W69-05273 03C

EMSCHERGENOSSENSCHAFT, ESSEN (WEST GERMANY).
LARGE TREATMENT PLANTS OF THE EMSCHER ASSOCIATION AND THEIR IMPORTANCE FOR IMPROVING CONDITIONS OF THE RHINE,
W69-05218 05D

ETHYL CORP., PITTSBURG, CALIF.
THE COMPETITION FOR WATER QUALITY INDUSTRY,
W69-05526 05G

FAIRFAX COUNTY WATER AUTHORITY, ANNANDALE, VA.
COMPLETION OF THE FAIRFAX COUNTY WATER AUTHORITY ACQUISITION PROGRAM.
W69-05539 03D

FEDERAL COUNCIL FOR SCIENCE AND TECHNOLOGY, WASHINGTON, D. C.
WATER RESOURCES POLICY AND POLITICAL INSTITUTIONS.
W69-05295 06B

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, CINCINNATI, OHIO. BIOLOGICAL AND CHEMICAL SECTION.
WRITING A WATER QUALITY REPORT,
W69-05212 10

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, CINCINNATI, OHIO.
IDENTIFICATION AND DIFFERENTIATION OF HEAVY RESIDUAL OIL & ASPHALT POLLUTANTS IN SURFACE WATERS BY COMPARATIVE RATIOS OF INFRARED ABSORBANCES,
W69-05421 05A

PHOSPHORUS IN FLOWING WATERS,
W69-05445 05B

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, CORVALLIS, OREG. PACIFIC NORTHWEST WATER LAB.
EVALUATION OF PRE-IMPOUNDMENT CONDITIONS FOR PREDICTION OF STORED WATER QUALITY,
W69-05468 02H

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, WHEELING, W. VA. OHIO BASIN REGION.
SOURCES OF COAL MINE DRAINAGE POLLUTION, WHEELING CREEK WATERSHED, OHIO.
W69-05202 05B

FISHERIES RESEARCH BOARD, NANAIMO (BRITISH COLUMBIA). PACIFIC OCEANOGRAPHIC GROUP.
A CONTINUOUS SIZE SPECTRUM FOR PARTICULATE MATTER IN THE SEA,
W69-05529 07C

FOREST SERVICE (USDA) JUNEAU, ALASKA. PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION.
HYDROLOGY OF A SLIDE-PRONE GLACIAL TILL SOIL IN SOUTHEAST ALASKA,
W69-05406 02G

FOREST SERVICE (USDA), ASHEVILLE, N. C. SOUTHEASTERN FOREST EXPERIMENT STATION FOREST SERVICE (USDA), MACON, GA. SOUTHERN FOREST FIRE LAB. NORTH CAROLINA DIV. OF FORESTRY.
SEASONAL AND DIURNAL VARIATION IN POCOSIN SHRUB MOISTURE CONTENT,
W69-05331 02I

FOREST SERVICE (USDA), BERKELEY, CALIF. PACIFIC SOUTHWEST FOREST AND RANGE EXPERIMENT STATION.
SNOW ACCUMULATION AS RELATED TO METEOROLOGICAL, TOPOGRAPHIC AND FOREST VARIABLES IN CENTRAL SIERRA NEVADA, CALIFORNIA,
W69-05226 02C

FOREST SERVICE (USDA), FORT COLLINS, COLO. ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION.
ENGINEERING TECHNIQUES AND PRINCIPLES APPLIED TO SOIL EROSION CONTROL,
W69-05333 04D

FOREST SERVICE (USDA), OLUSTEE, FLA. NAVAL STORES AND TIMBER PRODUCTION LAB.
SOIL OR FOLIAR FERTILIZATION OF WELL-DRAINED AND FLOODED SLASH PINE,
W69-05332 02G

FRIED-KRUPP, ESSEN (WEST GERMANY). ZENTRALINSTITUT FUER FORSCHUNG UND ENTWICKLUNG.
PORTABLE WATER PURIFIERS FOR COSTA RICA,
W69-05456 05D

GEOLOGICAL SURVEY, ALBUQUERQUE, N. MEX.
TREATED WATERSHED YIELDS IMPROVED WATER HARVEST,
W69-05410 03B

GEOLOGICAL SURVEY, CARSON CITY, NEV.
WATER-RESOURCES APPRAISAL OF THE SNAKE RIVER BASIN IN NEVADA,
W69-05414 02E

GEOLOGICAL SURVEY, CHEYENNE, WYO. WATER RESOURCES DIVISION.
TIME-OF-TRAVEL MEASUREMENTS AND OTHER APPLICATIONS OF DYE TRACING,
W69-05228 07B

GEOLOGICAL SURVEY, COLUMBIA, S. C.
SALT-WATER ENCROACHMENT OF TERTIARY LIMESTONE ALONG COASTAL SOUTH CAROLINA,
W69-05473 02L

GEOLOGICAL SURVEY, MADISON, WIS.
DETERMINING THE RATIO OF HORIZONTAL TO VERTICAL PERMEABILITY BY AQUIFER-TEST ANALYSIS,
W69-05452 02F

GEOLOGICAL SURVEY, MENLO PARK, CALIF.
RAINFALL-RUNOFF MODEL FOR SMALL BASIN FLOOD HYDROGRAPH SIMULATION,
W69-05420 02A

GEOLOGICAL SURVEY, PHILADELPHIA, PA.
THE LONGITUDINAL DIFFUSION COEFFICIENT IN THE DELAWARE RIVER ESTUARY AS DETERMINED FROM A STEADY-STATE MODEL,
W69-05428 02L

GEOLOGICAL SURVEY, RICHMOND, VA.
FLOODS IN VIRGINIA - MAGNITUDE AND FREQUENCY,
W69-05415 02E

GEOLOGICAL SURVEY, WASHINGTON, D. C.
IMPROVED DYES FOR WATER TRACING,
W69-05235 07B

NOMOGRAPHS FOR DETERMINING AMOUNT OF RHODAMINE B DYE FOR TIME-OF-TRAVEL STUDIES,
W69-05236 07B

SELECTION OF DYE-INJECTION AND MEASURING SITES FOR TIME-OF-TRAVEL STUDIES,
W69-05238 07B

COMPARISON OF RESULTS USING THREE SAMPLING TECHNIQUES FOR A FLUOMETRIC DYE STUDY IN A STREAM,
W69-05239 07B

COMPARISON OF FLOOD-WAVE AND WATER-PARTICLE TRAVELTIMES,
W69-05240 02E

DYE-CLOUD PHOTOGRAPHY,
W69-05241 07B

A MICROKIT FOR DISSOLVED OXYGEN DETERMINATION,
W69-05242 07B

FIELD KIT FOR DETERMINING ALKALINITY,
W69-05243 07B

RAPID FIELD FILTRATION OF WATER SAMPLES,
W69-05244 07B

FIELD MONITORING OF THE QUALITY OF WATER DURING THE DRILLING OF WELLS,
W69-05245 07B

SAMPLING APPARATUS TO MINIMIZE AERATION OF WATER FOR THE DETERMINATION OF DISSOLVED GASES,
W69-05246 07B

USE OF CARBON DIOXIDE IN BUBBLE GAGES TO PREVENT PRECIPITATION OF CALCIUM CARBONATE,
W69-05247 07B

POLYETHYLENE OIL TUBES FOR STILLING WELLS,
W69-05248 07B

WATER-MANOMETER-AIR-LINE ASSEMBLY FOR DETERMINING DEPTH TO WATER IN WELLS,
W69-05249 07B

MINIMUM AND MAXIMUM WATER-LEVEL RECORDING DEVICES,
W69-05250 07B

PSYCHROMETER,
W69-05251 07B

ADAPT FOR EVAPORATION-MEASUREMENT EQUIPMENT,
W69-05252 07B

WATER-STAGE AND RAINFALL DUAL RECORDER,
W69-05253 07B

POLAR COORDINATE CHART READER FOR STAGE-RAINFALL RECORDER,
W69-05254 07B

CORRECTING RIVER VELOCITIES MEASURED FROM AN UNANCHORED SHIP,
W69-05255 07B

PATTERNS OF BACKWATER AND DISCHARGE ON SMALL ICE-AFFECTED STREAMS,
W69-05256 07B

VARIABLE-SPEED POWER EQUIPMENT FOR DEPTH-INTEGRATION SEDIMENT SAMPLING,
W69-05257 07B

ELECTRIC CONTROL SYSTEM FOR DUAL OPERATION OF CURRENT METER AND SUSPENDED-SEDIMENT SAMPLER,
W69-05258 07B

CHARACTERISTICS OF LOGARITHMIC RATING CURVES,
W69-05259 07B

INTERPRETATION OF FLOOD-FREQUENCY DATA,
W69-05260 07B

AN OUTLINE OF GEOPHYSICAL LOGGING METHODS AND THEIR USES IN HYDROLOGIC STUDIES,
W69-05261 07B

WATER RESOURCES OF THE SALMON FALLS CREEK BASIN, IDAHO-NEVADA,
W69-05409 02E

HYDROLOGIC EFFECTS OF THE 1962-66 DROUGHT ON LONG ISLAND, N. Y.,
W69-05411 02A

FREQUENCY CURVES FOR ANNUAL FLOOD SERIES WITH SOME ZERO EVENTS OR INCOMPLETE DATA,
W69-05455 07C

GEORGIA UNIV., ATHENS. SCHOOL OF FORESTRY AND NORTHEASTERN FOREST EXPERIMENT STATION, UPPER DARBY, PA.
THE DEFENSE OF EXPERIMENTAL WATERSHEDS,
W69-05405 02A

GIDROMETEOROLOGICHESKII INSTITUT, ODESSA (USSR).
MOUNTAIN RIVER FLOOD RUNOFF THEORY, MEANS OF ITS INVESTIGATION AND CALCULATION,
W69-05230 02A

NUMERICAL FORECASTING OF MOUNTAIN RIVER FLOOD RUNOFF ON THE BASIS OF ESTABLISHING TERRITORIALLY - GENERALIZED RELATIONSHIPS,
W69-05231 02A

GREATER PORTLAND CHAMBER OF COMMERCE, MAINE UNION DESIGN GROUPS, NEWPORT, R. I.
HARBOR DEVELOPMENT PORT OF PORTLAND, MAINE.
W69-05298 06B

GUELPH UNIV. (ONTARIO).
HYDRODYNAMIC DISPERSION IN A SATURATED HOMOGENEOUS POROUS MEDIUM AT LOW PECLET NUMBERS AND NONHOMOGENEOUS SOLUTION,
W69-05434 01B

HAWAII INST. OF GEOPHYSICS, HONOLULU.
EVALUATION OF SOME GEOPHYSICAL TECHNIQUES APPLIED TO THE ENVIRONMENT OF A MAUI WELL,
W69-05418 02F

HYDROLOGICAL RESEARCH UNIT, WALLINGFORD (ENGLAND) GIBB (ALEXANDER) AND PARTNERS, LONDON (ENGLAND).
THE ASSESSMENT OF RUNOFF FROM A MOUNTAINOUS AND SEMI-ARID AREA IN WESTERN IRAN,
W69-05233 02E

HYDROMETEOROLOGICAL CENTRE (USSR).
STUDIES OF RUNOFF FORMATION UNDER CONDITION OF HIGH-ANGLE ATTITUDE OF THE IMPERVIOUS BED,
W69-05229 02E

IDAHO UNIV., MOSCOW. WATER RESOURCES RESEARCH INST.
LIMNOLOGICAL STUDIES OF LENTIC WATERS,
W69-05302 02H

A LETHAL INDEX FOR CLASSIFYING CHEMICALS WHICH AFFECT WATER QUALITY OF AQUATIC LIFE,
W69-05303 05C

STUDIES ON METHODS OF SOIL WATER DETERMINATION,
W69-05304 02G

STUDIES OF METHODS OF SOIL WATER DETERMINATION,
W69-05305 02G

ILLINOIS UNIV., URBANA.
FACTOR ANALYSIS AND REGRESSION,
W69-05517 06B

IMPERIAL COLL. OF SCIENCE AND TECHNOLOGY, LONDON (ENGLAND).
DESIGN CRITERIA FOR LABORATORY CATCHMENT EXPERIMENTS, WITH PARTICULAR REFERENCE TO RAINFALL SIMULATION,
W69-05234 02A

INDIAN AGRICULTURAL RESEARCH INST., NEW DELHI. DIV. OF BOTANY.
MEASUREMENT OF DROUGHT RESISTANCE IN CROP PLANTS,
W69-05265 02G

INSTITUTE FOR LAND AND WATER MANAGEMENT RESEARCH, WAGENINGEN (NETHERLANDS).
A METHOD OF DETERMINING EVAPOTRANSPIRATION IN SOIL MONOLITHS,
W69-05270 02D

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT, WASHINGTON, D. C.
WATER SUPPLY PROBLEMS IN DEVELOPING COUNTRIES,
W69-05513 03D

INTER-AMERICAN CENTER FOR INTEGRAL DEVELOPMENT OF LAND AND WATER RESOURCES.
INTERGRATING HUMAN-SOCIAL RESOURCES INTO THE WATER RESOURCE DEVELOPMENT PROJECT,
W69-05217 06B

IOWA STATE UNIV., AMES.
WATER ALLOCATION SUPPLY AND DEMAND RELATIONSHIPS,
W69-05483 06B

REGIONAL ECONOMIC DEVELOPMENT AND WATER,
W69-05488 06B

IOWA UNIV., IOWA CITY. AGRICULTURAL LAW CENTER.
LEGAL ASPECTS OF THE SMALL WATERSHED PROGRAM IN IOWA,
W69-05339 04D

JOHNS-MANVILLE PRODUCTS CORP., MANVILLE, N. J.
A PILOT PLANT STUDY FOR REMOVAL OF SOLUBLE SILICA FROM ROSWELL, NEW MEXICO WATER. PHASE 1. INITIAL CONSTRUCTION AND OPERATION,
W69-05335 03A

JOINT UNITED STATES-MEXICO INTERNATIONAL ATOMIC ENERGY AGENCY STUDY TEAM.
NUCLEAR POWER AND WATER DESALTING PLANTS FOR SOUTHWEST UNITED STATES AND NORTHWEST MEXICO.
W69-05208 03A

KANSAS STATE UNIV., MANHATTAN WEATHER BUREAU, SILVER SPRING, MD.
RELATIONSHIP OF PALMER DROUGHT VARIABLES TO YIELD OF WINTER WHEAT,
W69-05283 03F

KANSAS STATE UNIV., MANHATTEN.
DISCUSSION OF CONCEPTUAL ISSUES IN THE CONDUCT OF REGIONAL RESEARCH ON THE ECONOMICS OF WATER,
W69-05481 06B

KANSAS UNIV, LAWRENCE AND ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA, PA.

A LIMNOLOGICAL RECONNAISSANCE OF AN IMPOUNDMENT RECEIVING HEAVY METALS WITH EMPHASIS OF DIATOMS AND FISH,
W69-05465 02H

KANSAS UNIV., LAWRENCE.
UNSTEADY FLOW PARAMETERS IN HYDRAULIC DESIGN,
W69-05408 08B

WATER QUALITY CHANGES IN CONFINED HOG WASTE TREATMENT,
W69-05417 05D

KENTUCKY UNIV., LEXINGTON AND TEXAS A AND M UNIV., COLLEGE STATION. WATER RESOURCES INST.
PREDICTION OF SEDIMENT PROFILES IN OPEN CHANNEL FLOW BY TURBULENT DIFFUSION THEORY,
W69-05403 02J

MACDONALD (MURDOCH) AND PARTNERS, LONDON (ENGLAND).
THE ASSESSMENT OF SURFACE RUNOFF FROM RAINFALL DATA FOR AN ARID REGION OF WEST PAKISTAN,
W69-05232 02E

MARYLAND UNIV., COLLEGE PARK.
AN EXPERIMENTAL INVESTIGATION OF PARTIAL AREA CONTRIBUTIONS,
W69-05227 02A

METEOROLOGICAL SERVICE OF CANADA, TORONTO (ONTARIO). HYDROMETEOROLOGY SECTION.
HYDROMETEOROLOGICAL STUDIES IN SUPPORT OF THE INTERNATIONAL FIELD YEAR FOR THE GREAT LAKES,
W69-05222 02B

MICHIGAN STATE UNIV., EAST LANSING.
WATER RESOURCE DEVELOPMENT PUBLIC AND PRIVATE INVESTMENT,
W69-05486 06B

MICHIGAN UNIV., ANN ARBOR.
A COMMENT ON OPTIMIZATION METHODS FOR BRANCHING MULTISTAGE WATER RESOURCE SYSTEMS,
W69-05499 06A

MINISTRY OF IRRIGATION AND POWER (INDIA).
ECONOMICS AND FINANCING OF IRRIGATION PROJECTS,
W69-05221 06C

MINISTRY OF PUBLIC WORKS (SOUTH VIETNAM).
WATER SUPPLY IN THE BRACKISH-WATER REGIONS OF SOUTH VIETNAM.
W69-05457 02L

MINISTRY OF PUBLIC WORKS (VENEZUELA). DEPT. OF HYDRAULIC WORKS.
THE ORGANIZATION OF VENEZUELA FOR THE UTILIZATION OF ITS WATER RESOURCES (SPANISH),
W69-05220 06E

MINNESOTA UNIV., ST. PAUL, SCHOOL OF FORESTRY ARIZONA UNIV., TUCSON, DEPT. OF WATERSHED MANAGEMENT.
THE INTERCEPTION-TRANSPIRATION RELATIONSHIP OF WHITE SPRUCE AND WHITE PINE,
W69-05274 02D

MISSOURI UNIV., COLUMBIA HAWAII UNIV., HONOLULU, WATER RESOURCES RESEARCH CENTER AND ARIZONA UNIV., TUCSON. AGRICULTURAL EXTENSION SERVICE.
MEASUREMENT OF SMALL SURFACE DISPLACEMENTS INDUCED BY FLUID FLOW,
W69-05433 02F

MISSOURI UNIV., COLUMBIA.
A LAWYER LOOKS AT WATER RESOURCE ECONOMICS,
W69-05292 06E

MONTANA STATE UNIV., BOZEMAN. DEPT. OF BOTANY AND MICROBIOLOGY.
EFFECT OF IMPOUNDMENTS ON PRODUCTIVITY, WATER CHEMISTRY, AND HEAT BUDGETS OF RIVERS,
W69-05469 02H

NATIONAL WATERWAYS CONFERENCE, INC., WASHINGTON, D. C.
THE ORIGIN AND DEVELOPMENT OF THE WATERWAYS POLICY OF THE UNITED STATES,
W69-05338 04A

NEBRASKA UNIV., LINCOLN WASHINGTON STATE UNIV., PULLMAN.
SOIL MOISTURE CONDITIONS UNDER PASTURES OF COOL-SEASON AND WARM-SEASON GRASSES,
W69-05266 02G

NEVADA UNIV., RENO CORNELL UNIV., ITHACA, N. Y.
EFFECTS OF MOISTURE AND FERTILIZER ON YIELDS OF SPRING WHEAT AND BARLEY,
W69-05263 02I

NEW HAMPSHIRE UNIV., DURHAM NATIONAL MARINE WATER QUALITY LAB., KINGSTON, R. I.
DEMONSTRATION OF A TOXIN FROM APHANIZOMENON FLOS-AQUAE (L.) RALFS,
W69-05306 05C

NEW HAMPSHIRE UNIV., DURHAM.
ECONOMIC ANALYSIS OF PUBLIC WATER SUPPLY IN THE PISCATAQUA RIVER WATERSHED,
W69-05510 03E

NEW SOUTH WALES UNIV. KENSINGTON (AUSTRALIA) AND COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, CANBERRA (AUSTRALIA). DIV. OF LAND RESEARCH.
RECURRENCE INTERVALS BETWEEN EXCEEDANCES OF SELECTED RIVER LEVELS. 2. ALTERNATIVES TO A MARKOV MODEL,
W69-05454 02E

NEW SOUTH WALES UNIV., KENSINGTON (AUSTRALIA).
THE ESTIMATION OF MARGINAL PRODUCT FROM A COBB-DOUGLAS PRODUCTION FUNCTION,
W69-05521 06B

NEW YORK STATE DEPT. OF CONSERVATION, ALBANY. DIV. OF WAT RESOURCES.
A STATE VIEWPOINT ON RIVER BASIN PLANNING,
W69-05209 06B

NORTH CAROLINA UNIV., CHAPEL HILL. INST. OF GOVERNMENT A NORTH CAROLINA STATE UNIV., RALEIGH. WATER RESOURCES RESEARCH INST.
PROCEEDINGS OF SYMPOSIUM ON BETTER WATER AND SEWER SERVI FOR SMALL COMMUNITIES IN NORTH CAROLINA,
W69-05424 06B

NORTH CAROLINA UNIV., CHAPEL HILL. WATER RESOURCES RESEAR INST.
PROCEEDINGS-SYMPOSIUM ON BETTER WATER AND SEWER SERVICES SMALL COMMUNITIES IN NORTH CAROLINA.
W69-05312 03D

NORTH CENTRAL AGRICULTURAL EXPERIMENT STATION, IOWA CITY, IOWA.
REGIONAL AND NATIONAL PLANNING OF AGRICULTURAL RESEARCH,
W69-05482 06B

NORTH DAKOTA UNIV., GRAND FORKS. DEPT. OF BIOLOGY.
RESERVOIR EUTROPHICATION AND DYSTROPHICATION FOLLOWING IMPOUNDMENT,
W69-05471 02H

NOTTINGHAM UNIV. (ENGLAND) AND STANFORD UNIV., PALO ALTO, CALIF.
THE TYPICAL SPECTRAL SHAPE OF AN ECONOMIC VARIABLE,
W69-05522 06D

OFFICE OF SALINE WATER, WASHINGTON, D. C.
BASIC STUDIES OF SCALE CONTROL,
W69-05334 03A

OHIO AGRICULTURAL RESEARCH AND DEVELOPMENT CENTER, WOOSTER
A PROPOSED MECHANICS FOR THE INVESTIGATION OF SURFACE RU FROM SMALL WATERSHEDS. 1, DEVELOPMENT,
W69-05425 02A

OHIO STATE UNIV., COLUMBUS.
IDENTIFICATION OF ZOOGLOEA SPECIES AND THE RELATIONSHIP ZOOGLOEAL MATRIX AND FLOC FORMATION,
W69-05313 05C

DEVELOPMENT OF BIOLOGICAL INDICES TO POLLUTION LEVELS IN STREAMS AFFECTED BY ACID MINE DRAINAGE AND OIL FIELD BRI WASTES,
W69-05407 05A

OHIO STATE UNIV., COLUMBUS. WATER RESOURCES CENTER.
THE MICROBIAL FLORA OF ACID MINE WATER AND ITS RELATIONS TO FORMATION AND REMOVAL OF ACID,
W69-05314 05G

OREGON AGRICULTURAL EXPERIMENT STATION, CORVALLIS PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION, CORVALLIS, ORE. AND LOUVAIN UNIV. (BELGIUM).
PORE SIZE DISTRIBUTIONS AS MEASURED BY THE MERCURY INTRU METHOD AND THEIR USE IN PREDICTING PERMEABILITY,
W69-05439 02G

OREGON STATE UNIV., CORVALLIS.
CONCEPTUAL ISSUES IN THE CONDUCT OF REGIONAL RESEARCH ON ECONOMICS OF WATER,
W69-05480 06B

OREGON STATE UNIV., CORVALLIS. DEPT. OF CIVIL ENGINEERING AND STANFORD UNIV., CALIF. DEPT. OF CIVIL ENGINEERING.
SHOALING OF SOLITARY WAVES ON SMALL SLOPES,
W69-05450 02H

OREGON STATE UNIV., CORVALLIS. FOREST RESEARCH LAB.
PREDICTING TEMPERATURES OF SMALL STREAMS,
W69-05427 02E

OREGON STATE UNIV., CORVALLIS. WATER RESOURCES RESEARCH INST.
WATER LAW, POLITICS, AND ECONOMICS OUR COMPLEX WATER L AND WATER USE CUSTOMS,
W69-05296 06E

WATER LAW, POLITICS, AND ECONOMICS FEDERAL CONTROL OF WATER RESOURCES,
W69-05297 06E

PEAT, MARWICK, MITCHELL AND CO., SAN DIEGO, CALIF.
THE ACCOUNTANT'S VIEWPOINT ON WATER PRICING POLICY,
W69-05494 06C

PENNSYLVANIA STATE UNIV., UNIVERSITY PARK COLORADO UNIV., BOULDER.
GRANITES, GRUSSES, AND THE SHERMAN EROSION SURFACE, SOUT LARAMIE RANGE, COLORADO-WYOMING,
W69-05211 02J

PENNSYLVANIA STATE UNIV., UNIVERSITY PARK.
EFFECT OF MOISTURE REGIMES AND HARVESTS ON EFFICIENCY OF WATER USE BY TEN FORAGE CROPS,
W69-05268 02I

DISCUSSION OF REGIONAL ECONOMIC DEVELOPMENT AND WATER,
W69-05489 06B

DISCUSSION OF DATA SYSTEMS AND INFORMATION RETRIEVAL
DAPTABLE TO WATER RESOURCES,
9-05491 06B

NCETON UNIV., N. J.
NOTE ON THE DUAL PRICES OF INTEGER PROGRAMS,
9-05523 06C

NCETON UNIV., N. J. LEWIS F. MOODY HYDRODYNAMICS LAB.,
PRINCETON UNIV., N. J. DEPT. OF CIVIL AND GEOLOGICAL
NEERING.
TIFICIAL MIXING OF DENSITY-STRATIFIED FLUIDS A
BORATORY INVESTIGATION,
9-05412 02H

MANUFACTURERS RESEARCH LEAGUE, INC., APPLETON, WIS.
MPONENTS OF WOOD PULP BLEACH EFFLUENTS,
9-05402 05A

AB AGRICULTURAL UNIV., HISSAR (INDIA). COLL. OF
CULTURE.
UDIES ON WATER USE IN PEA (PISUM SATIVUM L.),
9-05287 03F

UE UNIV., LAFAYETTE, IND.
TATISTICAL ANALYSIS OF GROUND WATER USE AND REPLENISHMENT,
9-05475 02F

NSLAND UNIV., BRISBANE (AUSTRALIA). DEPT. OF BOTANY.
SSUE WATER RELATIONS FOR BRIGALOW AND MULGA,
9-05281 02I

N'S UNIV., KINGSTON (ONTARIO).
NG SWINGS,
9-05498 06B

ING UNIV. (ENGLAND). DEPT. OF GEOPHYSICS.
THE REPRESENTATION OF THE REYNOLDS STRESS IN A TIDAL
TUARY,
9-05213 02L

ARCH COUNCIL OF ALBERTA, EDMONTON.
UID FLOW IN THE WESTERN CANADA SEDIMENTARY BASIN - 1.
FECT OF TOPOGRAPHY,
9-05451 02F

ARCH FOR THE FUTURE, INC., WASHINGTON, D. C.
JOR RESEARCH PROBLEMS IN WATER QUALITY,
9-05519 05G

E ISLAND UNIV., KINGSTON. WATER RESOURCES CENTER.
STUDY OF THE EFFECT OF TAXATION ON THE SIX PRIVATE OR
ASI-MUNICIPAL WATER UTILITIES IN RHODE ISLAND,
9-05316 06C

RT A. TAFT SANITARY ENGINEERING CENTER, CINCINNATI,
. CINCINNATI WATER RESEARCH LAB.
TER QUALITY IN IMPOUNDMENTS AND MODIFICATIONS FROM
STRATIFICATION,
9-05467 02H

PPS INSTITUTION OF OCEANOGRAPHY, SAN DIEGO, CALIF.
. OF MARINE RESOURCES.
FECTS OF PHOSPHATE CONCENTRATION ON CELL DIVISION RATES
D YIELD OF A TROPICAL OCEANIC DIATOM,
9-05530 05C

ETY OF HYDROGEOLOGICAL SCIENTISTS GRAZ, (AUSTRIA).
LT WATER ENCROACHMENT IN KARST AQUIFERS, ISLAND OF
PHALLINIA, (IONIAN),
9-05472 02L

CONSERVATION SERVICE, MCCOOK, NEBR.
AT CHANNEL TERRACES,
9-05282 02J

CONSERVATION SERVICE, WASHINGTON, D. C.
ST FORK DUCK CREEK WATERSHED NOBLE AND WASHINGTON
UNTIES, OHIO.
9-05329 06B

H DAKOTA STATE UNIV., BROOKINGS AND WISCONSIN UNIV.,
SON.
GIONAL RESEARCH IN WATER IN THE NORTH CENTRAL REGION,
9-05478 06B

H DAKOTA STATE UNIV., BROOKINGS.
SCUSSION OF WATER ALLOCATION SUPPLY AND DEMAND
LATIONSHIPS,
9-05485 06B

HERN ILLINOIS UNIV., CARBONDALE. DEPT. OF BOTANY.
SERVOIR MANAGEMENT PROBLEMS CREATED BY INCREASED
OSPHORUS LEVELS OF SURFACE WATERS,
9-05470 02H

FORD UNIV., PALO ALTO, CALIF.
E OF THE DURBIN-WATSON STATISTIC IN INAPPROPRIATE
TUATIONS,
9-05516 06D

E HYDROLOGICAL INST., LENINGRAD (USSR).
OBLEMS OF THE METHODS AND ACCURACY OF HYDROLOGIC
SERVATIONS (RUSSIAN),
9-05210 07A

APORATION FROM BOGS IN THE EUROPEAN TERRITORY OF THE USSR,
9-05214 02D

CANAL AUTHORITY RESEARCH CENTER, ISMAILIA (EGYPT).
TER WAVES OVER A RECTANGULAR CHANNEL THROUGH A REEF,
W69-05448 02L

TECHNICAL UNIV. OF BUDAPEST (HUNGARY).
INCREASING OR DECREASING RETURNS TO SCALE IN THE CONSTANT
ELASTICITY OF SUBSTITUTION PRODUCTION FUNCTION,
W69-05505 06D

TEL AVIV UNIV. (ISRAEL).
CAPITAL FORMATION AND GOVERNMENT CAPITAL POLICY IN
DEVELOPING ECONOMIES,
W69-05518 06C

TENNESSEE UNIV., KNOXVILLE. DEPT. OF SANITARY ENGINEERING.
WATER QUALITY INVESTIGATION, PART 1 - BASIC DATA, FORT
LOUDOUN RESERVOIR, APRIL 1966 - JUNE 1968,
W69-05416 05A

TENNESSEE VALLEY AUTHORITY, KNOXVILLE.
USING ANALYTICAL METHODS TO DEVELOP A SURFACE-RUNOFF MODEL,
W69-05431 02A

TENNESSEE VALLEY AUTHORITY, KNOXVILLE. DIV. OF NAVIGATION
DEVELOPMENT.
BROAD SCOPE OF NAVIGATION'S ECONOMIC IMPACT,
W69-05449 06B

TENNESSEE VALLEY AUTHORITY, NORRIS. ENGINEERING LAB.
THE MECHANICS OF STRATIFIED FLOW IN RESERVOIRS,
W69-05464 02H

TEXAS A AND M UNIV., COLLEGE STATION AND TEXAS UNIV.,
AUSTIN.
OPTIMIZATION METHODS FOR BRANCHING MULTISTAGE WATER RESOURCE
SYSTEMS--A REPLY TO A COMMENT BY E. F. BRATER,
W69-05501 06A

TEXAS A AND M UNIV., COLLEGE STATION. DEPT. OF PLANT
SCIENCES.
PESTICIDE LEVELS AND FLUCTUATION IN SOIL BACTERIA IN AN
IRRIGATED FIELD AND A POND OF SOUTHWEST TEXAS,
W69-05272 05C

TEXAS AGRICULTURAL EXPERIMENT STATION, EL PASO.
VARIABLE ROW SPACING OF IRRIGATED COTTON AS A MEANS FOR
REDUCING PRODUCTION COSTS AND CONSERVING WATER,
W69-05277 03F

THOMAS J. WATSON RESEARCH CENTER, YORKTOWN HEIGHTS, N. Y.
SYNTHETIC HYDROGRAPHS EFFECTS OF NETWORK GEOMETRY,
W69-05432 02A

COMPUTER EXPERIMENTS WITH FRACTIONAL GAUSSIAN NOISES, PARTS
1, 2, AND 3,
W69-05453 07C

THOMAS J. WATSON RESEARCH CENTER, YORKTOWN HEIGHTS, N. Y.
AND OHIO STATE UNIV., COLUMBUS.
AN ALTERNATIVE PROOF OF HANNAN'S THEOREM ON CANONICAL
CORRELATION AND MULTIPLE EQUATION SYSTEMS,
W69-05511 06D

U S GEOLOGICAL SURVEY, WASHINGTON, D. C.
CONSTANT-RATE-INJECTION EQUIPMENT FOR DYE-DILUTION DISCHARGE
MEASUREMENTS,
W69-05237 07B

UNIVERSITY OF SOUTHERN CALIFORNIA, LOS ANGELES.
STATEMENT,
W69-05497 06C

UTAH STATE UNIV., LOGAN. DEPT. OF PLANT SCIENCE.
EFFECT OF EARLY-SUMMER SEEDING OF WINTER WHEAT ON YIELD,
SOIL MOISTURE, AND SOIL NITRATE,
W69-05280 03F

UTAH UNIV., SALT LAKE CITY.
THE ECONOMICS OF WATER ALLOCATION IN UTAH,
W69-05507 06D

VOLCANI INST. OF AGRICULTURAL RESEARCH, BET DAGAN (ISRAEL)
AND ISRAEL METEOROLOGICAL SERVICE, BET DAGAN.
AN ACCURATE SMALL ORIFICE RAIN GAGE,
W69-05404 07B

WARWICK UNIV., COVENTRY (ENGLAND).
WELFARE ECONOMICS, ECONOMIC GROWTH AND THE CHOICE OF
TECHNIQUES,
W69-05500 06B

WASHINGTON UNIV., SEATTLE WASHINGTON STATE UNIV., PULLMAN.
FOURTH ANNUAL REPORT OF THE STATE OF WASHINGTON WATER
RESEARCH CENTER, 1968.
W69-05322 09D

WEATHER BUREAU, SILVER SPRING, MD.
THE WEATHER BUREAU AND WATER MANAGEMENT.
W69-05336 07C

WHITE RIVER BASIN COORDINATING COMMITTEE.
COMPREHENSIVE BASIN STUDY ON WHITE RIVER BASIN, ARKANSAS AND
MISSOURI.
W69-05201 06B

WISCONSIN UNIV., MADISON.
AN INCOME-NET WORTH APPROACH TO MEASURING ECONOMIC WELFARE,
W69-05290 06B

NITROGEN CYCLE IN SURFACE AND SUBSURFACE WATERS,
W69-05323 05B

DISCUSSION OF WATER RESOURCE DEVELOPMENT PUBLIC AND

PRIVATE INVESTMENT,
W69-05487 06B

WISCONSIN UNIV., MADISON. DEPT. OF SOILS AGRICULTURAL RESEARCH SERVICE, WASHINGTON, D. C.
DETERMINATION OF ORGANOCHLORINE INSECTICIDES IN SOILS AND WATERS,
W69-05325 05A

WISCONSIN UNIV., MADISON. LAB. OF LIMNOLOGY,
BIOLOGICAL ASPECTS OF EUTROPHICATION IN LAKES MENDOTA, CRYSTAL, TROUT AND GREEN,
W69-05324 02H

WORLD HEALTH ORGANIZATION, GENEVA (SWITZERLAND).
WATER FOR LIVING,
W69-05219 05C

WORLD METEOROLOGICAL ORGANIZATION, GENEVA (SWITZERLAND).
PREPARATION OF CO-ORDINATED PRECIPITATION, RUNOFF AND EVAPORATION MAPS,
W69-05337 02A

WYOMING UNIV., LARAMIE. WATER RESOURCES RESEARCH INST.
COMPUTERIZED SYSTEM FOR WYOMING SURFACE WATER RECORDS,
W69-05326 02E

ACCESSION NUMBER INDEX

6B	W69-05201
6B	W69-05202
6A	W69-05203
6A	W69-05204
6A	W69-05205
6A	W69-05206
6A	W69-05207
6A	W69-05208
6B	W69-05209
6A	W69-05210
6J	W69-05211
6O	W69-05212
6L	W69-05213
6D	W69-05214
6G	W69-05215
6D	W69-05216
6B	W69-05217
6D	W69-05218
6C	W69-05219
6E	W69-05220
6C	W69-05221
6B	W69-05222
6A	W69-05223
6E	W69-05225
6C	W69-05226
6A	W69-05227
6B	W69-05228
6E	W69-05229
6A	W69-05230
6A	W69-05231
6E	W69-05232
6E	W69-05233
6A	W69-05234
6B	W69-05235
6B	W69-05236
6B	W69-05237
6B	W69-05238
6B	W69-05239
6E	W69-05240
6B	W69-05241
6B	W69-05242
6B	W69-05243
6B	W69-05244
6B	W69-05245
6B	W69-05246
6B	W69-05247
6B	W69-05248
6B	W69-05249
6B	W69-05250
6B	W69-05251
6B	W69-05252
6B	W69-05253
6B	W69-05254
6B	W69-05255
6B	W69-05256
6B	W69-05257
6B	W69-05258
6B	W69-05259
6B	W69-05260
6B	W69-05261
6G	W69-05262
6	W69-05263
6G	W69-05264
6G	W69-05265
6G	W69-05266
6	W69-05267
6	W69-05268
6G	W69-05269
6	W69-05270
6	W69-05271
6	W69-05272
6	W69-05273
6	W69-05274
6A	W69-05275
6	W69-05276
03F	W69-05277
02I	W69-05278
03F	W69-05279
03F	W69-05280
02I	W69-05281
02J	W69-05282
03F	W69-05283
02G	W69-05284
03F	W69-05285
02I	W69-05286
03F	W69-05287
06B	W69-05288
06B	W69-05289
06B	W69-05290
06B	W69-05291
06E	W69-05292
06E	W69-05293
03F	W69-05294
06B	W69-05295
06E	W69-05296
06E	W69-05297
06B	W69-05298
06B	W69-05299
02H	W69-05302
05C	W69-05303
02G	W69-05304
02G	W69-05305
05C	W69-05306
03D	W69-05312
05C	W69-05313
05G	W69-05314
06C	W69-05316
09D	W69-05322
05B	W69-05323
02H	W69-05324
05A	W69-05325
02E	W69-05326
05D	W69-05327
05D	W69-05328
06B	W69-05329
03F	W69-05330
02I	W69-05331
02G	W69-05332
04D	W69-05333
03A	W69-05334
03A	W69-05335
07C	W69-05336
02A	W69-05337
04A	W69-05338
04D	W69-05339
06E	W69-05340
06E	W69-05341
04A	W69-05342
04A	W69-05343
04A	W69-05344
04D	W69-05345
06E	W69-05346
06E	W69-05347
06E	W69-05348
06E	W69-05349
06E	W69-05350
06E	W69-05351
06E	W69-05352
06E	W69-05353
06E	W69-05354
06E	W69-05355
06E	W69-05356
06E	W69-05357
06E	W69-05358
06E	W69-05359
06E	W69-05360
04A	W69-05361
04A	W69-05362
04A	W69-05363
04A	W69-05364
06E	W69-05365
06E	W69-05366
06E	W69-05367
04A	W69-05368
04A	W69-05369
05G	W69-05370
06E	W69-05371
06E	W69-05372
06E	W69-05373
04C	W69-05374
06E	W69-05375
05B	W69-05376
04A	W69-05377
04C	W69-05378
04C	W69-05379
06E	W69-05380
04A	W69-05381
04A	W69-05382
06E	W69-05383
04A	W69-05384
05C	W69-05385
05G	W69-05386
05C	W69-05387
06E	W69-05388
05G	W69-05389
04A	W69-05390
04A	W69-05391
04A	W69-05392
04A	W69-05393
04A	W69-05394
04A	W69-05395
04A	W69-05396
04A	W69-05397
06E	W69-05398
06E	W69-05399
04A	W69-05400
02F	W69-05401
05A	W69-05402
02J	W69-05403
07B	W69-05404
02A	W69-05405
02G	W69-05406
05A	W69-05407
08B	W69-05408
02E	W69-05409
03B	W69-05410
02A	W69-05411
02H	W69-05412
02F	W69-05413
02E	W69-05414
02E	W69-05415
05A	W69-05416
05D	W69-05417
02F	W69-05418
08E	W69-05419
02A	W69-05420
05A	W69-05421
05D	W69-05422
02E	W69-05423
06B	W69-05424
02A	W69-05425
02A	W69-05426
02E	W69-05427
02L	W69-05428
02A	W69-05431
02A	W69-05432
02F	W69-05433
01B	W69-05434
07C	W69-05435
02F	W69-05436
02A	W69-05438
02G	W69-05439
02G	W69-05440
02G	W69-05441
02G	W69-05442
02G	W69-05443
02J	W69-05444
05B	W69-05445
02I	W69-05446
02L	W69-05447
02L	W69-05448
06B	W69-05449
02H	W69-05450
02F	W69-05451
02F	W69-05452
07C	W69-05453
02E	W69-05454
07C	W69-05455
05D	W69-05456
02L	W69-05457
02E	W69-05458
02E	W69-05459
02E	W69-05460
02E	W69-05461
02E	W69-05462
02H	W69-05463
02H	W69-05464
02H	W69-05465
02H	W69-05466
02H	W69-05467
02H	W69-05468
02H	W69-05469
02H	W69-05470
02H	W69-05471
02L	W69-05472
02L	W69-05473
02F	W69-05474
02F	W69-05475
06B	W69-05478
06B	W69-05479
06B	W69-05480
06B	W69-05481
06B	W69-05482
06B	W69-05483
06B	W69-05485
06B	W69-05486
06B	W69-05487
06B	W69-05488
06B	W69-05489
06B	W69-05490
06B	W69-05491
06C	W69-05492
06C	W69-05493
06C	W69-05494
06C	W69-05495
06C	W69-05497
06B	W69-05498
06A	W69-05499
06B	W69-05500
06A	W69-05501
06B	W69-05502
05G	W69-05503
06D	W69-05505
06D	W69-05506
06D	W69-05507
06B	W69-05508
06B	W69-05509
03E	W69-05510
06D	W69-05511
03D	W69-05513
06B	W69-05514
06B	W69-05515
06D	W69-05516
06B	W69-05517
06C	W69-05518
05G	W69-05519
06B	W69-05520
06B	W69-05521
06D	W69-05522
06C	W69-05523
05G	W69-05524
05G	W69-05525
05G	W69-05526
05G	W69-05527
05G	W69-05528
07C	W69-05529
05C	W69-05530
05C	W69-05531
06E	W69-05533
06E	W69-05534
06E	W69-05535
06E	W69-05536
02H	W69-05537
06E	W69-05538
03D	W69-05539
06E	W69-05540
06E	W69-05541
06E	W69-05542
06E	W69-05543
04A	W69-05544
06E	W69-05545
04A	W69-05546
04A	W69-05547
06E	W69-05548
04A	W69-05549
04A	W69-05550
04A	W69-05551
04A	W69-05552
05C	W69-05553
04A	W69-05554
04C	W69-05555
04C	W69-05556
04A	W69-05557
06E	W69-05558
05B	W69-05559
04A	W69-05560
05G	W69-05561
04A	W69-05562
04A	W69-05563
06E	W69-05564
06E	W69-05565
06E	W69-05566
04A	W69-05567
06E	W69-05568
06E	W69-05570
06E	W69-05571
04A	W69-05572
06E	W69-05573
06E	W69-05574
05G	W69-05575
06E	W69-05576
06E	W69-05577
04A	W69-05578
06E	W69-05579
06E	W69-05580
06E	W69-05581
06E	W69-05582
06E	W69-05583
06E	W69-05584
06E	W69-05585
05G	W69-05586
06E	W69-05587
04A	W69-05588
06E	W69-05589
06E	W69-05590
06E	W69-05591
06E	W69-05592
04A	W69-05593
04A	W69-05594
06E	W69-05595
06E	W69-05596
06E	W69-05597
06E	W69-05598
06E	W69-05599
04A	W69-05600

ABSTRACT SOURCES

A. Centers of Competence:	Accession Numbers	Tota
(1) U.S. Geological Survey - Hydrology	W69-05201 -- W69-05262 W69-05401 -- W69-05475	13
(2) University of Arizona - Arid Lands Water Resources	W69-05263 -- W69-05287	2
(3) Rutgers University - Water Resources Economics	W69-05288 -- W69-05294 W69-05478 -- W69-05528	5
(4) University of Chicago - Metropolitan Water Resource Management	W69-05295 -- W69-05299	
(5) University of Florida - Eastern U.S. Water Law	W69-05338 -- W69-05400 W69-05533 -- W69-05600	13
(6) University of Wisconsin - Eutrophication	W69-05529 -- W69-05531	
B. Other:		
(1) Georgia Inst of Tech - Water Resources Center		
(2) University of Idaho - Water Resources Research Institute	W69-05302 -- W69-05305	
(3) University of New Hampshire - Water Resources Research Center	W69-05306	
(4) University of North Carolina - Water Resources Research Institute	W69-05312	
(5) Ohio State University - Water Resources Center	W69-05313 -- W69-05314	
(6) University of Rhode Island - Water Resources Center	W69-05316	
(7) Washington State University - Water Research Center	W69-05322	
(8) University of Wisconsin - Water Resources Center	W69-05323 -- W69-05325	
(9) University of Wyoming - Water Resources Research Institute	W69-05326	
(10) Agricultural Research Service	W69-05327 -- W69-05328 W69-05330	
(11) Soil Conservation Service	W69-05329	
(12) National Agricultural Library	W69-05330 -- W69-05333	
(13) Office of Saline Water	W69-05334 -- W69-05335	
(14) Environmental Science Service Administration	W69-05336	
	Grand Total	37

Subject Fields

- 1 NATURE OF WATER
- 2 WATER CYCLE
- 3 WATER SUPPLY AUGMENTATION AND CONSERVATION
- 4 WATER QUANTITY MANAGEMENT AND CONTROL
- 5 WATER QUALITY MANAGEMENT AND PROTECTION
- 6 WATER RESOURCES PLANNING
- 7 RESOURCES DATA
- 8 ENGINEERING WORKS
- 9 MANPOWER, GRANTS, AND FACILITIES
- 10 SCIENTIFIC AND TECHNICAL INFORMATION

INDEXES

- SUBJECT INDEX
- AUTHOR INDEX
- ORGANIZATIONAL INDEX
- ACCESSION NUMBER INDEX
- ABSTRACT SOURCES

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF COMMERCE

LIBRARY RATE
PRINTED MATTER

U.S. DEPARTMENT OF COMMERCE
CLEARINGHOUSE FOR FEDERAL
SCIENTIFIC AND TECHNICAL INFORMATION
SPRINGFIELD, VA. 22151

OFFICIAL BUSINESS

16.3391
Se48

UNIVERSITY OF ILLINOIS
AUG 29 1969
LIBRARY

SELECTED WATER RESOURCES ABSTRACTS

VOLUME 2, NUMBER 14
JULY 15, 1969

W69-05601 -- W69-06000

Selected Water Resources Abstracts is published semimonthly for the Water Resources Scientific Information Center (WRSIC) by the Clearinghouse for Federal Scientific and Technical Information (CFSTI) of the Bureau of Standards, U. S. Department of Commerce. It is available to Federal agencies, contractors, or grantees in water resources upon request to: Manager, Water Resources Scientific Information Center, Office of Water Resources Research, U. S. Department of the Interior, Washington, D. C. 20240. Annual subscription is $22.00 (domestic), $27.50 (foreign), single copy price is $3.00. Certain documents abstracted in this journal can be purchased from the Clearinghouse at the prices indicated in the entry. Prepayment is required.

CLEARINGHOUSE
FOR FEDERAL SCIENTIFIC AND TECHNICAL INFORMATION
U.S. Department of Commerce, Springfield, Va., 22151

SELECTED
WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

VOLUME 2, NUMBER 14
JULY 15, 1969

W69-05601 -- W69-06000

se of funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States--now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources. WRSIC is not presently prepared to furnish loan or retention copies of the publications announced.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas. Centers, and their subject coverage, now in operation are:

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

CONTENTS

FOREWORD_____iii

SUBJECT FIELDS AND GROUPS

(Use Edge Index on back cover to Locate Subject Fields and Indexes in the journal.)

01 NATURE OF WATER
Includes the following Groups: Properties; Aqueous Solutions and Suspensions

02 WATER CYCLE
Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION
Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL
Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Non-Water Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION
Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING
Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA
Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS
Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS, AND FACILITIES
Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.

10 SCIENTIFIC AND TECHNICAL INFORMATION
Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

B. Aqueous Solutions and Suspensions

NIFIED VIEW OF DIFFUSION AND DISPER-ION,
linois Univ., Urbana. Dept. of Civil Engineering.
dward R. Holley.
SCE Proc, J Hydraul Div, Vol 95, No HY2, Pap 462, pp 621-631, Mar 1969. 11 p, 5 fig, 13 ref, ap-end.

escriptors: *Diffusion, *Dispersion, Tracers, low, Turbulent flow, Laminar flow, Steady flow, nsteady flow, Convection, Mass transfer, Mixing, lomentum transfer.
lentifiers: *Diffusion-dispersion relations.

iffusion and dispersion are basically convective ansport mechanisms. The method chosen for presenting the convection in a mass balance quation is the determining factor in deciding hether diffusion or dispersion must be included in e conservation equation for a given flow. This rinciple is illustrated for molecular diffusion, tur-ulent diffusion, and longitudinal dispersion. In a ven flow, the relative importance of diffusion or spersion in different transport problems depends n the steepness of the concentration gradient. It is roposed that the term 'diffusion' be reserved for ansport that is associated primarily with time-eraged velocity fluctuations and that 'dispersion' e used for transport associated primarily with the patial average of velocity variations. (Knapp-SGS)
'69-05619

2. WATER CYCLE

A. General

ENSITIVITY ANALYSIS METHOD OF YSTEM IDENTIFICATION AND ITS POTEN-IAL IN HYDROLOGIC RESEARCH,
nvironmental Dynamics, Inc., Los Angeles, Calif.; nd Banaras Hindu Univ., Varanasi (India).
or primary bibliographic entry see Field 07C.
'69-05603

RECIPITATION-RUNOFF RELATIONS FOR ERY SMALL SEMIARID RANGELAND ATERSHEDS,
gricultural Research Service, Tucson, Ariz.
. B. Osborn, and L. Lane.
ater Resources Res, Vol 5, No 2, pp 419-425, pr 1969. 7 p, 4 fig, 5 tab, 6 ref.

escriptors: *Rainfall-runoff relationships, *Ru-off forecasting, Streamflow forecasting, Hydro-aph analysis, Regression analysis, Antecedent ecipitation, Rainfall, Runoff, Routing, Small atersheds, Arid lands, Mathematical models, ydrographs.
entifiers: Rangeland watersheds.

mple linear regression models for predicting total lume of runoff, peak rate of runoff, duration of noff, and hydrograph lag-time were developed ing 3 yr of data from 4 small (0.56 to 11.0 acres) atersheds. The models developed indicated that noff volume was most strongly correlated to total ecipitation; that peak rate of runoff was most rongly correlated to the maximum 15-minute pth of precipitation; that flow duration was most rongly correlated to watershed length; and that g time was most strongly correlated to watershed ea. These independent variables accounted for , 70, 50, and 30%, respectively, of the variance the predicted variables. The exponential decay rm of the antecedent precipitation equation ac-unted for 8% of the variation in runoff on atershed but was insignificant on the others. nalysis indicates that the data represent the high frequency events. It is possible that these models will not accurately predict the low frequency events. (Knapp-USGS)
W69-05605

LINEAR TIME-VARYING MODEL OF A RAIN-FALL-RUNOFF RELATION,
Pittsburgh Univ., Pa. Dept. of Civil Engineering.
Chao-Liu Chiu, and Ronald P. Bittler.
Res supported by OWRR, Dept of Interior. Water Resources Res, Vol 5, No 2, pp 426-437, Apr 1969. 12 p, 11 fig, 3 ref. Grant No 14-01-0001-1590. OWRR Project No C-1146.

Descriptors: *Rainfall-runoff relationships, *Mathematical models, Synthetic hydrology, Unit hydrographs, Hydrograph analysis, Small watersheds, Statistical methods, Statistical models, Hyetographs, Hydrographs, Runoff forecasting, Streamflow forecasting.
Identifiers: Time-variant hydrological systems.

The linear time-varying system model of the rainfall-runoff relation can be represented by a first-order, linear differential equation with time-varying coefficients that depend on 2 parameters. The model does not require the time-variance assumption necessary in the conventional unit hydrograph method. The long- and short-term trends for a hydrologic system to change with time can be considered and described with the technique developed. Analysis of historical data for the rainfall-runoff relation of a basin used for an experimental study indicates that the response of the basin to rainfall significantly changes with months during a year, although the yearly variation is not significant. The developed model and techniques used in the experimental study to describe and predict the rainfall-runoff relation have proved satisfactory. (Knapp-USGS)
W69-05608

DETERMINATION OF THE GROUND-WATER COMPONENT OF PEAK DISCHARGE FROM THE CHEMISTRY OF TOTAL RUNOFF,
Nova Scotia Dept. of Mines, Halifax.
For primary bibliographic entry see Field 02F.
W69-05628

INVESTIGATION OF SURFACE AND UNDERGROUND RUNOFF (RUSSIAN).
Akademiya Nauk SSSR, Moscow. Council on the Problems of Water Economy.

Moscow, 'Nauka', 1967. 186 p, 13 pap, ref.

Descriptors: *Water resources development, *Water management (Applied), *Conservation, *Water balance, Water policy, Industrial water, Planning, Hydrologic cycle, Technical feasibility, River flow, Geomorphology, Saline water, Floods, Groundwater, Runoff.
Identifiers: *USSR, Monograph.

A necessity for rational utilization of water resources in the USSR and the International Hydrologic Congresses held in the USSR and abroad have served as an impetus for conducting several analytical and experimental investigations on the industrial water balance methods and distribution and conservation of water resources in the USSR. This volume, which is the result of this interest, contains articles on the physico-technical problems associated with water resources, stability of annual and seasonal runoff and drainage, changes introduced into a regime of underground water and its development to prevent the incursion of sea water, kinematic and morphologic elements of river flow, and analysis of snowmelt, rain, and flood discharges. (Gabriel-USGS)
W69-05659

PHYSICO-TECHNICAL PROBLEMS IN MANAGING WATER RESOURCES (RUSSIAN),
Akademiya Nauk SSSR, Moscow. Council on the Problems of Water Economy.
M. F. Skribnyy.
'Nauka', In 'Invest of Surface and Underground Runoff', Moscow,/Issledovaniye Poverkhnostnogo i Podzemnogo Stoka, pp 7-25, 1967. 18 p, 2 fig.

Descriptors: *Water resources, *Water management, *Water supply, *Water distribution, *Water demand, Water law, Hydrologic budget, Hydrologic data, Water structure, Water requirements, Groundwater, Water pollution, Water works, Forecasting.
Identifiers: USSR hydrology.

After briefly reviewing the problems discussed at the International Hydrologic and Meteorologic Congresses taking place from 1937 to 1965, the author discusses the USSR water supplies and water needs and indicates the importance of knowledge about physics of the hydrosphere. He believes that study of the hydrosphere should be used for solution of problems in the following areas: (1) relationship which exists between lithosphere, biosphere, and aerosphere; and (2) protection of man and the national economy from events associated with extremes in the water cycle. For convenience in studying the hydrologic parameters of the continents, the author subdivides segments of hydrology into the following topics: hydrology as a science; history of hydrology; hydronomy; paleohydrology; hydrography; hydrometry; water balance; aerohydrology; rain hydrology; snow research; glacier research; geohydrology; hydrology teaching; river water balance; low flow studies; river hydraulics; flood study; erosion and deposition study; hydrophysics of rivers; channel studies; coastal line study; river estuaries; hydrochemical processes; hydrobiological processes; limnology; reservoir hydrology; marshland study; forest hydrology; agricultural studies; and urban hydrology. (Gabriel-USGS)
W69-05660

MASS BALANCES OF SOME NORTH CASCADE GLACIERS AS DETERMINED BY HYDROLOGIC PARAMETERS: 1920-65,
Geological Survey, Tacoma, Wash.
For primary bibliographic entry see Field 02C.
W69-05664

SYNOPTIC TEMPERATURE MEASUREMENTS OF A GLACIER LAKE AND ITS ENVIRONMENT,
Geological Survey, Tacoma, Wash.
For primary bibliographic entry see Field 02C.
W69-05665

APPLICATION OF ELECTRONIC COMPUTERS TO IRRIGATION AND DRAINAGE SYSTEM PROBLEMS,
Bureau of Reclamation, Denver, Colo.
Francis E. Swain.
Pap, Symp Appl Comput Anal Various Probl Relating Irrig Drain Syst, Mexico City, Apr 1969. 32 p, 12 ref.

Descriptors: *Irrigation systems, Computer programming, Groundwater, *Drainage systems, Computer programs, Computers, Runoff forecasting, Hydrology, Flood routing, Sedimentation, Earthworks, Cross-sections, Land classification, Water conveyance, Irrigation, Drainage, Irrigation canals.
Identifiers: Cost savings, Problem solving.

Electronic computers are used to solve a wide variety of problems encountered in irrigation and drainage systems and in related fields. The most obvious reasons for using electronic computing equipment are: to reduce the time and cost required to carry out numerical calculations; to provide more data upon which more intelligent decisions can be based; and to free the engineer or scientist from the drudgery of routine manual computations. Studies of hydrologic, irrigation, and drainage systems have previously been conducted as separate analyses. All important aspects of such studies cannot be determined properly by this approach. For exam-

ple, simulation of ground-water systems on a digital computer and analysis of water quality requirements are intimately interconnected. To analyze water resource problems in an appropriate manner, the Bureau of Reclamation is attempting to integrate surface water systems, ground-water systems, and water quality control in project planning and operation studies. Such integrated analyses are possible only by using high-speed electronic computing equipment. Other problems of particular interest to irrigation and drainage specialists where computers can be used effectively are discussed. (USBR)
W69-05803

THE WESTERN WATER SUPPLY--WHERE IT IS,
Pacific Northwest River Basins Commission, Vancouver, Wash.
Charles W. Hodde.
Pap, League Women Voters Educ Fund Conf, Salt Lake City, Utah, Feb 1969. 15 p, 10 fig, 3 tab.

Descriptors: *Rainfall, Runoff, Reservoir storage, Streamflow, *Water supply, Water storage, Underground water storage, Groundwater, Glaciers, Groundwater mining, Groundwater recharge, Annual, *Water, Atmospheric precipitation, Colorado River Basin, Columbia River Basin, California, Great Basin, Oregon, Washington.
Identifiers: *Rainfall expectancy, *Water supply forecasting, Seasonal variations, Groundwater sources, *Western United States.

The water supply in the Western United States consists of present rainfall, accumulated rainfall, and reasonably safe predicted rainfall. Factors relative to water supply are discussed for the area west of the Mississippi River, paying particular attention to the Columbia-North Pacific Region, the Upper and Lower Colorado River Basins, the Great Basin Region of Utah and Nevada, and the California Region. The first consideration is that average or long-range mean annual rainfall or runoff (referred to as streamflow) is not always usable supply. Second, when discussing water in terms of quantity and distribution, more money problems associated with solutions exist than water problems. The third factor concerns dependable predictable future rainfall. (USBR)
W69-05807

A NONLINEAR HYDROLOGIC SYSTEM RESPONSE MODEL,
Illinois Univ., Urbana.
Ramanand Prasad.
Proc, Amer Soc Civil Eng, Vol 93, No HY4, pp 201-221, July 1967. 21 p, 9 fig, 2 tab, 15 ref, 2 append.

Descriptors: *Simulation analysis, *Analog computers, *Hydrologic equation, *River basins, Mathematical models, Numerical analysis, Rainfall-runoff relationship, Reservoirs, Storm runoff.
Identifiers: Illinois, Nonlinear differential equations.

The effects of the physical factors responsible for the transformation of rainfall excess into direct runoff were simulated by the action of a conceptual nonlinear reservoir. A nonlinear differential equation of the basin response was derived. Because no analytical solution for the system response equation existed, solutions were found by means of an electronic analog computer and a numerical method. Model parameters were found to be correlated with basin, main channel, and rainfall characteristics for seven east central Illinois basins. The consistency of the results obtained from an analysis of storms over those basins indicated that the proposed model could be adopted for nonlinear simulation of the hydrologic system response. (Gysi-Cornell)
W69-05858

THE INFILTRATION COMPONENT OF A PASTORAL EXPERIMENTAL CATCHMENT, PARTS 1 AND 2,
Soil Conservation Authority, Kew (Australia).
For primary bibliographic entry see Field 02G.
W69-05901

THE EVAPOTRANSPIRATION COMPONENT OF A PASTORAL EXPERIMENTAL CATCHMENT,
Soil Conservation Authority, Kew (Australia).
For primary bibliographic entry see Field 02D.
W69-05902

CLIMATIC ATLAS OF THE UNITED STATES,
Environmental Science Services Administration, Washington, D. C.
For primary bibliographic entry see Field 02B.
W69-05922

CALCULATION OF MAXIMUM WATER DISCHARGES ORIGINATING FROM RAIN AND SNOW (IN RUSSIAN),
Akademiya Nauk SSSR, Moscow. Council on the Problems of Water Economy.
For primary bibliographic entry see Field 02E.
W69-05943

2B. Precipitation

DETERMINING MAXIMUM RELIABILITY AND EFFICIENCY OF HYDROMETEOROLOGICAL SYSTEMS AND INSTRUMENTS,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 07A.
W69-05658

REGIONAL RAIN MODELS WITH SPACE- AND TIME-CORRELATED STRUCTURE,
Matson Research Corp., San Francisco, Calif.
Eric E. Sorensen.
Manage Sci, Vol 14, No 3, pp 239-249, Nov 1967. 11 p, 6 fig.

Descriptors: *Simulation analysis, *Rainfall simulators, *Regional analysis, Correlation analysis, Rainfall disposition, Spatial distribution, Time of concentration, Irrigation, Harvesting, Isohyets.

A generalized model was constructed which would simulate rainfall over regions containing gradient extremes of annual rainfall of 5 inches to 50 inches within the region for any given year. The specific application presented covered a region 5 miles by 14 miles. The model generated daily rain patterns of a spatial and temporal sequence correlated from over a large number of subareas within the region. Daily isohyets were constructed from simulated computer periods of an unlimited time horizon. It was concluded that the model could interact with irrigation or harvesting models in order to analyze the sensitivity of those models to rainfall incidence, severity and duration. (Gysi-Cornell)
W69-05731

THE LEGAL IMPLICATIONS OF ATMOSPHERIC WATER RESOURCES DEVELOPMENT AND MANAGEMENT.
Arizona Univ., Tucson. Weather Modification Law Project Staff

Final Report for Bureau of Reclamation, Office of Atmospheric Water Resources, October, 1968. 248 p, 1 append. 14-06-D-6224.

Descriptors: *Weather modification, *Cloud seeding, *Legal aspects, Agreements, Claims, Contracts, Damages, International compacts, Interstate compacts, *Liabilities, Leases, Riparian rights, *Torts, Water laws, *Water rights, Water resources, Land ownership, Public land, Real property, *Resource development, Water management, *Governments, Coordination

This report is an analysis of the legal implication atmospheric water resources development management. The arguments of landowners and weather modifiers and their clients for priv rights in water resources of the atmosphere are forth. There is an examination of the legal theo and factual situations upon which legal liabi might be based for precipitation management tivities and their consequences. Defenses to s liabilities and employment of insurance and demnification agreements to obtain relief fr financial losses are explored. The legal problem local development of additional yield from mospheric sources are set forth, and state licensi reporting, and other regulatory activities analyzed. Different methods of interstate allocat of water are measured against the need to alloc among the states the rivers in the sky. There study of federal management and development atmospheric water resources. International im cations of weather modification are also treat The report concludes with recommendations further acquisition of factual information ab weather modification, adjustments in state la and enactment of federal legislation to ens sound development of our atmospheric wa resources.
W69-05756

CLIMATIC ATLAS OF THE UNITED STATES
Environmental Science Services Administrati
Washington, D. C.
John L. Baldwin.
Environ Sci Serv Admin Atlas, June 1968. 80 271 map, 15 tab.

Descriptors: *Climatic data, *Data collections, nited States, Meterological data, Weather da Maps, Temperature, Precipitation (Atmospheri Winds, Atmospheric pressure, Humidity, D point, Cloud cover, Solar radiation, Evaporation
Identifiers: *Climatic atlas.

Climatic data for the U.S. are presented in an at of 40 sheets containing 271 climatic maps and tables. The maps present in uniform format a ser of analyses showing the national distribution mean, normal, or extreme values of temperatu precipitation, wind, barometric pressure, relat humidity, dewpoint, sunshine, sky cover, heati degree days, solar radiation, and evaporation. napp-USGS)
W69-05922

A COUNTRY-WIDE STUDY OF INTEN RAINFALL FOR THE UNITED KINGDOM,
Hydrological Research Unit, Wallingford (E gland).
John C. Rodda.
J Hydrol, Vol 5, No 1, pp 58-69, Mar 1967. 12 p fig, 1 tab, 9 ref.

Descriptors: *Rainfall intensity, *Probable ma imum precipitation, *Depth-area-duration analys Meteorology, Rain, Precipitation (Atmospheri Precipitation intensity.
Identifiers: *United Kingdom.

Rainfall station data in the United Kingdom a analyzed to estimate the magnitude, frequency a duration of daily rainfall. The calculated daily ra fall magnitudes are shown by maps. A method given for using average annual rainfall to calcula the one-day fall for a given return period. (Knap USGS)
W69-05925

AN INVESTIGATION OF METEOROLOGICA CONDITIONS DURING A CALIFORNIA RAI FALL PERIOD,
California Univ., Los Angeles. Dept. of Meteorol gy.
T. N. Krishnamurti, and Bobby J. Higgins.
Calif Univ Water Resources Center Contrib N 119, Jan 1967. 96 p, 21 fig, 3 tab, 30 ref, 2 appen

scriptors: *Rainfall, *Atmospheric physics, alifornia, Weather patterns, Winds, Air masses, mospheric pressure, Fronts (Atmospheric), Cli-tology, Meteorology, Weather forecasting, mote sensing, Synoptic analysis, Topography.
ntifiers: Hovmoller impulses, Atmospheric pres-e waves, Atmospheric pressure troughs, Wave pulses (Atmospheric).

tended periods of California rainfall are erally associated with a long wave upper trough the California coast. The trough is either slowly ving or stationary with several short wave impul- traveling through it from west to east. A Hov-iller impulse is a phenomenon frequently seen ing the amplification of several long wave ughs and ridges with a speed approximately that a group velocity in a non-divergent atmosphere. ge correlations of vorticity and mid-troposphere-divergence are found in the region of upper ughs and ridges and are important dynamic ameters in the maintenance of the Hovmoller pulse. The phase speed and group velocity of pospheric long waves are examined empirically theoretically. Actual wave movements are wn to compare closely to those in a barotropic, n-divergent atmosphere. A high correlation ween mid-tropospheric convergence and ab-ute vorticity, during passage of a group-velocity pulse through a trough, suggests the impulse is ntained largely through vorticity production-truction. The modifying effect of mountain bar-s and blocking systems upon the group-velocity pulse is discussed. Zonal harmonic analysis and e theory are combined to show that the group-city phenomenon seen in Hovmoller diagrams be explained as an interaction between abnor-ly progressive ultra-long waves and normally gressive long waves. Separation of wave num-s from normal 500 mb charts suggests an or-ized behavior of ultra-long waves. It is sug-ed that the Hovmoller diagram can be used ef-ively as a tool for daily and long-range forecast-

9-05933

CURACY IN DETERMINING THE MEAN ECIPITATION DEPTH OVER AN AREA,
n Geophysical Observatory, Leningrad SR).
V. Gushchina, R. L. Kagan, and A. I. shchuk.
ns from Trudy GGO, No 208, 1967, pp 49-63. iet Hydrol, Selec Pap, No 6, pp 585-596, 1967. , 2 fig, 5 tab, 6 ref.

criptors: *Network design, *Precipitation (At-pheric), Statistical methods, Data collections, n gages, Rainfall.
tifiers: *USSR, Mean areal precipitation.

distributions of precipitation over large areas variable physiography are studied statistically. a on statistical structure are used in estimating error in extrapolating areal precipitation on the s of individual station data. Warm season y-September) data from the Central Provinces, Valdai Hills, and Primor'ye, USSR, were used. uls were calculated for each for the hours 1900-0 and 0700-1900, for 24 hr, 10 days, 1 month, the period May-September. Mean square er- were determined and tabulated for 5,10,20,50, and 100 gaging stations covering s of 1,10,50,100,500,1000,2000, and 5000 sq In most cases the accuracy of interpolating between stations is considerably less than the racy of the areal mean. To make the interpola- accuracy equal to the accuracy at the mean, number of stations must be increased. Lack of ormity in the distribution of stations can result rge errors, and a weighted mean method must sed. (Knapp-USGS)
9-05948

THE ECONOMIC APPROACH TO THE PLANNING OF A NETWORK OF METEOROLOGICAL STATIONS,
Main Geophysical Observatory, Leningrad (USSR).
For primary bibliographic entry see Field 07A.
W69-05949

2C. Snow, Ice, and Frost

MASS BALANCES OF SOME NORTH CASCADE GLACIERS AS DETERMINED BY HYDROLOGIC PARAMETERS: 1920-65,
Geological Survey, Tacoma, Wash.
Wendell V. Tangborn.
Int Ass Sci Hydrol Pub No 79, Gen Assembly of Bern, Sept-Oct 1967, pp 267-274, 1967. 8 p, 4 fig, 10 ref.

Descriptors: *Hydrologic budget, *Glaciers, Alpine, Climatology, Ablation, Melting, Weather, Precipitation (Atmospheric), Temperature, Snow, Firn, Evaporation, Runoff, Storage, Statistical methods, Mathematical models, Washington.
Identifiers: *North Cascades (Wash).

Ice and snow storage changes in the glaciers of the Thunder Creek drainage basin for the period 1920-65 were calculated by using hydrologic and meteorologic data from low elevation stations. The basis for these computations was the difference between streamflow in glacierized and non-glacierized drainage basins, combined with precipitation data from nearby valley stations. A significant correlation was found between balances measured for South Cascade Glacier (14 km south of the Thunder Creek basin) and balances calculated for Thunder Creek glaciers for the period 1958-65. The balance history of South Cascade Glacier for the period 1928-57 was estimated on the basis of this statistical relationship. The balance trend for the higher altitude Thunder Creek glaciers shows a major change occurring about 1944, from generally negative balances between 1920-44 to a gain in glacier mass between 1945-65. The balance trend for the lower elevation South Cascade Glacier shows a consistent loss of mass at the rate of 1.7 m of water per yr for the period 1928-44, and a loss rate of 0.6 m per yr for the period 1945-65. As a check on these long-term estimated balances, the total mass changes of South Cascade Glacier and of the North and South Klawatti Glaciers in the Thunder Creek basin were calculated on the basis of detailed topographic maps and aerial photographs. The results show close agreement between these independent calculations. (Knapp-USGS)
W69-05664

SYNOPTIC TEMPERATURE MEASUREMENTS OF A GLACIER LAKE AND ITS ENVIRONMENT,
Geological Survey, Tacoma, Wash.
William J. Campbell.
Commission of Snow and Ice, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 79, pp 450-458, 1967. 9 p, 4 fig, 1 tab, 6 ref.

Descriptors: *Water temperature, *Lakes, *Glaciation, Thermal properties, Heat budget, Solar radiation, Remote sensing, Infrared radiation, Thermometers, Meteorology, Winds, Air temperature.
Identifiers: Lake water temperatures, Glacial lakes, Radiometry, Cold skin phenomenon (Lake water).

Temperature measurements of a 20 ha, 1,620 m high lake located at the terminus of South Cascade Glacier, Washington, and its ice and rock environment were made with infrared radiometers (8-14 micron range) during various meteorologic regimes. By making simultaneous measurements of lake surface temperatures with 4 sensors it was found that the 'cold skin' effect occurs, that is the radiometric temperature is cooler than that measured at the surface. The meteorological situation most favorable to the development of the 'cold skin' is a strong, dry drainage wind with clear skies. Temperature distributions of the lake surface and its background were mapped by remote infrared sensing from adjacent ridges. By correcting for reflectivity and emissivity changes, accurate synoptic maps of the lake surface temperature were obtained. It was found that the shallow, stable surface layer adjusts rapidly to changes in the drainage and valley winds. Several surface temperatures maps obtained during periods of strong drainage winds compare well with an infrared image obtained from an aircraft, showing a warm sector at the lake exit separated by a temperature front of high gradient from a cool sector having gradually cooler temperatures towards the glacier terminus. At times of no wind the surface temperature was uniform except for a narrow mixing zone at the glacier terminus. The warm sector was transported to the glacier terminus end of the lake by valley winds and a high gradient temperature front formed between it and the terminus mixing zone. (Knapp-USGS)
W69-05665

SEA-ICE DYNAMICS,
Geological Survey, Tacoma, Wash.
William J. Campbell.
Office Nav Res Rep 'Arctic Drifting Station,' pp 189-196, 1968. 8 p, 3 fig, 1 tab, 12 ref.

Descriptors: *Sea ice, *Drifting (Aquatic), *Ocean currents, Arctic Ocean, Flow, Water circulation, Icebergs, Coriolis force, Wind pressure, Winds, Model studies.
Identifiers: *Sea-ice dynamics, Ice pack drift.

Mathematical models of the motion of drifting sea ice are reviewed. Drift trajectories are the result of the interplay of forces of imperfectly understood nature. Theoretical models are so complex that the most recent can be solved only with the aid of high-speed computers. The models reviewed consider varying degrees of the effects of wind stress, water stress, coriolis force, internal ice stress, gradient currents, and boundary layers. The more recent models attempt to solve ice motion in terms of a fluid ice pack rather than a collection of independently-moving floes. Instruments and technology exist for determining the exact rheological properties of ice packs. Navigation techniques now permit fixes several orders of magnitude more accurate than past techniques. Satellite fixes permit the simultaneous, continuous, accurate position recording of several stations. Shorter-scale measurements may be made rapidly and accurately by laser and tellurometer surveys. In the present state of technology, more is to be gained by measuring several stations drifting together for a year than one drifting several years. (Knapp-USGS)
W69-05921

RELATIONSHIP OF AIR TEMPERATURE TO THE OCCURRENCE OF FRAZIL ICE AND ICE FLOW IN RIVERS,
Walenty Jarocki.
Warsaw, Cent Inst for Sci, Tech and Econ Inform, Transl of 'The action of frost on concrete hydraulic structures', Polish Pap no 29, 1966, Intro and Chapters 2, 3, and 4. 75 p, 4 fig, 13 tab, 53 ref, 10 append. Order from the Clearinghouse as TT-66-57040, Paper copy $3.00.

Descriptors: *Frazil ice, *Icebergs, *River flow, *Air temperature, Freezing, Ice-water interfaces, Velocity, Winds, Heat exchange, Soil physical properties, Thawing, Mathematical studies, Frequency, Probability, Channel morphology.
Identifiers: *Poland, Freezing phenomenon, Vistula river, Poprad river.

On the basis of earlier publications and using the Goncharova formula, the freezing of Polish rivers was investigated by utilizing the river cross section versus temperature and other pertinent data recorded for the Vistula, Poprad, and Skawa rivers. This investigation, however, is a part of a broader study for the evaluation of the effects of ice and freezing on the basic properties of hydraulic struc-

tures made of concrete and under the action of the Polish climate. The study shows that (1) frazil ice appears after a period of negative air temperatures; (2) the air temperature at which frazil ice appears is not constant but is dependent on the temperatures occurring during the period preceeding the appearance of the frazil ice, on the occurrence of wind, snow, water velocity, etc.; (3) in Poland, frazil ice is most frequently formed at air temperatures of -4 deg C; (4) the number of days with negative temperature during the period preceeding the appearance of frazil ice is not always the same; (5) the ice cover is in general formed after a lapse of some time from the appearance of frazil ice in the rivers; (6) the air temperature at which ice cover is formed may be higher, lower, or the same as the temperature at which frazil ice appears; (7) ice cover is generally formed at -8 deg C; (8) frazil ice or ice cover may not appear in spite of prevailing negative air temperatures; and (9) positive air temperatures of short periods may cause no thawing of rivers or drifting of ice after the ice cover is formed. (Gabriel-USGS)
W69-05923

CALCULATIONS OF SLIP OF NISQUALLY GLACIER ON ITS BED: NO SIMPLE RELATION OF SLIDING VELOCITY TO SHEAR STRESS,
Geological Survey, Tacoma, Wash.
Mark F. Meier.
Commission of Snow and Ice, Proc Gen Ass of Bern, Sept-Oct 1967, Int Ass Sci Hydrol, Pub No 79, pp 49-57, 1967. 9 p, 5 fig, 7 ref.

Descriptors: *Glaciers, *Movement, *Rheology, Mathematical models, Ice, Non-newtonian flow, Mechanical properties, Plasticity, Viscosity, Shear stress, Shear strength, Shear drag, Slopes.
Identifiers: *Nisqually Glacier (Wash), Glacial movement.

Measurements on Nisqually Glacier, Mount Rainier National Park, Washington, at a fixed geographic location, give 22 yearly values of surface velocity, surface slope, and changes in ice thickness. During this period (1943-66), surface velocity, slope and thickness varied continuously by large amounts. The data were used to calculate values of shear stress and slip on the bed by standard methods, making correction for the gradient in longitudinal normal stress. Slip on the bed was found not to be a simple single-valued function of shear stress. This implies that the velocity distribution within a valley glacier cannot be calculated by the standard methods, or that none of the existing theories of glacier sliding which relate sliding velocity to shear stress are valued. (USGS)
W69-05924

A COMPARISON OF MEASURED AND THEORETICAL SNOWPACK TEMPERATURES,
British Columbia Univ., Vancouver. Dept. of Civil Engineering.
M. C. Quick.
J Hydrol, Vol 5, No 1, pp 1-20, Mar 1967. 20 p, 8 fig, 5 ref.

Descriptors: *Snowpacks, *Temperature, *Mathematical models, Air temperature, Heat budget, Heat flow, Heat transfer, Melting, Conduction, Diffusion, Thermal conductivity.
Identifiers: Snowpack temperature profiles, Air temperature fluctuations.

Comparison of snowpack temperature measurements with a theoretical snowpack temperature model, showed that the model predicts both the damping and the increasing phase lag of surficially imposed temperature variations with depth in the snowpack. At least 150 hr is required for the snowpack to reach 85% of the air temperature at a depth of 1 ft. Analysis of the effect of a sinusoidal variation of air temperature shows increasing phase lag with depth. Both an increased rate of wave-form decay and a reduced rate of propagation of the temperature wave are shown when the snowpack is non-homogeneous. Daily temperature variations penetrate only about 1 ft into loose dry powder snow. The long term mean temperature variation penetrates to about 4 ft, where the temperature was a constant 32 deg F. The model studied was a snowpack at below-freezing temperatures. Extension of the model to melting snowpacks requires that the assumption of equality of air and snow temperature be dropped. The surface temperature of a melting snowpack is always 32 deg F. Surface heat transfer involves phase change from snow to water. The snowpack density and conductivity will modify with the amount of water saturation as melting progresses. (Knapp-USGS)
W69-05929

2D. Evaporation and Transpiration

ANALYSIS OF AN EVAPORATION CONTROL SYSTEM ON THE SEA OF GALILEE,
Arizona State Univ, Tempe.
For primary bibliographic entry see Field 03F.
W69-05601

EFFECT OF SMALL SURFACE WAVES ON EVAPORATION THROUGH MONOLAYERS,
Maryland Univ., College Park.
G. F. Dick Jr., and J. M. Marchello.
Res supported by Dept of Health, Education, and Welfare under Public Health Serv Grant. Water Resources Res, Vol 5, No 2, pp 395-400, Apr 1969. 6 p, 2 fig, 1 tab, 10 ref. Grant No 00323.

Descriptors: *Evaporation control, *Monomolecular films, Hexadecanol, Water conservation, Waves (Water), Model studies, Hydraulic models, Winds.
Identifiers: Capillary waves.

The role played by capillary-gravity waves on evaporation through monolayers was studied for waves in the 400 to 800 cpm range. Waves were generated in a small ripple tank during steady-state evaporation. Concentrations of n-hexadecanol ranging from 0 to 2.656 billionths of a mole per sq cm were studied. The waves destroyed much of the evaporation-retarding properties of the film. (Knapp-USGS)
W69-05604

RELATION OF WATER LOSS TO MOISTURE CONTENT OF HYDROPHYTES IN A NATURAL POND,
Geological Survey, Denver, Colo.
W. S. Eisenlohr, Jr.
Water Resources Res, Vol 5, No 2, pp 527-530, Apr 1969. 4 p, 2 fig, 3 ref.

Descriptors: *Water loss, *Evaporation, *Evapotranspiration, *Phreatophytes, Vegetation, Potholes, Ponds, Mass transfer, Energy budget, Moisture content.
Identifiers: Coteau du Missouri (ND), Hydrophytes, Prairie potholes.

Hydrophytes growing in natural ponds on the Coteau du Missouri in North Dakota have been studied. Previous studies in the same region showed how transpiration by hydrophytes could be separated from the total water loss from a natural pond, during the period that vegetation was growing in height, on the basis of a correlation between the height of vegetation and a mass-transfer coefficient. It is shown that a similar separation can be made during the period of declining activity of the vegetation. A significant correlation was found between the ratio of moisture content of vegetation to its oven-dry weight and the mass-transfer coefficient. Weekly photographs on Ektachrome Infrared Aero film helped to confirm some of the phenomena observed. (Knapp-USGS)
W69-05622

CONTROLLING TRANSPIRATION IN ASPEN WITH PHENYLMERCURIC ACETATE,
Utah State Univ., Logan.
For primary bibliographic entry see Field 03F.
W69-05627

AERODYNAMIC AND SURFACE FACTORS
EVAPORATION,
Rothamsted Experimental Station, Harpend
(England); and Munich Univ. (West German
Meteorologisches Institut.
For primary bibliographic entry see Field 02I.
W69-05631

SIMULATION OF EVAPORATION FROM CO
STANT SOURCE WITH FINITE AREAS,
California Univ., Los Angeles.
For primary bibliographic entry see Field 07C.
W69-05636

STUDIES WITH ANTITRANSPIRANTS O
GRAPEVINES (VITIS VINIFERA VA
SULTANA),
Commonwealth Scientific and Industrial Resear
Organization, Glen Osmond (Australia). Div.
Horticultural Research; and Commonwealth Sci
tific and Industrial Research Organization, M
bein (Victoria). Div. of Horticultural Research.
J. V. Possingham, G. H. Kerridge, and D. E.
Bottrill.
Aust J Agric Res, Vol 20, No 1, pp 57-64, J
1969. 5 fig, 4 tab, 5 ref.

Descriptors: *Transpiration control, *Retardan
*Consumptive use, *Leaves, *Films, Inhibito
Spraying, Rates of application, Root systen
Photosynthesis, Vine crops, Plant physiology.
Identifiers: *Antitranspirants, *Grapevin
*Acropol, *Polycote, Australia, Plastic films, D
matter.

Selected transpiration suppressants were test
under glasshouse conditions for their effectivene
in reducing the water consumption of grapevin
The substances tested included three that fo
plastic films, Polycote J (Tag), Polycote S720, a
Acropol (S789, a silicone type compound), and t
inhibitor phenyl mercuric acetate. Acrop
reduced water consumption by an average of 50
when applied as a leaf spray and was the only su
stance found to be an effective transpiration su
pressant. Repeated applications at 12-day interva
were necessary and the substance had
morphogenetic effect, causing a significant i
crease in leaf area but a decrease in dry matt
production, especially evident in the lower ro
weight of treated plants. The rate of sugar accum
lation in grapes was not affected by Acropol wh
it was applied to plants in the field. (Affleck-Ariz)
W69-05675

USE OF ATMOMETERS IN ESTIMATIN
EVAPOTRANSPIRATION,
California State Dept. of Water Resources, Bake
sfield.
John W. Shannon.
Irrig and Drain Speciality Conf, Las Vega
Nevada, Nov 2-4, 1966, pp 109-130, 6 fig, 3 tab.

Descriptors: *Evaporation, *Evapotranspiratio
*Atmometers, *Evaporation pans, Consumptiv
use, Instrumentation, Climatic data, Water requir
ments, Data collections, Energy, Water los
Monthly, Estimating.
Identifiers: Evaporation demand, Crop coefficient

The California Department of Water Resources ha
collected extensive records of evaporation fro
Livingston Black and White Atmometers. Severa
separate studies have been made to determine th
effect of various operational and environmenta
factors upon atmometer evaporation. Measure
ments of actual evapotranspiration have been mad
to correlate with atmometer data. Many question
exist as to exactly what the difference of evapora
tion between black and white atmometers mea
sures. The approach provided a reasonable mean
of estimating evapotranspiration for determinin
the water requirement of various crops. The ap

ach has given results as good as those from U. S. eather Bureau Class A evaporation pans in sently developed areas. In unirrigated areas, the of atmometers is superior to the use of evapora- n pans for estimating potential water require- nts of crops. (Blecker-Ariz)
9-05685

UCTUATIONS IN WATER DROPLET APORATION RATES,
w Mexico Univ., Albuquerque.
ward C. Bryant.
search Project Technical Completion Report to Water Resources Research Institute, New Mex- State University, June 1968. 5 p, 2 ref. OWRR ject A-014-NMex.

scriptors: Acoustics, Air-water interfaces, alytical techniques, Boundary processes, Cloud sics, Diffusion, *Drops, Electromagnetic waves, vaporation, Heat balance, Hygrometry, Instru- ntation, Latent heat, Light penetration, Liquids, ptical properties, Remote sensing, Resonance, nding waves, Surface tension, Theoretical anal- , Vapor pressure, Vibrations, Volatility, *Water perties.

e rate at which a motionless droplet evaporates be measured continuously and precisely by ermining the period of the intensity fluctuation aser light reflected off the center of the droplet. e back-scattered light is the coherent sum of t reflected from the external and the internal faces of the droplet; under typical conditions the kscattered light intensity oscillates at about 2 or z. This method is applied to pure water droplets he diam range from 0.6 to 1.8 mm, supported by d thermistors and beaded glass fibers, and the ults are compared to the 'quasi-stationary' ory of Maxwell. Our measurements show that, r steady state is reached, the rate of change of n is inversely proportional to the diam, as pre- ted in the quasi-stationary theory. Our experi- nts give a somewhat slower evaporation rate n the theory predicts; this discrepancy can be minated if one assumes that the surface tempera- e of the droplet is somewhat lower than mea- ed with the bead thermistor. No significant ematic fluctuations were found in the evapora- rate. Using the optical method mechanical onances of the droplet can be sensitively de- ted; acoustically-induced shape resonances are efly investigated.
9-05750

E EFFECTS OF WAVES ON EVAPORATION OM A FREE WATER SURFACE,
rnell Aeronautical Lab. Inc., Buffalo, N. Y.
vin C. Easterbrook.
, Amer Geophys Union Meet, San Francisco, if, Dec 1968. 21 p, 9 fig.

scriptors: *Waves (Water), Water vapor, Water face, Wind tunnels, Wind speed, Wind velocity, ss transfer, *Evaporation, Water resources, del tests, Reservoirs, *Reservoir evaporation, oratory tests, Field investigations, Lakes.
ntifiers: *Wave height, Evaporation coefficient, e Hefner (Okla), Water vapor transmission, nd waves, Wave tanks.

oratory and field measurements show that es on a water surface have a significant effect the evaporation rate. Laboratory studies were de with a combination wave tank and wind tun- apparatus and controlled wind speed and wave ameters. Experimental results indicate that poration rates are lower under certain wind ed and wave height conditions than under ilar wind speed and no wave conditions. oratory findings were supported by field poration measurements at Lake Hefner, Okla, g the eddy flux method. The dependence of poration on wave structure is attributed to nges in vertical mass transport through modifi- on of the airflow pattern over the water surface. BR)
9-05840

THE EVAPOTRANSPIRATION COMPONENT OF A PASTORAL EXPERIMENTAL CATCHMENT,
Soil Conservation Authority, Kew (Australia).
F. X. Dunin.
J Hydrol, Vol 7, No 2, pp 147-157, Jan 1969. 11 p, 1 fig, 5 tab, 3 ref.

Descriptors: *Evapotranspiration, *Hydrologic budget, Mathematical models, Water balance, Antecedent precipitation, Runoff, Moisture stress, Rainfall-runoff relationships, Demonstration watersheds, Model studies, Soil water movement.
Identifiers: *Australia, Potential evapotranspiration, Parwan Experimental Area (Australia).

The amount of evapotranspiration occurring from a pastoral catchment was determined by an assessment of the hydrologic balance within the catchment. A measure of the variable for changes in water content was achieved by the evaluation of soil store deficits antecedent to runoff events. Thus, the intervals of time for the determination of the amounts of evapotranspiration were confined to periods between runoff events. For those intervals when the index of topsoil moisture stress did not exceed a pF value of 3.5, a ratio of one existed between measured evapotranspiration and the index of potential evapotranspiration. With the use of this ratio in conjunction with the soil moisture record, variations in rates of evapotranspiration were presented for the years 1963 to 1966. Such data indicated that the prevailing land-use was inefficient in its consumption of water.
W69-05902

SOIL WATER MEASUREMENT WITH AN Am-241 Be NEUTRON SOURCE AND AN APPLICATION TO EVAPORIMETRY,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 02G.
W69-05926

2E. Streamflow and Runoff

THE EFFECTS OF BENDS ON DISPERSION IN STREAMS,
California Univ., Berkeley.
Hugo B. Fischer.
Water Resources Res, Vol 5, No 2, pp 496-506, Apr 1969. 11 p, 4 fig, 5 tab, 14 ref.

Descriptors: *Dispersion, *Streamflow, *Channel morphology, *Meanders, *Missouri River, Diffusion, Path of pollutants, Tracers, Dye releases, Model studies, Hydraulic models, Mathematical models, Computer programs, Mixing, Turbulence.
Identifiers: Longitudinal dispersion, Green-Duwamish Rivers (Wash).

Bends in streams induce secondary currents that alter the rates of both transverse mixing and longitudinal dispersion. Within a bend the transverse mixing coefficient depends on the square of the mean velocity, cube of the depth, and inversely on the shear velocity and square of the radius of curvature, as verified by a laboratory experiment. The longitudinal dispersion coefficient depends on the channel geometry, velocity distribution, rate of transverse mixing, and a dimensionless parameter that includes the mean velocity and length of an average bend. A numerical program for predicting dispersion coefficients in streams differs from previous theories by including the effect of the alternating direction of curvature in a series of bends; the difference is important for wide streams but not for narrow ones. Experimental findings in 2 streams, the Green-Duwamish in Washington (width 20 m), and the Missouri near Omaha, Nebraska (width 180 m), verify the numerical program. (Knapp-USGS)
W69-05609

CONDITIONAL PROBABILITIES OF FAILURES IN RESERVOIR OPERATION FOR THE MORAN-GOULD MODEL,
City Univ., London (England). Dept. of Civil Engineering.
C. Venetis.
Water Resources Res, Vol 5, No 2, pp 514-518, Apr 1969. 5 p, 1 fig, 5 ref.

Descriptors: *Reservoir operation, *Reliability, *Probability, Markov processes, Stochastic processes, Statistical models, Digital computers, Forecasting, Water yield, Water management (Applied).
Identifiers: Moran-Gould reliability model.

A method is given to calculate the distribution of the number of reservoir failures using the Moran-Gould model as seasonal inflows. The reservoir content is taken to be a discrete random variable with probabilities depending only on the content at the beginning of the year, assuming the yearly inflows to be independent and the yield constant. The fluctuations of content are approximated by a homogeneous finite Markov chain. (Knapp-USGS)
W69-05612

UNIFIED VIEW OF DIFFUSION AND DISPERSION,
Illinois Univ., Urbana. Dept. of Civil Engineering.
For primary bibliographic entry see Field 01B.
W69-05619

SURFACE TENSION IN FROUDE MODELS,
Illinois Univ., Urbana. Dept. of Civil Engineering.
W. Maxwell, C. Hall, and J. Richard Weggel.
ASCE Proc, J Hydraul Div, Vol 95, No HY2, Pap 6482, pp 677-701, Mar 1969. 25 p, 9 fig, 1 tab, 8 ref, append. Grant NSF-GK-901.

Descriptors: *Hydraulic models, *Hydraulic similitude, *Surface tension, Viscosity, Steady flow, Unsteady flow, Reynolds number, Froude number, Weber number, Hydraulics, Open channel flow.
Identifiers: Froude models, Model scale, Surface tension effects, Surface tension control (Chemical).

A criterion for avoiding surface tension effects in Froude models is obtained analytically for uniform flows. Experiments show that surface tension does not, in practice, limit the scale in curvilinear flow Froude models. In uniform flows the least scale is determined by instrumentation accuracy and Froude number or by the need to exceed a limiting Reynolds number. The least scale is found by including a surface energy term in the energy equation or by considering the celerity of small free surface disturbances. The scale is chosen so that experimental reading error scatter will mask any dependence on surface tension. Experiments on 3 weir geometries, for which flow at one head is interpreted as an imperfect Froude model of flow at a different head, are used to examine surface tension effects in Froude models of curvilinear flows. The viscosity was kept essentially constant and the surface tension varied using an additive. For all practical purposes variations due to surface tension are masked by the inherent scatter of the data. (Knapp-USGS)
W69-05621

ASSESSING UPLAND RESERVOIRS USING A DAILY FLOW MODEL,
Federal Water Pollution Control Administration, Washington, D. C.
George K. Young, William P. Somers, William C. Pisano, and William N. Fitch.
Water Resources Res, Vol 5, No 2, pp 362-379, Apr 1969. 18 p, 5 fig, 8 tab, 13 ref.

Descriptors: *Reservoir operation, *Water management (Applied), *Model studies, *Synthetic hydrology, Mathematical models, Probability, Statistical methods, Markov processes,

Stochastic processes, Water demand, Water supply, Recreation, District of Columbia.
Identifiers: *Washington (DC).

A procedure is given for analyzing multisite upland reservoir storage for water supply at a downstream point. Synthetic monthly streamflow for 6 sites replicates mean, standard deviation, and lag correlation coefficient of historic data; a matrix of spatial correlations interrelates the sites. Factors translate flow to 7 reservoirs operated in 2 modes and 1 use point. The Thomas-Fiering formula, using lag-one correlation and coefficient of variation of historic daily flows and a random gamma variable, converts monthly flow to daily supply at the use point. Results comprise probabilistic analyses of deficiencies and reservoir performances. A study of the Washington, D. C. requirements for 1985 indicates that 6 upland reservoirs reduce the duration of a deficiency occurring once in a hundred years and that a smaller volume of nearby storage is an alternative or can be used for standby. Sophisticated operation of upstream reservoirs should enhance recreational values while concurrently satisfying supply requirements at Washington. (Knapp-USGS)
W69-05632

DOWNSTREAM VARIATIONS IN THE HYDRAULIC GEOMETRY OF STREAMS: SPECIAL EMPHASIS ON MEAN VELOCITY,
Geological Survey, Arlington, Va.
Charles W. Carlston.
Amer J Sci, Vol 267, pp 499-509, Apr 1969. 11 p, 4 fig, 1 tab, 5 ref.

Descriptors: *Channel morphology, *Discharge (Water), *Statistical models, Depth, Width, Velocity, Streamflow, Shape, Slopes, Rivers, Model studies, Digital computers, Computer models.
Identifiers: River morphology.

Mathematical and statistical solutions for the exact description of river hydraulic geometry are reviewed, and new data are analyzed. The least squares solution of Matalas and Gilroy was applied to 10 gaged river basins to relate width, depth, and mean velocity to discharge. Downstream increase in discharge relates to downstream changes in geometry by a power function with exponents determined by Leopold and Maddock to be 0.5 for width, 0.4 for depth, and 0.1 for velocity. The least squares solution for the mean exponents of the 10 basins is w=0.461, d=0.333, and v=0.155. Studies in the Susquehanna basin show equal numbers of streams with downstream increases and decreases of velocity. Dye studies on 3 rivers over distances of 190 to 806 mi show constant velocity. Leopold shows that large-scale river floods that move much sediment have constant velocity. Large rivers accommodate downstream discharge increase mainly by depth increase, whereas smaller rivers generally accommodate the downstream discharge increase by width increase. (Knapp-USGS)
W69-05639

PRELIMINARY WATER YIELDS AFTER TIMBER HARVEST ON CASTLE CREEK, ARIZONA WATERSHEDS,
Arizona Univ., Tucson. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 03B.
W69-05642

WATERSHED PLANNING,
Forest Service (USDA), Tempe, Ariz. Forest Hydrological Lab
For primary bibliographic entry see Field 03B.
W69-05643

SANTA YNEZ BAROMETER WATERSHED,
Los Padres National Forest, Santa Barbara, Calif.
For primary bibliographic entry see Field 03B.
W69-05644

FLOOD PLAIN INFORMATION, ROCK RIVER AT BELOIT, WISCONSIN.
Corps of Engineers, Rock Island, Ill.
For primary bibliographic entry see Field 04A.
W69-05646

FLOOD PLAIN INFORMATION, IRWIN, LONG AND PAW CREEKS, CHARLOTTE, NORTH CAROLINA (VOLUME 1).
Corps of Engineers, Charleston, S. C.
For primary bibliographic entry see Field 04A.
W69-05647

FLOOD PLAIN INFORMATION, FORKED DEER RIVERS, AND LEWIS CREEK, IVERSBURG, TENNESSEE.
Corps of Engineers, Memphis, Tenn.
For primary bibliographic entry see Field 04A.
W69-05648

FLOOD PLAIN INFORMATION, CHEHALIS AND SKOOKUMCHUCK RIVERS, CENTRALIA-CHEHALIS, WASHINGTON.
Corps of Engineers, Seattle, Wash.
For primary bibliographic entry see Field 04A.
W69-05649

SUMMARY OF WATER RESOURCES DEVELOPMENT IN IRAN,
Ministry of Water and Power, Tehran (Iran).
H. Mahdavi.
For the 8 Volume Proceedings, see Vol 2, No 9, Field 06B and W69-03305. Int Conf on Water for Peace, Wash, D C, Vol 6, pp 68-77, 1968. 10 p.

Descriptors: *Water resources, *Surface waters, *Groundwater, Arid lands, Streamflow, Stream gages, Water wells, Water resources development, Water levels, Water utilization, Irrigation, Saline water, Salinity, Climates.
Identifiers: *Iran, Ghanats.

Iran, situated between 25 and 40 deg north latitude and 44 and 64 deg east longitude, covers 1.6 million sq km. The region is a high plateau surrounded by mountain ranges. In general, the climate is Mediterranean and arid or semiarid. Rainfall ranges from 50 to 300 mm over the interior lowlands and deserts and 500 to 2000 mm in the mountains. Most of the national population of 23 million is agrarian. Agriculture is developed mainly along the Caspian Sea coast, in the Lake Rezaieyeh area, and in many alluvial basins of various sizes where good quality water is available. Drainage into closed basins and contamination of surface waters and aquifers by evaporites and salt diapirs cause serious water quality problems, especially in the Central Basin and along the southern coast. Utilization of surface water and shallow groudnwater in the alluvial basins where historical dug wells and ghanats (underground drains) are common and have exploited many of the major sources of water in the basins. About 3000 deep wells produce 1,800 mcm (million cubic meters) per yr; 6,000 shallow-wells, 2,000 mcm; and 25,000 ghanats produce 12,000 mcm-a total of nearly 16,000 mcm per yr. Water levels have declined substantially in some places. Flow in major rivers of the country has been gaged continuously since 1943; more than 350 stations are now in operation. Since 1960 water resources studies have been carried out in 17 areas in various parts of the country. (Knapp-USGS)
W69-05651

WATER-RESOURCES APPRAISAL OF BUTTE VALLEY, ELKO AND WHITE PINE COUNTIES, NEVADA,
Geological Survey, Carson City, Nev.
For primary bibliographic entry see Field 02F.
W69-05656

INVESTIGATION OF SURFACE AND U[N]DERGROUND RUNOFF (RUSSIAN).
Akademiya Nauk SSSR, Moscow. Council on t[he] Problems of Water Economy.
For primary bibliographic entry see Field 02A.
W69-05659

WATER CONSUMPTION IN THE LOWE[R] COLORADO RIVER VALLEY,
Geological Survey, Yuma, Ariz. Water Resourc[es] Div.
Omar J. Loeltz, and Charles C. McDonald.
J Irrig and Drain Div, ASCE, Vol 95, No IR1, Pr[oc] paper 6457, pp 65-78, Mar 1969. 2 fig, 4 tab, [12] ref.

Descriptors: *Water consumption, *Colorad[o] River, *Streamflow, *Withdrawal, *Flow measur[e]ment, Dams, Flood plains, Runoff, Inflo[w] Discharge (Water), Measurement, Municip[al] water, Hydrologic budget, Evapotranspiration, I[r]rigation water.

This paper makes an appraisal of water consump[tion] in the flood-plain valley of the Colorado Riv[er] between Davis and Imperial Dams. Average annu[al] water consumption in the lower Colorado Riv[er] Valley between the two dams during 1950-196[9] was about 1,200,000 acre-feet. The average [of] values was computed by an inflow-outflow budge[t] and consumptive-use coefficients were applied t[o] acreages. Estimates of water consumption com[-] puted by each method differed by as much a[s] 115,000 acre-feet for some reaches. These di[f]ferences were not considered unreasonable in vie[w] of large flows of the Colorado River relative t[o] water consumed and uncertainties of many of th[e] values of individual items of both methods. (A[l]fleck-Ariz)
W69-05678

THE STATISTICAL MEASURE O[F] HYDROLOGIC TIME SERIES,
Agricultural Research Service, Riesel, Tex.
Walter G. Knisel, Jr., and Vujica Yevjevich.
Proc International Hydrology Symposium, For[t] Collins, Colorado, Sept 6-8, 1967. Vol 1, pp 306-313, 5 fig, 1 tab, 4 ref.

Descriptors: *Hydrology, *Streamflow, *Time se[-] ries analysis, Statistical methods, Marko[v] processes, Mathematical models.
Identifiers: *Autocorrelation, Mean daily discharge, Stochastic models.

Hydrologic time series of streamflows for 17 rivers were analyzed to determine the information contained in discrete time series of varying time increments, delta t, as statistical measures of time series. Ten time increments were studied to determine which would indicate how the time series information changes with delta t. First, the time series was made second-order stationary by removal of the periodic component. Then, linear Markov models were applied to describe time dependence in the stochastic component of the series. Series of independent and random variable epsilon sub t in the stochastic component were determined for each delta t of each station. This residual variable of the stochastic component was studied to evaluate the effect of time increments, or statistical measure, on variance of the mean of epsilon sub t. It was found that for a discrete time series of size N= T/delta t (T= total length of continuous series) the information decreases with an increase of delta t or with a decrease of size N. A series of 50 annual values has less information than a corresponding series of 50 x 365 daily values of river flows. (Knisel-ARS)
W69-05775

WHITE V PENNSYLVANIA RR (DAMAGES FOR OBSTRUCTION OF STREAM).
For primary bibliographic entry see Field 06E.
W69-05794

YDROLOGIC SIMULATION IN WATER-ELD ANALYSIS,
rps of Engineers, Sacramento, Calif.
o R. Beard.
oc, Amer Soc Civil Eng, Vol 93, No IR 1, pp 33-, Mar 1967. 10 p, 1 fig, 2 tab.

escriptors: *Simulation analysis, *Synthetic drology, *Water yield, Design flow, Design data, reamflow forecasting, Statistical methods, drologic data, Water analysis.

rage capacities required to maintain specific lds were determined independently for each half 12 long streamflow records on unregulated eams. In two thirds of the cases, design varied by actor to two, indicating the inadequacy of design sed upon the repetition of past streamflows. A thod was described for generating monthly eamflows that have the basic frequency and per-tence characteristics of the recorded data. It was ncluded that the simulated streamflows had the vantage that any length of record could be nerated, and that the expected benefits and tistical consequences of particular capacities uld be determined. (Gysi-Cornell)
59-05849

E OF INTERRELATED RECORDS TO SIMU-TE STREAMFLOW,
rps of Engineers, Sacramento, Calif.
o R. Beard.
oc, Amer Soc Civil Eng, Vol 91, No HY5, pp 13-, Sept 1965. 10 p, 4 tab, 3 ref, 1 append.

scriptors: *Simulation analysis, *Digital compu-s, *Statistical methods, *Regression analysis, ynthetic hydrology, Hydrologic data, Streamflow ecasting, Monte Carlo method.

electronic computer procedure was described t extracted a maximum degree of pertinent in-mation from monthly streamflow data and nerated values whose statistical characteristics re consistent with those of the observed monthly eamflow. Multiple linear regression of the data nsformed to unit normal standard deviates was d. A procedure was described for using data t were not simultaneous at all recorded loca-ns and that would permit formulating an interre-ed-streamflow generator for ungaged stations. ysi-Cornell)
59-05850

NONLINEAR HYDROLOGIC SYSTEM SPONSE MODEL,
nois Univ., Urbana.
r primary bibliographic entry see Field 02A.
59-05858

MULATION OF THE EVOLUTION OF AINAGE-BASIN NETWORKS WITH A GITAL COMPUTER,
rkson Coll. of Technology, Potsdam, N. Y.
bert Schenck, Jr.
eophys Res, Vol 68, No 20, pp 5739-5745, Oct 1963. 7 p, 6 fig, 5 tab, 7 ref.

scriptors: *Simulation analysis, *Drainage tems, *Digital computers, *Networks, Analyti-techniques, Water analysis, River basins, Monte rlo method, Hydrologic data, Streamflow ecasting, Synthetic hydrology.
ntifiers: Random-walks, Gray's law.

e techniques of Monte-Carlo or random-walk nputer simulation were used to generate othetical drainage-basin networks. Stream ection within the basin was controlled by ran-n choice, subject only to the constraints that erse flow and closed loops were not permitted. sulting networks were analyzed and the results npared with field data. The computer generated works compared closely with natural stream gths and numbers of streams of various order. mparison was also made with Gray's area-length correlation. Gray's law was roughly predicted by the random walk models. (Gysi-Cornell)
W69-05859

THE INFILTRATION COMPONENT OF A PASTORAL EXPERIMENTAL CATCHMENT, PARTS 1 AND 2,
Soil Conservation Authority, Kew (Australia).
For primary bibliographic entry see Field 02G.
W69-05901

THE EVAPOTRANSPIRATION COMPONENT OF A PASTORAL EXPERIMENTAL CATCHMENT,
Soil Conservation Authority, Kew (Australia).
For primary bibliographic entry see Field 02D.
W69-05902

RELIABILITY ESTIMATES FOR A STORAGE RESERVOIR WITH SEASONAL INPUT,
Slovak Academy of Sciences, Bratislava (Czechoslovakia). Inst. of Hydrology and Hydraulics.
For primary bibliographic entry see Field 06A.
W69-05906

FLOODS IN BEECHER EAST QUADRANGLE, NORTHEASTERN ILLINOIS,
Geological Survey, Washington, D. C.
Howard E. Allen, and Allen W. Noehre.
Geol Surv Hydrol Invest Atlas HA-302, 1 sheet, 1969. 8 fig, 1 map, 2 tab, 4 ref.

Descriptors: *Floods, *Stage-discharge relations, *Illinois, Hydrologic data, Data collections, Duration curves.
Identifiers: Beecher (Ill), Recurrence intervals, Flood frequencies, Flood profiles.

Hydrologic data are presented to be used to evaluate the extent, depth, and frequency of flooding that may be expected in the Beecher East quadrangle, northeastern Illinois. The flooded area is shown on a topographic map scaled 1:24,000. Flood profiles, cross sections, and frequency curves show heights and probabilities of past and predicted floods. (Knapp-USGS)
W69-05911

FLOODS IN NEW YORK- 1967,
Geological Survey, Albany, N. Y.
F. L. Robison.
N Y Water Resources Comm Rep of Invest RI-3, 1969. 32 p, 10 fig, 1 tab.

Descriptors: *Floods, *Data collections, *New York, Rainfall-runoff relationships, Hydrographs, Hyetographs, Hydrologic data, Discharge (Water).
Identifiers: Cattaraugus County (NY).

Information on floods in New York State in 1967 is presented. The only major flood of the year was in the western third of the state, Sept. 27-29, when a record rainfall of 6.54 in. in 28 hr caused widespread flooding and damages of over $1,250,000 in Cattaraugus County. Hyetographs and hydrographs show the rainfall-runoff relationship. Sites reporting flood damages are mapped. Newspaper items describing flood damages of 1967 are reprinted. Flood stages and discharges are tabulated. (Knapp-USGS)
W69-05912

FLOOD PLAIN INFORMATION, CONLEY CREEK-SOUTH RIVER, METROPOLITAN ATLANTA, GEORGIA.
Corps of Engineers, Savannah, Ga.
For primary bibliographic entry see Field 04A.
W69-05913

FLOOD PLAIN INFORMATION, CASEY CANAL SOUTH, SAVANNAH AND CHATHAM COUNTY, GEORGIA.
Corps of Engineers, Savannah, Ga.
For primary bibliographic entry see Field 04A.
W69-05914

COST OF RESERVOIRS IN ILLINOIS,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 06C.
W69-05915

MARKOV CHAIN STORAGE MODELS FOR STATISTICAL HYDROLOGY,
Cornell Univ., Ithaca, N. Y.
For primary bibliographic entry see Field 07C.
W69-05917

RELIABILITY OF WATER SUPPLY PERFORMED BY MEANS OF A STORAGE RESERVOIR WITHIN A LIMITED PERIOD OF TIME,
Slovak Academy of Sciences, Bratislava (Czechoslovakia). Inst. of Hydrology and Hydraulics.
Vit Klemes.
J Hydrol, Vol 5, No 1, pp 70-92, Mar 1967. 23 p, 9 fig, 3 tab, 10 ref, append.

Descriptors: *Water management (Applied), *Water storage, *Water supply, *Reliability, *Statistical methods, Reservoir yield, Optimization, Probability, Reservoir operation, River forecasting, Usable storage, Computers, Digital computers.
Identifiers: Reservoir reliability, Water supply probability.

The reliability of water supply is characterized by the portion of non-failure years in the period concerned. Although this portion, called certainty, tends to a constant value as the length of the period increases (in case of a finite reservoir and stationary processes of input and output), it varies considerably within short periods. This fact is of a practical importance, since the estimations of storage-reservoir effectiveness can seldom take into account more than 30-40 future years. A method is presented for straightforward computation of the certainty-distribution within a limited period of time, for random input and uniform or random reservoir-draft. A practical example has been solved by means of this method, using a digital computer. The results obtained are calculated and shown graphically.
W69-05930

ANALYSIS OF FLOOD PROCESSES IN DRAINAGE AREAS OF VARYING SEEPAGE CHARACTER (RUSSIAN),
Akademiya Nauk SSSR, Moscow. Council on the Problems of Water Economy.
M. F. Skribnyy.
In 'Invest of Surface and Underground Runoff', (Issledovaniye Poverkhnostnogo i Podzemnogo Stoka), Moscow, 'Nauka', pp 116-140, 1967. 25 p, 7 fig, 1 tab.

Descriptors: *Flood plains, *Floodwater, *Drainage systems, *Drainage effects, *Soil surfaces, Soil textures, Soil types, Runoff, Basins, Rain, Snow, Glaciers, Floods, Filtration, Turbulent flow, Laminar flow, Mathematical studies.
Identifiers: *Far East (USSR).

Flood processes were investigated on the basis of earlier detailed analytical studies and on some experimental verifications. In general the study is based on the concept that an understanding of flood genesis should be based on the study of both flood origins, such as rain, snow, glaciers, etc., and the character of rocks that form the upper layer of a drainage basin. The article contains the following chapters: (1) classification of small drainage basins on the basis of their surface structure and their flow characteristics; (2) natural characteristics of drainage basins with rocky permeable ground; (3) natural characteristics of swampy drainage basins; (4) investigation of flows characterized by seepage; (5) fundamental equations of flood motions; (6) flood motion under rain conditions; (7) determination of maximum discharges; (8) the construction

of Q=f(t) diagrams for maximum floods; (9) variable deposition intensity with respect to time; (10) flood motion after the rain; (11) flood motion during the rain of variable intensity; (12) flow velocities characterizing the drainage basins with rocky permeable surfaces; (13) flow velocities characterizing the swampy drainage systems. The article contains 51 formulas. (Gabriel-USGS)
W69-05940

GENERALIZED EXPRESSION FOR THE CONNECTION BETWEEN THE KINEMATIC AND MORPHOLOGIC ELEMENTS OF RIVER FLOW (IN RUSSIAN),
Akademiya Nauk SSSR, Moscow. Council on the Problems of Water Economy.
G. V. Zheleznyakov.
In 'Invest of Surface and Underground Runoff', (Issledovaniye Poverkhnostnogo i Podzemnogo Stoka), Moscow, 'Nauka', pp 141-143, 1967. 3 p.

Descriptors: *River flow, *Hydraulics, *Mathematical studies, *Parametric hydrology, Hydrologic equation, Hydrologic properties, Dynamics, Flow characteristics, Flow profiles, Channel morphology.
Identifiers: *USSR, Kinematic elements of streamflow.

Morphologic and kinematic elements of streamflows, were analytically investigated on the basis of Talmaza's analytical study (Kirkiz, SSR AN, 1964) modified to some extent by the author. The study shows that the mean value of a velocity parameter K, which is the logarithmic velocity profile, is a function of the mean and dynamic stream velocities. The investigation also shows that the maximum stream velocity, Vmax, may be considered as one of the most important kinematic stream characteristics. The author briefly discusses the analytical contributions made by Glushkov (AN USSR, 1961) and Altunin (M, 1962) in their studies of the morphologic and kinematic parameters of streamflows. The article contains 10 formulas. (Gabriel-USGS)
W69-05941

ANALYSIS OF THE FORMATION OF RAIN FLOODS IN SMALL BASINS (IN RUSSIAN),
Akademiya Nauk SSSR, Moscow. Council on the Problems of Water Economy.
I. L. Zimont.
In 'Invest of Surface and Underground Runoff', (Issledovaniye Poverkhnostnogo i Podzemnogo Stoka), Moscow, 'Nauka', pp 144-153, 1967. 10 p, 3 fig, 4 ref.

Descriptors: *Floods, *Rain, *Rainfall-runoff relationships, *Rainfall intensity, Precipitation (Atmospheric), Flood plains, Flood forecasting, Runoff coefficient, Groundwater, Water measurement, Water balance, Mathematical studies.
Identifiers: *USSR, Siberia, Central Asia.

The formation of rain floods was investigated on the basis of mathematical and graphical studies of flood-balance elements given by Zimont (AN USSR, 1960 M). The author gives the formulas of duration and precipitation intensity expressed as the static moments of rain forms and the moments of inertia of these forms characterizing the rain precipitation, and suggests the evaluation of static moments, inertia moments, and mean slope profile characteristics characterizing the basins. Some suggestions on the distribution of hydrologic stations, water wells, and graphical interpretation of the data are also given. The article contains 14 formulas. (Gabriel-USGS)
W69-05942

CALCULATION OF MAXIMUM WATER DISCHARGES ORIGINATING FROM RAIN AND SNOW (IN RUSSIAN),
Akademiya Nauk SSSR, Moscow. Council on the Problems of Water Economy.
G. V. Zheleznyakov, and B. B. Danilevich.
In 'Invest of Surface and Underground Runoff', (Issledovaniye Poverkhnostnogo i Podzemnogo Stoka), Moscow, 'Nauka', pp 154-161, 1967. 8 p, 1 tab, 3 ref.

Descriptors: *Runoff, *Rain, *Snowmelt, *Analytical techniques, Discharge coefficients, Water measurement, Water types, Mathematical studies, Mathematical models, Meltwater, Swamps, Hydrologic equation, Hydrologic properties.
Identifiers: *Ukraine, USSR, Moldavio, Crimea.

The analytical methods developed by A. V. Ogiyevskiy and his co-workers for the calculation of maximum water discharges are here analyzed and modified. The analysis of a formula for the maximum rain-water discharges developed by P. F. Vishnevskiy (AN Ukr.SSR, 1961) shows that the more exact water-yield values and their duration are necessary to obtain better results. The analysis of a formula developed by V. I. Moklyak (AN Ukr.SSR, 1962) for the determination of maximum snow-water discharges shows that the results of the application of this formula may be considered as satisfactory, although certain improvement may be desirable. The article contains 35 formulas. (Gabriel-USGS)
W69-05943

MUD FLOWS IN THE TRANSILIAN ALA-TAU AND THE MUD FLOW CATASTROPHE OF 7 JULY, 1963 IN THE ISSYK RIVER BASIN (IN RUSSIAN),
Akademiya Nauk SSSR, Moscow. Council on the Problems of Water Economy.
G. D. Rozhdestvenskiy.
In 'Invest of Surface and Underground Runoff', (Issledovaniye Poverkhnostnogo i Podzemnogo Stoka), Moscow, 'Nauka', pp 162-168, 1967. 7 p, 4 photo, 4 ref.

Descriptors: *Mudflows, *Mud, *Diasters, Snowmelt, River basins, Hydrologic properties, Geologic control, Geomorphology, Flow characteristics, Flow control, Lakes, Waterfalls, Damages, Dam failure, Flood damage.
Identifiers: *USSR, Kazkh and Kirgiz SSR, Issyk River basin.

After briefly discussing the history of mud-flow activities in the Soviet Union (Central Asia, Northern Caucasus, etc.) and abroad (San Gabriel, U.S.A.), the author describes in detail the hydrologic and geologic characteristics of Lake Issyk area prior to 7 July 1963 and after the mud flow catastrophe, and the hydrological and geological conditions of the Issyk River basin after the catastrophe. The estimated volume of mud flows into Issyk Lake was 2 to 3 million cu m and the volume of water outflow from the lakes was 17 million cu m. The maximum flood flow reached 1,000 cu m/sec. This lake water greatly deepened the channel of the Issyk River and flooding destroyed many buildings and roads. (Gabriel-USGS)
W69-05944

IMMENSE LANDSLIDE OBSTRUCTION OF ZERAVSHAN RIVER, APRIL 24, 1964 (IN RUSSIAN),
Akademiya Nauk SSSR, Moscow. Council on the Problems of Water Economy.
G. D. Rozhdestvenskiy.
In 'Invest of Surface and Underground Runoff', (Issledovaniye Poverkhnostnogo i Podzemnogo Stoka), Moscow 'Nauka', pp 175-176, 1967. 2 p, 3 ref.

Descriptors: *Obstruction to flow, *Landslides, *Runoff, *Discharge, *Precipitation excess, Precipitation gages, Snow, Glaciers, Snowmelt, Drainage program, Canal construction, Damages.
Identifiers: *USSR, *Central Asia, Zeravshan River.

This article describes the April 24, 1964 landslide and the hydrological and geographical conditions present in the Zeravshan basin before and after the obstruction took place. In April 1964 very in
sive precipitation occurred in the area and
result of it a landslide of 20 million cu m in vol
obstructed the flow of Zeravshan River on A
24, 1964. The river obstruction was 160 m
height and 800 m in width. As a result of this la
slide 90 million cu m of water collected in 13
behind the landslide dam. Rapid construction
bypass canal helped minimize the damage done
this obstruction. The author recommends a se
of investigations in the river basin in order
minimizing the damage that may occur from fu
landslides. (Gabriel-USGS)
W69-05946

ANALYTICAL METHOD OF COMPUTI MONSOON FLOODS (KELANI GANGA RIV BASINS AS AN EXAMPLE) (IN RUSSIAN),
Akademiya Nauk SSSR, Moscow. Council on
Problems of Water Economy.
M. F. Skribnyy.
In 'Invest of Surface and Underground Runo
(Issledovaniye Poverkhnostnogo i Podzemn
Stoka), Moscow, 'Nauka', pp 177-186, 1967. 1
1 fig, 4 tab.

Descriptors: *Floods, *Monsoons, *River basi
*Channel morphology, Precipitation intens
Rainfall intensity, Instrumentation, Maxim
probable flood, Hydrologic data, Hydrologic eq
tion, Hydrologic properties, Mathematical stud
Mathematical models.
Identifiers: *Ceylon, Kelani Ganga River.

Some analytical formulas derived by Skribnyy
AN USSR, 1959) are modified and applied to
hydrological data observed in the Kelani Ga
River basin for a number of years. These analyti
equations are primarily concerned with
establishments of the quantitative characteristic
a hydraulic channel parameter as a function of
channel form and channel roughness, as well as
the river slope and river bed sinuosity. Hydrolo
data are analyzed by giving a classification of ba
reliefs and climatic parameters, such as da
precipitation intensity, 1% discharge frequen
etc. Discussions are divided into topics on gene
characteristics of floods, initial formulas, det
mination of climatic parameters, and analysis of
Kelani Ganga River flood at 2 gaging stations. T
article contains 15 formulas. (Gabriel-USGS)
W69-05947

COMPUTATION OF ANNUAL NORMAL FLO OF INTERMITTENT WATERCOURSES AN MOUNTAIN RIVERS IN THE UKRAINIA CARPATHIANS,
Ukrainskii Nauchno-Issledovatelskii Gidr
Meteorologicheskii Institut, Kiev (USSR).
A. N. Befani, and O. N. Mel'nichuk.
Transl from Trudy Ukr Nauch-Issled Gidrom
Inst, No 69, 1967, pp 105-137. Soviet Hydr
Selec Pap, No 6, pp 606-632, 1967. 27 p, 12 fig,
tab, 8 ref.

Descriptors: *Statistical methods, *Streamflo
Frequency analysis, Time series analysis, Hydr
graph analysis, Groundwater, Recharge, Rainfal
runoff relationships, Routing, Streamflow forecas
ing, Runoff forecasting.
Identifiers: *Ukrainian Carpathians, USSR, No
mal annual flow.

The concept of normal annual flow is defined an
values are computed and compiled for 101 gagin
stations on intermittent streams in the Ukrainia
Carpathians. Short-term runoff and groundwate
flow parameters are assumed to vary, not from
constant long-term normal, but from a cyclical
time-variable parameter. The problem of comput
ing the annual runoff includes the derivation of th
cyclicity equation and evaluating the frequency
various deviations from this equation. The con
struction of regional runoff maps is reviewed. (K
napp-USGS)
W69-05950

OMPUTATIONS OF LEVEL CHANGES AND UNOFF DISTRIBUTION IN A DELTA BASED N OBSERVATIONAL DATA (DANUBE DELTA S AN EXAMPLE),
tate Oceanographic Institute, Moscow (USSR).
. N. Mikhaylov, G. N. Gan, and T. A. Makarova.
ransl from Trudy Gos Okeanogr Inst, No 89, 967, pp 140-160. Soviet Hydrol, Selec Pap, No 6, p 632-649, 1967. 18 p, 3 fig, 12 tab, 7 ref.

escriptors: *Streamflow, *Deltas, *Sedimentaon, *Water level fluctuations, Sediment transport, egime, Discharge (Water), Stage-discharge relaons, Routing, Winds, Tides.
lentifiers: *Danube River.

sing the Danube delta as an example, approxiate methods for computing the spatial distribuon of level, water runoff, and sediment runoff are escribed. The computations are based on graphs correlation of the corresponding levels for calm eriods, discharge curves and curves showing the orrelation between water and sediment runoff and raphs showing the correlation between nchronously measured water discharge, sediment scharge and turbidity, all based on observational ata. Results of computations made by different ethods are compared.
/69-05951

ORMATION OF A RIVER MOUTH BAR /HERE MARINE FACTORS PLAY AN IMPORANT ROLE (EXEMPLIFIED BY THE LIELUPE IVER),
tate Oceanographic Inst., Moscow (USSR).
or primary bibliographic entry see Field 02J.
/69-05952

OME PATTERNS OF FORMATION OF A IVER MOUTH BAR WHERE RIVER FACORS PLAY AN IMPORTANT ROLE (EXEMLIFIED BY THE VISTULA DELTA),
tate Oceanographic Institute, Moscow (USSR).
or primary bibliographic entry see Field 02J.
/69-05953

F. Groundwater

LUID FLOW IN THE WESTERN CANADA EDIMENTARY BASIN. 2. EFFECT OF EOLOGY,
esearch Council of Alberta, Edmonton.
rian Hitchon.
/ater Resources Res, Vol 5, No 2, pp 460-469, pr 1969. 10 p, 7 fig, 17 ref.

escriptors: *Hydrogeology, *Geohydrological nits, Aquifers, Groundwater basins, Groundwater ovement, Water resources, Flow nets, Flow rofiles, Flow rates, Water levels, Potentiometric vel.
lentifiers: *Western Canada Sedimentary Basin.

he observed effect of variations of geology on the uid potential distribution in the Western Canada asin is treated by considering the 3-dimensional ow net by stratigraphic units. Hydraulic head distibution maps for 27 stratigraphic units were repared, and those from the Upper Devonian eaverhill Lake Formation, Woodbend and Vabamum Groups and the Lower Cretaceous lannville Group and Viking Formation are illusated. The low fluid-potential drain that exists ithin the Upper devonian and Carboniferous caronate rocks itself contains drainage channels beonging to different fluid potential subsystems. Exellent examples of these subsystems are found in ie carbonate reef complexes of the Beaverhill ake Formation and the Woodbend Group. Drawown of the fluid potentials by some of the low uid-potential channels is reflected through up to 500 ft of strata and across a major unconformity. n general, relatively highly permeable beds signifiantly affect the regional fluid potential distribuon, although the dominant features are topoaphically controlled. An apparently 3-dimenonally closed hydraulic head low in the Viking Formation is most probably the result of the chemico-osmotic potential coupled with the regional elevation and pressure potential. (Knapp-USGS)
W69-05602

HYDROLOGY, SOIL PROPERTIES, CROP GROWTH AND LAND DRAINAGE,
Institute for Land and Water Management Research, Wageningen (Netherlands).
J. Wesseling.
Soil-Water-Plant, Proc and Inform No 15, Comm for Hydrol Res T.N.O., pp 9-27, 1969. 19 p, 10 fig, 2 tab, 30 ref.

Descriptors: *Drainage, *Soil water, Mathematical methods, Hydrology, Porosity, Permeability, Climates, Evapotranspiration, Crop response, Moisture availability, Saline soils, Water inuury, Drainage practices, Water table, Drainage effects, Land management, Soil water movement.
Identifiers: *Netherlands.

Soil drainage for crop production is discussed. Both steady and unsteady flow equations for drainage are listed. Solutions are given for computing water table depths for any given drainage system if permeability, effective porosity, and climatological data are available. Although some solutions are complex, application is nearly always possible with modern computation techniques and equipment. The effect of water table depth on productivity is not accurately known, and depends largely on climate. In humid climates, a depth of 20-30 cm is effective. In arid regions deeper levels must be maintained to control salinization. The minimum depth otherwise is a function of soil aeration, and several diffusion equations are given, but crop requirements are largely unknown. Optimum water depths must be based on local experience. (Knapp-USGS)
W69-05607

EVALUATION OF THE RATE OF FLOW THROUGH POROUS MEDIA USING ELECTROKINETIC PHENOMENA,
Egyptian Desert Inst., Cairo; and Utah Water Research Lab., Logan.
Mohamed M. I. Abaza, and Calvin G. Clyde.
Water Resources Res, Vol 5, No 2, pp 470-483, Apr 1969. 14 p, 15 fig, 11 ref.

Descriptors: *Flow measurement, *Porous media, *Electrical properties, *Electric currents, *Tracers, Ion transport, Solutes, Chlorides, Groundwater movement, Discharge (Water), Borehole geophysics, Model studies, Permeameters.
Identifiers: Streaming potential, Electrokinetic effect.

An analytical relationship is developed that relates the rate of flow through porous media to the streaming current I and streaming potential E induced by the flow. Thus, a measurement of either E or I would give a value related to the rate of flow. Laboratory experiments were conducted to test the analytical relationship. The effects of the concentration of dissolved salt in the percolating solutions, the size of the particles forming the beds, and the temperature of the solution on the streaming current and the streaming potential are determined. The analytical relationships, together with the experimental work, form the basis of a method of measuring the rate of flow through porous media. (Knapp-USGS)
W69-05611

ON THE RELATION BETWEEN TRANSPIRATION, SOIL PHYSICAL PROPERTIES AND CROP PRODUCTION AS A BASIS FOR WATER SUPPLY PLANS,
Institute for Land and Water Management Research, Wageningen (Netherlands).
For primary bibliographic entry see Field 02I.
W69-05613

FLOW RATES IN TWO-DIMENSIONAL, UNSTEADY, CONFINED GROUNDWATER FLOW,
Washington Univ., Seattle. Dept. of Civil Engineering.
Bruce W. Hunt.
ASCE Proc, J Hydraul Div, Vol 95, No HY2, Pap 6451, pp 603-608, Mar 1969. 6 p, 2 ref, append.

Descriptors: *Unsteady flow, *Groundwater movement, Aquifers, Mathematical models, Permeability, Saturated flow, Steady flow.
Identifiers: *Confined aquifers.

The theory of 2-dimensional unsteady confined groundwater flow is reviewed and extended to allow unsteady flow rates to be computed from steady-state solutions. Analysis of the method shows that unsteady flow rates closely approach flow rates calculated by replacing constant heads in the steady-state solutions with time-variant heads. The difference between steady and unsteady flow rates is small when aquifer permeability is small and when heads at the aquifer boundary vary slowly with time. (Knapp-USGS)
W69-05617

UNIFIED VIEW OF DIFFUSION AND DISPERSION,
Illinois Univ., Urbana. Dept. of Civil Engineering.
For primary bibliographic entry see Field 01B.
W69-05619

REFERENCES FOR WELL DATA AND WATER LEVELS IN CALIFORNIA BY THE GEOLOGICAL SURVEY,
Geological Survey, Menlo Park, Calif.
J. S. Bader.
Geol Surv Basic-data Compilation Rep, 1969. 13 p, 2 fig, 65 ref.

Descriptors: *Bibliographies, *Data collections, *Hydrologic data, *California, Water levels, Water level fluctuations, Water wells, Observation wells.
Identifiers: Periodic observations.

References to reports containing tabulated basic groundwater and water well data for California are listed. Index maps show the areas for which data are available and the locations of observation wells. (Knapp-USGS)
W69-05623

ON THE TEMPERATURE OF WATER FLOWING THROUGH FRACTURES,
Oregon State Univ., Corvallis. Dept. of Oceanography; and Oregon State Univ., Corvallis. Dept. of Mathematics.
Gunnar Bodvarsson.
J Geophys Res, Vol 74, No 8, pp 1987-1992, Apr 15, 1969. 6 p, 1 ref. Grant GA-1250 (NSF).

Descriptors: *Water temperature, *Groundwater, *Fractures (Geology), Geothermal studies, Permeability, Heat transfer, Heat budget, Heat flow.
Identifiers: Fracture permeability.

Fluids flowing through fractures in impermeable rock exchange heat with the surrounding medium. The fundamental equations governing the transport of heat in such systems are given. Solutions are derived for the case of constant mass flow and the fluid entering the fractures with a temperature that is a sinusoidal function of time. The rock is assumed to be a homogeneous and isotropic conductor. Approximate solutions are derived for the case in which the temperature at the intake is an arbitrary function of time. The case involving weak oscillations in the mass flow is treated on the basis of a perturbation method. Finally, some of the solutions derived are extended to the case of the laminated solid where the fluid flows between the laminas. (Knapp-USGS)
W69-05624

DETERMINATION OF THE GROUND-WATER COMPONENT OF PEAK DISCHARGE FROM THE CHEMISTRY OF TOTAL RUNOFF,
Nova Scotia Dept. of Mines, Halifax.
George F. Pinder, and John F. Jones.
Water Resources Res, Vol 5, No 2, pp 438-445, Apr 1969. 8 p, 5 fig, 1 tab, 9 ref.

Descriptors: *Base flow, *Surface-groundwater relationships, *Water chemistry, Discharge (Water), Groundwater, Rainfall-runoff relationships, Runoff, Hydrograph analysis, Subsurface runoff.
Identifiers: Nova Scotia.

The groundwater component of stream discharge may be determined from the chemical characteristics of the stream water by using chemical mass-balance to relate total, direct, and groundwater runoff. To solve the mass-balance equation, it is necessary to estimate the chemical composition of the groundwater and direct-runoff components. The solute concentration of groundwater is determined from total runoff during base-flow; the chemical characteristics of direct-runoff are estimated from samples of total runoff collected from selected locations in a basin during peak discharge periods. In 3 small watersheds in Nova Scotia groundwater runoff constituted from 32 to 42% of peak discharge for the period of analysis. (Knapp-USGS)
W69-05628

THE VERTICAL MOVEMENT OF WATER IN STRATIFIED POROUS MATERIAL. 1. INFILTRATION.
Agricultural Research Council, Cambridge (England). Unit of Soil Physics; and Cambridge Univ. (England). School of Agriculture.
For primary bibliographic entry see Field 02G.
W69-05630

SUMMARY OF WATER RESOURCES DEVELOPMENT IN IRAN,
Ministry of Water and Power, Tehran (Iran).
For primary bibliographic entry see Field 02E.
W69-05651

WATER-RESOURCES APPRAISAL OF BUTTE VALLEY, ELKO AND WHITE PINE COUNTIES, NEVADA,
Geological Survey, Carson City, Nev.
Patrick A. Glancy.
Nev Dep Conserv and Nat Resources, Water Resources-Reconnaissance Ser Rep 49, July 1968. 50 p, 3 fig, 1 plate, 1 photo, 16 tab, 27 ref.

Descriptors: *Water resources, *Groundwater, *Surface waters, Arid lands, Water wells, Water yield, Safe yield, Alluvium, Aquifers, Irrigation water, Streamflow, Nevada.
Identifiers: *Butte Valley (Nev).

The water resources of Butte Valley, east-central Nevada, are surveyed. Butte Valley includes 2 topographically closed valleys with a total area of about 1,000 sq mi. The precipitation of 6 inches in the valley to 20 inches on the surrounding mountains is probably the main source of recharge to the alluvial valley-fill reservoir, but the exact recharge boundaries are unknown because of underlying pervious carbonate rocks. Only about 20 wells have been drilled, and they are all shallow. No wells tap the carbonate rocks, which are probably a significant groundwater reservoir. Natural discharge is mainly evapotranspiration and totals almost 20,000 acre-ft per yr. Only 5 streams are perennial. Mean annual runoff is low. The water quality of the area is good; all waters tested are good for most purposes. Streamflow is used for irrigation of about 2,000 acre, but groundwater is mainly underdeveloped. Pumpage probably did not exceed 35 acre-ft in 1967. The perennial yield of the area is about 20,000 acre-ft per yr. (Knapp-USGS)
W69-05656

INVESTIGATION OF SURFACE AND UNDERGROUND RUNOFF (RUSSIAN).
Akademiya Nauk SSSR, Moscow. Council on the Problems of Water Economy.
For primary bibliographic entry see Field 02A.
W69-05659

A STEP IN OPTIMIZING THE DEVELOPMENT OF THE BASAL WATER LENS OF SOUTHERN OAHU, HAWAII,
Hawaii Univ., Honolulu. Water Resources Research Center.
L. Stephen Lau, and J. F. Mink.
Artificial Recharge and Management of Aquifers, Proc Symp of Haifa (Mar 1967) Int Ass Sci Hydrol, Pub No 72, pp 500-508, 1967. 9 p, 2 fig.

Descriptors: *Groundwater, *Saline water-freshwater interfaces, *Water wells, *Water resources development, Municipal water, Hawaii, Cities, Water requirements, Aquifers, Hydrogeology, Springs, Water yield.
Identifiers: *Ghyben-Herzberg lens, Honolulu.

The city of Honolulu on the island of Oahu in the State of Hawaii obtains its fresh water supply almost entirely from a Ghyben-Herzberg lens that underlies the southern portion of the island. In addition to the city proper, many small communities and military bases derive their water from the same source so that an average of about 100 mgd of low salinity fresh water is pumped from the lens for domestic use. The largest developments, however, serve agriculture which utilizes up to 150 mgd. Thus the lens which underlies no more than 200 sq mi is subjected to intense development, the pace of which is quickening. Recently the city of Honolulu planned a new pumping station designed to withdraw 10 mgd from the lens to assure optimum development in the sense of minimizing degrading effects in other pumping areas. Extensive laboratory and field tests were conducted to determine the best location for the well field. Laboratory investigations consisted principally of modeling the field situation. On the basis of laboratory-field evaluations, the well field was located and is now successfully supplying Honolulu with additional water. (Knapp-USGA)
W69-05663

NEW THRUSTS IN GROUND WATER,
Geological Survey, Washington, D. C. Water Resources Div.
C. L. McGuinness.
Ground Water, Vol 7, No 2, pp 7-10, Mar-April, 1969. 2 ref.

Descriptors: *Groundwater, *Water management (Applied), *Aquifers, *Domestic water, *Water supply, Groundwater recharge, Water storage, Artificial recharge, Economic feasibility, Waste storage, Hydrogeology, Saline water, Fresh water, Desalination, Pollution abatement.

Four major trends in management and use of ground water were discussed in this report. The first trend was that ground water will be used increasingly for domestic water supplies. Quantitative evaluation of the water supply under conditions of maximum development will have to be conducted, instead of just determining availability of a supply that does not strain the aquifer. Increasing use of aquifers as possible storage media for surplus flood water in place of reservoirs was the second trend discussed. Geohydrologists will have to determine when, where, and how ground water reservoirs can be recharged artifically at a reasonable cost. Third, saline aquifers will be considered as sources of water supply. Fourth, aquifers will be looked to increasingly as possible storage media for industrial and domestic waste effluents as efforts to prevent stream pollution increase. In order to develop a working model of a given hydrologic and socio-economic problem from which quantitative answers can be given to water planners a systems analysis approach is needed. (Affleck-Ariz)
W69-05677

NUMERICAL SIMULATION OF UNCONFINE FLOW INTO A SINGLE PUMPING WATE WELL USING TWO-PHASE FLOW THEORY,
Pennsylvania State Univ., University Park. Inst. f Research on Land and Water Resources.
Richard L. Cooley, and David A. T. Donohue.
Institute for Research on Land and Wat Resources, Research Project Technical Compl tion Report, University Park, Pa., March 1969. 7 p, 2 fig, 1 append. 14-01-0001-1406, A-013-PA.

Descriptors: *Groundwater, *Mathematical mode *Computer programs, Aquifers, Pumping, Po pressure, Permeability, Water flow, Drawdown.
Identifiers: *Two-phase flow, *Numerical simul tion, *Single-pumping well, Cylindrical system, U confined flows.

The equations describing the flow of water from a aquifer into a single pumping well have been i vestigated and a general numerical technique ha been proposed for their solution. Rather tha requiring the usual, grossly simplifying assumption in order to arrive at an analytical solution, the nu merical simulation is applied to a second-orde nonlinear, partial differential equation which, wit appropriate boundary and initial condition represents unsteady-state, two-phase flow in cylindrical system. The alternating-direction-im plicit-procedure (ADIP) is used to solve the ap propriate equations on a high speed digital com puter. Laboratory obtained correlations for capilla ry pressure and relative permeability function were incorporated into the solution when necessa ry. The approach shows great promise and th study is being continued. (Sink-Penn State)
W69-05755

GROUND WATER FLOW SYSTEMS AND THE ORIGIN OF EVAPORITE DEPOSITS,
Idaho Bureau of Mines and Geology, Moscow.
Roy E. Williams.
Idaho Bureau of Mines and Geology Pamphlet No 141, August 1968.

Descriptors: Mass transfer, *Mineral water, Salts Water quality, Connate water, *Ground wate movement.

The literature on evaporite mineral deposits suggests a functional relationship between the origin of these deposits and ground-water flow systems. Comparison of spatial distributions of groundwater quality with pertinent solutions to flow equations under specified boundary conditions reveals that quality of ground water is a function of flow path length, flow path route and flow velocity. Selected references provide evidence that sites of accumulation of non-marine evaporite minerals are discharge zones for poor quality water from regional ground-water flow systems. Isotope ratios in oil field brines and in standard mean ocean water indicates that water in some deep brines is of local meteoric origin; therefore, the brines are part of a ground-water flow system. Observed distribution of fluid potential in the saline portion of some groundwater flow systems on the Atlantic Coast of the United States reveals that saline ground water discharges toward the ocean floor. Therefore, ground water may also act as a transport medium for dissolved solids which are precipitated, under appropriate conditions, as marine evaporite desposits.
W69-05758

MECHANICS OF A MATHEMATICAL GROUND-WATER MODEL,
Wyoming Univ., Laramie; and Colorado State Univ., Fort Collins.
Frank J. Trelease, and Morton W. Bittinger.
Proc, Amer Soc Civil Eng, Vol 89, No IR1, pp 51-62, Mar 1963. 12 p, 3 fig, 8 ref, 1 append.

Descriptors: *Simulation analysis, *Groundwater basins, *Mathematical models, Water level fluctuations, Digital computers, Hydraulic properties, Aquifers, Pumping, Drawdown, Observation wells.
Identifiers: Fountain Creek (Colorado).

mathematical model was structured to study roundwater problems in the Fountain Creek Valy of Colorado. To set up the groundwater model, ie geohydraulic boundaries were located and lealized into straight lines, wells were grouped to pumpage centers, other inflows were idealized, id the model was tested to verify the assumptions. digital computer was used to compute drawowns in ten observation wells at 60-day intervals ver a 3-year period for various aquifer and bounary conditions. Favorable agreement was obined between computed and measured groundater levels. (Gysi-Cornell)
'69-05863

OME APPROXIMATE SOLUTIONS OF RADIL FLOW PROBLEMS,
diana Univ., Bloomington. Dept. of Geology.
aron M. Sternberg.
Hydrol, Vol 7, No 2, pp 158-166, Jan 1969. 9 p, 2 b, 6 ref, 1 append.

escriptors: *Groundwater movement, *Mathetical models, *Equations, Laplaces Equation, nsteady flow, Porous media, Aquifers, Wells, ischarge (Water), Numerical analysis, Water ells, Withdrawal.
entifiers: Laplace transformation, Exact soluons, Mellin's inversion, Radial flow.

large number of exact solutions to various bounry value problems in ground water flow have en solved in recent years using Laplace transforation. For most of the radial flow problems, the ansform does not have a simple inverse and varis methods such as the Mellin's inversion formula ust be employed. The resulting exact solution is equently in a form of a complex integral or an inite series which is difficult to evaluate. It is own that an approximate inversion formula for aplace transforms, developed for the solution of sco-elastic problems is applicable to most radial ow problems. Three cases are considered: (1) that a well pumping a constant discharge from an inite aquifer; (2) that of a well pumping a constant scharge from an infinite leaky aquifer; and (3) at of a well drawing an infinite leaky aquifer subct to a constant drawdown. The method leads to nple analytical solution for each of the above ses and agreement between this method and the act solution for each case is excellent. (Knapp-SGS)
69-05903

HE USE OF THE GEOELECTRIC METHOD OR INVESTIGATING GEOLOGIC AND YDROLOGIC CONDITIONS IN SANTA LARA COUNTY, CALIFORNIA,
nta Clara Valley Water Conservation District, alif.
r primary bibliographic entry see Field 07B.
69-05904

HLORIDE CONCENTRATION IN GROUNDATER, RECHARGE RATE AND RATE OF EPOSITION OF CHLORIDE IN THE ISRAEL OASTAL PLAIN,
ockholm Univ. (Sweden). International eteorological Inst.; and Department of Natural esources, Bangkok (Thailand).
ik Eriksson, and Vachi Khunakasem.
Hydrol, Vol 7, No 2, pp 178-197, Jan 1969. 20 p, fig, 1 tab, 7 ref.

escriptors: *Recharge, *Groundwater, *Groundater movement, *Water quality, Chlorides, ecipitation (Atmospheric), Infiltration, scharge (Water), Water balance, Hydrologic dget.
entifiers: *Israel, Airborne salt deposition, Israel oastal Plain.

e use of chloride concentrations in groundwater indicators in estimating recharge rates is scussed. Published data from the Coastal Plain quifer in Israel are used in an example calculaon. The method can be applied where rates of deposition of airborne chloride are known if the matrix of the aquifer does not also contribute chloride. The Coastal Plain aquifer consists of the sandy parts of a Cretaceous to Quaternary sequence of sands, limestones, clays, marls, and conglomerates. The direction of natural groundwater flow is seaward. The chloride deposition rate is about 20-30 kg/ha near the coast and decreases inland. The average recharge rate is calculated to be 92 mm per yr, or practically all the rainfall. This compares well with hydrologic budget computations. (Knapp-USGS)
W69-05905

COST OF MUNICIPAL AND INDUSTRIAL WELLS IN ILLINOIS, 1964-1966,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 06C.
W69-05910

NUMERICAL MODELING OF UNSATURATED GROUND WATER FLOW,
Kansas Univ., Lawrence.
Don W. Green, Charles F. Weinaug, and Hassan Dabiri.
Contrib No 31, Kans Water Resources Res Inst Proj Completion Rep, 1968. 105 p, 43 fig, 4 tab, 56 ref, 2 append (sep.-vol). OWRR Project B-011-KAN.

Descriptors: *Infiltration, *Soil water movement, *Unsaturated flow, *Mathematical models, Computer models, Digital computers, Computer programs, Numerical analysis, Permeability, Porosity, Unsteady flow, Hysteresis, Wetting, Drying.
Identifiers: Numerical modeling.

A mathematical model was developed to describe isothermal, 2-phase, 1- and 2-dimensional flow in porous media. The model was applied to the problem of vertical groundwater movement in unsaturated soils. The second-order nonlinear partial differential equations for 2-phase flow in porous media were converted to finite difference form and solved with an interative implicit digital computer procedure. The model treats permeabilities and capillary pressures as functions of saturation and computes hysteresis effects. Results of model computations were compared with results of a field test of saturation 22 ft beneath a pond. Neutron logs were run during wetting and drying periods. Agreement between calculated and measured results was excellent. (Knapp-USGS)
W69-05918

SEEPAGE FLOW ANALYSIS OF A SMALL POLDER IN THE SOUTHWESTERN PART OF THE NETHERLANDS,
Institute for Land and Water Management Research, Wageningen (Netherlands).
N. A. De Ridder, and K. E. Wit.
J Hydrol, Vol 5, No 1, pp 47-57, Mar 1967. 11 p, 6 fig, 2 ref.

Descriptors: *Seepage, *Discharge (Water), Saline water, Aquifers, Drainage programs, Arable land, Drainage water, Land management, Land reclamation, Pumping, Flow nets, Water levels, Piezometry, Potentiometric level.
Identifiers: *Polder seepage, *Netherlands.

Seepage in a small polder was estimated by use of data from 32 observation wells in 2 underlying aquifers. Piezometric heads were analyzed mathematically and by use of flow nets. Salt supply to the polder was estimated, using the calculated inflow, to be 4.8 kg/ha per day in 1961, 2.4 in 1962, and to average about 3.4 kg/ha per day. The rate of seepage inflow is about 0.25 mm per day. The chloride concentration of the groundwater varies between 77 and 7500 mg/l. (Knapp-USGS)
W69-05927

SALT ACCUMULATION PROCESSES IN THE GROUND WATERS OF THE KIROVABAD-KAZAKH MASSIF,
Academy of Sciences of the Azerbaijanian, Baku (USSR).
R. I. Bagirova.
Transl from Dokl Akad nauk Azerb, SSR, Vol 23, No 12, 1967, pp 35-37. Soviet Hydrol, Selec Pap, No 6, pp 671-673, 1967. 3 p, 1 fig, 4 ref.

Descriptors: *Water quality, *Saline water, *Groundwater, *Water chemistry, Aqueous solutions, Sodium, Calcium, Sulfates, Bicarbonates.
Identifiers: *Kirovabad-Kazakh massif, USSR.

The relationships between total dissolved solids and the concentrations of individual ions in the groundwater of the Kirovabad-Kazakh massif, USSR, were determined and presented graphically. With increasing concentration, the waters change from bicarbonate-sodium-calcium to bicarbonate-sulfate sodium to sulfate-sodium, chloride-sulfate-sodium, and finally to chloride-sodium compositions. The total mineralization of the waters ranges from about 0.2 g/l to about 120 g/l. (Knapp-USGS)
W69-05954

2G. Water in Soils

HYDROLOGY, SOIL PROPERTIES, CROP GROWTH AND LAND DRAINAGE,
Institute for Land and Water Management Research, Wageningen (Netherlands).
For primary bibliographic entry see Field 02F.
W69-05607

ON THE RELATION BETWEEN TRANSPIRATION, SOIL PHYSICAL PROPERTIES AND CROP PRODUCTION AS A BASIS FOR WATER SUPPLY PLANS,
Institute for Land and Water Management Research, Wageningen (Netherlands).
For primary bibliographic entry see Field 02I.
W69-05613

CALCULATION OF PARAMETERS FOR THE EVALUATION OF THE LEACHING OF SALTS UNDER FIELD CONDITIONS, ILLUSTRATED BY NITRATE,
Institute for Soil Fertility, Groningen (Netherlands).
G. J. Kolenbrander.
Soil-Water-Plant, Proc and Inform No 15, Comm for Hydrol Res, T. N. O., pp 59-73, 1969. 15 p, 7 fig, 2 tab, 10 ref.

Descriptors: *Leaching, *Soil water movement, Unsaturated flow, Irrigation effects, Nitrates, Percolation, Salts, Water quality, Clays, Soils, Rainfall, Diffusion.
Identifiers: Day's equation, Glueckaufs theory.

Mathematical methods for calculating the downward leaching of soil salts are reviewed and developed and parameters for various soils are determined and listed. The leaching of applied nitrate was studied on 8 different soil profiles under field conditions. The process can be described by the theory of Glueckauf, or with corrections, by the less complicated equation of Day. A distribution factor (K) was calculated for the 8 different soil profiles and was found to be closely related to the soil air content at pF=2.0. The value of K is about 8-12 cm at air contents higher than 10%; with small change with depth. Below 10% air, (in clay soils), K increases strongly with depth, because of subsoil cracks. It is impossible to use laboratory soil columns to determine K because disturbance of field conditions causes K to be about 1/3 the field value. (Knapp-USGS)
W69-05616

INSTALLATION AND FIELD CALIBRATION OF NEWTRON-SCATTER EQUIPMENT FOR

HYDROLOGIC RESEARCH IN HETEROGENEOUS AND STONY SOILS,
Department of Agriculture, University Park Pa. Northeast Watershed Research Center.
For primary bibliographic entry see Field 07B.
W69-05626

THE VERTICAL MOVEMENT OF WATER IN STRATIFIED POROUS MATERIAL. 1. INFILTRATION.
Agricultural Research Council, Cambridge (England). Unit of Soil Physics; and Cambridge Univ. (England). School of Agriculture.
E. C. Childs, and M. Bybordi.
Water Resources Res, Vol 5, No 2, pp 446-459, Apr 1969. 14 p, 9 fig, 1 tab, 14 ref.

Descriptors: *Infiltration, *Soil water movement, *Unsaturated flow, Soil profiles, Permeameters, Mathematical models, Percolation, Model studies, Hydraulic models.
Identifiers: Heterogeneous soil profiles, Vertical permeability.

The infiltration law of Green and Ampt is extended to include heterogeneous profiles. Formulas are developed to express 3 relationships. The infiltration law is derived for a profile consisting of a succession of n different layers with conductivity decreasing from the surface. An expression is derived for the conductivity profile that will give a specified infiltration law, and in particular a linear infiltration law with specified parameters. This expression serves to determine the conductivity when the infiltration law is observed. Experiments are described to measure the infiltration rates into layered columns or porous material, the results of which confirm the theory. (Knapp-USGS)
W69-05630

SALT AND WATER BALANCE, COACHELLA VALLEY, CALIFORNIA,
Agricultural Research Service, Riverside, Calif. Salinity Lab.; and Coachella Valley County Water District, Calif.
Charles A. Bower, James R. Spencer, and Lowell O. Weeks.
J Irrig and Drain Div, ASCE, Vol 95, No IR 1, Proc Paper 6437, pp 55-64, Mar 1969, 2 fig, 4 tab, 6 ref.

Descriptors: *Irrigated land, *Drainage effects, *Salt balance, *Water balance, *Leaching, Drainage water, Irrigation effects, Drains, Salts, California, Arid lands, Evapotranspiration, Soil chemistry, Tile drains, Input-output analysis, Ions.
Identifiers: *Coachella Valley, California, Salt balance index.

This study reported salt and water balance conditions in irrigated land by years for the period 1957-1965, and compared measured and calculated values for leaching and evapotranspiration as well as indicating nature and extent of chemical reactions occurring in soil as a consequence of irrigation. The salt balance index (output/input) for irrigated land was highly related to both area of irrigated land having tile drainage and leaching percentage, the index becoming close to one when about half the land became tiled and when leaching percentage increased to about 30. At salt balance evapotranspiration, taken as the difference between depths of applied and drainage water, agreed within about 10% of that calculated by the Blaney-Criddle formula. About 10% of the applied salt appeared to precipitate in soil largely as calcium carbonate and magnesium in water replaced exchangeable sodium in soil during irrigation operations. (Affleck-Ariz)
W69-05670

RELATIONSHIP OF TEXTURE TO SOME IMPORTANT SOIL MOISTURE CONSTANTS,
Punjab Agricultural Univ., Hissar (India). Dept. of Soils.
I. P. Abrol, B. K. Khosla, and D. R. Bhumbla.
Geoderma, Vol 2, 1968/1969, pp 33-39. 2 fig, 3 tab, 16 ref.

Descriptors: *Soil moisture, *Soil texture, *Moisture content, *Field capacity, *Correlation analysis, Wilting point, Semiarid climates, Soil profiles, Silts, Sampling, Clays, Calcium carbonate.
Identifiers: *India, Available water capacity.

A study was conducted to determine whether a relationship existed between soil texture and the soil moisture contents of field capacity, wilting point, and available water capacity of some semiarid region soils. Seventy-nine soil samples were collected from 14 profiles in the Hissar district of India. The major factor contributing to moisture held at 1/3 atmosphere was silt, while clay bore a highly positive and significant correlation with 15 atmospheres. There is a linear increase in available water capacity with increase in clay and silt content up to 50% clay and silt, beyond which there is a tendency for A. W. C. to decrease. It was suggested that calcium carbonate should be taken into account when inferring moisture constants from textural data. (Affleck-Ariz)
W69-05679

USE OF VEGETATION AS AN INDICATOR FOR SOIL PROPERTIES UNDER DESERT CONDITIONS,
Negev Inst. for Arid Zone Research, Beersheba (Israel).
Gideon Orshan, Uri Gavish, and Ilan Borovic.
Negev Institute for Arid Zone Research, Beer Sheva, 50 p, Mar 1968. 2 tab, 17 ref. U. S. Dept of Army DA-91-591-EC 3806.

Descriptors: *Root systems, *Desert plants, *Soil profiles, *Sierozems, *Soil-water-plant relationships, Irrigation effects, Sands, Soil properties, Habitats, Soil moisture, Arid lands, Competition, Vegetation effects.
Identifiers: *Israel, *Negev Desert.

Root systems of 13 leading species in sandy desert vegetation were excavated and described. They were classified into three types. The stability of root pattern and nature of soil layers penetrated by roots differed for the various species. In some cases they may account for plant distribution in the sandy soils of the Negev of Israel. Soil moisture was measured at 2 locations in the Negev Desert during summer, 1966, and its use by plants was discussed. At one location it was evident that plants mainly used soil moisture of the upper 90 cm and only to a smaller extent, soil moisture of deeper layers. No such differences in use of soil moisture from different soil layers were found at the second location. The effect of sand cover and irrigation on the competition between leading desert psamophytes was also examined. (Affleck-Ariz)
W69-05682

MOVEMENT OF WATER THROUGH SOIL AS INFLUENCED BY OSMOTIC PRESSURE AND TEMPERATURE GRADIENTS,
California Agricultural Experiment Station, Riverside.
J. Letey.
Hilgardia, Vol 39, No 14, pp 405-418, Nov 1968. 1 fig, 5 tab, 13 ref.

Descriptors: *Soil water movement, *Osmotic pressure, *Thermocline, *Flow, Darcys law, Hydraulic conductivity, Soil temperature, Equations, Vapor pressure, Salts, Temperature, Moisture content, Soil physics.
Identifiers: *Suction, Steady-state flow.

Darcy's Law has been used directly or combined with the continuity equation to produce equations to describe water flow through soils. In the use of these equations, it must be assumed that osmotic pressure or temperature gradients do not exist, or if such gradients do exist, their effects on water movement are negligible. Osmotic pressure and temperature gradients under many conditions, particularly irrigated arid lands, are readily recognized. The critical question is whether or not these gradients significantly effect the flow of water through soil. This paper presents equations for water flow which include the osmotic pressu gradient and the temperature gradient and revie the information available on the effect of t osmotic pressure and temperature gradients water flow through soil. (Affleck-Ariz)
W69-05683

AN AGROCLIMATOLOGY SURVEY OF SEMIARID AREA IN AFRICA SOUTH OF TH SAHARA,
Joint FAO/UNESCO/WMO Interagency Proje on Agroclimatology.
For primary bibliographic entry see Field 02I.
W69-05684

DESALINIZATION OF SOILS UNDER CO TROLLED UNSATURATED FLOW COND TIONS,
California Univ., Davis. Dept. of Irrigation.
D. R. Nielsen, J. W. Biggar and J. N. Luthin.
Proc International Commission on Irrigation ar Drainage, Sixth Congress, Vol 2, pp 19.15-19.2 1966. 10 p, 6 fig, 10 ref.

Descriptors: *Unsaturated flow, *Desalinatio processes, *Soil water movement, *Saline soil *Leaching, Ion transport, Land reclamation, Satu ration, Infiltration, Solutes, Pores, Diffusion, Satu rated soils, Salts, Rates of application, Soil su faces, Ponding, Chlorides.

This paper suggests that efficiency of leaching saline soil may be significantly increased by co trolling the degree of water saturation and rate water movement through the soil profile. In area where infiltration rates are not a limiting factor, sufficient number of intermittent application could be made without adversely affecting th growing crop and yet accomplish sufficien leaching for continuous production. For a give quantity of water transported, solutes are move through soils in markedly different manners. Th processes involved are (1) variation in the por water velocities, (2) ionic or molecular diffusion and (3) interaction among solute ions, water an charged soil particle surfaces. (Blecker-Ariz.)
W69-05687

SOIL MOISTURE TRANSPORT DUE TO THER MAL GRADIENTS: PRACTICAL ASPECTS,
Agricultural Research Service, Kimberly, Idaho Snake River Research Center.
J. W. Cary.
Soil Sci Soc Amer Proc, Vol 30, No 4, pp 428-433 July-August 1966. 3 tab, 23 ref, append.

Descriptors: *Thermal conductivity, *Soi moisture, *Thermocline, *Porous media, *Soi temperature, Thermal properties, Heat flow, Heat transfer, Soil surfaces, Temperature, Diurnal Equations, Fluctuation, Flow characteristics Moisture content, Cooling, Heating.
Identifiers: *Thermal moisture transport, *Soil moisture transport, Head flow.

The present status of knowledge concerning thermally induced transport of moisture in soil was reviewed. This included various theories on proposed mechanisms of thermal moisture transport and experimental data showing the magnitude of moisture flow in various porous materials. Data were chosen to show the relative importance of thermal versus head-type flow. Equations were developed to describe thermally induced moisture flow near the soil surface which arises from transient thermal gradients produced by the diurnal temperature cycle. This cycle, which is very pronounced in arid climates, can play an important part in supplying moisture to desert plants. A practical example of thermally induced moisture flow together with its implications was given. (Blecker-Ariz.)
W69-05691

SOIL INVESTIGATIONS IN ARID REGIONS,
Ye P. Gusenkov, and B. A. Kalachev.

oviet Soil Science, No 8, pp 871-879, August 965. 3 fig, 7 tab, 25 ref.

escriptors: *Saline soils, *Arid climates, *Soil investigations, *Soil classifications, *Salts, Land reclation, Salinity, Maps, Toxicity, Ions, Chlorides, arbonates, Sulfates, Sodium, Electrical conuctance, Variability, Evaporation.
dentifiers: *U.S.S.R., *Salinization, Anions, Cations, Salinometer.

his article discussed investigation of saline soils in id climates and how these soils should be anaged in order to minimize salinity problems. A orough study of the dynamics of salts in soil is ecessary to develop methods for controlling linization. Planning of improvement programs for ils of arid regions is governed by the degree and ature of their salinization. The soil map is the ain document on which to base predictions on the nprovement conditions and recommendations for e most economical and effective control of soil linization. Since salts differ in toxicity, their maxnum permissible concentration in the soil must be etermined on the basis of their species composion. (Blecker-Ariz.)
/69-05692

OIL MOISTURE RESPONSE TO RANGE IMROVEMENT IN THE NORTHERN GREAT LAINS,
gricultural Research Service, Miles City, Mont.
or primary bibliographic entry see Field 02I.
/69-05693

VATER AVAILABILITY AND GRASS ROOT ISTRIBUTION IN SELECTED SOILS,
lew Mexico State Univ., University Park. Water esources Research Inst.
. F. Bailey.
IS Thesis, New Mexico State University, 1967. 67 , 5 fig, 13 tab, 64 ref, 3 append. OWRR Project A-04-NMEX.

escriptors: *Moisture availability, *Root distribuon, Caliche, Particle size, Soil-water-plant relaonships, Specific retention, Root zone, Hard pan.
dentifiers: Moisture equivalent.

oils underlain by indurated caliche at depths of 9 o 24 inches store more water for plant use than oils without restrictive layers. The maximum torage of available water from a simulated one nch rain was by a coarse textured soil underlain by aliche at 14 inches. Summer rains of less than one alf inch were found ineffective for plant growth. oncentration of black grama (bouteloua riopoda) roots was greatest in the surface horizon f each of five soils, and was greater in soils underain by indurated caliche than in soils without estrictive layers. A high correlation (r=0.97) was ound between moisture equivalent and percent lay. (Anderson-N Mex)
/69-05759

NFILTRATION STUDIES ON NON-WETTALE SOILS,
levada Univ., Reno. Desert Research Inst.
. T. Cory, R. J. Morris, and S. B. Hussain.
enter for Water Resources Research, Project Reort No. 11, July 1968. 28 p, 7 tab, 2 fig, 22 ref. OWRR Project A-020-NEV.

escriptors: *Infiltration, Habitats, Molecular tructure, *Infiltrometer, Loam, Vegetation, Overand flow, Sediment yield, Erosion control, Moisture content.
dentifiers: *Sierra Nevada, *Non-wettable soils.

his project report is the result of research into inltration rates on decomposed granitic soils of the astern Sierra Nevada. Results are presented as two eparate papers dealing with preliminary findings f this research which is continuing during FY 68-9. The first paper is concerned with factors estricting infiltration rates on decomposed granitic oils representing soils from both natural unburned habitat and areas subjected to fire. As the organic matter from fired soils causes a significantly greater water repellency effect and a change in molecular composition, it is postulated that the repellent layer formed under these conditions may represent a partially polymeric or silica-organic system. The second paper deals with infiltrometer studies on non-wettable soils on East Sierra Nevada. Infiltration plots were located in pure strands of loam, manzanita, and tobaccobrush with 100% litter cover to test the differences in over land flow and sediment yield among the three cover types. Tests were also made on plots where mat-like pine litter was peeled off leaving bare soil. Experimental results indicate that soil non-wettability is caused by pine litter in this locality, and the compensating importance of litter in physically restraining erosion of soil and increasing moisture holding capacity is emphasized. (Pineolini-Nev)
W69-05760

THE INFLUENCE OF SUBSURFACE ASPHALT BARRIERS ON THE WATER PROPERTIES AND THE PRODUCTIVITY OF SAND SOILS,
Michigan State Univ., East Lansing.
A. E. Erickson, C. M. Hansen, and A. J. M. Smucker.
Pap 35, 9th Int Congr Soil Sci Trans, Vol 1, pp 331-337, 1969. 7 p, 1 fig, 4 tab.

Descriptors: *Sands, Soils, Soil sealants, Soil treatment, *Asphalt, Barriers, Root zone, *Impervious membranes, Productivity, Agriculture, *Crop production, Soil-water-plant relationships, Water conservation, Irrigation, Crops, Retention, Water properties.
Identifiers: Soil moisture storage, Soil moisture movement, Soil water storage, Soil suction, *Asphalt membranes, *Barrier films.

Techniques have been developed for placing a thin continuous asphalt barrier that is impervious to water at various depths in sand soils. This barrier decreases the deep penetration of water and increases the amount of water held in the plant root zone. The optimum depth of the barrier depends on moisture tensions relations of the sand and the normal rooting pattern of crops to be grown. The extent of the barrier is determined by drainage considerations. Field experiments have been conducted with vegetables and field crops (with and without irrigation) in various parts of humid and arid regions of the U S, and with rice and sugar cane in Taiwan. The amount of water held in the root zone can often be doubled. Barriers have greatly increased productivity of sand soils in humid climates. In arid climates, barriers have made economies in water use possible by preventing deep percolation and increasing water retention. These barriers are economically feasible in many areas of the world for high profit crops. With the need for additional land and water, this technique could be valuable in producing more food on unproductive droughty sand soils. (USBR)
W69-05802

CABLE AND CLAMP MODIFICATIONS FOR MODEL 104 MOISTURE PROBES,
Forest Service (USDA), Logan. Intermountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 07B.
W69-05883

INSTALLATION OF SOIL MOISTURE ACCESS TUBES IN ROCKY SOILS,
Forest Service (USDA), Logan, Utah. Intermountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 07B.
W69-05887

A TOOL FOR REPAIRING INSTALLED SOIL MOISTURE ACCESS TUBES,
Forest Service (USDA), Logan, Utah. Intermountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 07B.
W69-05888

THE INFILTRATION COMPONENT OF A PASTORAL EXPERIMENTAL CATCHMENT, PARTS 1 AND 2,
Soil Conservation Authority, Kew (Australia).
F. X. Dunin.
J Hydrol, Vol 7, No 2, pp 121-146, Jan 1969. Total 24 p, 8 fig, 6 tab, 13 ref.

Descriptors: *Surface-groundwater relationships, *Hydrograph analysis, Rainfall-runoff relationships, Rainfall disposition, Infiltration, Recharge, Streamflow, Runoff, Bank storage, Base flow, Water storage, Antecedent precipitation, Demonstration watersheds, Model studies, Water management (Applied).
Identifiers: *Australia, Parwan Experimental Area, Antecedent soil moisture.

A method of hydrographic analysis is proposed for the determination of the average infiltration rate during specified intervals of a surface runoff event. This method uses the continuity equation to follow the disposition of the rainfall during the selected hydrograph intervals, using a measure of the surface detention relations for the catchment under study. The variation of the infiltration rate during the runoff event under analysis was expressed as an inverse exponential relationship between infiltration rate and accumulated soil moisture. Description of infiltration characteristics in this form facilitates the assessment of hydrologic effects of changed land-use. Infiltration characteristics of a series of runoff events were compared as a measure of the efficacy of hydrographic analysis and also to provide a mathematical description of the infiltration component of the experimental catchment. This involved the estimation of soil moisture antecedent to runoff production by an indirect method based on the simulation of runoff production by an indirect method based on the simulation of runoff production. The comparison demonstrated that infiltration characteristics were consistent with either of two relationships derived from hydrographic analysis. The variation of the infiltration performance between these two sets of infiltration characteristics was shown to be seasonal and was attributed to swelling of the colloid fraction of the soil. (Knapp-USGS)
W69-05901

GEOMORPHIC GROUPING OF SOILS IN WATERSHED ENGINEERING,
Agricultural Research Service, Beltsville, Md. Hydrograph Lab.
C. B. England, and H. N. Holtan.
J Hydrol, Vol 7, No 2, pp 217-225, Jan 1969. 9 p, 3 fig, 2 tab, 20 ref.

Descriptors: *Soil properties, *Hydrologic aspects, *Watershed management, Rainfall-runoff relationships, Hydrology, Soil management, Soil classifications, Geomorphology, Topography, Slopes, Infiltration, Soil water movement, Soil profiles, Vegetation, Climates, Land use, Demonstration watersheds.
Identifiers: *Geomorphic soil groupings, Watershed engineering.

Soil properties significant to processes of infiltration, moisture storage, drainage, and the hydraulics of surface flow are related to topographic position. Areal and elevational distributions of soils provide a basis for interpretative grouping of soil mapping units in computations for watershed engineering. Soils on an ARS experimental watershed, grouped by deep upland, shallow hillside, and very deep depositional, were plotted on a coutour map of the watershed surface. The elevational sequences thus obtained are representative of the hydraulic relationships between hydrologic response units in small agricultural watersheds. Profile characteristics, areal distribution, and relative elevation position of the units determine watershed response to storm rainfall. (Knapp-USGS)
W69-05907

THIXOTROPIC AGING OF SYNTHETIC SOIL AGGREGATES,
Minnesota Univ., St. Paul.

G. R. Blake, and R. D. Gilman.
North Central Reg Coop Res Proj NC-56. Sci J Ser Pap No 6815, Minn Agr Exp Sta, St. Paul, 1969. 15 p, 5 fig, 3 tab, 12 ref.OWRR Project No. B-003-MINN.

Descriptors: *Soil aggregates, *Soil stability, *Soil water, Laboratory tests, Soil physical properties, Chemical properties, Physical properties, Soil strength, Soil structure, Clays, Viscosity.
Identifiers: *Thixotropy, Thixotropic soil aggregates.

Increase in relative stability of artificially prepared aggregates held at constant water content followed a pattern analogous to a thixotropic sol-gel transformation and strength aging of packed soil. Aggregates were not perceptibly stable to wet sieving at time of formation. Matrix stability of aggregates increased at a rate dependent on water content at which aggregates were stored, on soil type and on storage temperature. High relative stabilities were commonly attained in 24-48 hr at intermediate water contents and at 25 deg C. Extent of slaking resistance was dependent on aging from time of aggregate formation rather than from time of wetting pulverized soil in preparation for pressing into aggregates. The aging phenomenon was independent of organic matter content and of a viable microflora. Data are compatible with the explanation that orientation of water molecules and associated cation equilibrium, and spontaneous shifting of clay particles to positions of lowered potential energy account for the build-up during aging. (Knapp-USGS)
W69-05908

NUMERICAL MODELING OF UNSATURATED GROUND WATER FLOW,
Kansas Univ., Lawrence.
For primary bibliographic entry see Field 02F.
W69-05918

SOIL WATER MEASUREMENT WITH AN Am-241 Be NEUTRON SOURCE AND AN APPLICATION TO EVAPORIMETRY,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
C. H. M. Van Bavel, and G. B. Stirk.
J Hydrol, Vol 5, No 1, pp 40-46, Mar 1967. 7 p, 4 fig, 2 tab, 4 ref.

Descriptors: *Soil moisture meters, *Nuclear moisture meters, Neutron absorption, Instrumentation, Nuclear meters, Moisture content, Soil moisture, Soil water, Research and development, Lysimeters.
Identifiers: Neutron probes, Neutron logging.

The use of a 150 mc Am-Be source in an otherwise standard neutron soil water content probe gave several significant advantages. These were elimination of gamma radiation and attendant health hazard, reduction in weight, increased counting rate, and an apparently increased depth resolution. Soil water inventories at one site to a depth of 170 cm could be obtained with a precision of around 0.1 cm of water. A suggestion is made that improved neutron logging be combined with a suction-type percolation lysimeter to obtain short-term amounts of evaporation without weighting mechanism
W69-05926

A RECORDING FIELD TENSIOMETER WITH RAPID RESPONSE CHARACTERISTICS,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab
K K Watson
J Hydrol, Vol 5, No 1, pp 33-39, Mar 1967. 7 p, 2 fig, 4 ref, 1 append

Descriptors: *Tensiometers, *Soil moisture meters, Instrumentation, Research and development, Calibrations, Moisture tension, Pore pressure, Moisture content, Soil water, Soil moisture.
Identifiers: Tensiometer-pressure transducer unit.

A self-contained tensiometer-pressure transducer system for field use is described. Its advantages over standard tensiometer-remote transducer installations are more rapid response, ease of recording data, lack of interference of surface temperature effects, and lack of the hydraulic response problems common in valving several tensiometers to a remote transducer. Field calibration is easily accomplished using compressed air. Pressure changes of 0.2 mB are detectable. Response errors are negligible with a time constant of 0.2 sec. The complete specifications of the commercially available transducer used are listed. (Knapp-USGS)
W69-05931

2H. Lakes

THERMAL STRATIFICATION IN LAKES: ANALYTICAL AND LABORATORY STUDIES,
University of Science and Technology, Kumasi (Ghana); and Massachusetts Inst. of Tech., Cambridge. Hydrodynamics Lab.
Jonas M. Dake, and Donald R. F. Harleman.
Water Resources Res, Vol 5, No 2, pp 484-495, Apr 1969. 12 p, 8 fig, 1 tab, 20 ref.

Descriptors: *Thermal stratification, *Lakes, *Mathematical models, *Energy budget, Model studies, Laboratory tests, Diffusion, Conduction, Water temperature, Heat transfer, Evaporation, Turbulence, Mass transfer, Dispersion, Solar radiation.
Identifiers: Thermal stratification model, Lake Tahoe.

Theories are developed for the time dependent vertical temperature distribution in a deep lake during the yearly cycle of solar heating and cooling. A portion of the incoming solar radiation is assumed to be absorbed at the water surface, whereas the remainder is absorbed exponentially beneath the surface. Heat is also conducted downward by molecular diffusion. A heat flux balance at the water surface, which accounts for back radiation and evaporative heat loss, is formulated as a boundary condition. The linear, second-order heat transfer equation is solved by superposition of solutions for the surface absorbed radiation and the internally absorbed radiation. Analytical solutions are given for 3 different assumptions regarding the time dependence of the incoming radiation and the surface heat losses. At certain times, the resulting temperature and density distribution in the epilimnion are unstable. Under these conditions convective mixing and turbulent diffusion are accounted for by generating a surface mixed layer of uniform temperature. The depth of the surface mixed layer is determined by a thermal energy balance. The theory shows good agreement with field observations of temperature distributions in Lake Tahoe. Experiments are performed using artificial insolation (mercury vapor and infrared lamps) on a laboratory tank. It is possible to simulate the development of thermal stratification under laboratory conditions. (Knapp-USGS)
W69-05610

CIRCULATION IN SHALLOW HOMOGENEOUS LAKES,
Cornell Univ., Ithaca, N. Y. Coll. of Engineering; and Puerto Rico Univ., Mayaguez. Engineering and Water Resources Research Inst.
James A. Liggett, and Christos Hadjitheodorou.
Work partially supported by Nat Sci Found Grant. ASCE Proc, J Hydraul Div, Vol 95, No HY2, Pap 6454, pp 609-620, Mar 1969. 12 p, 7 fig, 9 ref, append. Grant GK559 (NSF).

Descriptors: *Lakes, *Water circulation, *Wind pressure, Currents (Water), Mathematical models, Numerical analysis, Topgraphy, Path of pollutants, Coriolis force.
Identifiers: Eddy viscosity, Ekman drift.

The steady state, wind driven circulation of a shallow, homogeneous lake on a rotating earth is studied by means of a solution of the equations of fluid motion. The equations are linearized, dissipation is assumed to result only from bottom friction an constant eddy viscosity is employed. These appr imations assume a shallow lake where a char teristic horizontal dimension is large compared the maximum depth and the depth is of the orde magnitude of the Ekman 'depth of frictional fluence'. The solution gives the 3-dimensional culation patterns for a lake of arbitrary plan fo and bottom topography. The effect of bott topography is shown in sample calculations. napp-USGS)
W69-05618

ABSORPTION COEFFICIENTS CHLOROPHYLL DERIVATIVES,
Queen's Univ., Kingston (Ontario). Dept. of Bio gy.
Seward R. Brown.
J Fish Res Board, Can, Vol 25, No 3, pp 523-54 1968. 7 fig, 2 tab, 26 ref.

Descriptors: *Chlorophyll, *Diagenesis, *Optic properties, *Plant pigments, *Spectrophotomet Analytical techniques, Biochemistry, Chemic degradation, Chlorella, Chromatography, Lak Limnology, Pigments, Sedimentation.
Identifiers: *Absorption coefficients, *Chlorophy derivatives, *Molar absorption coefficients, E perimental limnology.

Availability of molar absorption coeffcients is cr cial to quantitative spectrophotometric determin tion of derivatives of chlorophyll in studies of diagenesis in lacustrine sediments. Author fe radiocarbon dioxide to cultures of Chlorella, hea killed cells after nine days' growth, extracted pi ments, and isolated chlorophyll-a and -b chromat graphically. Regression on absorbance at 667 na nometers of counts per minute for solutions radioactive pheophorbide-a prepared chemicall from chlorophyll so isolated and concentrations milligrams of carbon per liter of crystallin pheophorbide resulted in plots which were statist cally similar, thus permitting calculation of concer trations of all derivatives from knowledge specific activities and molecular weights. Labelle compounds, with molar absorption coefficients thousands of square centimeters per mole indicate in parentheses (first figure, at wavelength of re maximum; second, at blue) are: chlorophyll- (135.8, 100.7); allomerised chlorophyll-a (166.5 86.5); chlorophyllide-a (80.6, 54.2); pheophytin- (135.6, 66.8); allomerised pheophytin-a (171.2 69.1); pheophorbide-a (83.9, 41.6); methy pheophorbide-a (82.0, 39.7); chlorophyll-b (200.9 72.5); chlorophyllide-b (99.0, 32.9); allomerise chlorophyllide-b (128.8, 31.5); methyl chlorophyl lide-b (117.3, 39.5); allomerised methy chlorophyllide-b (170.9, 34.5); pheophorbide-b (151.9, 31.6); allomerised pheophorbide-b (177.9 29.8). (Eichhorn-Wis.)
W69-05695

NATURAL AND ARTIFICIALLY (AIR-PLOUGHING) INDUCED MOVEMENT OF RADIOACTIVE PHOSPHORUS FROM THE MUDS OF LAKES,
Wisconsin Univ., Madison. Dept. of Zoology.
A. D. Hasler.
UNESCO Int Conf Radioisotopes, Vol IV, pp 658-675, 1957. 2 fig, 9 tab, disc, 16 ref.

Descriptors: *Lakes, *Mud, *Phosphorus radioisotopes, *Water circulation, Cycling nutrients, Phosphorus compounds, Phosphates, Eutrophication, Diffusion, Water chemistry, Sediment-water interface, Lime, Limnology, Thermal stratification, Aeration.
Identifiers: *Experimental limnology, Lake Peter (Wis), Lake Paul (Wis), Sawmill Pond (Wis), Fish production, Alkalization.

Lakes are wasteful of the phosphorus entering them. Therefore intrafertilization procedures hold promise toward increasing the production of fish. In an undisturbed mud-water system, the percentage, as well as the amount of phosphorus which is

leased to the superimposed water, is very small. /hen radiophosphorus is placed at various depths the mud the diffusion into the overlying noncir- ilating water is negligible if placed deeper than 1 n in the mud. Application of lime to the water, or the mud, reduces the amount of soluble iosphorus available. Acidification of previously kalized mud will, upon agitation, increase the nount of phosphorus entering solution. In an quarium experiment, circulation of the water ove phosphorus-rich mud with the aid of air bub- es increases the phosphorus in solution. Ther- ally stratified lakes can be synthetically circu- ted by compressed air bubbles for the purpose of rtilizing the surface water. An example is given here a small lake was completely aerated with an fort of 2.4 horsepower hours per kg of oxygen dded. These studies demonstrate that lakes can be ilized as experimental models for oceanographic d isotope studies. (Hasler-Wis)
69-05698

AKE SEDIMENTS: THE BOTTOM DEPOSITS F THE NORTH BASIN OF WINDERMERE, ITH SPECIAL REFERENCE TO THE IATOM SUCCESSION,
eshwater Biological Association, Ambleside (En- and).
inifred Pennington.
ew Phytologist, Vol 42, No 1, pp 1-27, May 1943. fig, 35 ref.

escriptors: *Diatoms, *Cores, *Paleolimnology, diments, Eutrophication, Ecology, Paleoecology, mnology.
entifiers: *Lake Windermere, English Lake Dis- ct, Asterionella, Diatoma, Lake evolution, Lake ccession, Gomphonema, Melosira, Organic con- nt of cores, England, Pollen analysis, Laminated ay.

atom vertical succession was studied on cores m glacial Lake Windermere, English Lake Dis- ct. In cores examined, four main types of sedi- ent found were: laminated clay; narrow clay nds; brown mud; surface ooze. Results show that rliest deposits in lake basin, ie, laminated clay, ntained practically no organic matter and no mains of living organisms. Deposits between top laminated clay and topmost narrow clay band in- cate second period. Changes in lake's environ- ent seem most marked for this period. Large atoms, notably Melosira, are present throughout ne, but these disappear or decrease abruptly at vel of topmost clay band. After deposition of atomaceous sediment began, ie, when organic oduction started, sediment's organic content in- eased progressively. Uniform brown atomaceous detritus mud represents lake's third riod. Large diatoms that characterized lower posits are rare or absent, replaced by mphonema and Pinnularia. Deposit appears to dicate long period of equilibrium conditions after d of glacial influence. Lake's latest period is presented by 20 cm of surface ooze containing undant Asterionella. Factor causing change was obably increasing dissolved salts caused by wage pollution following human settlement on e's shores. Tentative time scale based on sedi- entation rates, varve counts, and pollen data is ven. (Bortelson-Wis)
69-05707

PRELIMINARY REPORT OF THE FOSSIL ATOM FLORA FROM LAKE HURON SEDI- ENTS,
ichigan Univ., Ann Arbor. Great Lakes Research v.
F. Stoermer, and J. J. Yang.
pported by FWPCA. Proc 11th Conf Great kes Res, Vol 11, pp 253-267, Apr 1968. 15 p, 4 , 1 tab, 37 ref.

escriptors: *Diatoms, *Lake Huron, Paleolim- logy, Quaternary period.
entifiers: *Species diversity, Microfossils.

This paper reports floristic analysis of subfossil diatom remains recovered from bottom sediments taken in a core from 45 deg 01.0 min N, 82 deg 01.0 w, Lake Huron. Thirteen 1 ccm samples, spaced at 15 cm intervals, were taken from a 1.8 m core. Examination of standard subsamples in microscopic preparations revealed a total of 187 discernable taxonomic entities. Of these, 160 have been referred to recognized taxa. Considering the location of the sampling area, an unexpectedly high proportion of the taxa find their primary habitat in biocoenoses other than the plankton. There is a tendency for the number of specimens recovered per sample to decrease with depth in the section, although there is considerable variation between samples throughout its length. On the basis of fluctuations in diversity of the flora, it appears that a major disturbance is recorded in the 135 cm sample. On the basis of shifts in relative abundance of the dominant plankton species and their known autecology, it appears that the disturbance represents a return to relatively lower mineral nutrient levels. It is postulated that this event is correlated with the Nipissing Stage of Lake Huron. It appears that either raising or lowering nutrient levels may affect diatom diversity hence diversity estimates alone prove misleading.
W69-05762

NEARSHORE PHYTOPLANKTON POPULATIONS IN THE GRAND HAVEN, MICHIGAN VICINITY DURING THERMAL BAR CONDITIONS,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
E. F. Stoermer.
Proc. 11th Conf. Great Lakes Res., Vol 11, pp 137-150, Apr 1968. 14 p, 13 fig, 1 tab, 17 ref.

Descriptors: *Phytoplankton, *Lake Michigan, *Water circulation, Nuisance algae, Thermal pollution, Diffusion, Diatoms, Chlorophyta, Chrysophyta, Dinoflagellates, Cyanophyta.
Identifiers: *Thermal bar.

In late April 1967, the thermal bar phenomenon had profound effects on both the abundance and species composition of phytoplankton in nearshore Lake Michigan waters in the vicinity of Grand Haven, Michigan. Landward of the thermal bar populations averaged between 1500 and 2000 cells/ml compared with average values of about 400 cells/ml in water entering the lake from the Grand River and about 350 cells/ml in water outside the thermal bar. The highest populations observed, occurred in the interface between inshore and offshore waters. The relative abundance of most species of algae was strikingly dissimilar in the different water masses. Four general types of species distribution were noted: (1) species which were abundant in the harbor flora, rare in the inshore waters, and very rare or lacking in the offshore waters; (2) species which were abundant in the inshore waters, rare in the harbor flora, and rare or lacking in the offshore waters; (3) species which were abundant in the offshore waters, rare in the inshore area and lacking in the harbor flora; (4) species which were most abundant in the interface water with secondary abundance peaks in either of the other habitats. It appears that the primary effect of thermal additions to Lake Michigan is through constraint on circulation which traps nutrients near shore.
W69-05763

DEATH OF A LAKE,
For primary bibliographic entry see Field 05C.
W69-05844

ARTIFICIALLY INDUCED CIRCULATION OF LAKES BY MEANS OF COMPRESSED AIR,
Wisconsin Univ., Madison. Dept. of Zoology.
For primary bibliographic entry see Field 05C.
W69-05866

AVAILABILITY OF IRON AND MANGANESE IN SOUTHERN WISCONSIN LAKES FOR THE GROWTH OF MICROCYSTIS AERUGINOSA,
Wisconsin Univ., Madison. Dept. of Botany.
For primary bibliographic entry see Field 05C.
W69-05867

CELL CONTENTS OF NITROGEN AND PHOSPHORUS AS A MEASURE OF THEIR AVAILABILITY FOR GROWTH OF MICROCYSTIS AERUGINOSA,
Wisconsin Univ., Madison. Dept of Botany.
For primary bibliographic entry see Field 05C.
W69-05868

A COMPARATIVE STUDY IN EUTROPHICATION,
Yale Univ., New Haven, Conn. Osborn Memorial Lab.
For primary bibliographic entry see Field 05C.
W69-05869

MOVEMENTS OF RADIOSODIUM (Na-24) WITHIN AN ICE-COVERED LAKE,
Wisconsin Univ., Madison. Dept. of Zoology.
Gene E. Likens, and Arthur D. Hasler.
Limnology and Oceanography, Vol 7, No 1, pp 48-56, 1962. 9 p, 9 fig, 15 ref.

Descriptors: *Lakes, *Water circulation, Cycling nutrients, Sodium compounds, Diffusion, Water chemistry, Limnology, Wisconsin, Radiochemical analysis, Analytical techniques, Radioecology, Iced lakes, Radioisotopes, Dystrophy, Temperature, Conductivity, Ecosystems.
Identifiers: *Sodium radioisotopes, *Experimental limnology, Tub Lake (Wis), Crushing devices, Scintillation counting, Biological orientation, Winter stagnation.

Radiosodium was transported horizontally a maximum distance of 15-20 meters during the first 24 hours of replicated experiments conducted during January of 1960 and 1961 in a small ice-covered lake in northwestern Wisconsin. Subsequent horizontal displacement was somewhat slower but reached a maximum distance of almost 30 meters from the release point in three days. The dispersed pattern was asymmetrical and different in each of the two experiments. Results indicated that some vertical movement occurred during the experimental periods but was of very low velocity. A crushing device for releasing the radioactive solution in deep water is described. In addition, a 'portable' scintillation counting system was developed for measuring the radioactivity within the lake. (Hasler-Wisc)
W69-05870

PRELIMINARY OBSERVATIONS ON A YEAR'S CYCLE OF SEDIMENTATION IN WINDERMERE, ENGLAND,
For primary bibliographic entry see Field 02J.
W69-05876

QUALITY OF WATER IN SELECTED LAKES OF EASTERN SOUTH DAKOTA,
Geological Survey, Washington, D. C.
L. R. Petri, and L. R. Larson.
S Dak Water Resources Comm Rep of Invest No 1, 1967. 55 p, 3 fig, 7 tab, 7 ref, append.

Descriptors: *Water quality, *Lakes, *South Dakota, Data collections, Evaporation, Algae, Water chemistry, Water utilization, Recreation, Irrigation water, Municipal water, Aquatic bacteria.
Identifiers: Lake water quality.

Significant seasonal changes in water quality were detected from 4 sets of samples taken from 26 lakes from October 1964 to September 1965. Increased concentrations of dissolved solids, sulfate, and other constitutents in February 1965 were caused by ice formation; decreased concentrations resulted from subsequent thawing and spring in-

flow. Dissolved oxygen, which was between 9.4 to 13.4 ppm in all but 3 lakes in October 1964, was virtually absent in 8 lakes and markedly depleted in 9 other lakes in February 1965. In some of the lakes depletion of oxygen was accompanied by increased iron and manganese concentrations. Of 9 common insecticides, 6 were detected in several lakes in May 1965, but only in minute concentrations. Algae were abundant in water from 6 lakes; 79 genera were detected and estimated for population. Water from all lakes is very hard. If softened and treated to remove iron and manganese, water from many of the lakes could be used for municipal supply. Depletion of oxygen and relatively shallow depths severely limit the potential of some of the lakes for fishing and other recreational uses. Water from all but 4 of the lakes is suitable for irrigation on well-drained land. There is no evidence of pollution in any of the lakes. (Knapp-USGS)
W69-05932

2I. Water in Plants

HYDROLOGY, SOIL PROPERTIES, CROP GROWTH AND LAND DRAINAGE,
Institute for Land and Water Management Research, Wageningen (Netherlands).
For primary bibliographic entry see Field 02F.
W69-05607

ON THE RELATION BETWEEN TRANSPIRATION, SOIL PHYSICAL PROPERTIES AND CROP PRODUCTION AS A BASIS FOR WATER SUPPLY PLANS,
Institute for Land and Water Management Research, Wageningen (Netherlands).
P. E. Rijtema.
Soil-Water-Plant, Proc and Inform No 15, Comm for Hydrol Res, T. N. O., pp 28-58, 1969. 31 p, 13 fig, 9 tab, 26 ref.

Descriptors: *Soil moisture, *Soils, *Crop response, *Crop production, Moisture availability, Evaporation, Water levels, Permeability, Evapotranspiration, Climates, Water table, Land management, Soil management, Irrigation practices, Irrigation efficiency, Water requirements.
Identifiers: Dry water production.

The effects of climate and soil physical conditions on agricultural crop transpiration and dry matter production are discussed. Evapotranspiration is calculated with a combined meteorological and energy balance approach, using vapor pressure, net radiation, aerodynamic roughness, and wind velocity data. Irrigation requirements are calculated by multiplying free water surface evaporation by an empirical crop coefficient. Crop coefficients may be transferred to other climatic conditions with an empirical equation using albedo and wind data. The relation between water table depth and crop requirements is calculated using capillary conductivity and suction at the lower boundary of the root zone. The relation between dry matter production and transpiration depends on climate and soil fertility may be estimated taking vapor pressure deficit into account. Production is severely affected by severe moisture deficit during heading and early flowering of grains. The drought resistance of soils may be classified by available soil moisture, which depends on soil physical properties. (Knapp-USGS)
W69-05613

SOIL WATER CONTENT IN RELATION TO NUTRIENT UPTAKE BY THE PLANT,
Institute for Soil Fertility, Groningen (Netherlands).
I. K. Wiersum.
Soil-Water-Plant, Proc and Inform No 15, Comm for Hydrol Res, T. N. O., pp 74-89, 1969. 16 p, 3 fig, 56 ref.

Descriptors: *Soil-water-plant relationships, *Soil management, *Nutrient requirements, Crop response, Water levels, Water level fluctuations, Drainage effects, Irrigation effects, Root distribution, Root zone.
Identifiers: Soil water-nutrient mobility relationships.

The relationships of soil moisture content, soil water movement, and nutrient transport are reviewed and recommendations for proper soil water management are made. Movement of nutrients with the flow of water to roots is much more important quantitatively than molecular or diffusion movement. Substances supplied to the vicinity of the root in excess of uptake will accumulate, while substances supplied in deficiency will be depleted, causing a great difference in soil solutions near to and distant from roots. Ions such as phosphate, K, Mn, Fe, and Zn are transported mainly by diffusion. The more mobile nutrients including Ca, Mg, and Na are supplied largely by mass water flow. The continuous presence of available water in the whole root profile is desirable for production of crops. Nutrient loss by leaching is caused by excessive water. Keeping the soils as moist as possible as long as aeration is sufficient for root growth allows the best use of nutrients because of favorable mass flow, diffusion, and root growth conditions. Water level fluctuations should be prevented within reach of roots, which grow downward with low water and are then killed by rising water. Low aeration in saline soils may cause strong increase in sodium uptake, and should be avoided. High moisture content with low aeration could result in increased Mn availability or even in Mn toxicity. (Knapp-USGS)
W69-05615

CALCULATION OF PARAMETERS FOR THE EVALUATION OF THE LEACHING OF SALTS UNDER FIELD CONDITIONS, ILLUSTRATED BY NITRATE,
Institute for Soil Fertility, Groningen (Netherlands).
For primary bibliographic entry see Field 02G.
W69-05616

AERODYNAMIC AND SURFACE FACTORS IN EVAPORATION,
Rothamsted Experimental Station, Harpenden (England); and Munich Univ. (West Germany). Meteorologisches Institut.
G. Szeicz, Gabriella Endrodi, and S. Tajchman.
Water Resources Res, Vol 5, No 2, pp 380-394, Apr 1969. 15 p, 6 fig, 3 tab, 44 ref.

Descriptors: *Evapotranspiration, *Evaporation, *Crops, Energy budget, Diffusion, Advection, Stomata, Winds, Turbulence, Solar radiation.
Identifiers: Eddy conductivity, Roughness (Aerodynamic).

Measurements were made of the roughness length and other aerodynamic qualities of pine forest, lucerne, and potatoes in Germany, and analyzed with additional data obtained from publications. For pliable crops, roughness length decreases by 1/2 for winds of 1-3 m/sec; in this range of winds, roughness length is approximately equal to 1/10 the crop height. Eddy conductivities are about 3 times open-water values for crops and 30 times open-water values for trees. Stomatal diffusion resistance values in trees are alqays 2-4 times as great as in crops, with winds from 1.0-1.5 cm/sec. Energy balance computations give estimates of evaporation for open water, pine forest, potatoes, and lucerne that agree within 5-15% with measurements in England and California. (Knapp-USGS)
W69-05631

PLANT ECOLOGY OF AN ARID BASIN, TRES ALAMOS-REDINGTON AREA, SOUTHEASTERN ARIZONA,
Geological Survey, Washington, D. C.
Robert C. Zimmermann.
Geol Surv Prof Pap 485-D, pp D1-D51, 1969. 51 p, 22 fig, 2 plate, 31 tab, 73 ref.

Descriptors: *Soil-water-plant relationshi
*Ecology, *Moisture, *Arid lands, *Arizo
Channels, Hydrologic budget, Non-perenn
streams, Perennial streams, Surface runoff, S
face-groundwater relationships, Arizona.
Identifiers: Arid basin plant ecology.

The plant ecology of a 750 sq mi area in the S
Pedro Valley of Arizona was studied in relation
the flow regiments of the streams. The average a
nual rainfall is 12 inches. Streamflow durati
ranges from ephemeral to perennial. The vege
tion changes from shrubs and cactuses at 3,000
altitude to spruce-fir forests at 8,000 ft. In the stu
area, water tables deeper than 40-50 ft probably
not sustain plant life. This is indicated mainly
the aspect of mesquite, probably the deepest ro
ing species in the area. Most plants probably ha
root zones within the top 20-30 ft of the substra
Most of the valley-floor vegetation in the study ar
appears to grow independently of regional water
bles, as these are in most reaches deeper than 40
The species that seem to require shallow groun
water at least part of the yr are few and probab
cover too small an area to affect the regior
hydrology. The variations in the vegetation of t
San Pedro Valley can be related to easily reco
nized differences in moisture regimens. Distrib
tions of a few plants may be related to flow ever
with recurrence intervals of 1 to about 20 yea
Variations in the plant cover can thus be explaine
in terms of current conditions or processes, thou
the processes may occur either frequently or i
frequently. (Knapp-USGS)
W69-05634

THE PHREATOPHYTE PROBLEM I ARIZONA,
Geological Survey, Tucson, Ariz.; and Bureau
Reclamation, Phoenix, Ariz.
For primary bibliographic entry see Field 03B.
W69-05645

STUDIES ON PRESOWING DROUGHT HARDENING OF WHEAT,
Queensland Wheat Research Inst., Toowoomb
(Australia). Primary Industries Dept.
D. R. Woodruff.
Aust J Agric Res, Vol 20, No 1, pp 13-24, Ja
1969. 7 fig, 3 tab, 20 ref.

Descriptors: *Drought resistance, *Wheat, *See
treatment, *Moisture content, *Crop productior
Planting management, Plant physiology, Arid cli
mates, Growth stages, Leaves, Stomata, Moistur
stress, Phenology, On-site tests, Greenhouses, En
vironmental effects, Plant growth, Photoperiodism
Identifiers: *Presowing, *Australia, *Drough
hardening, Relative water content, Parameters.

Results of glasshouse and field experiment
designed to study effects of presowing drough
hardening treatment on growth, yield, and relative
water contents (RWC) of wheat under a wid
range of environmental conditions are reported in
this paper. The rate at which critical levels of RWC
developed during periods of moisture stress was
reduced in general by the treatment but not neces
sarily the final value to which the RWC fell. Grain
yield increases due to the hardening treatment
varied from 0 to 20% in different experiments.
Results were discussed in relation to both cause of
observed RWC differences and potential practical
role of the technique in arid zone agriculture. (Af
fleck-Ariz)
W69-05672

STOMATAL OPENING IN ISOLATED EPIDERMAL STRIPS OF VICIA FABA. II. RESPONSES TO KCL CONCENTRATION AND THE ROLE OF POTASSIUM ABSORPTION,
California Univ., Davis. Lab. of Plant-Water Relations.
R. A. Fischer, and Theodore C. Hsiao.
Plant Physiol, Vol 43, pp 1953-1958, 1968. 6 fig, 1 tab, 21 ref.

Descriptors: *Stomata, *Epidermis, *Vetch, *Potassium, *Absorption, Ions, Chlorides, Cytological studies, Tracers, Light, Plant physiology, Plant tissues, Crop response, Carbon dioxide, Air.
Identifiers: Starch.

The stimulation by KCL of stomatal opening in isolated epidermal strips of Vicia faba was examined in this study. The opening response of stomata was maximal at 100 mm KCL in dark plus normal air, while in light plus CO sub 2-free air it was maximal at about 10 mm KCL. CO sub 2-free air was more influential than light in reducing the KCL concentration required for maximal opening. In these processes CL- seemed to be of secondary importance, while K+ was traced with super 86 Rb+ and showed that the increase in stomatal aperture under various conditions was well correlated with K+ uptake. It was suggested that the absorption of extracellular solutes, such as K+, may be the primary mechanism of stomatal opening. The increase in stomatal aperture was also well correlated with the decrease in suitable starch in guard cells under all conditions. This, however, was thought to be a secondary change. (Affleck-Ariz)
W69-05681

AN AGROCLIMATOLOGY SURVEY OF A SEMIARID AREA IN AFRICA SOUTH OF THE SAHARA,
Joint FAO/UNESCO/WMO Interagency Project on Agroclimatology.
J. Cocheme, and P. Franquin.
World Meteorological Organization, Technical Note 86, 136 p, 1967. 67 fig, 33 tab.

Descriptors: *Semiarid climates, *Rainfall, *Crop production, *Climatic data, *Surveys, Agriculture, Soils, Vegetation, Tropical regions, Air circulation, Air temperature, Evaporation, Soil moisture, Moisture availability, Dry seasons, Wet seasons.
Identifiers: *Africa, *Agroclimatology.

An area with a semiarid climate of summer rains in Africa south of the Sahara was delineated and its soils and vegetation briefly described. A simple model of atmospheric circulation illustrated the origins of its tropical climate with a long dry northern winter and summer rains. During the growing season of summer rains, air dryness, temperatures and rates of evaporation were reduced to amounts less likely to impose severe stress on annual crops than those prevailing immediately before and after the rains. Comparisons of yield with climatic factors of rainfall and availability of water periods showed that, where there was a marked relation, the regression tended to be curvilinear, with yield dropping off whenever values of the climatic variables exceeded an optimum range, as well as when they fell short of it. A consideration of the information gathered by the survey and its scale suggested that great caution must be exercised in extrapolating this information to delineate agroclimatic sub-regions for agricultural planning and development. (Blecker-Ariz)
W69-05684

CONSUMPTIVE USE ESTIMATES FROM SOLAR RADIATION AND TEMPERATURE,
Bureau of Reclamation, Denver, Colo.
David C. N. Robb.
Irrig and Drain Specialty Conf, Las Vegas, Nevada, Nov 2-4, 1966, pp 169-191, 12 ref, 6 fig, append.

Descriptors: *Consumptive use, *Evapotranspiration, *Solar radiation, *Air temperature, *Climatic data, Estimating, Data collections, Instrumentation, Irrigation efficiency, Measurement, Water requirements.
Identifiers: *Jensen-Haise method, Short-wave, Crop coefficient.

The Jensen-Haise method for estimating consumptive use from total short-wave solar radiation and mean air temperature shows promise of being a valuable tool for the engineer. Its advantages include simplicity of application and suitability for use in areas unfamiliar to the user. It provides the very real advantage of presenting, in the computed potential evapotranspiration modified by a factor of up to 1.2, a theoretical maximum value of consumptive use under normal climatic conditions. In areas where solar radiation data might be considered inadequate, collection of supplemental solar radiation data, using relatively inexpensive and simple-to-use equipment, should provide enough information to allow transfer of data from other stations with confidence. (Blecker-Ariz.)
W69-05686

AN IMPROVEMENT SCHARDAKOW DYE TECHNIQUE FOR THE MEASUREMENT OF PLANT WATER POTENTIALS,
Central Arid Zone Research Inst., Jodhpur (India).
Man Singh Manohar.
Annals of Arid Zone, Vol 4, No 2, pp 159-163, September 1965, 2 tab, 10 ref.

Descriptors: *Dye releases, *Plant tissues, *Leaves, *Measurement, Plant physiology, Biochemistry, Tracers, Tracking techniques, Analytical techniques.
Identifiers: *Water potential, *Schardakow dye method, Potential, Equilibration.

An improved version of the Schardakow dye technique was described as applied in a study for measurement of the water potential of Ricinus communis leaf. Advantages noted over the original Schardakow dye technique were as follows: (1) Quantity of test material for recording an observation is reduced to a minimum. (2) Necessity of removing the tissue from the test solution for obtaining potential value is avoided. (3) Use of already colored test solution makes it possible to take a series of observations during the equilibration period on the same tissue. The role of plant water potential on physiological and biochemical processes governing quality and quantity of plant growth in an arid climate is important. (Blecker-Ariz.)
W69-05688

MEASUREMENTS OF PRECIPITATION INTERCEPTION BY AN ARID ZONE PLANT COMMUNITY (ACACIA ANEURA F. MUELL),
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Land Research and Regional Survey.
R. O. Slatyer.
UNESCO Arid Zone Research, Vol 25, pp 181-192, 1965, 7 fig, 2 tab, 13 ref, disc.

Descriptors: *Rainfall, *Throughfall, *Interception, *Stemflow, *Measurement, Biological communities, Arid climates, Desert plants, Precipitation (Atmospheric), Canopy, Climatic data, Gages, Microenvironment, Wet seasons, Rainfall intensity.
Identifiers: *Acacia, Australia.

This paper describes measurement techniques and results from a study concerning the fate of rainfall on a desert woodland plant community (Acacia aneura F. Muell) in the Australian arid zone. There was no measureable throughfall until 0.03 in. of area rainfall was received and no measurable stemflow until area rainfall reached 0.01 in. The proportion of area rainfall partitioned into throughfall and stemflow increased rapidly until area rainfall of the order of 0.50 in were reached whereupon subsequent changes were much slower. Throughfall is observed as soon as rain commences (even though it is not measurable immediately) and the first measurable throughfall values are approximately 30%. The proportion of area rainfall partitioned into throughfall and stemflow rose rapidly and it may be assumed that a progressively greater contribution to throughfall was made by water dripping from the wetted surfaces. (Blecker-Ariz.)
W69-05689

ROOT SYSTEM OF FOUR DESERT TREE SPECIES,
Central Arid Zone Research Inst., Jodhpur (India).
C. P. Bhimaya, and R. N. Kaul.
Annals of Arid Zone, Vol 4, No 2, pp 185-194, September 1965, 4 fig, 1 tab, 2 ref.

Descriptors: *Root development, *Root distribution, *Root systems, *Root zone, *Desert plants, Plant physiology, Seeds, Speciation, Trees, Arid lands.
Identifiers: *Transplanting, Tap roots, Shoots.

Trees used in the root study were Tecomella undulata, Prosopis cineraria (Syn. spicigera), Albizia lebbeck and Acacia senegal. The study consisted of two plants from each of the four species, one raised by transplanting and one from seedling. Data collected on each species included shoot length, collar diameter, length of tap root, maximum lateral spread, number of secondary roots, air dry weight of shoot and root, and root to shoot ratio. Compared to the plants from direct seedling the transplanted plants of all tree species exhibited increased length of tap root. The species did not differ markedly in their maximum lateral spread of roots under seeding and transplanting. (Blecker-Ariz.)
W69-05690

SOIL MOISTURE RESPONSE TO RANGE IMPROVEMENT IN THE NORTHERN GREAT PLAINS,
Agricultural Research Service, Miles City, Mont.
Walter R. Houston.
J Range Management, Vol 18, No 1, pp 25-30, January 1965. 4 tab, 21 ref.

Descriptors: *Soil moisture, *Crop production, *Range management, *Moisture stress, *Stocking, Clay loam, Fertilizers, Nitrogen, Semiarid climates, Carrying capacity, Droughts, Range grasses, Montana, Treatment, Great Plains, Soil-water-plant relationships, Precipitation (Atmospheric).
Identifiers: *Pitting.

A study was established to investigate influence of several range improvement practices on soil moisture regimes and soil moisture-herbage production relationships on native semi-arid rangeland in eastern Montana. Range pitting effectively reduced soil moisture stress in the soil profile even during drought. Application of nitrogen fertilizer in the fall reduced soil moisture stress on certain soils. Average soil moisture stress was significantly correlated with several components of herbage production. Many significant interaction effects were evident between different combinations of treatments, years, soils and stocking rates. Interaction effects were observed on both total soil moisture stress and soil moisture stress-herbage production relationships. (Blecker-Ariz.)
W69-05693

2J. Erosion and Sedimentation

SEDIMENT CONTROL METHODS, INTRODUCTION AND WATERSHED AREA,
American Chemical Society, New York. Hydraulics Div.
Vito A. Vanoni.
ASCE Proc, J Hydraul Div, Vol 95, No NY2, pp 649-673, Mar 1969. 25 p, 6 fig, 1 tab, 34 ref.

Descriptors: *Sediment control, *Erosion, *Sedimentation, *Erosion control, Land management, Sediment transport, Water supply, Gully erosion, Mass wasting, Channel improvement, Harbors, Reservoirs, Rivers, Vegetation, Bank protection, Check structures, Contour farming, Diversion structures, Soil management, Terracing.
Identifiers: Sediment control methods.

The varying implications regarding the control of sediments to individuals working in different fields are discussed. The subject is considered in 2 general areas, the land surface and the fluvial channels and associated water bodies. Sediment control on land is discussed in terms of watershed areas, and includes considerations of sheet erosion and rills, gullies, or other small fluvial channels. Larger

channels are discussed separately in terms of natural and artificial channels, since control of the former is restricted generally by its existing form and the design of the latter is permitted many more degrees of freedom. Controls in reservoirs and harbors are treated separately, since the concepts or purposes differ measurably. The prevention of the erosion of sediment particles from the land or from fluvial channels and the controls applicable in fluvial channels or in the lakes, reservoirs, estuaries, or bays into which they flow are also explored. (K-napp-USGS)
W69-05620

THE BEHAVIOR OF LARGE PARTICLES FALLING IN QUIESCENT LIQUIDS,
Geological Survey, Washington, D. C.
G. E. Stringham, D. B. Simons, and H. P. Guy.
Geol Surv Prof Pap 562-C, pp C1-C36, 1969. 36 p, 27 fig, 7 tab, 23 ref.

Descriptors: *Sedimentation, *Settling velocity, *Movement, Particle shape, Particle size, Density, Reynolds number, Turbulence, Sedimentology.
Identifiers: Particle fall behavior, Settling.

The free-fall behavior patterns of specific idealized particles falling singly in quiescent liquids were observed with respect to fall patterns, fall velocity, and travel path. Particle shapes and densities were chosen to represent the limiting conditions of natural gravel-sized sediment found in alluvial channels. The liquids used in the fall column were water, various mixtures of water and glycerine, and pure glycerine. The particles were dropped in a vertical clear plexiglass fall column 3 meters high and 40 cm in diameter. Two 16-mm movie cameras set at right angles to each other and focused on a timer and a 1-meter test section of the column recorded the particle behavior. The spheres usually fell straight, but disks exhibited four types of fall behavior: (1) steady-flat fall when the Reynolds number was less than 100; (2) regular oscillation-oscillation occurred about a diameter perpendicular to the direction of fall, and there was very little horizontal translation; (3) glide-tumble-the frequency of oscillation was less than regular oscillation, the amplitude increased until the disks fell vertically on edge part of the time, and sometimes tumbling occurred at the end of each glide; and (4) tumble-the axis of the fall path was virtually a straight inclined line, the disk continually rotated, and the frequency of rotation approached the frequency of oscillation in the oscillation behavior pattern. The steadiness of a falling particle is dependent upon the stability of the resultant of the pressure forces in the wake of the particle. Extremes in shape and high R cause the resultant force to be the least stable. The more unsteady the particle the greater the path length. (Knapp-USGS)
W69-05625

MATHEMATICAL MODEL AND FORTRAN IV PROGRAM FOR COMPUTER SIMULATION OF DELTAIC SEDIMENTATION,
Stanford Univ., Calif.; and Canterbury Univ., Christchurch (New Zealand).
For primary bibliographic entry see Field 07C.
W69-05657

EVOLUTION OF A DUNED BED UNDER OSCILLATORY FLOW,
Georgia Inst. of Tech., Atlanta. School of Engineering; and Georgia Inst. of Tech., Atlanta. Water Resources Center
Marion R. Carstens, and Frank M. Neilson.
J Geophys Res, Vol 72, No 12, pp 3053-3059, June 15, 1967. 7 p, 3 fig, 2 tab, 4 ref. DA-49-055-CIVENG-65-1

Descriptors: *Dunes, *Ripple marks, *Waves (Water), *Hydraulic models, Currents (Water), Beaches, Sedimentation, Erosion, Turbulent flow, Laminar flow
Identifiers: *Oscillatory water flow.

The evolution of a duned bed from an initially flat bed was observed in a large water tunnel in which water moved over a sand bed with simple harmonic motion. Bed forms were observed to be of two types, (1) rolling-grain and (2) vortex, which are called ripples and dunes, respectively. Ripples are the initial transient bed forms that are replaced by dunes. Ripples formed spontaneously when the water-motion amplitudes by placing an obstruction on the otherwise flat bed. The history of a duned bed was observed and is described from birth to equilibrium. (Knapp-USGA)
W69-05662

AN OPERATIONS RESEARCH APPROACH TO BASIN SEDIMENT CONTROL,
Johns Hopkins Univ., Baltimore, Md.
Erhard F. Joeres.
Proc Third Annu Amer Water Resources Conf, San Francisco, pp 261-273, Nov 1967. 13 p, 3 fig, 18 ref, 1 append.

Descriptors: *Sediment control, *Dynamic programming, River basins, Optimization, Damages, Stochastic processes, Decision making, Deposition (Sediments), Alternative costs, Estuaries, Mathematical models, Reservoir design.

A deterministic dynamic programming model was structured to find the minimum total cost of control measures and damage costs for sedimentation in a hypothetical river basin (a main stem, fed by two tributaries, which discharged into an estuary) assumptions used were: (1) a pre-development equilibrium used for comparison; (2) a post-development fixed sediment load; and (3) decisions for degree of control and damages were independent of size distribution of sediment load. The solution proceeded by finding the optimum return in the tributaries, and then working recursively upstream from estuary in the main stem. The difficulties of handling stochastic variations of the sediment load were discussed. (See also W69-02227). (Gysi-Cornell)
W69-05733

THE DEVELOPMENT, USE AND EFFICIENCY OF INDICES OF SOIL ERODIBILITY,
Alberta Univ., Edmonton.
Rorke B. Bryan.
Geoderma, Vol 2, No 1, pp 5-26, Sept 1968. 22 p, 3 fig, 5 tab, 37 ref.

Descriptors: *Soil erosion, *Erosion, *Indexes, Soil science, Rainfall simulators, Soil aggregates, Soils, Bibliographies, Soil structure, Soil texture, Statistical analysis, Soil physical properties, Silts, Clays, Dispersion.
Identifiers: *Erosion index, Raindrop splash.

Development and use of indices of soil erodibility during the past 30 yr are reviewed. The ambiguous record of some indices is mentioned and a theoretical assessment made of their validity and limitations. Testing index efficiency against a standard reference of soil loss from samples subjected to artificially simulated rainfall is described. The efficiency of each index is measured by statistical analysis. The most efficient indices of soil erodibility are: (1) percentage-weight of water-stable aggregates (WSA) greater than 3 mm, (2) percentage-weight of WSA greater than 0.5 mm, (3) erosion ratio, (4) surface-aggregation ratio, (5) modified surface-aggregation ratio, and (6) clay ratio. Further statistical analysis shows that percentage-weight of WSA greater than 3 mm is the only completely reliable index of erodibility. (USBR)
W69-05826

BEHAVIOR OF MIDDLE LOUP RIVER CHANNEL AS INFLUENCED BY MILBURN DIVERSION DAM.
Bureau of Reclamation, Denver, Colo.
Pap, Sedimentation Br, Div Proj Invest, B Reclam, Denver, Colo, May 1968. 35 p, 24 fig, tab.

Descriptors: *Aggradation, *Degradatio *Degradation (Stream), Slope protection, *Sed mentation, Sedimentation rates, Deposition (Sed ments), Sediment control, Sediments, *Sedime transport, Stream channels, Stream erosion, Cha nel erosion, Channel improvement, Channels.
Identifiers: Sediment deposits, Sediment-wate relationship, Channel protection, *Milburn Dive sion Dam (Nebr).

This report updates aggradation and degradatio studies made at Milburn Diversion Dam on th Middle Loup River in central Nebraska. Aggrada tion above the dam has proceeded at a rate and t an extent beyond original expectations. Approxi mately 180 acre-ft of sediment per year is bein deposited in the aggrading reach. Degradation ha reached a depth greater than anticipated and ex tends at least 3-1/2 mi downstream from the dam Sediment transport computations indicate a average annual movement of 400 acre-ft of sedi ment into the depositional area. Bedload transport studies indicate that a channel having a slope o 0.0012 and a width of 100 ft would be capable o transporting the annual sediment through the depositional area. Mechanical removal of the deposited sediment is necessary to initiate and maintain a channel through the depositional area for transporting the sediment load to the dam where it can be sluiced downstream. Controlling the lateral movement of the channel will be a major problem. The banks possibly can be stabilized with car bodies, jacks, riprap, or a combination of these. (USBR)
W69-05841

PRELIMINARY OBSERVATIONS ON A YEAR'S CYCLE OF SEDIMENTATION IN WINDERMERE, ENGLAND,
Winifred Tutin.
Mem Ist Ital Idrobiol, Suppl 8, pp 467-484, 1955. 7 fig, 1 tab, 7 ref.

Descriptors: *Sedimentation, *Sedimentation rate, Diatoms, Lakes, Limnology, Organic matter, Silica.
Identifiers: Lake Windermere, Lake Ennerdale, England, Sediment traps, Annual sedimentation cycle, Asterionella, Diatomaceous silica, Lake deposits.

Amounts of sediment, in milligrams per square meter per week, were collected in cylindrical vessels in Lakes Windermere and Ennerdale. The sediment collected was fractionated into diatom silica, organic content, and mineral silt. In general, variations in quantity of sediment collected were fairly consistent in Windermere at 30 and 60 meters; the vessels at 15 meters sometimes caught more or less. The period of lowest sedimentation was in late summer after the peak organic production had passed. For the rest of the year the sedimentation rate was approximately constant with minor fluctuations. Organic matter was fairly constant throughout the year at 30% of the dry weight. The diatomaceous silica and mineral fraction showed more variation throughout the year, mineral sediment being high in winter and diatomaceous silica showing a steep rise in June when the spring crop of Asterionella began to settle out from the photic zone. The sedimentation rate for the middle of the north basin of Windermere was calculated to be 2.6 millimeters per year. (Bortleson-Wisc)
W69-05876

THE ROLE OF SOME STATISTICAL AND MATHEMATICAL METHODS IN THE INTERPRETATION OF REGIONAL GEOCHEMICAL DATA,
Royal School of Mines, London (England); and Imperial Coll. of Science and Technology, London (England). Dept. of Geology.
Ian Nichol, R. G. Garrett, and J. S. Webb.
Econ Geol, Vol 64, No 2, pp 204-220, Mar-Apr 1969. 17 p, 14 fig, 4 tab, 40 ref.

escriptors: *Geochemistry, *Sediments, Streams, *Exploration, Surveys, Statistical ethods, Geologic control, Soil analysis, Trace ele-ents, Chemical analysis.
entifiers: Trend surface analysis, Factor vector nalysis, Sierra Leone.

terpretation of regional geochemical survey data quires consideration of the effects of bedrock ochemistry and the influence of weathering and her secondary factors tending to modify the drock-soil-stream sediment relationship. Visual terpretation of complex multi-element data may ly serve to recognize the more obvious ochemical patterns leaving subtle though signifi-nt features undetected. In the Basement Com-ex of Sierra Leone, trend surface and rolling ean analysis were used to portray trends in metal stribution and to focus attention on local areas here the data deviate significantly from the trend. diment samples were collected over 1,500 sq mi a density of 4-5 samples per sq mi. Analysis owed variation in distribution of elements with drock type. Co, Cr, Mn, Ni, Ti, V and Zn tend to enriched over areas of basic and ultrabasic rock hereas Ga and Pb are concentrated in granite. A connaissance over 15,000 sq mi at a density of 1 mple per 70 sq mi showed marked regional varia-n in minor elements with rock, soil, and topog-phy. Similarly, in areas of complex geology and ochemistry, factor-vector analysis is applicable a method of determining and delineating pat-ns of variation in the trace element composition a whole which may then be correlated with the ology, secondary environment or some other usal factor. (Knapp-USGS)
69-05895

RMATION OF A RIVER MOUTH BAR HERE MARINE FACTORS PLAY AN IMPOR-NT ROLE (EXEMPLIFIED BY THE LIELUPE VER),
te Oceanographic Inst., Moscow (USSR).
V. Romashin.
ansl from Trudy Gos Okeanogr Inst, No 89, 1967, 161-174. Soviet Hydrol, Selec Pap, No 6, pp 9-658, 1967. 10 p, 5 fig, 3 tab, 14 ref.

escriptors: *Deltas, *Sedimentation, *Beach ero-n, Erosion, Coasts, Rivers, Sediment transport, aves (Water), Currents (Water), Littoral drift, dimentary structures.
entifiers: *Lielupe River (USSR).

e mechanism of reformation of a bar in the outh of the Lielupe River by frontal (head) waves d accompanying local currents is analyzed. The rmation and dynamics of submerged sand ridges e examined as one of the forms of sediment livery to the shore of a river mouth. Starting in 59, annual soundings and shore surveys and an-al delta, bar, and shore deposit maps were made. the western part of the bar, erosion is relatively iform whereas in the eastern and central parts, ere is net deposition. In the whole delta system ere is net removal of material.
69-05952

ME PATTERNS OF FORMATION OF A VER MOUTH BAR WHERE RIVER FAC-RS PLAY AN IMPORTANT ROLE (EXEM-IFIED BY THE VISTULA DELTA),
te Oceanographic Institute, Moscow (USSR).
N. Mikhaylov.
ans from Trudy Gos Okeanogr Inst, No 89, pp 5-190. Soviet Hydrol, Selec Pap, No 6, pp 659-1, 1967. 13 p, 4 fig, 4 tab, 16 ref.

escriptors: *Deltas, *Sand bars, *Coasts, *Cur-nts (Water), Rivers, Sedimentation, Streamflow, aves (Water), Winds, Coastal structures, Jetties, ore protection, Littoral drift, Sedimentary struc-es, Erosion, Beach erosion.
entifiers: *Vistula River.

e formation of a bar in the Vistula delta near ibno is used as an example to study the main pat-ns of river mouth bar development where river factors play the predominant role. It is demonstrated that bar morphology depends on the characteristics of the hydrologic and channel regime of the river. The factors affecting bar morphology are the volume of sediments delivered, the volume of sediments delivered, the volume of sediments moving off the bar, river discharge, longshore drifting, shore configuration, sediment composition, sea floor morphology, ice phenomena, and offshore depth. The total volume of the Vistula bar was 163.5 million cu m in 1953, and an average of 2.5 million cu m were deposited from 1895-1953. The weak longshore drift is west to east. Wave action is weak. Engineering structures and dredging have little success in bar control; the channel fills in weeks or months. (Knapp-USGS)
W69-05953

2K. Chemical Processes

DETERMINATION OF THE GROUND-WATER COMPONENT OF PEAK DISCHARGE FROM THE CHEMISTRY OF TOTAL RUNOFF,
Nova Scotia Dept. of Mines, Halifax.
For primary bibliographic entry see Field 02F.
W69-05628

RATE OF SULFURIC ACID FORMATION IN YELLOWSTONE NATIONAL PARK,
Geological Survey, Menlo Park, Calif.
Robert Schoen.
Geol Soc Amer Bull, Vol 80, No 4, pp 643-650, Apr 1969. 8 p, 2 fig, 1 plate, 2 tab, 16 ref.

Descriptors: *Acidic water, *Hot springs, Water chemistry, Gases, Hydrogen sulfides, Sulfates, Geysers, Aerobic bacteria, Sulfur bacteria, Chemical reactions, Oxidation, Sulfides, Thermal springs, Thermal water, Water quality, Hydrogen ion concentration, Wyoming.
Identifiers: *Yellowstone National Park, Sulfuric acid.

Sulfuric acid forms near sulfurous hot springs as the result of oxidation of hydrogen sulfide exhalations by atmospheric oxygen. This strong acid rapidly alters the surrounding rocks and can destroy man-made structures and contaminate streams. Acid-altered ground in Yellowstone National Park was studied in order to determine the rate at which sulfuric acid is forming. Although the size of the hot-spring areas varied by as much as a factor of 19, acid production was nearly uniform at about 10 g per sq m of area per day. The near constancy of acid production per unit area implies that the area of land surface is a major control of the oxidation reaction of sulfide to sulfate. This is consistent with a biological origin for the acid by aerobic sulfur-oxidizing bacteria living close to the land surface. Laboratory rates of acid production for sulfur-oxidizing bacteria are as much as 200 times greater than the rates measured in Yellowstone National Park. A strictly biological origin for the acid is, therefore, quantitatively feasible. This does not rule out the possibility of the formation of natural sulfuric acid in hot springs by inorganic processes. (Knapp-USGS)
W69-05635

BACTERIAL ORIGIN OF SULFURIC ACID IN SULFUROUS HOT SPRINGS,
Geological Survey, Menlo Park, Calif.
R. Schoen, and Garry G. Ehrlich.
Proc 23rd Int Geol Congr, Vol 17, pp 171-178, 1968. 8 p, 2 fig, 1 tab, 10 ref.

Descriptors: *Sulfur bacteria, *Hot Springs, *Acids, Sulfur compounds, Hydrogen sulfide, Sulfates, Sulfides, Oxidation, Wyoming, Aerobic bacteria, Hydrogen ion concentration.
Identifiers: Thiobacillus thiooxidans, Yellowstone Park, Sulfuric acid, Acid groundwater.

The sulfur-oxidizing bacterium Thiobacillus thiooxidans has been found in abundance in many sulfurous hot-spring areas in the western United States. T. thiooxodans occurs only in samples taken from depths less than 18 cm and at temperatures less than 50 deg C. Hot-spring areas in which hydrogen sulfide, carbon dioxide, and water are constantly supplied from depth and the ground temperature is uniformly warm throughout the year, are ideal places for the prolific growth of T. thiooxidans. The quantity of sulfuric acid that T. thiooxidans can produce in its life processes appears to be adequate to account for the sulfuric acid observed in most acid thermal springs. Although an inorganic mechanism may exist for the natural oxidation of hydrogen sulfide and elemental sulfur to sulfuric acid, its rate is probably so much slower than exhibited by T. thiooxidans as to be quantitatively insignificant. (Knapp-USGS)
W69-05654

DETERMINATION AND ISOTOPE-RATIO ANALYSIS OF DIFFERENT FORMS OF NITROGEN IN SOILS: 6. MINERALIZABLE NITROGEN,
Iowa State Univ., Ames. Dept. of Agronomy.
For primary bibliographic entry see Field 05A.
W69-05699

DETERMINATION AND ISOTOPE-RATIO ANALYSIS OF DIFFERENT FORMS OF NITROGEN IN SOILS: 3. EXCHANGEABLE AMMONIUM, NITRATE, AND NITRITE BY EXTRACTION-DISTILLATION METHODS,
Iowa State Univ., Ames. Dept. of Agronomy.
For primary bibliographic entry see Field 05A.
W69-05700

DETERMINATION AND ISOTOPE-RATIO ANALYSIS OF DIFFERENT FORMS OF NITROGEN IN SOILS: 4. EXCHANGEABLE AMMONIUM, NITRATE, AND NITRITE BY DIRECT-DISTILLATION METHODS,
Iowa State Univ., Ames. Dept. of Agronomy.
For primary bibliographic entry see Field 05A.
W69-05701

CHARACTERIZATION OF MINERALIZABLE NITROGEN IN SOILS,
Iowa State Univ., Ames. Dept. of Agronomy.
For primary bibliographic entry see Field 05A.
W69-05703

STEAM DISTILLATION METHODS FOR DETERMINATION OF AMMONIUM, NITRATE AND NITRITE,
Iowa State Univ., Ames. Dept. of Agronomy.
For primary bibliographic entry see Field 05A.
W69-05709

EFFECT OF CULTIVATION ON THE NITROGEN DISTRIBUTION IN SOILS,
Iowa State Univ., Ames. Dept. of Soils.
D. R. Keeney, and J. M. Bremner.
Soil Sci Soc Amer Proc, Vol 28, No 5, pp 653-656, Sept-Oct 1964.

Descriptors: *Cultivation effects, *Soils, *Nitrogen, *Nitrogen compounds, Nitrogen forms.

The effect of cultivation on 10 soils was studied. Cultivation led to a marked decrease in all forms of nitrogen, except non-exchangeable ammonium-nitrogen. The average percent loss of total nitrogen on cultivation was 36.2%, and the average losses of different forms of nitrogen, based on the percent loss in total nitrogen, decreased in the order: hydrolyzable nitrogen (70.5%) greater than amino acid nitrogen (29.8%) greater than non-hydrolyzable nitrogen (29.5%) greater than unidentified hydrolyzable nitrogen (20.0%) greater than hydrolyzable ammonium-nitrogen (17.1%) greater than hexosamine nitrogen (3.5%) greater than non-exchangeable ammonium-nitrogen (0.5%). The average losses of different forms of nitrogen, based

as a percentage of nitrogen in the virgin soils decreased in the order: amino acid nitrogen (43.0%) greater than non-hydrolyzable nitrogen (39.4%) greater than total nitrogen (36.2%) greater than total hydrolyzable nitrogen (35.2%) greater than unidentified hydrolyzable nitrogen (34.5%) greater than hydrolyzable ammonium-nitrogen (28.6%) greater than hexosamine nitrogen (27.6%) greater than non-exchangeable ammonium-nitrogen (0.2%). The results leave very little doubt that native non-exchangable ammonium-nitrogen is practically unavailable to both plants and microorganisms. (Konrad-Wis)
W69-05710

INORGANIC NITROGEN IN PRECIPITATION AND ATMOSPHERIC SEDIMENTS,
Hamilton Filtration Plant (Ontario).
For primary bibliographic entry see Field 05B.
W69-05712

SIGNIFICANCE OF REDOX POTENTIAL IN NATURAL WATERS (IN FRENCH),
Paris Univ., St. Maur (France). Faculte des Sciences.
G. Michard.
Mineral Deposita, Vol 2, pp 34-36, 1967. 4 p, 1 fig, 12 ref.

Descriptors: *Water chemistry, *Oxidation-reduction potential, *Geochemistry, Aeration, Catalysts, Iron, Manganese, Oxygen, Hydrogen ion concentration, Sulfur.
Identifiers: *Nernst equation.

Comparison of measurements with predictions derived from the Nernst equation revealed an anomaly in behavior of the redox system in aerated natural waters. Consideration of these departures from theory led to the following conclusions: (1) The water-oxygen redox system reacts very slowly near the equilibrium point; (2) all systems containing a very small proportial term, for instance Fe (III)/Fe (II) when Fe (II) is less than 0.00001 M, react very slowly; and (3) measurements at the platinum electrode in slow systems are mixed potentials for which Nernst's law is not applicable. In the case of aerated waters, it is proposed to substitute thermodynamic Eh for the measured value in Eh/pH diagrams. In sulfurated waters, such diagrams should be replaced by a log S/pH diagram, where S is the total amount of S (-II). Based upon these considerations, the redox behavior of manganese is considered in some detail.
W69-05877

SALT ACCUMULATION PROCESSES IN THE GROUND WATERS OF THE KIROVABAD-KAZAKH MASSIF,
Academy of Sciences of the Azerbaijanian, Baku (USSR).
For primary bibliographic entry see Field 02F.
W69-05954

2L. Estuaries

MATHEMATICAL MODEL AND FORTRAN IV PROGRAM FOR COMPUTER SIMULATION OF DELTAIC SEDIMENTATION,
Stanford Univ., Calif.; and Canterbury Univ., Christchurch (New Zealand).
For primary bibliographic entry see Field 07C.
W69-05657

SOME OBSERVATIONS ON THE DEPENDENCE OF ZOOPLANKTON GRAZING ON THE CELL SIZE AND CONCENTRATION OF PHYTOPLANKTON BLOOMS,
Fisheries Research Board of Canada, Nanaimo (British Columbia). Pacific Oceanographic Group.
T. R. Parsons, R. J. LeBrasseur, and J. D. Fulton.
J Oceanogr Soc Japan, Vol 23, No 1, pp 10-17, Feb 1967. 4 fig, 1 tab, 15 ref.

Descriptors: *Biomass, *Grazing, *Phytoplankton, *Zooplankton, Estuaries, Ecosystems, Eutrophication, Nannoplankton, Diatoms, Copepods, Fjords, Growth stages, Feeding rates, Productivity, Particle size.
Identifiers: *Cell size, Biological oceanography, Flagellates, Chaetoceros socialis, Chaetoceros debilis, Calanus pacificus, Euphausia pacifica, Pseudocalanus minutus.

Furcilia, Coulter counter, Ivlev's relationship, Particulates, Saanich Inlet, British Columbia. Authors determined, with Coulter counter (apertures: 100 and 400 microns), size and quantity of particulate food consumed by different zooplankters during occurrence of two natural phytoplankton blooms. Individual organisms constituting Chaetoceros bloom could be readily utilized by Euphausia pacifica (EP); but Calanus pacificus (CP), euphausiid furcilia (EF), and Pseudocalanus minutus (PM) could derive only a subsistence diet from same plants. Unidentified nannoplankters, about 8 microns diameter, were less available as food for EP but a better food source for CP and EF. Authors suggest that differences may relate to food's physical availability in terms of its size and shape. Data relating zooplanktonic feeding at various phytoplanktonic concentrations could be described by following modification of relationship originally proposed by Ivlev: r= R (1 - (exp (-kp)) (exp (-kp-sub-0))), where r= ration, p= food density, R= maximum ration, k= proportionality constant, and p-sub-0= low prey density at which feeding ceased. In experiments described, rations as carbon (percentage body weight) were: (mean food size, 32 microns) PM, 0.8; EP, 15.0; CP+ EF, 2.0; (mean food size, 8 microns) CP+ EF, 4.1. EP food above subsistence level apparently went into egg production, observable as a distinct size fraction of the particulate biomass during Chaetoceros bloom. (Eichhorn-Wis)
W69-05696

STATE PROGRAMS FOR ESTUARINE AREA CONSERVATION,
North Carolina Univ., Cahpel Hill. Inst. of Government.
Milton S. Heath, Jr.
Report to the North Carolina Estuarine Study Committee, pp 1-25, April 1968. 25 p, 5 ref.

Descriptors: Estuaries, *Conservation, Administrative agencies, Atlantic Coastal Plain, Planning, *North Carolina, *Water law, Water policy, Easements, Condemnation, Judicial decisions, Legal aspects, Legislation, Ownership of beds, Riparian rights, State governments, Landfills, Zoning, Administrative decisions, Dredging, Expenditures.
Identifiers: Corps of Engineers, *Constitutional law.

This work consists of a report to the North Carolina Estuary Study Committee on state programs for estuarine area conservation. The first part of the report deals with existing North Carolina programs and laws. Present state programs and their legislative authorization are dealt with generally, and provisions for fill easements for riparian owners, permits for work on navigable waters, registration of dredging equipment, present state ownership of estuarine areas, and marshland construction are discussed. Legal aspects of the ownership, management and use of estuarine areas are analyzed, concentrating on constitutional issues involved in state regulation. The second part sets forth the experience of various other states as to types of regulation of estuarine areas, the agencies involved, planning, court tests, and inter-agency coordination. This is preceeded by a general summary of the practice of these states. (Patterson-Fla)
W69-05776

COMPUTER SIMULATION OF ESTUARIAL NETWORKS,
California Univ., Berkeley; Public Health Service, San Francisco, Calif.; and Water Resources Engineers, Inc., Lafayette, Calif.
Robert P. Shubinski, James C. McCarty, and Marvin R. Lindorf.
Proc, Amer Soc Civil Eng, Vol 91, No HY5, pp 3[illegible] 49, Sept 1965. 17 p, 6 fig, 15 ref, 1 append.

Descriptors: *Simulation analysis, *Digital computers, *Estuaries, *Deltas, *Hydraulic properties, Input-output analysis, Hydraulic systems, Mathematical model, Water quality control, Tidal effects, Velocity, Water levels, Discharge (Water), Spatial distribution, Temporal distribution.
Identifiers: Sacramento-San Joaquin Delta.

A predictive water quality mathematical model was developed that characterized the dynamic tidal estuary conditions in the Sacramento-San Joaquin River Delta network of California. The basic hydraulic conditions of surface water inflow, Delta consumptive uses, export demands, outflow, and tidal action were used as inputs to the model. A high speed digital computer program was described that would treat up to 1000 channel reaches interconnected at up to 750 junctions. Output gave values for input conditions, total head, velocity, surface width, and flow at selected points in both space and time. Limitations of the procedure were discussed and plans for the development of a dynamic water quality program were considered. (Gysi-Cornell)
W69-05861

FOOD AND FEEDING HABITS OF JUVENILE COHO SALMON AND STEELHEAD TROUT IN WORTHY CREEK, WASHINGTON,
Washington Univ., Seattle. Fisheries Research Inst.
James M. Johnston.
M.A. Thesis, University of Washington, 1967. 77 p, 16 tab, 24 fig, 13 ref. See Vol 2, No 8, W 69-03190.
OWRR Project B-004-WASH.

Descriptors: Salmon, *Fish diets, *Aquatic environment, Fish behavior, Fish management, Washington, Fish food organisms, Fish migration.
Identifiers: *Coho salmon, *Steelhead trout, Worthy Creek (Washington), Fish macrohabitat, Fish microhabitat.

Results from stomach analyses of 421 (Oncorhynchus kisutch) collected from six diverse ecological habitats and 155 steelhead trout sampled from three of these habitats from April, 1966, to March, 1967, indicated that the influences of macrohabitat on diet were minor. With the exception of Ephemeroptera nymphs, no significant difference (95% confidence level) was found among the stomach contents of coho taken from four areas. F tests were used to determine any significant differences in the diet of coho in time as well as space during the sampling period. Diptera larvae, Diptera adults, Ephemeroptera nymps, Tricoptera larvae, Homoptera adults, and Aquatic Annelida were found in significantly different amounts in time at the 95% level of confidence. Statistical analysis of the steelhead diet in two of these areas indicated there was no significant difference between these areas for any food organism. Only Diptera adults, Plecoptera nymphs, and aquatic Annelid showed a statistical significance for any monthly differences. Coho occupy microhabitat positions near the water surface in areas of low stream velocity. Steelhead were associated with the substrate regardless of the water velocity. In both species the subsurface foods (immature aquatic-life phases) constituted the greatest volume of the diets, although coho and steelhead in the same macrohabitat had a tendency to feed more on surface foods than did steelhead, and steelhead fed more on the bottom foods.
W69-05890

A CHANGE OF GROUNDWATER REGIME AS A METHOD OF CONTROLLING THE INCURSIONS OF SEA WATER (RUSSIAN),
Akademiya Nauk SSSR, Moscow. Council on the Problems of Water Economy.
For primary bibliographic entry see Field 04B.
W69-05939

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3B. Water Yield Improvement

RELATION OF WATER LOSS TO MOISTURE CONTENT OF HYDROPHYTES IN A NATURAL POND,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 02D.
W69-05622

PRELIMINARY WATER YIELDS AFTER TIMBER HARVEST ON CASTLE CREEK, ARIZONA WATERSHEDS,
Arizona Univ., Tucson. Rocky Mountain Forest and Range Experiment Station.
Lowell R. Rich.
Proc 12th Annu Ariz Watershed Symp, Sept 18, 1968, Tempe, Ariz, pp 9-12, 1968. 4 p, 3 fig, 1 photo, 1 tab, 2 ref.

Descriptors: *Water yield improvement, *Watershed management, *Clear-cutting, Arizona, Cutting management, Forest management, Water conservation, Demonstration watersheds, Water yield, Runoff, Small watersheds.
Identifiers: Gila River watershed, Castle Creek (Ariz).

Water yields after timber harvesting were studied on 2 small watersheds of 900 and 1,163 acre-ft in the Apache National Forest, Arizona. Elevations vary from 7,835 to 8,580 ft. Topography is relatively flat with average slopes of 12%. The average temperature is 43.3 deg F with 250 days below 32 deg and 15 days below 0 deg. Water yields are measured with V-notch weirs. Annual precipitation averages 26.6 in; 53% of the precipitation occurs between October and June. Streamflow averages 1.4 in. annually from the 900 acre watershed and 1.2 from the 1,163 acre watershed. Timber harvesting started in June 1965 and ended in September 1967. Water yields increased by 1/3 in. in a total yield of 1 in. in 1967, and by 1 in. in a total yield of 3 in. in 1968. Covariance analysis indicated a statistical significance (F=8.7). (Knapp-USGS)
W69-05642

WATERSHED PLANNING,
Forest Service (USDA), Tempe, Ariz. Forest Hydrological Lab.
Joseph F. Arnold.
Proc 12th Annu Ariz Watershed Symp, Sept 18, 1968. Tempe, Ariz, pp 13-19, 1968. 7 p, 6 fig, 2 tab, 7 ref.

Descriptors: *Watershed management, *Water yield improvement, Planning, Forest management, Water conservation, Demonstration watersheds, Runoff, Arizona.
Identifiers: Runoff improvement, Watershed planning.

The methods of planning watershed research, development, and use by the U. S. Forest Service are reviewed with emphasis on the study of the hydrologic aspects of vegetation. Soils and parent rocks are studied in pits, road cuts, stream channels, and by portable seismic equipment, as well as analyses of samples in the laboratory. Densities and compositions of plant communities are studied and mapped. Water yields may be improved by changing deeply rooted woody species to shallow-rooted grasses and forbs, reducing interception and transpiration losses. Precipitation, streamflow, temperatures, wind, and solar radiation are recorded. Groundwater and water quality data are collected. Areas of similar vegetation, soils, geology, and hydrologic character are called water management units and will show similar response to treatment. Fire is often used to change the vegetation type, but herbicides are usually necessary to control fast-growing woody species that compete with grasses. (Knapp-USGS)
W69-05643

SANTA YNEZ BAROMETER WATERSHED,
Los Padres National Forest, Santa Barbara, Calif.
William H. Hansen.
Proc 12th Annu Ariz Watershed Symp, Sept 18, 1968, Tempe, Ariz, pp 20-24, 1968. 5 p, 2 photo.

Descriptors: *Watershed management, *Water yield improvement, *Planning, Forest management, Water conservation, Demonstration watersheds, Water yield, Runoff, California.
Identifiers: *Barometer watersheds, Experimental watersheds, Santa Ynez watershed (Cal).

The Santa Ynez watershed, southern California, is studied as a 'barometer watershed' in the measurement and determination of the effect of wildland management on water yields, to assess the benefits of land management for soil and water improvements, and to collect data for use in areas of similar climate and physiography. Solar radiation, wind, dewpoint, and precipitation data are collected at a climatic station. Streamflow and sediment data are collected at a weir. A hydrologic survey estimates that conversion of 35,000 acre-ft to grass will save 5,600 acre-ft of water per yr. Criteria for treatment are: sites must have C soil horizons deeper than the depth of root penetration by replacement vegetation; areas to be worked by machines must have slopes less than 30%; dense stands of water-consuming brush (30%canopy or more); and sites must have a fair potential for grass production. The barometer watershed was divided into 4 types of areas: riparian-phreatophyte, which will yield 1 acre-ft increase per treated acre; riparian-brush, with a 1/2 acre-ft increase; lower chaparral, with a 1/4 acre-ft increase; and upper chaparral, with a 1/2 acre-ft increase. Recreational value is expected to increase with treatment because of improvement of fish habitat. (Knapp-USGS)
W69-05644

THE PHREATOPHYTE PROBLEM IN ARIZONA,
Geological Survey, Tucson, Ariz.; and Bureau of Reclamation, Phoenix, Ariz.
H. M. Babcock, and C. A. Pugh.
Proc 12th Annu Ariz Watershed Symp, Sept 18, 1968, Tempe, Ariz, pp 34-38, 1968. 5 p, 3 photo, 1 tab, 2 ref.

Descriptors: *Phreatophytes, *Consumptive use, Water management (Applied), Evapotranspiration, Riparian plants, Water loss, Water yield improvement.
Identifiers: *Central Arizona Project.

The problems of water consumption by phreatophytes in the Southwestern U. S. are reviewed. About 25 million acre-ft of water are consumed by phreatophytes per year, or about twice the flow of the Colorado River. By 1964, 30 government agencies were working in phreatophyte research. The most effective way to salvage water is probably to lower the water table below the root depth level, which kills the plants. Land clearing permits crops to be grown in place of phreatophytes. The Lower Colorado River water salvage program consists of a channelization project, regulating reservoirs, a groundwater recovery program, and a phreatophyte removal program, all of which are opposed by wildlife and recreation interests. Phreatophyte control may save water at the cost of wildlife, recreational, scenic, and various intangible benefits. (Knapp-USGS)
W69-05645

CREATING HYDROPHOBIC SOIL FOR WATER HARVESTING,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
Lloyd E. Myers, and Gary W. Frasier.
J Irrig and Drain Div, ASCE, Vol 95, No IR1, Proc Paper 6436, pp 43-54, Mar 1969, 1 fig, 2 tab, 10 ref.

Descriptors: *Water harvesting, *Soil surfaces, *Feasibility studies, *Chemical reactions, *Repellents, Economic feasibility, Soil stabilization, Rainfall-runoff relationships, Erosion control, Chemical analysis, Runoff, Spraying, Application methods, Water yield improvement.
Identifiers: *Hydrophobic soils.

Investigations were conducted to determine feasibility of increasing precipitation runoff from soil surfaces by spraying them with chemicals that cause the soil to become hydrophobic. Five different types of chemicals were evaluated and their performance characteristics were described. One chemical, sodium methyl silanolate, proved suitable for field application and produced 94% runoff from a field plot of sandy loam soil for 5 months after application. Runoff from a 0.04 in. rain falling on dry soil was 60%. Erosion of the hydrophobic soil surface reduced runoff to 76% during the following year. Results indicated that water-repellent chemicals, in combination with soil stabilizers, have potential value for construction of efficient, low cost harvesting catchments. (Affleck-Ariz)
W69-05676

ATTACK ON CUMULUS CLOUDS BY MAN-MADE VERTICAL ASCENDING CURRENTS,
N. I. Vulfson, and A. V. Kondratova.
Meteorol i Gidrol, No 9, pp 22-27, 1968. Transl from Russ, Joint Publ Res Serv Transl 47001, pp 26-33, Dec 1968. 8 p, 4 fig, 2 tab, 4 ref.

Descriptors: Artificial precipitation, Clouds, *Convection, Cloud cover, *Cumulus clouds, Precipitation (Atmospheric), Experimental data, *Weather modification, Wind velocity, Foreign research, *Meteorology, *Cloud physics, Cloud seeding.
Identifiers: Artificially induced nucleation, *Cloud modification, Cloud-droplet samplers, Convective clouds, USSR, Cumulonimbus clouds.

The possibilities of stimulating development of intramass cumulus clouds by artificially created vertical ascending air currents are discussed. Parameters of an installation, based on using turbo-jet motors for creating vertical streams of heated air, are given. Results of preliminary experiments under natural conditions on influencing convective clouds by these hot air streams are discussed. Forming induced clouds is much easier when highly active condensation nuclei were used. However, such clouds had an inferior vertical development, apparently due to their greater stability. Two measurements of the microstructure of these clouds showed a greater concentration of finer droplets than in clouds forming without the introduction of additional nuclei. (USBR)
W69-05821

THE EFFECTS OF WAVES ON EVAPORATION FROM A FREE WATER SURFACE,
Cornell Aeronautical Lab. Inc., Buffalo, N. Y.
For primary bibliographic entry see Field 02D.
W69-05840

3C. Use of Water of Impaired Quality

EVAPORATIVE COOLING OF HEATED IRRIGATION WATER BY SPRINKLER APPLICATION,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
J. F. Cline, M. A. Wolf, and F. P. Hungate.
Water Resources Res, Vol 5, No 2, pp 401-406, Apr 1969. 6 p, 1 fig, 3 tab, 20 ref.

Descriptors: *Sprinkler irrigation, *Heated water, *Water reuse, *Cooling water, Water temperature, Thermal power, Thermal pollution, Evaporation, Irrigation, Sprinkling, Waste water disposal.

Identifiers: Heated irrigation water, Evaporative cooling.

Heated water was cooled rapidly to impact temperatures that produce optimum growth in plants by applying the water with a standard irrigation sprinkler. Maximum cooling was observed nearest the sprinkler, where the smallest droplets were measured, and temperatures and mean diameters generally increased with distance from the source. Impact temperatures of the water droplets approached but did not reach wet bulb temperatures. Water as hot as 50 deg C was cooled to droplet temperatures of 25 deg C or less when the sprinklers were operated in an associated arid climate and at line pressures greater than 25 psi. A theoretical treatment correlated well with one selected set of experimental data and with predicted cooling rates for specified droplets in several typical atmospheric conditions and one untypical condition for an arid climate. Only under the condition of high relative humidity at a given ambient temperature does it appear that cooling might be insufficient to produce usable sprinkler water from 50 deg C supply water for crop production. (Knapp-USGS)
W69-05606

3D. Conservation in Domestic and Municipal Use

AN ANALYSIS OF WATER NEEDS FOR ARID AND SEMI-ARID LANDS,
Texas Technological Coll., Lubbock. Dept. of Civil Engineering; and Texas Technological Coll., Lubbock. Water Resources Center.
For primary bibliographic entry see Field 03E.
W69-05673

3E. Conservation in Industry

AN ANALYSIS OF WATER NEEDS FOR ARID AND SEMI-ARID LANDS,
Texas Technological Coll., Lubbock. Dept. of Civil Engineering; and Texas Technological Coll., Lubbock. Water Resources Center.
Dan M. Wells, and Keith R. Marmion.
Symposium on Increasing Food Prod in Arid Lands, Icasals Pub No 3, Texas Tech Coll, Lubbock, Texas, 1969, pp 19-29. 1 tab, 10 ref.

Descriptors: *Arid lands, *Industrial water, *Beneficial use, *Water values, *Water reuse, Water requirements, Water utilization, Water demand, Water consumption, Semiarid climates, Administration, Municipal water, Agriculture, Cost-benefit theory, Economic feasibility, Water resources development, Water allocation (Policy).

A discussion is given of needs, values, and alternative uses of water in arid and semi-arid lands. It si suggested that water should generally be used for the purpose that will return greatest wealth to the region and that water may be too precious a resource to permit its being used for relatively low-valued agricultural production in arid areas. The possibility of utilizing available water resources for industrial production, municipal use, or recreational use should not be ruled out without thorough study when considering alternative uses of water. Considerations of optimality strongly suggest that industrial development be encouraged in arid areas, if necessary at the expense of agriculture development. It appears, however, that with sound management techniques industrial development can take place in arid areas without serious adverse effects on agricultural production. (Affleck-Ariz)
W69-05673

THE FUTURE AGRICULTURAL USE OF WATER - SOUTHERN HUMID REGION,
Tennessee Valley Authority, Wilson Dam, Ala., Agricultural Development Div
For primary bibliographic entry see Field 06B.
W69-05738

SOME ECONOMIC ASPECTS OF INDUSTRIAL WATER SUPPLY IN THE SOUTH,
Clemson Univ., S. C.
For primary bibliographic entry see Field 06B.
W69-05739

3F. Conservation in Agriculture

ANALYSIS OF AN EVAPORATION CONTROL SYSTEM ON THE SEA OF GALILEE,
Arizona State Univ, Tempe.
C. O. Reiser.
Water Resources Res, Vol 5, No 2, pp 413-418, Apr 1969. 6 p, 2 fig, 1 tab, 10 ref.

Descriptors: *Evaporation control, *Monomolecular films, Alcohols, Water conservation, Water temperature, Energy budget, Dissolved oxygen, Evaporation, Winds, Waves (Water), Arid lands.
Identifiers: *Israel, Lake Zohar, Sea of Galilee.

Water Planning for Israel is conducting field tests to determine the feasibility of applying long-chain alcohols on the Sea of Galilee for evaporation reduction. Good film covers have been obtained on 280-acre Lake Zohar with winds up to 15 mph, and a spray system is being installed on Lake Kishon to test a larger lake with stronger prevailing winds. Using meteorological data and estimated evaporation rates for the Sea of Galilee, the reduced evaporation when covered with an alcohol film has been calculated from the added film resistence. The iterative solution of an energy balance equating the reduced evaporation energy to increased energy storage, back radiation, and conduction to the atmosphere gave a 40% reduction of the annual evaporation rate of 300 million cu m when applying a film for a 10-month period. The film produces a maximum temperature increase of 5 deg C at the surface. (Knapp-USGS)
W69-05601

EFFECT OF SMALL SURFACE WAVES ON EVAPORATION THROUGH MONOLAYERS,
Maryland Univ., College Park.
For primary bibliographic entry see Field 02D.
W69-05604

EVAPORATIVE COOLING OF HEATED IRRIGATION WATER BY SPRINKLER APPLICATION,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
For primary bibliographic entry see Field 03C.
W69-05606

RULES OF TRANSFER OF WATER MANAGEMENT EXPERIENCE, WITH SPECIAL REFERENCE TO THE ASSESSMENT OF DRAINAGE DESIGN CONSTANTS,
Institute for Land and Water Management Research, Wageningen (Netherlands).
For primary bibliographic entry see Field 04A.
W69-05614

CONTROLLING TRANSPIRATION IN ASPEN WITH PHENYLMERCURIC ACETATE,
Utah State Univ., Logan.
G. E. Hart, J. D. Schultz, and G. B. Coltharp.
Water Resources Res, Vol 5, No 2, pp 407-412, Apr 1969. 6 p, 3 fig, 3 tab, 10 ref.

Descriptors: *Evapotranspiration control, *Transpiration control, Stomata, Water conservation, Forests, Water yield improvement, Watershed management, Forest management, Water management (Applied).
Identifiers: Phenylmercuric acetate, Aspen trees.

A 0.0001 M spray of phenylmercuric acetate was applied by helicopter to part of an aspen stand in northern Utah in June, 1967. The natural fluttering action of the aspen leaves facilitated delivery of the spray to the stomate-bearing underside of the leaves. Nine days after treatment, stomate width on treated trees averaged 2.4 microns as compar with 4.0 microns measured on untreated tre Heat pulse measurements indicated reduction daylight sap velocity from 11 cm/hr to 6 cm/ Seasonal soil moisture depletion was not signi cantly affected, although the pattern of water usa was delayed for about 6 weeks on the treated are (Knapp-USGS)
W69-05627

THE CONTRIBUTION OF RESEARCH TO TH EFFICIENT USE OF WATER IN AGRICU TURE,
Volcani Inst. of Agriculture Research, Bet-Daga (Israel). Div. of Irrigation.
E. Shmueli.
For the 8 Volume Proceedings, see Vol 2, No Field 06B and W69-03305. Int Conf on Water fo Peace, Wash, D C, Vol 3, pp 407-422, 1968. 16 1 fig, 4 tab, 80 ref.

Descriptors: *Irrigation efficiency, *Arid lands *Irrigation practices, *Soil-water-plant relation ships, Farm management, Irrigation programs, I rigation effects, Irrigation engineering, Lan management, Crop production, Experimenta farms, Sprinkler irrigation, Water reuse.
Identifiers: *Israel, Agricultural research, Salin water irrigation.

Recently Israel agriculture has shown marke progress in efficient use of water; between 195 and 1964 the irrigated area increased by 23% despite the fact that no additional water allocation were made. The added acreage included orchard and irrigated crops in the arid south. Althoug water application per unit area of irrigated land wa reduced, yields continued to rise. These result were made possible by research, irrigation exten sion work, close cooperation with farmers, and use of sprinklers on about 95% of the country's ir rigated land. By the early sixties, research findings concerning field crops were widely applied, and at tention was directed to a more intensive study of the consumptive water use of fruit trees, particularly citrus. Recommendations were adopted by the more progressive farms only a year after results of the tests were obtained; within 2-3 years they became standard practice. In the field crops studied, a 20% to 40% reduction of water use was generally achieved without affecting the yield level, and in some cases, the reduction was accompanied by increased yields. In putting the findings of field and laboratory experiments into practice, use was made of plant indicators (especially stomatal aperture), meteorological indicators, and soil indicators. Studies were undertaken to find non-conventional means for reducing water consumption, such as anti-transpirants, growth-retardants, water and nutrient supply by trickle irrigation, and the utilization of water of relatively high salinity. (Knapp-USGS)
W69-05650

AN APPROACH TO ATTACKING HUMAN-SOCIAL PROBLEMS RETARDING IRRIGATION AND AGRICULTURAL DEVELOPMENT IN LATIN AMERICA,
Inter-American Center for the Integral Development of Land and Water Resources.
Stephen L. Brower.
For the 8 Volume Proceedings, see Vol 2, No 9, Field 06B and W69-03305. Int Conf on Water for Peace, Wash, D C, Vol 5, pp 931-938, 1968. 8 p, 10 ref.

Descriptors: *Water resources development, *Social impact, *Education, *Training, Employee relations, Irrigation programs, Social change, Labor, Crop production.
Identifiers: *Latin America, Campesino.

Key human-social factors singly or in combination block or reduce the effectiveness of irrigation development projects in Latin America. As a consequence, the productive capacity of people is reduced and the resource is poorly used. The

roblem areas are: (1) Failure to effectively in-grate the 'campesino' and his family into the evelopment process in such a way as to help him ke the giant step from primative to modern griculture; (2) institutional patterns and organiza-onal structures do not support and facilitate evelopment projects; (3) knowledge, skill and ex-erience in the management processes are lacking administer adequately all aspects of a develop-ent project. A combined experimental research, emonstration, and training proposal aimed at at-cking specific aspects of these three human-so-al problem areas is proposed. Three proposed rojects are identified and elaborated relative to ese problem areas. (Vorhis-USGS)
'69-05652

OIL AND CROP MANAGEMENT FOR MAX-IMUM WATER-USE EFFICIENCY ON ARID ND SEMIARID LANDS,
gricultural Research Service, Bushland, Tex.
R. Johnston, and C. E. Van Doren.
ternational Symposium on Increasing Food Prod Arid Lands, Icasals Pub, No 3, Texas Tech Col-ge, Lubbock, Texas, 1969, pp 91-108. 9 fig, 6 tab, ref.

escriptors: *Soil management, *Planting manage-ent, *Crop production, *Water utilization, *Arid nds, Water harvesting, Semiarid climates, Irriga-n efficiency, Precipitation (Atmospheric), Great ains, Groundwater, Surface waters, Fallowing, il water, Water storage, Soil profiles, Furrow stems, Dry farming.

proved water-use efficiency is essential in hieving the production potential of arid and miarid environments. This paper deals specifi-lly with problems and opportunities for increased ficiency in using precipitation, surface, and oundwater supplies for crop production in arid mates. Soil water, crop geometry, soil profile ysical conditions, plant nutrient availability, effi-nt use of limited irrigation water, water harvest-g and storage were considered and discussed in s paper as important for enhancing production m arid and semi-arid lands. Particular reference s made to the southern Plains of the United ates. (Affleck-Ariz)
69-05669

LT AND WATER BALANCE, COACHELLA ALLEY, CALIFORNIA,
gricultural Research Service, Riverside, Calif.
linity Lab.; and Coachella Valley County Water strict, Calif.
r primary bibliographic entry see Field 02G.
69-05670

LT BALANCE, IRRIGATION EFFICIENCY, ND DRAINAGE DESIGN,
gricultural Research Service, Phoenix, Ariz.
ater Conservation Lab.
rman Bouwer.
rig and Drain Div, ASCE, Vol 95, No IR1, Proc per 6465, pp 153-170, Mar 1969. 4 fig, 3 tab, 27

scriptors: *Salt balance, *Salt tolerance, *Irriga-n efficiency, *Leaching, *Drainage systems, Ir-ation water, Root zone, Equations, Water lization, Water requirements, Rates of applica-n, Drains, Design, Salts, Crop response, Water le.
ntifiers: *Leaching efficiency, Salt concentra-n.

simplified procedure was presented to predict w much irrigation water was necessary, in addi-n to that for evapotranspiration, to maintain salt lance in the root zone. The key factor in the cedure was the leaching efficiency, which ap-ared to range from 0.2 for fine-textured soils to for coarse-textured soils. Also taken into ac-unt were salt tolerance of the crop, salt concen-tion of the irrigation water and evapotranspira-tion. The procedure accurately predicted known leaching requirements for salt balance of 3 irrigated regions. In defining irrigation efficiency, distinction was made between efficiency of water utilization and efficiency of water application. In conclusion, it was shown that drainage flow from the root zone decreased with time after an irrigation and that the water table response of a system of parallel drains to this flow could be computed for design of a drainage system to avoid high water tables. (Affleck-Ariz)
W69-05671

PREDICTING EFFECTS OF WATER SHORTAGE ON CROP YIELD,
California Univ., Davis. Dept. of Water Science and Engineering.
J. Ian Stewart, and Robert M. Hagan.
J Irrig and Drain Div, ASCE, Vol 95, No IR1, Proc paper 6443, pp 91-104, Mar 1969. 9 fig, 14 ref.

Descriptors: *Crop production, *Water shortage, *Water utilization, *Water allocation (Policy), *Planning, Evapotranspiration, Alfalfa, Sorghum, Wheat, Soil moisture, Water management, Precipitation (Atmospheric), Irrigation efficiency, Moisture deficit, Water supply, Data collections.

This paper discusses relationships existing between water use, expressed as evapotranspiration, and yields of alfalfa, wheat and grain sorghum. Data, assembled from a number of sources, was used to tentatively formulate water production functions in both absolute and relative forms. A detailed hypothetical example of use of such a function for water allocation and management planning for maximization of wheat production during a water shortage was given. The example showed the disproportionate importance which can be attached to stored soil moisture and in-season precipitation when maximization of total production is the goal. Conclusions were basically that definition of water use-yield relationships can be done for certain crops from experimental data, and that the functions thus produced would greatly assist planners at all levels in making water allocation and management decisions, particularly in situations of water shortage. (Affleck-Ariz)
W69-05674

ECONOMIC IMPACT OF WATER RESOURCE DEVELOPMENT,
North Dakota State Univ., Fargo.
For primary bibliographic entry see Field 06B.
W69-05751

WATER AVAILABILITY AND GRASS ROOT DISTRIBUTION IN SELECTED SOILS,
New Mexico State Univ., University Park. Water Resources Research Inst.
For primary bibliographic entry see Field 02G.
W69-05759

THE INFLUENCE OF SUBSURFACE ASPHALT BARRIERS ON THE WATER PROPERTIES AND THE PRODUCTIVITY OF SAND SOILS,
Michigan State Univ., East Lansing.
For primary bibliographic entry see Field 02G.
W69-05802

AUTOMATION AND SEMI-AUTOMATION OF SURFACE IRRIGATION,
Oklahoma State Univ., Stillwater.
James E. Garton.
Pap, Amer Soc Civ Eng Nat Irrig Drain Spec Conf, Phoenix, Ariz, pp 237-251, Nov 1968. 15 p, 6 fig, 13 ref.

Descriptors: *Automation, *Surface irrigation, Irrigation, *Irrigation systems, *Automatic control, Furrow irrigation, Furrows, Irrigation operation and maintenance, Laterals, Irrigation practices.
Identifiers: Cost savings.

Automated irrigation systems can be designed to eliminate practically all labor. One major weakness is the inability to define precisely the design conditions and how these conditions vary. Present automated systems apply water at a cutback rate for a time period equal to that required for initial furrow wetting. This will not result in as uniform an application along the furrow as would additional time periods of 4 or 5 times the initial wetting time; instead of increasing the labor requirement for cutback irrigation, this system reduces labor approximately 98%, compared to a conventional siphon-tube system. Automation will separate the decision of when to apply irrigation water from reliance on the availability of a labor supply. The more timely irrigations should result in increased yields. Research on the hydraulics of spatially varied flow in irrigation distribution channels has made possible the design of more uniform releases of water into individual furrows. An economic analysis of automated systems indicates that labor savings will pay construction costs of the system in less than their useful life. The degree of automation that can be justified economically depends primarily on the availability and cost of labor. (USBR)
W69-05829

DESIGN OF AN AUTOMATED SURFACE IRRIGATION SYSTEM WITH REUSE SYSTEM,
Nebraska Univ., Lincoln.
Paul E. Fischbach.
Pap, Amer Soc Civ Eng Nat Irrig Drain Spec Conf, Phoenix, Ariz, pp 219-236, Nov 1968. 18 p, 10 fig, 7 ref.

Descriptors: Automatic control, Automation, *Irrigation systems, Field tests, *Irrigation design, *Water reuse, *Surface irrigation, Hydraulic gates and valves, Land forms, Slopes, Furrow irrigation, Pumping plants, Furrows, Irrigation, Tensiometers, Control systems, *Irrigation canals, Gate control.
Identifiers: Reuse.

Design and component features for an automatic surface irrigation system with provision for reuse of runoff water are described. Requirements for the system are: a supply of water available on demand; an enclosed pipe system designed to carry water from the source to the point of release for irrigation; a method of sequencing irrigation sets; control of the water flowing over the land surface; a runoff collection and return system; soil moisture sensing devices that sense the need for water to start and stop the system; and electrical controls. Land forming, row direction, furrow stream size, length of run, and application time are discussed. To test and evaluate the theories propounded, an automatic surface irrigation system with runoff water reuse was operated for 3 seasons at the University of Nebraska field laboratory, Mead, Nebr. The system is described and results are discussed. (USBR)
W69-05830

AUTOMATIC SPRINKLER IRRIGATION AND ITS FUTURE IN THE MIDWEST,
Nebraska Univ., Lincoln.
H. Robert Mulliner.
Pap, Amer Soc Civ Eng Nat Irrig Drain Spec Conf, Phoenix, Ariz, pp 139-159, Nov 1968. 20 p, 10 fig.

Descriptors: *Sprinkler irrigation, *Automatic control, Distribution systems, *Automation, *Irrigation systems, Irrigation, Nebraska, Crop production, Irrigation operation and maintenance, Forecasting, Productivity.
Identifiers: Crop yield.

Automatic sprinkler irrigation has become increasingly popular in the midwest during the last 5 yr. Two factors have contributed to this popularity: (1) high priced, unavailable labor and (2) increasing demands for water. Irrigators are increasing profits by substituting capital invested in automated sprinklers for high priced and, many times, unreliable labor. The demand for water by industry, municipalities, and agriculture is increasing each year. Sprinklers are one of the most efficient

methods for distributing water to cropland. Field operations have been reduced by using the automated sprinkler systems for applying nitrogen fertilizers and certain insecticides and fungicides. In northcentral Nebraska, automatic sprinkler irrigation has increased corn yields on 100 sections of land from 30 bu/acre (with favorable rainfall) to 155 bu/acre. Complete irrigation systems are being amortized in 6 to 8 yr. Maintenance costs have been less than $100/yr over a 10-yr period. In the foreseeable future, 1000 more quarter sections of land will be irrigated with automatic sprinkler irrigation systems in northcentral Nebraska. Various types of sprinkler irrigation equipment and methods of operation are described. (USBR)
W69-05831

DEVELOPMENT OF AUTOMATION ON THE SALT RIVER PROJECT,
Salt River Project, Phoenix, Ariz.
H. Shipley.
Pap, Amer Soc Civ Eng Nat Irrig Drain Spec Conf, Phoenix, Ariz, pp 45-67, Nov 1968. 23 p, 11 fig.

Descriptors: *Automation, *Automatic control, Remote control, Canals, *Irrigation systems, Water delivery, Hydrographs, Distribution systems, Telemetry systems, Telemetry, *Gate control, Gates, *Irrigation canals, Supervisory control (Power), Digital systems, Transducers, Construction costs, Hydraulic gates, Hydraulic gates and valves, Bids.
Identifiers: Salt River Project (Ariz), *Digital transducers, Cost savings.

Installation of a remote supervisory control system for controlling irrigation water releases on the Salt River Project in Arizona is expected to result in a savings of approximately $380,000 annually. Officials of the Salt River Valley Water Users' Association decided to contract for installation of a direct digital transducer control system after a study showed that only 4% of the Association's 120 ditchriders' time was spent in regulating the canal gates to obtain the desired flow. The transducer system will provide control at the headworks, main diversion points, and the pumping booster plant. Cost of the first phase (automating the canal system) is estimated at $1,500,000. Automating the entire canal and lateral system would cost about $2,750,000. (USBR)
W69-05832

REMOTE CONTROL OF IRRIGATION WATER FACILITIES,
Coachella Valley County Water District, Calif.
Lowell O. Weeks, and Keith H. Ainsworth.
Pap, Amer Soc Civ Eng Nat Irrig Drain Spec Conf, Phoenix, Ariz, pp 23-43, Nov 1968. 22 p, 8 fig.

Descriptors: *Remote control, *Irrigation systems, Irrigation, Digital systems, Distribution systems, Telemetry systems, Telemetry, Arid lands, Irrigation districts, Electronic equipment, History, Water conservation, Rehabilitation, Deserts, Check structures, *Control systems, *Irrigation canals, *Gate control.
Identifiers: Coachella Valley (Calif), Coachella Valley Water Dist (Calif), Irrigation Districts (Calif), Analog instruments.

In 1963 the 620,000-acre Coachella Valley County Water District entered into a Rehabilitation and Betterment Contract with the Federal Government for certain improvements to be made in the District's irrigation and drainage system. Within the scope of the work were included the purchase and installation of a supervisory remote control system for all canal check gates, pumping plants, debris screens, and monitoring stations. This system consists of the telemetering equipment, communications system, and electrically operated machinery to perform the desired field operation. The telemetering equipment consists of 4 systems--the main canal and 3 domestic water systems. The communications system tying all telemetering together consists of microwave transmitters with interconnection of a VHF radio on an interrogate basis for the remote sites and a tie-in of local land lines where telephone service is available. At all locations a complete alarm system is provided, sounding an audible alarm and flashing light at the headquarters console when trouble occurs. Cost of the remote control system will be paid in 7 yr through savings of labor and equipment costs. Twenty thousand acre-ft of water were conserved in the first 6 mo of operation. (USBR)
W69-05833

AUTOMATION OF IRRIGATION,
Bureau of Reclamation, Washington, D. C.
Maurice N. Langley.
Pap, Amer Soc Civ Eng Nat Irrig Drain Spec Conf, Phoenix, Ariz, pp 1-21, Nov 1968. 21 p, 5 fig.

Descriptors: *Automation, *Irrigation systems, Electronic equipment, *Automatic control, Scheduling, Telemetry systems, Telemetry, Irrigation operation and maintenance, Wilting point, Soil-water-plant relationships, Soil moisture meters, Tensiometers, Irrigation efficiency, Percolation, Evapotranspiration, Experimental farms, Field capacity, Water users.

If automation of irrigation is to include efficient use and management of water, proper scheduling of irrigation applications as to time and amount is an essential first step. Reliable techniques available for such scheduling have been field tested on a farm-by-farm basis. These techniques must be tested on an entire project basis. Several methods of automating on-farm irrigation systems have been used on a field basis for different crops. Research by private industry, state universities, and Government agencies is refining these methods and developing new methods. Electronic controls are available for remote and supervisory control, telemetering, stream gaging, automatic gate operation, and other forms of project irrigation system automation. All of these steps lend themselves to automatic data processing and, in the case of large irrigation systems, to computer analysis techniques. Implementation is largely dependent on knowledge of the very complex soil-water-plant relationship that makes precise scheduling difficult and the direct evidence that automation is profitable for a farmer and project. Although refinements must be made in existing techniques and equipment, 'irrigation automation' is far more than a dream or cliche. (USBR)
W69-05834

THE VALUE OF WATER FOR IRRIGATION IN THE KANSAS RIVER VALLEY,
Kansas State Univ., Manhattan. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 06B.
W69-05919

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

RULES OF TRANSFER OF WATER MANAGEMENT EXPERIENCE, WITH SPECIAL REFERENCE TO THE ASSESSMENT OF DRAINAGE DESIGN CONSTANTS,
Institute for Land and Water Management Research, Wageningen (Netherlands).
W. C. Visser.
Soil-Water-Plant, Proc and Inform No 15, Comm for Hydrol Res, T. N. O., pp 90-149, 1969. 60 p, 28 fig, 12 ref.

Descriptors: *Water management (Applied), *Soil-water-plant relationships, Adoption of practices, Optimization, Drainage systems, Irrigation, Irrigation practices, Land management, Parameter hydrology, Water utilization, Administration, Cr response, Crop production.
Identifiers: Agricultural water management.

Irrigation and drainage management techniqu are presented in a form suitable for field and pr ject-design uses. Project design and econom return are influenced most by the accuracy of co stants and the methods of reducing available dat Comprehensive planning requires optimizing cor plicated functions with many unknowns an minimizing the effects of error. A field procedu for solving management problems using only th simpler techniques of soil moisture study, cro yield determination, and mathematical data redu tion is presented. Curve-fitting techniques adjus ment of constants, and graphic solutions ar stressed to improve practicality and reduce depe dence on computers. Alternatives are chosen b varying the values of parameters representin processes that may be manipulated in practice. Th management technique is based on formulae fo plant response, groundwater discharge, evapora tion, soil moisture profile, desorption curve, an rainfall frequency. The methods may be used wit proper caution, for preliminary management dec sions in areas in which insufficient data are availa ble. (Knapp-USGS)
W69-05614

FLOOD PLAIN INFORMATION, ROCK RIVER AT BELOIT, WISCONSIN.
Corps of Engineers, Rock Island, Ill.

Corps Eng Flood Plain Rep, June 1968. 55 p, 2 fig, 13 plate, 11 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives Wisconsin, Maximum probable flood, Historic flood.
Identifiers: *Beloit (Wis), Rock River, Standard project flood, Intermediate regional flood.

Flooding of the Rock River, Beloit, Wisconsin is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-05646

FLOOD PLAIN INFORMATION, IRWIN, LONG AND PAW CREEKS, CHARLOTTE, NORTH CAROLINA (VOLUME 1).
Corps of Engineers, Charleston, S. C.

Corps Eng Flood Plain Rep, June 1968. 75 p, 24 fig, 33 plate, 14 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, North Carolina, Maximum probable flood, Historic flood.
Identifiers: *Charlotte (NC), Long Creek, Paw Creek, Standard project flood, Intermediate regional flood.

Flooding of Irwin, Long, and Paw Creeks, Charlotte, North Carolina is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)

V69-05647

LOOD PLAIN INFORMATION, FORKED EER RIVERS, AND LEWIS CREEK, DYER-BURG, TENNESSEE.
Corps of Engineers, Memphis, Tenn.

Corps Eng Flood Plain Rep, Aug 1968. 86 p, 10 fig, 9 plate, 21 tab.

escriptors: *Floods, *Flood damage, Flood lains, Flood control, Non-structural alternatives, ennessee, Maximum probable flood, Historic ood.
lentifiers: *Dyersburg (Tenn), Forked Deer iver, Lewis Creek, Standard project flood, Inter-ediate regional flood.

looding of the Forked Deer Rivers and Lewis reek, Dyersburg, Tennesse is described in a re-ort of flood plain problems based on records of ainfall, runoff, and historical and present flood eights. Maps, photographs, profiles, and cross sec-ons indicate the extent of flooding that has oc-rred and which may be expected to occur in the ture. The information is for use in study and anning ways to minimize vulnerability to flood mages by control of flood plain use by zoning d subdivision regulations, the construction of ood protection works, or by combinations of ese approaches. (Knapp-USGS)
69-05648

LOOD PLAIN INFORMATION, CHEHALIS ND SKOOKUMCHUCK RIVERS, CEN-RALIA-CHEHALIS, WASHINGTON.
orps of Engineers, Seattle, Wash.

orps Eng Flood Plain Rep, June 1968. 47 p, 11 , 16 plate, 13 tab.

escriptors: *Floods, *Flood damage, Flood ains, Flood control, Non-structural alternatives, ashington, Maximum probable flood, Historic ood.
entifiers: *Centralia (Wash), Chehalis, Chehalis ver, Skookumchuck River, Standard project ood, Intermediate regional flood.

ooding of the Chehalis and Skookumchuck vers, Centralia and Chehalis, Washington is scribed in a report of flood plain problems based records of rainfall, runoff, and historical and esent flood heights. Maps, photographs, profiles, d cross sections indicate the extent of flooding at has occurred and which may be expected to cur in the future. The information is for use in udy and planning ways to minimize vulnerability flood damages by control of flood plain use by ning and subdivision regulations, the construc-n of flood protection works, or by combinations these approaches. (Knapp-USGS)
69-05649

IE CONTRIBUTION OF RESEARCH TO THE FFICIENT USE OF WATER IN AGRICUL-URE,
olcani Inst. of Agriculture Research, Bet-Dagan rael). Div. of Irrigation.
r primary bibliographic entry see Field 03F.
69-05650

IE UDA WALAWE RESERVOIR PROJECT,
epartment of Irrigation, Colombo (Ceylon). Div. Planning, Research and Designs.
de S. Manamperi.
r 8 Volume Proceedings, see Vol 2, No 9, Field B and W69-03305. Int Conf on Water for Peace, ash, D C, Vol 8, pp 182-198, 1968. 16 p, 6 fig, 1 .

escriptors: *Water resources development, *Mul-le-purpose projects, *Reservoirs, Hydroelectric wer, Powerplants, Irrigation, River basin velopment, Social aspects, Economics, Canals, ms, Human population, Migration, Water users.
entifiers: *Ceylon, Uda Walawe Reservoir.

The Uda Walawe Reservoir is located on the Walawe Ganga (river), one of the large perennial rivers that drain the Island of Ceylon. The Walawe Ganga basin covers an area of 965 sq mi or approximately 4% of the total land area of the island. The dam consists of 2 earthen flank embankments, connecting to a concrete section across the river, a powerplant, irrigation outlets, one on each bank of the river. Increasing the reservoir by 23,000 acre-ft, together with the adoption of a new cropping pattern which included sugar, citrus and cotton in addition to rice, made it possible to increase the irrigable command of the reservoir to 60,000 acres. The cropping pattern took into account soil factors, rainfall, and the social and economic conditions in the project region, a very sparsely populated area. It was therefore necessary to plan for the settlement of people from other areas of the island on the lands to be developed under Uda Walawe. The transference of population into undeveloped jungle areas with a dry climate necessitates planning for access, water supply, housing, electric power, food, hospitals, schools, and markets. The project area was made accessible by opening a road network of about 70 mi. Over 3,000 families have already been settled on the project lands. (Knapp-USGS)
W69-05653

PHYSICO-TECHNICAL PROBLEMS IN MANAGING WATER RESOURCES (RUSSIAN),
Akademiya Nauk SSSR, Moscow. Council on the Problems of Water Economy.
For primary bibliographic entry see Field 02A.
W69-05660

LIST OF REFERENCES ON CONTROL OF AQUATIC PLANTS, INCLUDING ALGAE,
Chipman Chemical Co., Inc., Bound Brook, N. J. Research Div.
For primary bibliographic entry see Field 05G.
W69-05705

SUPPLEMENT TO THE LIST OF REFERENCES ON CONTROL OF AQUATIC PLANTS, INCLUDING ALGAE,
Chipman Chemical Co., Inc., Bound Brook, N. J. Research Div.
For primary bibliographic entry see Field 05G.
W69-05706

OPTIMAL OPERATING RULES FOR MULTI-RESERVOIR SYSTEMS,
Massachusetts Inst. of Tech., Cambridge.
Richard Michael Males.
Ph D Thesis, Mass Inst Technol, Cambridge, Mass, Aug 1968. 184 p, 20 fig, 14 tab, 22 ref, 3 append.

Descriptors: *Linear programming, *Simulation analysis, *Reservoir operation, Marginal benefits, Optimization, Comparative benefits, Analytical techniques, Digital computers, Computer models water policy, Water management (Applied).
Identifiers: *Multi-reservoir system, Sensitivity analysis, *Operating rules.

A technique called Linear Programming-Simulation-Search (LPSS) was investigated to analyze the problem of determining optimal operating rules for multiple reservoir systems. A linear programming model was used to obtain initial values for operating parameters. Starting with those values, simple search techniques of sensitivity, single-factor, and marginal analysis were used to determine near-optimal values of the parameters by searching the benefit response surface. The benefit response surface was defined through the use of a simulation model of the basin, which yielded values as a function of the various operating parameters. Three different computer simulation models were tested and their results indicated the feasibility of LPSS. It was concluded that steady-state linear programming models consistently gave lower release values than LPSS. (Gysi-Cornell)
W69-05723

MATHEMATICAL PROGRAMMING MODELS APPLIED TO A WATER RESOURCE SYSTEM,
Massachusetts Inst. of Tech., Cambridge.
Juan Antonio Poblete Reichhard.
M S Thesis, Mass Inst Tech, Dep Econ, Dep Civil Eng, Jan 1969. 325 p, 25 fig, 3 map, 110 tab, 57 ref, 7 append.

Descriptors: *Linear programming, *Mathematical models, *Water resources, *River systems, Multiple-purpose projects, Reservoir operation, River basin development, Simulation analysis.
Identifiers: Maule River Chile, Mixed integer linear programming.

Different mathematical programming model, set up for preliminary study of a multiunit, multipurpose river basin system on the Maule River in Chile, were analyzed. Three different steady-state, in-year storage linear programming (LP) models were developed, using increasing numbers of time periods in each. Two over-year steady state LP models were introduced. Finally a mixed integer LP model of the system. The advantages and drawbacks of each approach were discussed and compared. A discussion of the usefulness of the results, in relation to a simulation model of the system, was presented. (Gysi-Cornell)
W69-05725

DESIGN OF WATER-RESOURCE SYSTEMS,
Harvard Univ., Cambridge.
Arthur Maass, Maynard M. Hufschmidt, Robert Dorfman, Harold A. Thomas, Jr., and Stephen A. Marglin.
Cambridge, Harvard Univ. Press, 1962. 620 p, 98 fig, 93 tab.

Descriptors: *Water resources, *Systems analysis, *Mathematical models, *Economics, *River basins, Analytical techniques, Linear programming, Simulation analysis, Synthetic hydrology, Design, Decision making, Planning.

The results of a large-scale research program devoted to the methodology of planning or designing complex, multiunit, multipurpose water-resource systems were reported. A detailed presentation of methods and techniques for translating design criteria in designs of river-basin systems by means of combined economic and engineering analysis was given. The new methods of river-system design were compared with methods now in use. The two principal new techniques examined were the simulation of river-basin systems on digital computers and the construction of mathematical models that produce optimal decisions. (Gysi-Cornell)
W69-05729

MATHEMATICAL MODELS: A STOCHASTIC SEQUENTIAL APPROACH,
Harvard Univ., Cambridge, Mass.
Harold A. Thomas, Jr., and Peter Watermeyer.
Design of Water-Resource Systems, by Maass et al, Chap 14, pp 540-561, Harvard Univ Press, 1962. 22 p, 6 fig, 7 tab, 8 ref.

Descriptors: *Linear porgramming, *Stochastic processes, *Reservoir operation, Probability, Decision making, Queuing theory, Mathematical models, Optimization, Reservoir design, Reservoir storage.
Identifiers: Operating policies, Target outputs.

A stochastic linear programming model, used to determine optimal operating policies for given target outputs and reservoir size, and optimal policies and targets for given reservoir size was presented. The probability distribution of inflows for particular yearly design periods were assumed known and independent (no serial correlation). The objective was to maximize net benefits (a function of target level and short run loss or surplus drafts) subject to probability and continuity constraints. The model was designed for a single multi-purpose reservoir, with the benefits assumed additive. The solution, shown graphically, indicated the optimal draft in

any period for any level of available supply (inflow plus storage). The consistency of the linear programming solution was checked using a queuing theory model. (Gysi-Cornell)
W69-05730

OPTIMUM MANAGEMENT OF A COMBINED PUMPED HYDRO AND IRRIGATION STORAGE FACILITY,
Stanford Research Inst., Menlo Park, Calif.
William G. Keckler.
Pap, Stanford Res Inst, Mar 1966. 28 p, 8 fig, 2 ref.

Descriptors: *Dynamic programming, *Pumped storage, Pumping plants, *Irrigation, Reservoir operation, *Hydroelectric plants, Electric power rates, Optimization, *Water management (Applied), Water allocation (Policy), Water demand, Reservoir design, Planning, Design.

A forward dynamic programming model was structured to determine the optimum management policy for a combined pumped hydro and irrigation storage facility. The state variables were the upper and lower reservoir storages (quantized and normalized to six discrete values). The control variables were the rates of pumping between river and lower reservoir, and pumping-or-generating between the lower and upper reservoirs. Time increments of one hour were used for a study period of one day. Different values for electrical energy were charged at different hours of the day. The method of solution was described. The computer program was shown in a flow diagram. The results from a hypothetical problem were graphed and discussed. The advantages and limitations of the method for larger problems and longer time periods were outlined. (Gysi-Cornell)
W69-05734

CHICAGOLAND DEEP TUNNEL SYSTEM FOR POLLUTION AND FLOOD CONTROL: FIRST CONSTRUCTION ZONE, DEFINITE PROJECT REPORT.
Harza Engineering Co., Chicago, Ill.; and Bauer Engineering, Inc., Chicago, Ill.
For primary bibliographic entry see Field 05G.
W69-05743

ALLEN V STATE (FLOOD DAMAGE DUE TO CONSTRUCTION OF DIKE).
For primary bibliographic entry see Field 06E.
W69-05798

DIVERSION WORKS FOR CONSTRUCTION,
U S Army Corps of Engineers, Vicksburg, Miss.
James P. Stafford.
Pap, Amer Soc Civ Eng Nat Meet Water Resour Eng, New Orleans, La, Feb 1969. 61 p, 8 plate, 5 tab, 7 ref.

Descriptors: Construction, *Earth dams, Flood control, Safety, Floods, *Gravity dams, *Concrete dams, Mississippi, Arkansas, Geology, Climatic data, Multiple-purpose reservoirs, Runoff, Storage capacity, Streamflow, Atmospheric precipitation, River regulation, *Diversion works, Diversion tunnels, Hydrology, *Diversion, *Diversion structures.
Identifiers: *Streamflow regulation, Corps of Engineers, Grenada Dam (Miss), Narrows Dam (Ark), Blakely Mountain Dam (Ark), DeGray Dam (Ark).

Four projects constructed by the Vicksburg District, Army Corps of Engineers, on tributaries of the Yazoo River, Miss, and the Ouachita River, Ark, were selected as examples of diversion techniques for flood control dams. Climate, temperature conditions, precipitation, runoff, geology, diversion plans, and implementation for each of these projects are discussed. Reservoir data are tabulated for each project. Grenada Reservoir illustrates simpler techniques available in a wide river plain permitting alternate channel diversion with normal flow through a river gap with cofferdams protecting first stage embankments. Second stage diversion is through the flood control structure and conduit with cofferdams protecting second stage construction. Narrows Reservoir illustrates an alternate diversion over low monoliths of a concrete gravity dam in a narrow river valley. Blakely Mountain Reservoir is an example of diversion in a narrow river valley through flood control and power tunnels during the dry season. First season flood flows pass over first stage embankments with second stage embankments providing storage capacity to permit full diversion through tunnels. DeGray Reservoir illustrates dry season diversion through a joint flood control-power tunnel, the diameter determined by diversion requirements. (USBR)
W69-05816

FLOOD PROOFING IN A FLOOD PLAIN: A STOCHASTIC MODEL,
Engineering Construction Corp., Ltd, Bombay (India); and Carnegie Inst. of Tech., Pittsburgh, Pa.
Viraf S. Bhavnagri, and George Bugliarello.
Proc, Amer Soc Civil Eng, Vol 92, No HY4, pp 63-76, July 1966. 14 p, 2 fig, 2 tab, 40 ref, 1 append.

Descriptors: *Floodproofing, *Flood plains, *Mathematical models, *Stochastic processes, Statistical methods, Probability, Flood damage.
Identifiers: Expected values.

A mathematical model of an urban flood plain was presented which incorporated a statistical description of flood proofing measures. Measures that were contingent and dependent on the flood warning time were considered. Dynamic flood proofing was treated by a probabilistic approach which accounted for the uncertainty of flood warnings. The expected value and standard deviation of damage to the entire flood plain were expressed in terms of the 'flood proofing index,' which indicated the extent of dynamic flood proofing in the flood plain. The influence of the flood proofing index on the flood damage statistics was studied by means of a hypothetical example. (Gysi-Cornell)
W69-05851

MATHEMATICAL REPRESENTATION OF AN URBAN FLOOD PLAIN,
Carnegie Inst. of Technology, Pittsburgh, Pa.
Viraf S. Bhavnagri, and George Bugliarello.
Proc, Amer Soc Civil Eng, Vol 91, No HY2, pp 149-173, Mar 1965. 25 p, 9 fig, 3 tab, 12 ref, 3 append.

Descriptors: *Flood plains, *Mathematical models, *Flood damage, Statistical methods, Contours, Depth, Time series analysis, Economics, Reservoir design, Optimization.
Identifiers: Expected values.

A mathematical model was presented which formalized the computations of flood damages to an urban area. The flood depth-damage relationship of a structure was written as the product of a unit damage function and an individual characteristic damage coefficient. The sum of such coefficients for all establishments within a small contour interval of the flood plain denoted the damage susceptibility of that contour interval. The expected value and standard deviation of the present worth of a time series of damages was expressed in terms of the current contour characteristic damages and a growth-discount factor that accounted for changes in level of economic activity with time. A hypothetical example illustrated the application of the model for determining the optimal size of an upstream single-purpose flood control reservoir. (Gysi-Cornell)
W69-05852

ANALOG MODELS FOR FLOOD CONTROL SYSTEMS,
California Univ., Berkeley.
J. A. Harder.
Proc, Amer Soc Civil Eng, Vol 88, No HY2, pp 63-74, Mar 1962. 12 p, 3 fig, 4 ref, 2 append.

Descriptors: *Analog computers, *Rainfall-run relationships, *Flood control, Reservoir desi Reservoir operation, Project planning, Flo forecasting, Rainfall simulators, Time of conc tration, State-discharge relationship.

Methods for the simulation of flood control cha nels were described, with particular attention pa to the non-linear properties of the stage-dischar and stage-storage relation. The introduction boundary conditions in the form of streamflo and rainfall excesses was programmed for each hours of the prototype, for a total period of t days. Each simulated flood required five m liseconds, after which initial conditions of flo were reestablished in preparation for the next flo period. The time history of stage or discharge any two of fifty stations could be displayed simu taneously on an oscilloscope screen. Provision w made for the insertion of up to six reservoirs in the analog, each of which was provided with a pr grammable output simulating the action of rese voir release gates. It was concluded that the anal would be useful in project planning and duri flood emergencies. (Gysi-Cornell)
W69-05856

MATHEMATICAL MODEL FOR FLOOD RIS EVALUATION,
Cornell Univ., Ithaca, N. Y.
Richard M. Shane, and Walter R. Lynn.
Proc, Amer Soc Civil Eng, Vol 90, No HY6, pp 20, Nov 1964. 20 p, 8 fig, 3 tab, 5 ref, 2 append.

Descriptors: *Probability, *Mathematical model *Risks, *Floods, *Duration curves, Statistic methods, Design flood, Data processing, Evalu tion, Estimating equations.
Identifiers: Graphical methods, Poisson probabili law.

A mathematical model was developed for use wit partial-duration data that related design flow t several different measures of risk. The analysis wa based on the Poisson probability law and the proba bility theory of sums of a random number of ran dom variables. Design equations that related thre measures of risk (recurrence interval distributio encounter probability, and expected recurrence in terval) to design discharge were derived. A statisti cal procedure was presented for estimating desig equation parameters from a partial-duration serie of data. A graphical procedure for solving th equations was also presented. (Gysi-Cornell)
W69-05860

EFFECTS OF SEEDING AND GRAZING ON IN FILTRATION CAPACITY AND SOIL STABILI TY OF A SUBALPINE RANGE IN CENTRAL UTAH,
Forest Service (USDA), Logan, Utah. Intermoun tain Forest and Range Experiment Station.
For primary bibliographic entry see Field 04D.
W69-05889

FLOOD PLAIN INFORMATION, CONLEY CREEK-SOUTH RIVER, METROPOLITAN AT-LANTA, GEORGIA.
Corps of Engineers, Savannah, Ga.

Corps Eng Flood Plain Rep, July 1968. 53 p, 23 fig, 36 plate, 18 tab.

Descriptors: *Floods, *Flood damage, *Georgia, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Atlanta (Ga), Conley Creek, South River, Standard project flood, Intermediate regional flood.

Flooding of Conley Creek and South River, Atlanta, Georgia is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information

s for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-05913

FLOOD PLAIN INFORMATION, CASEY CANAL SOUTH, SAVANNAH AND CHATHAM COUNTY, GEORGIA.
Corps of Engineers, Savannah, Ga.

Corps Eng Flood Plain Rep, June 1968. 35 p, 21 g, 22 plate, 6 tab.

Descriptors: *Floods, *Flood damage, *Georgia, lood plains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: Savannah (Ga), Chatham County, asey Canal, Standard project flood, Intermediate egional flood.

looding of Casey Canal, Savannah and Chatham ounty, Georgia is described in a report of flood lain problems based on records of rainfall, runoff, nd historical and present flood heights. Maps, hotographs, profiles, and cross sections indicate e extent of flooding that has occurred and which ay be expected to occur in the future. The information is for use in study and planning ways to inimize vulnerability to flood damages by control f flood plain use by zoning and subdivision regulaons, the construction of flood protection works, by combinations of these approaches. (Knapp-SGS)
69-05914

ETHODS FOR WORKING OUT A NATIONAL ATER BALANCE (RUSSIAN),
kademiya Nauk SSSR, Moscow. Council on the roblems of Water Economy.
T. Turchinovich.
'Invest of Surface and Underground Runoff', ssledovaniye Poverkhnostnogo i Podzemnogo oka), Moscow, 'Nauka', pp 26-81, 1967. 56 p, 1 b, 17 ref.

escriptors: *Water resources, *Water balance, conomic prediction, *Water supply, Water poltion, Groundwater, Runoff, Water users, Water recasting, Water-resources development, anning, River basin development, River basins, ver flow, Fish harvest, Reservoirs.
entifiers: *USSR, Water planning, Water econo-.

e purpose of this investigation was the analysis of e redistribution of water resources in the USSR long-term planning of the development of nanal economy. However this goal is intimately nnected with the practical problems of variable ter use and conservation of water reservoirs and uifers. It is also assumed that the analysis of nal water balances and the best methods suitable such redistribution should lead to more efficient ter economy. The article contains the following apters: (1) the purpose of water-economy ances; (2) the basic postulates of a method for rking out national water balances; (3) preliminy water balance for a river basin or an industrial ion; (4) examples of preliminary national water ances; and (5) a method of working out a ecise national water balance. The article contains references and 2-page supplement containing ne regulations for protection of surface waters m waste waters confirmed by the Ministry of alth Protection, USSR, 15 July 1961. (Gabriel-GS)
9-05936

MEANING OF NATIONAL WATER LANCE IN RATIONAL USE OF WATER SOURCES (RUSSIAN),
ademiya Nauk SSSR, Moscow. Council on the oblems of Water Economy.
. Kuznetsov.

In 'Invest of Surface and Underground Runoff', (Issledovaniye Poverkhnostonogo i Podzemnogo Stoka), Moscow, 'Nauka', pp 82-87, 1967. 6 p, 1 fig.

Descriptors: *Water resources, *Water supply, *Water distribution (Applied), *Water works, Runoff, Economics, Forecasting, Planning, Surface waters, Groundwater, Glaciers, Saline water, Water balance, Water basins, Water transfer.
Identifiers: *USSR, *National water balance, Water transfer, Caspian basin, Lake Ladoga.

The author briefly discusses the unequal distribution of runoff in the USSR and the need for water transfer from water-rich regions to dry ones. The existence of several canals, such as Moscow-Volga, Irtysh-Karaganda, and several hydroelectric stations are described and recommendations are made for the transfer of water from Lake Ladoga to the Volga-Caspian basin. Lake Ladoga has a drainage area of 276,000 sq km and the water volume of the lake is about 911 cu km; water transfer would not necessitate the flooding of adjacent areas. It was estimated that the transfer of 20 cu km of water into the central and southern areas can be accomplished by a canal 320 km in length and of 625 cu m/sec capacity. A schematic map of water transfer from Lake Ladoga to the Caspian Sea basin is attached. (Gabriel-USGS)
W69-05937

THE STABILITY OF NORMAL ANNUAL RUNOFF AND SEASONAL RIVER DISCHARGES UNDER CONDITIONS OF DEVELOPMENT OF AGROTECHNICAL ENTERPRISES IN THEIR DRAINAGE AREAS (RUSSIAN),
Akademiya Nauk SSSR, Moscow. Council on the Problems of Water Economy.
G. R. Yunusov.
In 'Invest of Surface and Underground Runoff', (Issledovaniye Poverkhnostnogo i Podzemnogo Stoka), Moscow, 'Nauka', pp 88-100, 1967. 13 p, 6 fig, 6 tab, 16 ref.

Descriptors: *Water resources, *Agronomic crops, *Runoff, *Water distribution, Economics, Surface water, Subsurface flow, Water balance, Groundwater, River flow, Water control, Water harvesting, Water users.
Identifiers: *USSR, Stability of runoff, Don River, Dnieper River.

Annual runoffs and seasonal discharges of the Don and Dnieper Rivers were investigated at various points beginning with observations in 1877 and 1881 for the respective rivers. The study shows that relatively no substantial decrease has occurred in the annual runoffs of these rivers and no change has been identified in the amount of evaporation due to the agricultural activities in the basins. In general the stability of annual runoffs of the Don and Dnieper Rivers indicates the stability of runoffs in all their seasonal formation stages. Although the Don River shows some decrease (down 3%) in the spring runoffs and some increase (up to 5%) in the base flow periods, nevertheless the effect of agricultural activities on the values of river runoff may be considered of importance only in the areas characterized by extensive agricultural development. (Gabriel-USGS)
W69-05938

MUD FLOWS IN THE TRANSILIAN ALA-TAU AND THE MUD FLOW CATASTROPHE OF 7 JULY, 1963 IN THE ISSYK RIVER BASIN (IN RUSSIAN),
Akademiya Nauk SSSR, Moscow. Council on the Problems of Water Economy.
For primary bibliographic entry see Field 02E.
W69-05944

METHODS OF PREVENTING MUDFLOWS (IN RUSSIAN),
Akademiya Nauk SSSR, Moscow. Council on the Problems of Water Economy.
I. I. Mechitov.

In 'Invest of Surface and Underground Runoff', (Issledovaniye Poverkhnostnogo i Podzemnogo Stoka), Moscow, 'Nauka', pp 169-174, 1967. 6 p, 55 ref.

Descriptors: *Mudflows, *Runoff, *Water control, Drainage system, Flood damage, Flood forecasting, Economic justification, Hydrologic properties, Technical feasibility, Economy, Forest management, Barriers, Basins, Structures.
Identifiers: *USSR, *Mudflow control, Ukraine, Central Asia, Caucasus, Armenia.

Methods of preventing mudflows are discussed on the basis of several earlier publications by USSR investigators. The author concludes that effective mudflow control may be achieved only by reliable flood forecasting and by detailed studies of the hydrologic, technical, economic, and other conditions present in the mudflow areas. Choice of a control method cannot be made in a general form because each mudflow basin demands its own specific solution. Studies by Lakhtionov (1962) and Ibad-Zade (1962), describe mudflow prevention in the Alma-Atu area and indicate the effectiveness of using several prevention methods simultaneously. (Gabriel-USGS)
W69-05945

IMMENSE LANDSLIDE OBSTRUCTION OF ZERAVSHAN RIVER, APRIL 24, 1964 (IN RUSSIAN),
Akademiya Nauk SSSR, Moscow. Council on the Problems of Water Economy.
For primary bibliographic entry see Field 02E.
W69-05946

ALLEY V FICKEL (DIVERSION OF WATER BY LEVEE).

49 NW 2d 544-547 (Iowa 1951).

Descriptors: *Iowa, *Levees, *Floodwater, *Streams, Diversion, Diversion structures, Legal aspects, Judicial decisions, Riparian land, Natural flow, Conservation, Remedies, Damages, Alteration of flow, Embankments.
Identifiers: Injunctions (Mandatory).

Defendant, owner of property adjacent to plaintiff's property, constructed a levee on a stream that flowed through his property. The levee was built in compliance with good conservation practice. During a flood plaintiff's property was damaged by water flowage claimed to have been diverted by the defendant's levee. Plaintiff sought to enjoin defendant from further use of the levee. The trial court held for plaintiff and ordered defendant to remove a portion of the levee. In affirming the trial court, the appellate court stated that a riparian proprietor may not embank against the natural overflow when the effect may be to cast an increased volume of water to the detriment of other proprietors. A lower proprietor is not required to receive the drainage diverted in his direction by artificial means. The court felt that since a part of the levee was actually washed away during the flood, the levee was the direct cause of the excess water. (Holt-Fla)
W69-05957

KAY-NOOJIN DEV CO V KINZER (SURFACE WATERS AND THE NATURAL FLOW DOCTRINE).

65 So 2d 510-516 (Ala 1953).

Descriptors: *Diffused surface water, *Natural flow doctrine, *Surface runoff, *Alabama, Surface waters, Drainage systems, Flooding, Surface drainage, Channels, Pipes, Drains, Ditches, Surface-groundwater relationships, Culverts, Drainage water, Slopes, Streamflow, Alteration of flow, Judicial decisions, Legal aspects.
Identifiers: *Nuisance, *Upper landowners, *Lower landowners.

Plaintiff brought this suit to recover for damages caused by the casting of surface water upon his land after it was diverted from its natural course. The defendant, a housing developer, made himself the highland proprietor by building up the land. The defendant was not shown to be negligent in the construction of his sewer and drainage systems. Nevertheless, the drainage system caused unusually large quantities of surface water to be cast upon plaintiff's low land property. The court held that the defendant, upper proprietor, was liable for the damage caused by the diversion of surface water from its natural course. (Stewart-Fla)
W69-05958

PANAMA CITY V YORK (SURFACE WATERS AND THEIR NATURAL FLOW).

26 So 2d 184-186 (Fla 1946).

Descriptors: *Florida, *Natural flow, *Diversion, *Surface runoff, Judicial decisions, Streamflow, Obstruction to flow, Diversion structures, Drainage systems, Surface waters, Controlled drainage, Ditches, Cities, Streamflow, Alteration of flow, Legal aspects.
Identifiers: *Lowland proprietors.

Plaintiff brought suit against defendant municipality for damages resulting from the diversion of water from its natural flow onto the property of the plaintiff. In holding for the plaintiff, the court ruled that no person has the right to gather surface waters that would naturally flow in one direction and divert them from their natural course onto the lands of a lowland owner and to his detriment. (Stewart-Fla)
W69-05959

ADAMS V LAWLER (SURFACE WATERS AND THE NATURAL FLOW DOCTRINE).

4 Chester County Reports 89-95 (CP Pa 1948).

Descriptors: *Pennsylvania, *Embankment, *Natural flow doctrine, *Surface runoff, Obstruction to flow, Drainage systems, Flooding, Surface drainage, Rainfall-runoff relationships, Streamflow, Drainage water, Slopes, Judicial decisions, Surface waters, Legal aspects.
Identifiers: *Lowland proprietors, *Upper landowners.

Plaintiffs brought this suit to restrain the defendants from interfering with the natural flow of surface water from the plaintiffs' land. Defendants were lowland proprietors and water draining from the plaintiffs' land followed a natural course across their own land. Defendants constructed an embankment which impeded the natural flow of the water. The result was serious flooding and backing up of the water onto the plaintiffs' land. The court granted plaintiffs' request for an injunction, finding that the defendants had obstructed the natural flow of surface waters from the plaintiffs' property. This caused damage to the land and interfered with plaintiffs' use and enjoyment of it. (Stewart-Fla)
W69-05960

NEWTON COCA COLA BOTTLING CO V MURPHREY (DIVERSION OF SURFACE WATERS).

55 So 2d 485-489 (Miss 1951).

Descriptors: *Mississippi, *Artificial watercourses, *Surface runoff, *Diversion, Surface waters, Drainage systems, Judicial decisions, Ditches, Surface drainage, Natural flow doctrine, Drainage water, Surface drainage, Channels, Diffused surface water, Slopes, Storm runoff, Legal aspects, Alteration of flow.

Plaintiff brought suit to recover for damages caused by the wrongful diversion of surface waters from defendant's land onto that of the plaintiff. The court found that the defendant caused the surface water to become concentrated in an artificial manner and then discharged upon the land of the plaintiff in a more concentrated flow than would have naturally occurred. The recognized rule is that a landowner cannot collect surface water into an artificial channel and precipitate it in greatly increased quantities upon his neighbor's property causing substantial damage. Judgment for the plaintiff was affirmed. (Stewart-Fla)
W69-05961

YONADI V HOMESTEAD COUNTRY HOMES (SURFACE WATERS AND THE NATURAL FLOW DOCTRINE).
35 N J Super 514, 114 A 2d 564-569 (App Div 1955).

Descriptors: *New Jersey, *Surface drainage, *Surface runoff, *Natural flow, Surface waters, Channels, Culverts, Runoff, Drainage water, Time of concentration, Surface-groundwater relationships, Drainage systems, Groundwater movement, Flow measurement, Drains, Ditches, Judicial decisions, Alteration of flow, Flow augmentation, Legal aspects.
Identifiers: *Upper landowners, *Lower landowners.

Plaintiffs filed suit to recover damages for the casting of casual surface waters onto their land. Defendants, upper landowners, erected houses on their land and constructed drains to remove surface water. The principal question is whether defendants are to be charged with liability for a resultant increase in the flow of surface water which runs onto the plaintiffs' land. The trial court found for plaintiffs. The superior court, reversing, held that the casting of surface waters in increased quantities through artificial means onto the land of another, without more, is not unlawful. The general rule is that neither the diversion nor the altered transmission of surface water gives rise to actionable injury. The water diverted by the defendant continued to flow into the locality where it would naturally have flowed. The burden of the increased quantities is put on the lowland proprietor. The increased quantity and force was a necessary incident of the legitimate beneficial user, and any injury arising therefrom was not actionable. (Stewart-Fla)
W69-05962

MISKOTTEN V DRENTEN (ARTIFICIAL DRAINAGE OF SURFACE WATERS).

318 Mich 538, 29 NW 2d 91-94 (1947).

Descriptors: *Michigan, *Surface runoff, *Artificial watercourses, *Drainage systems, Embankment, Surface waters, Ditches, Floods, Storm runoff, Surface drainage, Rainfall-runoff, Diffused surface waters, Precipitation excess, Property boundaries, Drains, Flow augmentation, Legal aspects, Judicial decisions.

Plaintiffs brought action to enjoin defendants from constructing an embankment near the drainage ditch which served as the boundary line between their respective properties. The problem arose when the neighboring river flooded the lands of both parties after a heavy rainfall. The plaintiffs dug drainage ditches perpendicular to the ditch that served as the property line. Defendant sought to build an embankment to keep the water coming from the plaintiff's land from flowing onto his land. The court ruled for the defendant, holding that the right to drain surface water cannot be exercised by concentrating or releasing it upon adjacent property by means of an artificial ditch, in greater quantities or forces than would otherwise be natural. The plaintiff had no right to collect water in ditches and dump it upon the lands of an adjoining owner. (Stewart-Fla)
W69-05963

UPPER GREENWOOD LAKE PROPER OWNERS ASS'N V GROZING (CONTROLL USE OF LAKE WATERS).
6 N J Super 538, 69 A 2d 896-899 (1949).

Descriptors: *New Jersey, *Ownership of be *Lakes, *Relative rights, Judicial decisions, Le aspects, Lake beds, Fishing, Boating, Bodies water, Recreation, Water utilization, Water use Land development, Land use, Lake soils, La shores, Obstruction to flow.
Identifiers: Injunctions (Prohibitory), Coven running with land.

A developer created a group of lakefront lots damming a brook. Deeds from this develop granted fishing rights in the lake and subjected su rights to the privilege of adjoining owners to use t lake for like purposes. Property owners in t development formed plaintiff corporation operate the lake for the benefit of the owners. T developer conveyed land to the plaintiff, whi conveyance included 90 per cent of land benea the lake. This deed contained covenants affecti lake use, which were common to all deeds development owners. Several owners began renti boats for public fishing. Plaintiff sued in equi praying that defendants be enjoined from renti boats for public fishing on the lake. Injunctive rel was granted against all but the one defendant whom prior permission to rent boats had be given. The court ruled that the privilege to fish w a right appurtenant to and running with the lan Such right could not be transferred to others, eve temporarily, without transferring the land itse Plaintiff was held to have the right to control lak use, subject only to rights of adjoining owner (Wheeler-Fla)
W69-05966

VINSON V TURNER (INJUNCTION AGAINS CONCENTRATION OF SURFACE WATE RIDDANCE).

40 So 2d 863-866 (Ala 1949).

Descriptors: *Alabama, *Riddance (Leg aspects), *Relative rights, *Surface runof Drainage effects, Overflow, Ditches, Natural flow Natural flow doctrine, Damages, Running water Surface waters, Channels, Water spreading Discharge (Water), Flow augmentation, Channe flow, Overlying proprietor, Water law, Lega aspects.
Identifiers: Injunctions (Mandatory).

Petitioners owned farm lands adjacent to and lowe than respondent's land. Roadside ditche discharged surface waters into a ditch runnin across respondent's land to petitioners' land. Th county once cleaned out this ditch across respon dent's land, but it later became filled. In order t protect his well from water spreading and to cul tivate more land, respondent did not reopen the ol ditch but created a separate drainway which emp tied waters upon complaints' land at a different lo cation. Petitioners, alleging damages from the con centrated flow, sought a mandatory injunctio forcing respondent to reopen the old ditch. The trial court found for respondent. The appellat court affirmed, following Alabama's modified civi law rule concerning surface water riddance. The rule provides that an upper landowner may rid hi land of surface waters as he sees fit, provided such riddance does not cause detriment to the lowe estate. Under exceptional circumstances, the uppe owner is permitted to prudently exercise the right to concentrate water which previously flowed by divers channels over a wider area and to discharge such waters on the lower estate. The jury found that this right existed in the circumstances of this case. (Wheeler-Fla)
W69-05967

ATCHISON T AND S F RY V TAYLOR (FLOOD DAMAGE DUE TO RAILWAY EMBANKMENT).

87 F Supp 313-318 (ED Mo 1949).

Descriptors: *Missouri, *Railroads, *Legislation, *Embankments, Legal aspects, Judicial decisions, Ditches, Overflow, Flood damage, Drainage systems, Surface waters, Overlying proprietor, Surface runoff, Floodwater, Control structures, Flood protection, Flood control, Channels, Backwater, Water law, Relative rights, Riddance (Legal aspects), Repulsion (Legal aspects), Obstruction to flow.
Identifiers: Proximate cause.

To avoid a multiplicity of suits arising out of a flood, plaintiff railroad sought a declaratory judgment against defendant individuals and drainage districts. Defendants filed counterclaims for damages, alleging that the railroad embankment obstructed an overflow of waters by failure to provide adequate bridging of ditches, drains, and watercourses as required by state statute. Plaintiff contended that any damages were due to an act of God and not to any failure to observe statutory requirements. The court found for the plaintiff and denied the counterclaims, stating that the only issue was whether plaintiff complied with the statute. The court held that the statute did not require construction of openings in the embankment unless such opening would connect with a ditch, drain, or watercourse. Plaintiff's embankments fulfilled the statutory requirements. The court also stated that flood waters should be treated as surface waters, and that the effect of the statute was to modify the common-enemy rule with respect to railroad embankments. (Wheeler-Fla)
W69-05968

ECK V HAFLEY (DIVERSION OF STREAM LOW).

37 SW 2d 527-530 (Ky 1951).

Descriptors: *Kentucky, *Eminent domain, Diversion, *Natural flow, State governments, Damages, Remedies, Streams, Channel flow, Stream flow, Floods, Condemnation, Obstruction to flow, Judicial decisions, Legal aspects.
Identifiers: Inverse condemnation.

Plaintiff brought suit alleging that state officials, in the construction of a highway next to his land, had changed the channel of a creek. This diversion of the natural flow resulted in the inundation of his land and crops. The lower court held for the plaintiff, and the state appealed. Although reversing on other grounds, the court held that changing a creek channel and diverting the natural flow of a stream so as to cause inundation of land is a taking of property. The court stated that a suit for damages by the owner was in effect a reverse condemnation. (Gabrielson-Fla)
W69-05969

OMMONWEALTH V KELLEY (NEGLIGENT BSTRUCTION TO FLOW).

96 SW 2d 695-698 (Ky 1951).

Descriptors: *Compensation, *Kentucky, *State governments, *Obstruction to flow, Overflow, Inversion, Eminent domain, Condemnation, Natural flow, Culverts, Ditches, Remedies, Judicial decisions, Flood damage, Relative rights, Discharge (Water), Operation and maintenance.

Plaintiff brought suit to recover for injury to his land which allegedly resulted from the negligent management and operation of an adjacent highway and culvert system. Evidence tended to show that after heavy rains the culverts overflowed, depositing mud on appellee's land and damaging the foundations of his house. From a judgment awarding $,000 in damages, the state appealed. While reversing on other grounds, the court held that if culverts were allowed to overflow so as to discharge surface waters upon adjacent land, such discharge would constitute a trespass. Such a trespass amounts to nothing less than a taking of private property for public use and requires compensation. (Gabrielson-Fla)
W69-05970

FINDLEY LAKE PROPERTY OWNERS, INC V TOWN OF MINA (MAINTENANCE AND CONTROL OF WATER LEVEL OF LAKE).
154 NYS 2d 775-809 (SC 1956).

Descriptors: *New York, *Dams, *Prescriptive right, *Water levels, Judicial decisions, Flow, Lakes, Wells, Navigable waters, Easements, Water rights, Recreation.

Plaintiff, owners of the dam through which Findley Lake drained, had allowed the water level to lower in order to repair the dam and remove weeds threatening to ruin the lake. Defendant had taken over control of the dam to raise the water level, alleging imminent danger to life, health and property by reason of the exposed bed and existence of a prescriptive right and public interest in the minimum level of the lake. Plaintiff sought a judgment of eviction and injunction preventing trespass and control of the dam by defendant. The court held that plaintiff had acquired the right to flowage of the lake to the extent of its predecessor in title. The evidence was held insufficient to show a nuisance detrimental to life, health and property. The lowering of the water level was held to not deprive property owners on the lake of prescriptive right in the maintenance of a certain water level. Plaintiff's predecessors in title had never recognized any obligation to maintain a minimum level, and therefore the public had only a permissive right to use the waters at the level maintained. Thus the defendant's action constituted an unlawful taking of plaintiff's property. (Childs-Fla)
W69-05973

COATES V UNITED STATES (DIKES AS THE PROXIMATE CAUSE OF FLOODING).
110 F Supp 471-476 (Ct Cl 1953).

Descriptors: *Missouri, *Streams, *Navigable rivers, *Flooding, Floodwater, Farms, Flow rates, Natural flow, Missouri River, Running waters, Dikes, Riparian lands, Riparian rights, Banks, Judicial decisions, Legal aspects.
Identifiers: Proximate cause.

Plaintiffs brought action to recover just compensation for the taking of certain lands and crops by defendant. Plaintiffs contend that the acts of defendant: (1) increased the water surface elevation of a river, thereby increasing flood stages; (2) caused an increase in the velocity of the flood waters over plaintiffs' land; and (3) resulted in a taking of plaintiffs' property without due process of law. The defendant denied the acts attributed to him. Further, defendant contended that an increase in the velocity of the river as a result of the acts complained of effected only indirect and inconsequential damage. The court held that the plaintiffs had failed to prove that construction of the dikes by defendant had caused the flood damage suffered. (Katz-Fla)
W69-05978

BOROUGH OF AUSTIN V A AND P CORRUGATED BOX CORPORATION (FLOODING BELOW A DAM).

60 Pa D and C 166-194 (C P 1947).

Descriptors: *Pennsylvania, *Flooding, *Impounded waters, *Dams, Reservoirs, Streams, Overflow, Flood damage, Riparian rights, Riparian lands, Runoff, Storm runoff, Precipitation excess, Surges, Waves (Water), Judicial decisions, Legal aspects.
Identifiers: Proximate cause, Act of God.

Defendant's negligently maintained dam collapsed during a very heavy rainfall causing extensive damages to plaintiff town. The plaintiff obtained a $35,000 verdict below, and the defendant sought a judgment non obstante veredicto. The court held that the defendant was liable for the entire amount of damage caused by his negligence in concert with an act of God. The court denied the defendants contention that the extraordinary rainfall alone would have caused the flooding complained of by the plaintiff. The court found that the amount of damages awarded was incorrectly determined and ordered a remittitur in defendant's favor. (Katz-Fla)
W69-05979

UNITED STATES V 2973 ACRES OF LAND (CONDEMNATION OF FLOWAGE EASEMENTS).
For primary bibliographic entry see Field 06E.
W69-05984

MOLTION V STATE (FLOODING ABOVE A DAM).

84 NYS 2d 521-527 (Ct Cl 1948).

Descriptors: *New York, *New York State Barge Canal, *Dams, *Flood damage, Flooding, Lakes, Canals, Legal aspects, Judicial decisions, Flood control, Erosion, Flood gates, Dam construction, Dam failure, Water levels, Navigable waters, Rivers, Ice, Operation and maintenance.

Plaintiffs sued to recover for damage caused by the flooding of Lake Oneida. They alleged that lake level was raised due to the negligent operation of the state dam located on the lake. The state claimed the structures were erected to facilitate operation of the Barge Canal and not for flood control purposes. The court held that if the state operated the canal in such a way as to cause damage to plaintiffs' property, it is legally responsible for the injuries caused. The state had a duty to watch the water level more closely and to open the gates at the dam at an earlier date. The state, in changing the natural water level of the lake in order to enhance the navigability of the canal system, became liable for damages to property owners whose lands were flooded as a result of such action. (Shevin-Fla)
W69-05988

BLACK V STATE (FLOODING OF LAND BY THE STATE).
195 Misc 484, 90 N Y S 2d 766-769 (Ct Cl 1949).

Descriptors: *New York, *Flooding, *New York State Barge Canal, *Prescriptive rights, Lakes, Dams, Canals, Judicial decisions, Legal aspects, Flood control, Flood damage, Erosion, Floodgates, Dam construction, Dam failure, Water levels, Navigable waters.

Claimants sued the state for flood damages caused by the negligent construction and maintenance of a dam. The dam had inadequate flood control facilities. The state claimed it had used the lake regularly over the last 20 years in each navigation season. The state contended that it had thus acquired a prescriptive right to flood the lands in question. The court held that the evidence was insufficient to establish that the state had acquired this right with regard to claimants' properties. The awards were granted. (Shevin-Fla)
W69-05989

HANCOCK V STULL (OBSTRUCTION TO NATURAL FLOW OF SURFACE WATER).
110 A 2d 522-524 (Md Ct App 1955).

Descriptors: *Maryland, *Obstruction to flow, *Surface waters, *Artificial watercourses, Ditches, Natural flow, Reasonable use, Water law, Legal aspects, Judicial decision, Walls, Barriers, Stream improvement, Equitable apportionment, Repulsion (Legal aspects), Drains, Alteration of flow, Remedies.

Plaintiff owned property adjacent to and above defendant's property. The natural flow of surface water was from plaintiff's land onto defendant's land until defendant graded his land. After grading, defendant created an artificial ditch midway

through his property which collected surface water and passed it onto plaintiff's property. Defendant constructed a concrete wall to obstruct the artificial channel. Plaintiff brought this action to have defendant enjoined from obstructing the natural drainage of surface water. The court stated that generally upper landowners are entitled to have surface water flow naturally over lower land without the flow being obstructed. However, upper owners may not discharge water into an artificial channel that results in more than the natural flow. If such a flow is created, the lower owner may protect his property. As an equitable solution the court ordered that the wall be removed and that plaintiff construct a valley gutter along the common property line. The court said that when a strict application of the general rule results in hardship the 'reasonableness of use' rule should be applied. (Holt-Fla)
W69-05990

INDIAN GRAVE DRAINAGE DIST V CONDRON (SUIT TO ESTABLISH RIGHTS OF PERSON OUTSIDE DRAINAGE DISTRICT).
2 Ill 2d 183, 117 NE 2d 96-98 (1954).

Descriptors: *Illinois, *Drainage districts, *Remedies, *Settling basins, Judicial decisions, Watershed (Basins), Artificial watercourses, Silting, Downstream, Riparian rights, Streams, Levees, State governments, Diversion, Alteration of flow, Legislation, Damages, Relative rights.
Identifiers: Standing.

Landowners within a drainage district instigated a petition praying that the commissioners be ordered to abandon all holding basins within that district. The state's attorney filed a motion on behalf of individuals outside the drainage district to dismiss the petition. The main issue was whether the individuals outside the district fell under the statutory definition of 'interested persons' so as to have standing to contest the petition. The court ruled that drainage districts are creatures of the state and are set up for the exclusive benefit of the territory within the district. Therefore, only those within the district are 'interested persons' within the meaning of the clause confering standing to appear and resist an application for abandonment. Those injured property owners outside the district whose property rights are prejudiced by occurrences within the district may maintain an action for damages or seek some other appropriate remedy against the drainage district. (Logan-Fla)
W69-05993

GROBART V NORTH JERSEY DIST WATER SUPPLY COMMISSION (DIVERSION OF FLOW).

58 A 2d 796-799 (N J Ct Ch 1948).

Descriptors: *New Jersey, *Land tenure, *Obstruction to flow, *Alteration of flow, Diversion structures, Water distribution (Applied), Water districts, Reasonable use, Relative rights, Easements, Hydraulic structures, Water supply, Streams, Judicial decision, Legal aspects, Real property, Remedies, Potable water, Water users.

The plaintiff brought this action to have defendant water district enjoined from diverting waters from a tributary of the Passaic River. The plaintiff alleged that she was owner of certain lands downstream from the point of diversion and that she was entitled to full use and enjoyment of the waters flowing in the stream. The defendant asked plaintiff to prove her title. Plaintiff could only show a dower right in the property in question. The court held that the defendant's grantor by virtue of a deed from the state was entitled to make authorized diversions from the stream in question and that the defendant could exercise this right by substitution. The plaintiff contended that the defendant was diverting water from the stream in a different manner than its predecessor in title. The court, in refusing to issue an injunction, indicated that the method of diversion could be modified by a successor as long as the amount of water so diverted remains constant. (DKatz-Fla)
W69-05994

JENNINGS V LEAGUE OF CIVIC ORGANIZATIONS (BREACH OF CONTRACT TO PRODUCE WATER).
180 Pa Super 398, 119 A 2d 608-611 (Pa Super Ct 1956).

Descriptors: *Pennsylvania, *Water contracts, *Reservoir sites, *Water sources, Legal aspects judicial decision, Contracts, Benefits, Reservoir construction, Reservoir storage, Impounded waters, Testing, Shales, Excavation, Rock excavation, Water supply, Supply contracts, Water storage, Water table, Construction, Compensation, Construction costs.
Identifiers: Express warranties.

Defendant was in great need of water for use in certain picnic grounds. Plaintiff contractor offered to construct a reservoir upon defendant's property, and represented that he would guarantee to supply all the necessary water. He further represented that if he did not produce sufficient water he would forfeit all compensation. Defendant, having no knowledge of the proposed type of construction, relied on the plaintiff's representations and hired him to perform the work. Because the reservoir was built in shale rock, it would only hold water in wet seasons. It, therefore, proved inadequate for defendant's needs. Defendant refused to pay, and plaintiff sued for the contract price. In affirming the jury verdict for defendant, the appellate court held that plaintiff, by his breach of express warranty to produce water, forfeited the right to compensation even for expenses. The court noted that the reservoir, where it was built, was of no value to defendant. Plaintiff should have known this before beginning construction. (Wheeler-Fla)
W69-05995

GEORGIA POWER CO V DREESE (NEGLIGENT WATER DISCHARGE).

51 SE 2d 724-728 (Ga 1949).

Descriptors: *Drowning, *Discharge (Water), *Georgia, *Dams, Overflow, Electric powerplants, Fishing, Judicial decisions, Legal aspects, Water law, Boats, Rivers, Recreation, Hazards.
Identifiers: Licensee, Duty of care, Respondeat superior, Fact questions, Invitee.

Plaintiff claimed that defendant power company negligently caused the death of plaintiff's husband. While plaintiff and her husband were fishing in a boat below defendant's power dam, employees of the defendant opened the flood gates causing 2 to 3 foot waves in the river below. The waves capsized the boat, and plaintiff's husband drowned. Plaintiff alleged that the river below the dam was commonly fished by the public with defendant's knowledge, that deceased was an invitee, and that defendant had a duty to keep the premises in a safe condition. The court held that plaintiff's husband was a licensee since the privilege to fish in the river was for his sole benefit. The defendant had the duty to use ordinary care to avoid injuring a licensee when his presence was known or reasonably to be anticipated. Whether defendant's employees breached this duty of ordinary care and whether such action by the employees under the circumstances amounted to wilful and wanton conduct were proper questions for the jury. (Holt-Fla)
W69-05996

LEVIN V MYERS (DISCHARGE OF SURFACE WATERS).

211 Ga 474, 86 SE 2s 283-285 (1955).

Descriptors: *Georgia, *Surface waters, *Discharge, Natural flow, Drainage, Surface runoff, Overland flow, Reuplsion (Legal aspec
Riddance (Legal aspects), Drainage water, Judi
decisions, Legal aspects.
Identifiers: Injunctions (Mandatory), Injuncti
(Prohibitory).

Plaintiff brought action to enjoin defendant fr
causing the discharge of surface water upon pla
tiff's lands, and defendant filed a cross-petit
seeking similar injunctive relief. Defendant
permanently enjoined, and the parties were
lowed sixty days to effectuate the decree. Du
said period, defendant filled the gap in the cop
on the top of her driveway and wall, but she a
cut several new holes at various places along
coping. Plaintiff filed motion alleging that def
dant had aggravated rather than remedied
nuisance and prayed for such further relief
would prevent defendant from discharging surfa
water upon his property. The trial court entere
permanent injunction, and defendant appeal
The court found that, under the pleadings a
evidence, the decree permanently enjoining def
dant from causing or permitting the discharge
any surface water upon the property of plaintiff
proper and the judgment was affirmed. (Reed-Fl
W69-05997

LOCH SHELDRAKE ASSOCIATES, INC EVANS (RESERVATION OF REASONAB USE).

306 N Y 297, 118 NE 2d 444-451 (1954).

Descriptors: *New York, *Lakes, *Easemen
*Impoundments, Mill dams, Pipes, Conveyan
structures, Hydraulic structures, Artificial u
Riparian rights, Reasonable use, Overlying propr
tor, Appropriation, Water rights, Judicial de
sions, Legal aspects.
Identifiers: Easements appurtenant, Easements
gross, Licenses.

The plaintiff's predecessor in title received a de
from one Devine conveying to plaintiff the whole
the lake and shore in question but specifica
reserving the right and privilege to dam the la
and to use the impounded waters up to the natu
low water mark. The grantor also reserved the rig
to pipe such water to his downstream propert
referred to as the 'mill lot.' The grantor later co
veyed the mill lot and the reserved water rights
the defendant. The defendant operated a hot
business adjacent to the mill lot and commence
utilization of the water diverted to the mill for bu
ness purposes. Plaintiff brought action for
declaratory decree that the reservation of wat
rights by the common grantor created an easeme
appurtenant to the mill lot and for use of the m
only. The court held that the language of the rese
vation created an absolute privilege and right to u
the water in whatever manner desired up to the lo
water mark and did not indicate an intent to creat
an easement. (Katz-Fla)
W69-05998

HALSRUD V BRODALE (PRIVATE DRAINAG EASEMENT AGREEMENTS).

72 NW 2d 94-101 (Iowa 1955).

Descriptors: *Iowa, *Easements, *Drainag
systems, *Tile drainage, Judicial decisions, Wate
law, Legal aspects, Drainage, Natural flow, Ob
structions to flow, Relative rights, Alteration o
flow.
Identifiers: Injunctions (Prohibitory).

Plaintiff sought to restrain defendant from ob
structing a drain tile, and defendant counter
claimed for an injunction to restrain plaintiff fro
draining additional lands through the drain ob
structed. In 1916, a private agreement for drainag
was entered into by the grantors of the parties. Th
agreement provided for the drainage of section 35
Plaintiff purchased the dominant tenement, while
defendant became owner of the servient estate

Subsequently, plaintiff acquired land adjacent to his original tract. He constructed a drain tile on this adjacent land and connected it to the drainage system in section 35. The defendant then obstructed the drain tile, and this action was initiated. The court rejected plaintiff's claim and granted defendant's counterclaim for an injunction prohibiting plaintiff's draining section 2 through the existing easement. The court applied the rule that a drainage easement cannot be enlarged to accommodate property not within the original agreement without stipulation of the landowners. The connection of the two drainage systems constituted a violation of the implied terms of the easement for section 35. (Holt-Fla)
W69-05999

STATE V BROWNS, INC (OBSTRUCTION OF DRAINAGE EASEMENTS).

18 NJ Super 327, 87 A 2d 54-56 (1952).

Descriptors: *New Jersey, *Easements, *Drainage water, *Highways, Flood water, Judicial decisions, Legal aspects, Pipes, Watercourses (Legal), Surface waters, Channels, Water law, Obstruction to flow, State governemnts, Relative rights, Diversion losses.

Defendants acquired their property subject to prior easements in favor of the plaintiff. These easements gave plaintiff the right to drain excess surface water into a stream which flowed through defendants' property. Due to diversion of a substantial quantity of stream water, the natural channel flowing through defendants' property became dry. Subsequently, defendants filled in the natural channel and in so doing covered a state highway drain. This caused flooding of the highway and precipitated this action by the state to remove the obstruction. The court held that defendants would be required to provide adequate drainage for the surface water flowing from the highway. (Holt-Fla)
W69-06000

4B. Groundwater Management

RULES OF TRANSFER OF WATER MANAGEMENT EXPERIENCE, WITH SPECIAL REFERENCE TO THE ASSESSMENT OF DRAINAGE DESIGN CONSTANTS,
Institute for Land and Water Management Research, Wageningen (Netherlands).
For primary bibliographic entry see Field 04A.
W69-05614

THE CONTRIBUTION OF RESEARCH TO THE EFFICIENT USE OF WATER IN AGRICULTURE,
Volcani Inst. of Agriculture Research, Bet-Dagan (Israel). Div. of Irrigation.
For primary bibliographic entry see Field 03F.
W69-05650

STEP-DRAWDOWN TEST NEEDS CRITICAL REVIEW,
Universal Oil Products, St. Paul, Minn.
Joe L. Mogg.
Ground Water, Vol 7, No 1, pp 28-34, Jan-Feb 1969. 7 p, 5 fig, 1 tab, 13 ref.

Descriptors: *Water wells, Water yield, *Specific capacity, *Drawdown, *Wells, Groundwater, Groundwater mining, *Aquifers, Discharge (Water), Efficiencies, Discharge coefficients.
Identifiers: *Step-drawdown tests, Groundwater hydrology, Well yield, Pumping tests.

Well testing by the step-drawdown procedure is reviewed; examples show that presently used analysis and interpretation can be misleading. The usefulness of step-drawdown tests is discussed for determining well efficiency, predicting drawdown, selecting pumping rates, and predicting specific capacity at various discharge rates. Certain step-drawdown tests show a large reduction in specific capacity not attributed to turbulent losses in the formation. Reduction of specific capacity may be caused by aquifer compaction because of reduction in aquifer pressure. The step-drawdown test can reasonably predict drawdown and specific capacity, but should not be used to determine efficiency of a water well. The step-drawdown test should not be used for wells in water table aquifers unless the reduction in saturated thickness is small at the maximum pumping rate, or a simple curve is needed to predict an optimum rate or specific capacity at some rate not used during the test. (USBR)
W69-05813

AQUIFER STORAGE DETERMINATION BY RADIOTRACER TECHNIQUES,
Federal Water Pollution Control Administration, Ada, Okla.
For primary bibliographic entry see Field 07B.
W69-05814

GROUNDWATER MANAGEMENT FOR THE NATION'S FUTURE--COMPUTER SIMULATION OF GROUNDWATER BASINS,
International Business Machines Corp., Los Angeles, Calif.; and California State Dept. of Water Resources, Los Angeles.
Howell N. Tyson, Jr., and Ernest M. Weber.
Proc, Amer Soc Civil Eng, Vol 90, No HY4, pp 59-77, July 1964. 19 p, 9 fig, 15 ref, 1 append.

Descriptors: *Simulation analysis, *Groundwater basins, *Analog computers, *Digital computers, Hydrologic data, Mathematical models, Water management (Applied), Water level fluctuations, Groundwater recharge, Groundwater mining.
Identifiers: Differential equations.

A mathematical model of a groundwater basin, representing its storage and transmissive characteristics, was developed and tested using general purpose analog and digital computers. The model permitted predictions of water level responses to extraction and recharge activities. Geologic and hydrologic data were collected, analyzed, and reduced for use in the computer simulation. A model of an aquifer system was developed that led to the diffusion equation in two dimensions. The diffusion model was approximated by a system of difference-differential equations defined by a set of asymmetrically-spaced node points. The procedure was extended to handle certain nonlinear features. It was concluded that analog computers were advantageous in the modeling phase, while digital computers were best suited for operational analysis of the model. (Gysi-Cornell)
W69-05864

RIVER WATER QUALITY FOR ARTIFICIAL RECHARGE,
Nebraska Univ., Lincoln. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05B.
W69-05894

A CHANGE OF GROUNDWATER REGIME AS A METHOD OF CONTROLLING THE INCURSIONS OF SEA WATER (RUSSIAN),
Akademiya Nauk SSSR, Moscow. Council on the Problems of Water Economy.
N. N. Favorin.
In 'Invest of Surface and Underground Runoff', (Issledovaniye Poverkhnostnogo i Podzemnogo Stoka), Moscow, 'Nauka', pp 101-115, 1967. 15 p, 7 fig, 7 ref.

Descriptors: *Groundwater, *Groundwater basin, *Sea water, *Groundwater movement, Water pollution sources, Water quality control, Water supply, Water wells, Water yield improvement, Water balance, Water chemistry, Infiltration, Water levels, Water works, Dams, California.
Identifiers: *Estonia, USSR, Sea water incursion controls.

The methods of controlling incursions of sea water into fresh groundwater reservoirs were investigated on the basis of earlier investigations the results of which were published in the USSR (2 publications) and abroad (5 publications). An analysis of available information shows that the following procedures may be effective in controlling sea water incursions: (1) conservation of groundwater levels by decreasing the amounts of withdrawals by wells; (2) artificial replenishment of groundwater; (3) setting and maintaining a water barrier or a knoll of fresh groundwater at a certain definite level along the sea coast; (4) the formation of a depression crater of groundwater along the sea coast to be used as a reservoir for the infiltration of sea water; and (5) the construction of an underground dam to impede the movements of sea water within the coastal strip. (Gabriel-USGS)
W69-05939

DI GIACINTO V NEW JERSEY ZINC COMPANY (DIVERSION OF SUBTERRANEAN WATERCOURSE).

26 Lehigh County Law Journal 247-252 (CP Pa 1955).

Descriptors: *Underground streams, *Percolating water, *Diversion structures, *Pennsylvania, Hydraulic structures, Bypasses, Streams, Legal aspects, Judicial decisions, Mining, Mine water, Mine drainage, Competing use, Relative rights, Damages, Stream flow.

Plaintiff brought this action in trespass, alleging that defendant mining company pumped 24 million gallons of water per day out of a subterranean stream which previously fed plaintiff's well. Plaintiff also alleged that the defendant did not use this water but diverted it to a nearby creek. Defendant stated, by way of answer, that one engaged in mining has an absolute right to deal as he pleases with any water found on his premises. The court pointed out that the test used to determine liability for interference with a neighbor's watercourse is whether a possessor of the land destroyed the water supply in the use of his land for a lawful purpose, not whether the owner is consuming the water which has been cut off, diverted, or polluted. The court noted that the rule concerning watercourse destruction provides that such destruction is actionable if done with malice or negligence or if avoidable by a reasonable expenditure of cary and money. Defendant's demurrer was sustained. (Katz-Fla)
W69-05975

GOWING V LEHMANN (WATER USE EASEMENT).
For primary bibliographic entry see Field 06E.
W69-05985

4C. Effects on Water of Man's Non-Water Activities

SURVEY OF WATER INDUCED LAND-INSTABILITY HAZARDS IN THE PORTLAND, OREGON REGION,
Portland State Coll., Oreg. Dept. of Earth Science; and Oregon State Univ., Corvallis.
For primary bibliographic entry see Field 08D.
W69-05640

COMMENTS ON WATER TRANSFERS AND RELATED URBAN PROBLEMS,
Idaho Univ., Moscow. Dept. of Hydrology.
For primary bibliographic entry see Field 06D.
W69-05766

4D. Watershed Protection

CRITERIA FOR DESIGNING AND LOCATING LOGGING ROADS TO CONTROL SEDIMENT,
Forest Service (USDA), Logan, Utah. Intermountain Forest and Range Experiment Station.
Paul E. Packer.
Forest Science, Volume 13, No 1 (March, 1967): 1-18.

Descriptors: *Water quality, *Erosion control, *Sediment control, *Roads, *Sediment transport, Water pollution, Water supply, Soil erosion, Roadbanks, Bank erosion, Bank protection, Slope protection, Rocky Mountain Region, Watersheds (Basins), Construction, Road design.
Identifiers: *Location, Logging (Forest).

A recently completed study developed criteria for the design, location, and construction of logging roads in the northern Rocky Mountains to prevent damage to the water resource and to conserve soil. Results reveal which characteristics of watersheds and of secondary logging roads influence erosion of road surfaces and movement of sediment downslope from roads. They define the manner and degree in which these characteristics affect road-surface erosion and sediment movement, and they indicate which characteristics are controllable or alterable by design, management, or choice. They also provide the quantitative criteria needed to develop road design and location requirements that should be considered in planning and executing timber harvest operations, so that soil and water resources will be protected.
W69-05884

FOREST TREATMENT EFFECTS ON WATER QUALITY,
Forest Service (USDA), Logan, Utah. Intermountain Forest and Range Experiment Station.
Paul E. Packer.
Proceedings, International Symposium on Forest Hydrology, 687-699, Pergamon Press, Oxford, England. 1967.

Descriptors: *Water quality control, *Drainage systems, *Vegetation effects, *Soil erosion, Water demand, Running waters, Environmental effects, Sediment transport, Forest management, Lumbering, Clear-cutting, Bank erosion, Streamflow, Reforestation, Vegetation regrowth.
Identifiers: *Undisturbed forest, *Disturbed forest, Water damage, Disturbance of soil, Logging (Forest).

Most water flowing in our streams comes from forested watersheds. With continually increasing demands for high-quality water, we need to know how forest management activities affect the quality of water supplies. As the gentler forest lands become used more intensively, and as timber harvest activities extend further into rugged terrain, the opportunities for damage to water quality increase as a result of destruction of vegetation and disturbance of soil. Research to determine the affects on water quality of forest treatment associated with timber harvesting has shown that: (1) undisturbed forests produce only small amounts of sediment and a streamflow usually suitable for drinking; (2) with the possible exceptions of substantial increases in streamflow temperatures and some increases in streambank erosion caused by higher streamflow peaks, timber cutting does not adversely affect water quality; (3) logging, or skidding of logs from forests, can sometimes increase sedimentation considerably, depending upon the location and drainage of skidways, the erodibility and stoniness of soils, and the rapidity of revegetation of skidways; (4) roadx that are inadequately drained or are located too close to streams are the main cause of deterioration of water quality in forests. This article contains 35 references.
W69-05885

THE INFLUENCE OF ROADS ON WATER QUALITY CHARACTERISTICS,
Forest Service (USDA), Logan, Utah. Intermountain Forest and Range Experiment Station.
Paul E. Packer, and Harold F. Haupt.
Proceedings, Society of American Foresters, Detroit, Michigan, 1965 (1966): 112-115.

Descriptors: *Water quality, *Road design, *Sediment control, *Soil erosion, *Drainage practices, Access routes, Impaired water quality, Water resources, Drainage systems, Channel flow, Safe yield, Turbidity currents, Fish reproduction, Infiltration, *Water quality control, Overland flow.
Identifiers: *Road location, Water damage, Clean streams.

Road systems needed to serve interregional traffic as well as local uses, including those for timber harvesting, increase the potential for damaging the high quality of water. Examples are cited where poorly-built roads produce large amounts of sediment. Well-built forest roads contribute some sediment after construction; but, because of good location and design characteristics with respect to drainage, erosion scars heal rapidly. The importance of keeping even small quantities of sediment out of stream channels has been stressed repeatedly by fishery biologists. Turbid streamflow may drastically reduce aquatic fauna and the hatchability of fish eggs. Watershed scientists have observed that, when well-constructed roads are located some distance from streams, muddy overland flow does not reach the stream, but infiltrates harmlessly into the undisturbed intervening protective strip. Road location, drainage design, and nature of the protective strip, therefore, are essential factors in water-quality control on managed forest lands. Guides for locating and draining roads have been developed from investigations in specific locations where soil and terrain factors were studied. Similar study techniques would be valuable for determining the influence of roads on water quality characteristics under other conditions of soil and terrain. This article has 17 references.
W69-05886

EFFECTS OF SEEDING AND GRAZING ON INFILTRATION CAPACITY AND SOIL STABILITY OF A SUBALPINE RANGE IN CENTRAL UTAH,
Forest Service (USDA), Logan, Utah. Intermountain Forest and Range Experiment Station.
Richard O. Meeuwig.
Journal of Range Management, Volume 18, No 4, (1965): 173-180.

Descriptors: *Grazing, *Soil stability, *Soil properties, *Permeability, *Vegetation effects, Seed treatment, Cultivation, Density, Physical properties, Water properties, Percolation, Plants, Planting management, *Compaction, Range management, Organic matter.
Identifiers: *Treatment effects, *Cover density, Rangelands.

Seven years after disking and seeding to grass, the main effects of seeding and moderate grazing on infiltration and soil stability were: decreased plant and litter cover, decreased soil organic matter and capillary porosity, and greater bulk density. Infiltration capacity and soil stability were not significantly affected by the seeding treatment. Cattle grazing during the previous four years decreased plant and litter cover and noncapillary porosity of the surface soil. Both infiltration capacity and soil stability were decreased by grazing. Results of this study on soils that are predominantly silty clay loams derived from limestone and shale indicate that infiltration capacity is influenced primarily by soil bulk density and noncapillary porosity and secondarily by the amount of protective cover afforded by plants, litter, and stone. Soil stability is influenced primarily by the density of protective cover and secondarily by soil bulk density. (Packer-Forest Service)
W69-05889

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

DETERMINATION AND ISOTOPE-RATIO ANALYSIS OF DIFFERENT FORMS OF NITROGEN IN SOILS: 6. MINERALIZABLE NITROGEN,
Iowa State Univ., Ames. Dept. of Agronomy.
D. R. Keeney, and J. M. Bremner.
Soil Sci Soc Amer Proc, Vol 31, No 1, pp 34-39, Jan-Feb 1967. 10 tab, 16 ref.

Descriptors: *Analytical techniques, *Water chemistry, *Nitrogen compounds, Cycling nutrients, Eutrophication, Soils, Sediments, Stable isotopes, Water pollution sources, Nutrients, Ammonium, Nitrate, Nitrite.
Identifiers: *Isotope-ratio analysis, *Exchangeable ammonium-nitrogen, *Nitrate-nitrogen, *Nitrite nitrogen, Mineralizable nitrogen, Incubation method.

An incubation method for estimating mineralizable soil nitrogen is described. The method involves determination of nitrogen as the sum of exchangeable ammonium, nitrite, and nitrate produced when 10 g of soil mixed with 30 g of sand and 6 ml of water are incubated for 14 days at 30 deg C. Incubation conditions must ensure adequate aeration without loss of water. The method is based on the fact that the amount of water required for maximal aerobic mineralization of nitrogen is the same for all soils if the sample is just mixed with three times its weight of quartz sand (30 to 60 mesh). The method was compared to five other incubation methods (three of the methods measure only nitrate-nitrogen produced), and the results were found to be highly correlated to methods in which ammonium-nitrogen and nitrate-nitrogen are measured. Correlation was high between all methods for soils in which only nitrate-nitrogen was produced. (Konrad-Wis)
W69-05699

DETERMINATION AND ISOTOPE-RATIO ANALYSIS OF DIFFERENT FORMS OF NITROGEN IN SOILS: 3. EXCHANGEABLE AMMONIUM, NITRATE, AND NITRITE BY EXTRACTION-DISTILLATION METHODS,
Iowa State Univ., Ames. Dept. of Agronomy.
J. M. Bremner, and D. R. Keeney.
Soil Sci Soc Amer Proc, Vol 30, No 5, pp 577-582, Sept-Oct 1966. 9 tab, 10 ref.

Descriptors: *Nitrites, *Nitrates, *Analytical techniques, *Water chemistry, *Nitrogen compounds, Eutrophication, Soils, Sediments, Water pollution sources, Nutrients.
Identifiers: *Ammonium, Nitrogen forms, Steam-distillation method.

Methods for determination of exchangeable ammonium, nitrate and nitrite in soils are described. The sample is extracted with 2M potassium chloride and analyzed by steam distillation methods. The extract is treated with magnesium oxide for distillation of ammonium, ball-milled Devarda alloy for reduction of nitrate and nitrite to ammonium and sulfamic acid for destruction of nitrite. The methods gave quantitative recovery of ammonium, nitrate and nitrite added to soil extracts and were applicable to turbid, colored, and unfiltered extracts. (Konrad-Wis)
W69-05700

DETERMINATION AND ISOTOPE-RATIO ANALYSIS OF DIFFERENT FORMS OF NITROGEN IN SOILS: 4. EXCHANGEABLE AMMONIUM, NITRATE, AND NITRITE BY DIRECT-DISTILLATION METHODS,
Iowa State Univ., Ames. Dept. of Agronomy.
D. R. Kenney, and J. M. Bremner.

Soil Sci Soc Amer Proc, Vol 30, No 5, pp 583-587, Sept-Oct 1966. 8 tab, 12 ref.

Descriptors: *Analytical techniques, *Water chemistry, *Nitrogen compounds, Cycling nutrients, Stable isotopes, Eutrophication, Soils, Sediments, Water pollution sources, Nutrients, Ammonium, Nitrate, Nitrite.
Identifiers: *Isotope-ratio analysis, *Steam distillation method.

Methods of determining exchangeable ammonium, nitrate, and nitrite in soils which do not require extraction of the soil sample are described. The soil sample is treated with 2M potassium chloride (5 milliliters/gram of soil) and analyzed directly by steam-distillation methods involving use of magnesium oxide for liberation of ammonium, ball-milled Devarda alloy for reduction of nitrate and nitrite to ammonium, and sulfamic acid for reduction of nitrite. The methods are rapid, specific, and precise, and they permit nitrogen isotoperatio analysis of exchangeable ammonium, nitrate, and nitrite in nitrogen (N-15) tracer studies of nitrogen transformation in soils. Results of soil analyses by these direct distillation methods are practically identical to those obtained by extraction-distillation methods. (Keeney-Wis)
W69-05701

CHARACTERIZATION OF MINERALIZABLE NITROGEN IN SOILS,
Iowa State Univ., Ames. Dept. of Agronomy.
D. R. Keeney, and J. M. Bremner.
Soil Sci Soc Amer Proc, Vol 30, No 6, pp 714-719, Nov-Dec 1966. 7 tab, 18 ref.

Descriptors: *Nitrogen compounds, *Chemical analysis, *Soils, Analytical techniques, Water chemistry, Eutrophication, Cycling nutrients, Sediments, Water pollution sources, Nutrients.
Identifiers: *Mineralizable nitrogen, Nitrogen availability, Fixed ammonium nitrogen, Hydrolyzable nitrogen, Non-hydrolyzable nitrogen.

Incubation conditions which promoted mineralization of soil nitrogen showed that prolonged incubation resulted in a decrease in total nitrogen and hydrolyzable and non-hydrolyzable forms of nitrogen. No decrease was found in fixed ammonium-nitrogen indicating that fixed ammonium-nitrogen is practically unavailable to microorganisms. Studies of 26 soils showed marked differences among soils with regard to the nature of the nitrogen that is most readily mineralized and made available for plant growth and also indicated that any chemical method of obtaining an index of soil nitrogen availability based on determination of a hydrolyzable or non-hydrolyzable form of soil nitrogen will prove unsatisfactory. (Konrad-Wis)
W69-05703

STEAM DISTILLATION METHODS FOR DETERMINATION OF AMMONIUM, NITRATE AND NITRITE,
Iowa State Univ., Ames. Dept. of Agronomy.
J. M. Bremner, and D. R. Kenney.
Anal Chim Acta, Vol 32, pp 485-495, 1965. 2 fig, 6 tab, 20 ref.

Descriptors: *Steam-distillation method, *Analytical techniques, *Nitrogen compounds, *Ammonia, *Nitrates, *Nitrites, Nitrogen forms, Ammonium compounds.

Steam distillation methods for determining ammonium-nitrogen, nitrate-nitrogen are described, along with the steam distillation apparatus used. The methods involve use of magnesium oxide for distillation of ammonium, ball-milled Davarda alloy for reduction of nitrate and nitrite to ammonium and sulfuric acid for destruction of nitrite. The methods gave quantitative recovery of ammonium, ammonia and nitrite added to soil and plant extracts, and they are rapid, accurate and precise. (Konrad-Wis)
W69-05709

A STUDY OF GROUNDWATER CONTAMINATION DUE TO SALINE WATER DISPOSAL IN THE MORROW COUNTY OIL FIELDS,
Ohio State Univ., Columbus. Dept. of Geology.
For primary bibliographic entry see Field 05B.
W69-05749

DETERMINATION AND ISOTOPE-RATIO ANALYSIS OF DIFFERENT FORMS OF NITROGEN IN SOILS: 7. UREA,
Iowa State Univ., Ames. Dept. of Agronomy.
D. R. Keeney, and J. M. Bremner.
Soil Sci Soc Amer Proc, Vol 31, No 3, pp 317-321, May-June 1967. 7 fig, 1 tab, 7 ref.

Descriptors: *Analytical techniques, *Soil chemistry, *Nitrogen compounds, Water chemistry, Eutrophication, Enzymes, Cycling nutrients, Stable isotopes, Soils sediments, Water pollution sources, Ammonium, Nitrate, Nitrite, Chemical analysis.
Identifiers: *Isotope-ratio analysis, *Steam distillation methods, *Extraction-distillation methods, *Direct-distillation methods, Urease, Urea-nitrogen, Chemical transformations.

Two methods of determining urea in soils are described. In one (extraction-distillation method), soil samples are extracted with potassium chloride (2 Molar) (10 milliliters/gram of soil) for 5 minutes, and an aliquot of the extract is treated with potassium phosphate buffer (pH 8.00) and urease for two hours at 30 deg Celsius to convert urea-nitrogen to ammonium-nitrogen. In the other (direct-distillation method), soil sample is treated directly with potassium phosphate buffer (pH 8.0) and urease for one hour at 30 deg Celsius. In both, ammonium released by urease treatment is separated by steam distillation of the treated sample for 3.3 minutes and determined by titration of distillate with standard acid. Extraction-distillation method is useful when analyses for nitrate and nitrite as well as urea are required, but it does not give completely quantitative recovery of urea added to some soils. Methods are rapid, specific and precise, and they permit isotope-ratio analysis of urea-nitrogen in tracer (N-15) studies of urea transformation in soils. (Keeney-Wisc)
W69-05872

USE OF THE COLEMAN MODEL 29A ANALYZER FOR TOTAL NITROGEN ANALYSIS OF SOILS,
Iowa State Univ., Ames.
D. R. Keeney, and J. M. Bremner.
Soil Sci, Vol 104, No 5, pp 358-363, 1967. 5 tab, 17 ref.

Descriptors: *Chemical analysis, *Nitrogen, *Soil analysis, Analytical techniques, Ammonium compounds, Eutrophication, Nitrates, Nitrites, Organic soils, Nitrogen compounds, Nutrients, Soils, Sediments, Water chemistry, Water pollution sources.
Identifiers: *Coleman nitrogen analyzer, *Dumas procedure, Kjeldahl procedure, Mineral soils.

Studies to evaluate an automated Dumas procedure (Coleman Model 29A Nitrogen Analyzer) for determination of total soil nitrogen showed that maximal total nitrogen values were obtained by a procedure involving combustion of soil mixed with wire-form copper oxide-platinum catalyst at 940 deg Celsius for 12.6 minutes in a tube filled with this catalyst. This procedure permitted analysis of up to 3 grams of mineral soil containing up to 0.4 milliliter of water and gave almost quantitative recovery of nitrate-nitrogen and nitrite-nitrogen added to soil. A comparison of the results obtained in total nitrogen analysis of soils by this Dumas procedure and by Kjeldahl and HF-Kjeldahl techniques showed that, when applied to surface samples of mineral and organic soils, these methods gave practically identical results, whereas their results with two subsoils containing large amounts of fixed ammonium were in the order: HF-Kjeldahl greater than Dumas greater than Kjeldahl. The findings reported indicate that total nitrogen in most soils can be determined satisfactorily by Dumas or Kjeldahl methods but that these methods do not give complete recovery of native fixed ammonium-nitrogen in some soils containing high levels of fixed nitrogen. (Keeney-Wisc)
W69-05874

A SIMPLE STEAM DISTILLATION METHOD OF ESTIMATING (BETA-HYDROXY-ALPHA-AMINO) ACIDS,
Iowa State Univ., Ames. Dept. of Agronomy.
D. R. Keeney, and J. M. Bremner.
Analytical Biochemistry, Vol 18, No 2, pp 274-285, Feb 1967. 1 fig, 5 tab, 15 ref.

Descriptors: *Amino acids, *Soil analysis, *Soil chemistry, Ammonium compounds, Analytical techniques, Chemical analysis, Cycling nutrients, Eutrophication, Nitrogen compounds, Nutrients, Sediments, Soils, Water chemistry, Water pollution sources.
Identifiers: *Beta-hydroxy-alpha-amino acids, *Steam distillation methods, Serine, Threonine.

A simple method of estimating beta-hydroxy-alpha-amino acids from ammonium released by their reaction with alkaline periodate is described. This involves steam distillation with phosphate-borate buffer (pH 11.2) before and after treatments with periodic acid (to oxidize beta-hydroxy-alpha-amino-nitrogen to ammonium-nitrogen) and with sodium arsenite (to reduce excess periodate). Ammonium liberated by second distillation can be determined by titration of distillate with standard acid. Method is rapid and precise and gives quantitative results with serine, threonine, and other beta-hydroxy-alpha-amino acids. When applied to protein hydrolysates, results closely agree with those obtained by periodate method of estimating similar amino acids proposed by Van Slyke, Hiller, and MacFadyen. (Keeney-Wisc)
W69-05875

POTOMAC RIVER WATER QUALITY NETWORK, 1968 WATER YEAR.
Interstate Commission on the Potomac River Basin, Washington, D. C.
For primary bibliographic entry see Field 05B.
W69-05920

QUALITY STANDARDS FOR NATURAL WATERS,
For primary bibliographic entry see Field 05G.
W69-05934

5B. Sources of Pollution

THE EFFECTS OF BENDS ON DISPERSION IN STREAMS,
California Univ., Berkeley.
For primary bibliographic entry see Field 02E.
W69-05609

BACTERIAL ORIGIN OF SULFURIC ACID IN SULFUROUS HOT SPRINGS,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 02K.
W69-05654

RECOMMENDATIONS FOR WATER POLLUTION CONTROL IN RACCOON CREEK BASIN, OHIO.
Federal Water Pollution Control Administration, Washington, D. C.
For primary bibliographic entry see Field 05G.
W69-05661

EFFECT OF CULTIVATION ON THE NITROGEN DISTRIBUTION IN SOILS,
Iowa State Univ., Ames. Dept. of Soils.
For primary bibliographic entry see Field 02K.
W69-05710

INORGANIC NITROGEN IN PRECIPITATION AND ATMOSPHERIC SEDIMENTS,
Hamilton Filtration Plant (Ontario).
DeLoss H. Matheson.
Can J Technol, Vol 19, pp 406-412, 1951. 4 tab, 7 ref.

Descriptors: *Nitrogen, *Precipitation, *Atmospheric sedimentation, Ammonia, Nitrate, Eutrophication, Cycling nutrients.

Daily determinations of the inorganic nitrogen (ammonium and nitrate) contained in precipitation and atmospheric sediments were made over a period of 18 months. The total nitrogen fall was 5.8 lb/acre/year with 61% of the total falling on 25% of the days when precipitation occurred. The remaining 40% of the total nitrogen fell on days of no precipitation and was attributed to inorganic nitrogen associated with atmospheric dust. The inorganic nitrogen precipitated during the entire period averaged 56% nitrate-nitrogen; however, individual samples varied widely from day to day. In general, the nitrogen concentration of short storms was higher than prolonged storms. This may result in a lower nitrogen fall per day than will be the case with shorter, more intense storms. (Konrad-Wis)
W69-05712

A STUDY OF GROUNDWATER CONTAMINATION DUE TO SALINE WATER DISPOSAL IN THE MORROW COUNTY OIL FIELDS,
Ohio State Univ., Columbus. Dept. of Geology.
Jay H. Lehr.
Research Project Completion Report, Water Resources Center, March, 1969. 81 p, 10 tab, 16 fig, 2 ref. OWRR Project A-004-OHIO.

Descriptors: *Saline water, Groundwater recharge, Oil wastes, Brine disposal, Chlorides, Water pollution.
Identifiers: *Oil field wastes, Evaporation pits, *Groundwater contamination.

The purpose was to study the effects of pollution of ground water in Morrow and Delaware Counties, Ohio, due to the introduction of saline oil field wastes through evaporation pits. The investigation was directed toward the determination of the source, severity, areal extent, and probable future movement of the pollution. It was found that contaminated ground water tends to move as slug rather than mixing with contacting fresh waters. The shallow levels of the reservoir carried the bulk of the contamination at first, but with time and continued salt-water introduction through the pits, inversion occurred, and the deeper levels became more contaminated. Resistivity studies have indicated soil contamination in the zone of aeration which shows that ion-exchange phenomena may greatly extend the time period required for natural clearing of saline enclaves. The addition of resistivity and conductivity techniques to supplement chloride analysis was successful in this study. The use of unlined evaporation pits in humid areas where fresh ground water may be contaminated by brines should be prohibited by state legislation.
W69-05749

WATER QUALITY IN HAWAII,
Hawaii Univ., Honolulu. School of Public Health.
For primary bibliographic entry see Field 05G.
W69-05893

RIVER WATER QUALITY FOR ARTIFICIAL RECHARGE,
Nebraska Univ., Lincoln. Dept. of Civil Engineering
Leon S. Directo, and Merlin E. Lindahl.
J Amer Water Works Ass, Vol 61, No 4, pp 175-180, Apr 1969. 6 p, 8 fig, 1 tab, 8 ref. Res supported by Nebr Univ Water Resources Center.

Descriptors: *Water quality, *Artificial recharge, *Data collections, Pit recharge, Water supply, Municipal water, Sediment load, Conductivity, Calcium, Magnesium, Alkalinity, Sulfates, Chlorides, Sodium, Iron, Dissolved soilds, Phosphates, Nitrogen, Algae, Coliforms.
Identifiers: Platte River, Lincoln (Nebr).

The Platte River was sampled in 1966-67 at 3 locations near Ashland, Nebraska to investigate seasonal variations in its physical, chemical, and biological qualities in a study of the feasibility of using the river water for recharge of the aquifer supplying the wells for the city of Lincoln. All the samples were taken using the equal transit rate method of depth integration. Streamflow data were obtained from USGS gaging station records. The mean specific conductance of 439 micromhos/cm was exceeded 60% of the time. The mean solids concentration was 1090 mg/l. This is expected to cause clogging problems in use of the water for recharge unless solids are removed. The sodium absorption ratio averaged 1.05 mg/l and iron concentration 0.41 mg/l, neither of which should cause any problem. Phosphate concentration averaged 1.07 mg/l with an algae count of 910, which could result in heavy algal growth on sand recharge beds. Coliform density was 6,610/100 ml at Ashland. All the collected data, including temperature, pH, alkalinity, and hardness are shown graphically. River water is similar in chemical quality to the groundwater in the well field, and should cause no compatibility problems. The high solids, algae, and coliform concentrations may cause clogging. (Knapp-USGS)
W69-05894

HYDROGEOLOGIC DATA FROM FOUR LANDFILLS IN NORTHEASTERN ILLINOIS,
Illinois State Geological Survey, Urbana.
For primary bibliographic entry see Field 07C.
W69-05896

MICROBIAL SULFATE REDUCTION AND ITS POTENTIAL UTILITY AS AN ACID MINE WATER POLLUTION ABATEMENT PROCEDURE,
Ohio State Univ., Columbus. Dept. of Microbial and Cellular Biology.
For primary bibliographic entry see Field 05G.
W69-05898

MICROBIAL DISSIMILATORY SULFUR CYCLE IN ACID MINE WATER,
Ohio State Univ., Columbus. Dept. of Microbial and Cellular Biology.
Jon H. Tuttle, Patrick R. Dugan, Carol B. Macmillan, and Chester I. Randles.
J Bacterial, Vol 97, No 2, pp 594-602, Feb 1969. 9 p, 6 fig, 4 tab, 20 ref. OWRR Grant No 14-01-0001-805,980.

Descriptors: *Reduction (Chemical), *Biodegradation, *Aquatic bacteria, *Acid mine water, Nutrients, Sawdust, Wood wastes, Fermentation, Aquatic microbiology.
Identifiers: Sulfate-reducing bacteria.

Heterotrophic microflora in and below a sawdust mass across a stream carrying acid mine drainage included dissimilatory sulfate-reducing bacteria which reduce sulfate to sulfide. The sawdust was the source of nutrients to allow enough sulfate-reducing bacteria growth to cause increase of pH downstream from the sawdust. Mixed cultures which included sulfate-reducing bacteria reduced sulfate at pH 3.0 in the laboratory with sawdust as the only nutrient, while pure cultures of sulfate-reducing bacteria could not reduce sulfate below pH 5.5. (Knapp-USGS)
W69-05899

TRAVEL OF SOLUTES IN THE LOWER MISSOURI RIVER,
Geological Survey, Washington, D. C.
J. E. Bowie, and L. R. Petri.
Geol Surv Hydrol Invest Atlas HA-332, 1 sheet, 1969. Text, 1 map, 9 chart, 1 tab, 5 ref.

Descriptors: *Path of pollutants, *Tracers, *Dy release, *Missouri River, Streamflow, Velocit Dispersion, Diffusion, Adsorption, Fluorometry.
Identifiers: *Travel time (Missouri River).

The results of a dye-tracer study of the flow of th lower Missouri River are presented in a 1-she hydrological atlas consisting of text, index map the river from Yankton, S. D. to St. Louis, Mo charts, and tables. Travel times are calculate tabulated, and shown by time-concentratio graphs. The graphs may be used to estimate th dispersion and travel of any conservative contam nant. (Knapp-USGS)
W69-05909

POTOMAC RIVER WATER QUALITY NET WORK, 1968 WATER YEAR.
Interstate Commission on the Potomac Rive Basin, Washington, D. C.

Interstate Comm Data Compilation Rep, 1968. 2 p, 1 fig, 3 map, 1 chart.

Descriptors: *Water quality, *Rivers, Biochemica oxygen demand, Turbidity, Coliforms, Alkalinity Hydrogen ion concentration, Water temperature Streamflow, Dissolved oxygen, Suspended load Dissolved solids, Water pollution effects, Standards, Pennsylvania, Maryland, Virginia, West Virginia, District of Columbia.
Identifiers: *Potomac River Basin.

Water quality data are compiled for the Potomac River basin for the 1968 water year. Data were obtained from 79 stream sampling stations. Standard analyses include streamflow, water temperature, turbidity, alkalinity, pH, dissolved oxygen, saturation (%), BOD, coliforms, total bacteria, suspended solids, and total solids. (Knapp-USGS)
W69-05920

QUALITY STANDARDS FOR NATURAL WATERS,
For primary bibliographic entry see Field 05G.
W69-05934

5C. Effects of Pollution

IMPOUNDMENT AND TEMPERATURE EFFECT ON WASTE ASSIMILATION,
Vanderbilt Univ., Nashville, Tenn. Dept. of Sanitary and Water Resources Engineering.
Peter A. Krenkel, Edward L. Thackston, and Frank L. Parker.
ASCE Proc, J Sanit Eng Div, Vol 95, No SA1, Pap 6406, pp 37-64, Feb 1969. 28 p, 11 fig, 3 tab, 56 ref. Grant No WPD-168-01-67.

Descriptors: *Waste assimilative capacity, *Reservoirs, *Impoundments, Thermal stratification, Biochemical oxygen demand, Dissolved oxygen, Reaeration, Path of pollutants, Water temperature, Photosynthetic oxygen, Oxygen sag. Water pollution.
Identifiers: *Impoundment effects.

The waste assimilative capacity of streams can be greatly affected by changes in temperature and hydraulic regime caused by impoundment. The increase in depth and decrease in mixing reduce atmospheric oxygenation but provide a more favorable environment for photosynthetic oxygenation. While surface layers remain well aerated, benthal demands and sedimentation of organic material may deoxygenate the lower waters. This effect is accentuated by thermal stratification. The effect of impoundment on all phases of the oxygen balance is considered. References and case studies show that the net effect can be a greatly reduced capacity for waste assimilation. (Knapp-USGS)
W69-05637

REAERATION PREDICTION IN NATURAL STREAMS,
Vanderbilt Univ., Nashville, Tenn. Dept. of Sanitary and Water Resources Engineering.

Edward L. Thackston, and Peter A. Krenkel.
ASCE Proc, J Sanit Eng Div, Vol 95, No SA1, Pap 6407, pp 65-94, Feb 1969. 30 p, 13 fig, 4 tab, 34 ref, append.

Descriptors: *Reaeration, *Streams, Diffusion, Mass transfer, Mixing, Open channel flow, Turbulence, Aeration, Oxygenation, Water circulation.
Identifiers: *Stream reaeration prediction.

The reaeration coefficient can be shown to be proportional to the vertical mass transfer coefficient at the surface and inversely proportional to the square of the average depth. The constant is evaluated from experimental data for various scales of flow and the resulting single equation is shown to have greater accuracy, cover a wider range of flow scales, and be less sensitive to variations in basic data than any of the presently used methods of prediction. (Knapp-USGS)
W69-05638

THE EFFECTS OF ALGAE ON WATER QUALITY,
Syracuse Univ., N. Y. Dept. of Civil Engineering.
Daniel F. Jackson.
Water Quality Res Symp, 1st Proc, New York State Dept Health, Feb 20, 1964. 23 p, 5 fig, 2 tab, 53 ref.

Descriptors: *Algae, *Water quality, *Eutrophication, Color, Taste, Odor, Toxins, Dissolved oxygen, Lakes, Rivers, Light penetration, Fluorescence, Photosynthesis, Blue-green algae, Phytoplankton, Ohio River, Pennsylvania, Water supply.
Identifiers: Photosynthetic rate, Phytoplankton dynamics, Extracellular products, Algal cells.

Historical occurrences of colored water caused by algal growth are cited. Investigations (1797) revealed that Volvocales caused red water, with first recorded study on phytoplanktonic development (Oscillatoria) conducted by DeCandolle (1825). In Pymatuning Reservoir, Pennsylvania, cyanophytes bloom annually, restricting light penetration to less than 46 cm during July and August, retarding growth of rooted aquatic plants, and exposing bottom soil to wave-action erosion and consequent suspension of nutrient-rich materials. Tabular data on odors and tastes are discussed. Author determined percentage of viable cells to validate common assumption that degree of odor is associated with quantity of algal cells. Average viable fraction for 1,700 measurements on Ohio River samples (1960-61) was 59%; measurements were based on chlorophyll fluorescence. Dead algal cells, which create odors and taste, should be determined in plankton algae studies. Discussion of algal contribution to dissolved oxygen indicates that each species has its own minimum/maximum photosynthetic rate influenced by environment, and total oxygen production follows a phylogenetic hierarchy. Literature review and experiments show that algae contribute significant amounts of dissolved oxygen. Author's review of algal excretion and secretion includes discussion of toxins. He discusses theoretical equation to evaluate phytoplankton dynamics reported by Riley and Von Arx (1949). (Kerrigan-Wis)
W69-05697

RUSSIAN RADIOECOLOGY, A BIBLIOGRAPHY OF SOVIET PUBLICATIONS WITH CITATIONS OF ENGLISH TRANSLATIONS AND ABSTRACTS,
Nevada Operations Office (AEC), Las Vegas.
Alfred W. Klement, Jr., Charles F. Lytle, and Vincent Schultz.
Sept 1968, 131 p, TID-3915.

Descriptors: *Radioecology, *Bibliographies, Abstracts, Cycling nutrients, Ecosytems, Radioactivity, Radioactivity effects, Radioisotopes, Translations, Water pollution effects, Water pollution sources.
Identifiers: *Soviet Russia, Radioactive uptake, Freshwater environments, Marine environments, Terrestrial environments.

Active efforts of Soviet scientists in the field of radioecology during recent years have resulted in a rapidly expanding body of literature, much of which is neither well known nor readily accessible to many American scientists. In this bibliography of 1340 entries, compilers attempted to bring together a comprehensive listing of this material, indicating those papers for which English translations are known to exist. For this bibliography they adopted a broad working definition of radioecology to include research dealing with distribution, effects, and utilization of radionuclides in freshwater, marine, and terrestrial environments; ecological techniques employing radionuclides; and laboratory studies (particularly those dealing with wild species of plants and aninals) which appear to have either direct or indirect ecological implications. References to English abstracts generally available in American technical libraries are given in most cases. Citations cover the period from 1916 to 1968, of which some 910 appeared in the period 1960-1968. Report includes appendices comprising list of abbreviations and report number prefixes, list of Soviet journals being translated cover-to-cover, and a list of Russian acronyms. (Eichhorn-Wis)
W69-05708

A FIELD AND LABORATORY STUDY OF FLUORIDE UPTAKE BY OYSTERS,
North Carolina State Univ., Raleigh. Dept. of Zoology.
David J. Moore.
North Carolina Univ WRRI Report, March 15, 1969. 13 p, 2 fig, 5 ref. OWRR Project A-030-NC.

Descriptors: *Oysters, *Fluorides.
Identifiers: Fluoride uptake rate, Fluoride concentration, Fluoride tissue, Water fluoride levels.

The uptake and concentration of fluoride in the tissues of oysters was studied under laboratory conditions. Experimental animals were maintained for up to two months in water fluoride levels of 0.5, 2, 8, 32, and 128 ppm using fluoride free artificial sea water containing specific amounts of sodium fluoride. Tissue fluoride analyses were made at intervals throughout the experiment and the fluoride uptake rates were determined. It was found that oysters did accumulate fluoride at all of the experimental fluoride concentrations except 0.5 ppm which is within the range of natural water fluoride levels. Maximum uptake occurred during the first five days of exposure and was followed by an abrupt decrease in the accumulation rate throughout the remainder of the study period. Tissue fluoride levels as high as 100 ppm (dry weight basis) were observed in oysters from 32 ppm water; 30 ppm from 8 ppm water; and 18 ppm from 2 ppm water. Oysters with these higher tissue fluoride concentrations, e.g., 100 and 30 ppm, are believed to represent a potential public health problem if they are consumed in large amounts by the general public. Difficulty was encountered in maintaining oysters for longer than 30 days at 32 ppm and for longer than five days at 128 ppm water fluoride. This indicates that prolonged exposure to water fluoride levels as low as 32 ppm will be disastrous to oyster populations in the affected area.
W69-05752

A PRELIMINARY REPORT OF THE FOSSIL DIATOM FLORA FROM LAKE HURON SEDIMENTS,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
For primary bibliographic entry see Field 02H.
W69-05762

NEARSHORE PHYTOPLANKTON POPULATIONS IN THE GRAND HAVEN, MICHIGAN VICINITY DURING THERMAL BAR CONDITIONS,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
For primary bibliographic entry see Field 02H.
W69-05763

INFLUENCE OF CHRONIC EXPOSURE TO ANIONIC DETERGENTS ON TOXICITY OF PESTICIDES TO GOLDFISH,
Ohio State Univ., Columbus.
Patrick R. Dugan.
J. Water Poll. Contr. Fed., Vol 39, No 1, pp 63-71, Jan 1967. 9 p, 9 fig, 1 tab, 11 ref.

Descriptors: *Pesticides, *Toxicity, *Detergents, Chronic toxicity effects, Water pollution, *Fish mortality, Environmental effects, Synergistic influence.
Identifiers: Pesticide toxicity, Chlorinated hydrocarbons.

Goldfish with a history of exposure to sub-lethal concentrations of alkyl benzene sulfonate (ABS) detergent are more susceptible to the toxic effects of either DDT or dieldrin than control fish which do not have a history of exposure to ABS.
W69-05768

GROWTH AND RESISTANCE TO STRESS IN BROOK TROUT FED SUBLETHAL LEVELS OF DDT,
Kenneth J. Macek.
J. Fish. Res. Bd. Canada, 1968. 25 (11): 2443-2451.

Descriptors: *Brook trout, Salmonoid, *DDT, Survival, Stress.
Identifiers: Brook trout growth, Resistance, Sublethal levels DDT.

When underyearling brook trout (Salvelinus fontinalis) were fed DDT at a rate of 2.0 mg/kg per week for 31 weeks, they exhibited greater weight gain (43.2 plus or minus 0.8 g) during the period than did untreated fish (36.6 plus or minus 1.1 g). When underyearling fish were fed DDT at different rates for 26 weeks and then starved or fed at a rate equivalent to 10% of the usual feeding rate, the cumulative mortality during this period was 96.2% among fish exposed to 3.0 mg/kg per week, 88.6% among fish exposed to 2.0 mg/kg per week, and 1.2% among untreated fish. Differences in the length of survival of DDT-exposed fish occurred due to dosage, sex, and type of starvation. The evidence suggests that the mortality of DDT-exposed fish was due to the interaction of DDT residues with a combination of environmental stresses, namely starvation, decreasing water temperature and possibly the physiological stress associated with the spawning season.
W69-05770

REPRODUCTION IN BROOK TROUT (SALVELINUS FONTINALIS) FED SUBLETHAL CONCENTRATIONS OF DDT,
Kenneth J. Macek.
J. Fish. Res. Bd. Canada, 1968. 25 (9): 1787-1796.

Descriptors: *Brook trout, Salmonoid, *DDT, Sac fry, Gametes.
Identifiers: Brook trout reproduction, Sublethal levels DDT.

When sexually maturing yearling brook trout were fed for 156 days with DDT at rates that evidently caused no mortality, fish fed at the lower dosages produced more mature ova than untreated fish. Those fed at the highest dosage produced fewer mature ova than untreated fish. The size of the male fish at the end of the feeding period tended to increase according to dosage of DDT. In eggs and sac fry obtained from various mating combinations of gametes from the experimental groups, mortality was with one exception higher when at least one of the gametes came from treated fish than when they both came from untreated fish. A major portion of the mortality of sac fry in groups where the eggs came from treated fish accurred during the 15th week of development. This period coincided with the period of maximum utilization of yolk fat reported to occur in other salmonid fry, and indicated that insecticide residues in the eggs were released at this time and resulted in the observed mortality. The residue concentrations in the fish at

the end of the feeding period were similar to those reported for wild fish.
W69-05771

DEATH OF A LAKE,
David C. Flaherty.
Quest, Vol 6, No 4, pp 6-15, Dec 1968. 10 p, 9 fig.

Descriptors: *Lakes, *Eutrophication, Fertilization, Fish, *Limnology, Fishkill, Nutrients, *Algae, *Algal control, Algal poisoning, Algicides, Aquatic algae, Aquatic environment, Aquatic plants, Aquatic populations, Conservation, Water quality, Water pollution, Water resources.
Identifiers: Algal nutrients.

The natural process of lake eutrophication is being accelerated by the activities of man. Sewage discharges, waste effluents, and agricultural fertilizers draining into a lake produce an overabundance of nutrients in the lake. The abundance of nutrients greatly stimulates the growth of algae and other water plants, but sets off a destructive chain reaction. At first, the abundant food chain will benefit the fish, but in severe cases, the algae may grow in such numbers that when they die, they deplete the oxygen supply and release toxic substances. The result may be a loss of a sparkling fresh lake, slime infestation, bad flavor and odor, discoloration of water, stagnation, and massive fishkill. Clean-water and polluted-water algae are described and methods for algae control are covered. Limnology studies at Williams Lake and Rock Lake, Wash, are discussed. Many bodies of water appear destined to die long before their natural time, producing an economic loss amounting to millions of dollars. The loss in aesthetic values of lakes cannot be measured. (USBR)
W69-05844

ARTIFICIALLY INDUCED CIRCULATION OF LAKES BY MEANS OF COMPRESSED AIR,
Wisconsin Univ., Madison. Dept. of Zoology.
William R. Schmitz, and Arthur D. Hasler.
Science, Vol 128, No 3331, pp 1088-1089, Oct 31, 1958. 1 fig, 9 ref.

Descriptors: *Lakes, *Mud, *Phosphorus radioisotopes, *Water circulation, Cycling nutrients, Phosphorus compounds, Phosphates, Eutrophication, Diffusion, Water chemistry, Sediment-water interface, Limnology, Thermal stratification, Aeration, Winterkilling, Wisconsin.
Identifiers: *Experimental limnology, Sawmill Pond (Wis), Tub Lake (Wis), Katharine Lake (Wis), Fish production, Temperate lakes, Lake management.

Turbulence induced by air bubbles causes circulation in small thermally stratified lakes. Tests were made under summer and winter (ice-cover) conditions. Homoisothermal conditions, isometric concentrations of phosphorus, and increases of dissolved oxygen were achieved, at various rates of treatment. The application of the technique for lake management and studies of lake dynamics is suggested. (Hasler-Wis)
W69-05866

AVAILABILITY OF IRON AND MANGANESE IN SOUTHERN WISCONSIN LAKES FOR THE GROWTH OF MICROCYSTIS AERUGINOSA,
Wisconsin Univ., Madison. Dept. of Botany.
Gerald C. Gerloff, and Folke Skoog.
Ecology, Vol 38, No 4, pp 551-556, Oct 1957. 7 tab, 10 ref.

Descriptors: *Eutrophication, *Iron, *Lakes, *Manganese, *Wisconsin, Algae, Calcium, Chelation, Cyanophyta, Nuisance algae, Nutrient requirements, Nutrients, Toxicity, Water chemistry, Water pollution effects.
Identifiers: *Nutrient availability, *Algal growth, *Microcystis aeruginosa, Antagonisms, Algal nutrition, Algal physiology, Lake Mendota (Wis), Lake Monona (Wis), Lake Waubesa (Wis), Spaulding Pond (Wis), Lake Delavan (Wis), Pewaukee Lake (Wis), North Lake (Wis), Lake Nagawicka (Wis).

Cellular contents were compared of iron and manganese in Microcystis aeruginosa, collected from blooms in seven southern Wisconsin lakes, with critical levels of these elements for maximum growth as determined in the laboratory. Critical levels were approximately 100 ppm iron and 4 ppm manganese. Range of algal iron content for lakes sampled was 164-543 ppm; manganese, 13-232 ppm. For 36 samples from eutrophic Lake Mendota collected at surface and at 10 and 0.5 meters above bottom at 12 dates during all seasons for one year, iron concentrations in water had range 0.000-0.083 ppm; manganese, 0.035-0.673 ppm. Cellular contents of iron and manganese were sufficiently in excess of such critical values that it seems unlikely that either is important in development of Microcystis blooms in lakes. Antagonistic relationships between manganese and iron and between calcium and manganese were demonstrated and contributed to difficulties in determining levels of iron and manganese required for nutrition. Such antagonisms were considered as insufficiently serious to significantly affect accuracy of their studies and conclusions derived therefrom. Manganese appears to attain concentrations in lake water sufficiently high to be toxic to algae were it not for antagonism of calcium, also present in relatively high concentrations. (Eichhorn-Wisc)
W69-05867

CELL CONTENTS OF NITROGEN AND PHOSPHORUS AS A MEASURE OF THEIR AVAILABILITY FOR GROWTH OF MICROCYSTIS AERUGINOSA,
Wisconsin Univ., Madison. Dept of Botany.
Gerald C. Gerloff, and Folke Skoog.
Ecology, Vol 35, No 3, pp 348-353, July 1954. 5 fig, 7 tab, 8 ref.

Descriptors: *Chemical analysis, *Nitrogen, *Phosphorus, Algae, Cyanophyta, Nitrates, Nitrogen compounds, Nuisance algae, Nutrient requirements, Nutrients, Phosphorus compounds, Water chemistry, Water pollution effects, Water quality, Wisconsin, Lakes, Eutrophication.
Identifiers: *Chemical composition, *Microcystis aeruginosa, *Nutrient availability, Algal growth, Algal nutrition, Algal physiology, Kjeldahl procedure, Luxury consumption, Nutrient removal, Spaulding's Pond (Wis), Lake Waubesa (Wis), Green Lake (Wis).

Quantitative relationships were studied between total nitrogen and phosphorus contents of Microcystis aeruginosa grown in nutrient solutions containing these elements in quantities varying from highly deficient to excessive. Cellular content of nitrogen or phosphorus increases with external supply over a wide range, for a major portion of which the amount of growth remained practically constant. Thus, above fairly constant critical levels of nitrogen and phosphorus required for maximum yield, large cellular excesses accumulated, representing luxury consumption. Although not influencing growth, these excesses reflect abundance of external supplies. Nitrogen and phosphorus contents of Microcystis collected from blooms in three Wisconsin lakes, when compared with cultures grown in laboratory, showed that cellular contents of these elements in collected samples were in range of luxury consumption and sufficiently above critical levels to suggest that neither phosphorus nor nitrogen limited algal growth in these lakes. Nitrogen occurred in relatively smaller excess than phosphorus. Cellular excesses were sufficient to permit considerable growth when algae were transferred to media deficient in these nutrients. Efficacy of phosphorus removal from cultural effluents may be doubtful unless levels are also much reduced, both in other inflowing water and in 'sinks' within lakes. (Eichhorn-Wisc)
W69-05868

A COMPARATIVE STUDY IN EUTROPHICATION,
Yale Univ., New Haven, Conn. Osborn Memorial Lab.
Ursula M. Cowgill.
Developments In Applied Spectroscopy, Vol 6, pp 299-321, 1968. 18 fig, 11 ref.

Descriptors: *Eutrophication, *Water chemistry, *Geochemistry, Calcium, Chemical composition, Connecticut, Cooper, Cycling nutrients, Density currents, Hydrogen sulfide, Hypolimnion, Epilimnion, Ice, Iron, Lakes, Limnology, Magnesium, Manganese, Oxygen, Phosphorus, Rain, Water pollution effects, Sediment-water interface, Stratification, Sulfur, Sulfur bacteria, Temperature, Urbanization.
Identifiers: *Linsley Pond (Conn), *Comparative studies, Cedar Lake (Conn), Clinolimnion, Deoxygenation, Hypereutrophication, Iron cycle, Manganese cycle, Sulfate reduction, Sulfur cycle, Thiopedia, X-ray emission spectroscopy.

Linsley Pond, Connecticut, has been studied for 30 years, while becoming increasingly hypereutrophic. From August 1965 through August 1966, author sampled water column of 14 meters weekly, monitored oxygen and temperature, and made a geochemical study of elements detectable by X-ray emission spectroscopy and their movement during thermal stratification. Process of heating, described during 1937-1938, has apparently changed. Late in 1966 heating period, a vertically undisturbed layer (5-7 meters) apparently transmitted heat downward solely by molecular conduction. Below this, heating was probably controlled by profilebound chemical density currents. Totals of calcium, magnesium, phosphorus and sulfur, though seasonally variable, are generally 2-8 times greater than in 1937-1938. Precipitation of ferrous sulfide tends to decrease sulfur in stagnated deeper waters. Iron concentrations of deep hypolimnion are markedly lower than 1938 values, while manganese, not precipitable as sulfide at usual pH, is strikingly higher. Phosphorus is now greatly enriched but is stoichiometrically less than Fe (II) in deep water, so that phosphorus sediments out as iron oxidizes during autumnal overturn. Cooper content is lower than recorded in 1937, increases in deeper hypolimnion being irregular and insignificant compared to iron and manganese. As in 1938, large seasonal changes in phosphorus were noted. (Eichhorn-Wisc)
W69-05869

THRESHOLD PREDICTION AND CHARACTERISTICS OF LOG-NORMAL PHENOMENA,
Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.
For primary bibliographic entry see Field 07C.
W69-05871

INTERACTION OF FOOD LEVEL AND EXPLOITATION IN EXPERIMENTAL FISH POPULATIONS,
Bureau of Commercial Fisheries, Seattle, Wash. Biological Lab.
Ralph P. Silliman.
Fish Bull, Vol 66, No 2, pp 425-439, 1968. 10 tab, 9 fig, 9 ref.

Descriptors: *Exploitation, *Fish populations, *Food abundance, Biomass, Growth.
Identifiers: *Interaction, *Yield, *Experimental populations, Lebistes reticulatus, Fishery dynamics, Population response, Management strategies.

Food supply and exploitation rate are important factors in determining biomass and yield of exploited fish populations. Nine experimental populations of guppies were exposed to combinations of food supply (0.5, 1.0, 1.5 times standard diet) and exploitation rate (0.25, 0.33, 0.50 per 3-week period) in 20-liter tanks over 72 weeks. The three-week period represents interval between broods. Food consisted of commercial dry fish food, frozen Daphnia and Artemia nauplii. Exploitation was in-

itiated at 29 to 34 weeks. Higher diet levels resulted in greater biomass over first 28 weeks, this due more to faster growth than better survival. Populations responded to exploitation by initial drop in biomass followed by stabilization at a lower level; numbers were less stable than weight. Yield-biomass and yield-exploitation rate comparisons indicate yield-exploitation rate relationship is independent of diet level. Maximum yields represented conversion efficiencies of 25% at all diet levels. Results suggest that management strategies may be applied independently of food abundance. Tabular data include weekly numbers, weights, food levels, and yields. Data in figures include growth and population size curves, yield-exploitation curves, and yield-biomass curves. (Voigtlander-Wisc)
W69-05873

ECONOMICS OF POLLUTION CONTROL,
Resources for the Future, Inc., Washington, D. C.
Allen V. Kneese.
For main entry see Field 06B, W69-05737. Water Resources and Econ. Develop. in the South, North Carolina Univ., API, Series 16, pp 97-107, Aug 1965. 11 p.

Descriptors: *Water pollution, *Water quality control, *Waste water treatment, Organic matter, Water pollution sources, Administrative agencies.
Identifiers: *Water pollution control in Germany.

A balance between the valuable use of water courses for waste disposal and the resultant external or downstream costs must be achieved. The usual economic institution of market forces in a private enterprise system does not result in a satisfactory balance between these costs and returns. Two federal devices of improving water quality are discussed. First is financial support to local communities to build water treatment facilities. The second device is federal subventions to local communities. Payments should be made for waste reduction rather than treatment. A possibility to control pollution is a charge on waste discharge reflecting the offsite costs associated with the discharge. Other possibilities of controlling are also discussed. The features of the success of the Rhur region water pollution control in Germany are given. (Grossman-Rutgers)
W69-05880

5D. Waste Treatment Processes

A FEASIBILITY STUDY OF A LIVESTOCK WASTE DISPOSAL SYSTEM INVOLVING THE REUSE OF WATER,
North Dakota State Univ., Fargo.
George L. Pratt.
Research Project Technical Completion Report to Office of Water Resources Research, December 1968, Washington, D. C. 24 p, 11 tab, 2 ref. OWRR Project A-001-NDAK.

Descriptors: *Water reuse, Stock water, Domestic animals, *Farm wastes, Potable water, Solid wastes, Urine, Water pollution, Aeration, Aerobic treatment, Biological treatment, Coagulation, Filtering systems, Filtration, Flocculation, Oxidation, Waste storages, *Waste water treatment, Water purification, Water treatment.

Separating solid materials from liquid wastes that have been removed from a livestock barn can be accomplished in several ways. In trials at the North Dakota Agricultural Experiment Station settling tanks and sand filters were evaluated. In one phase of the work treatment of overflow from a settling tank that collected beef waste was emphasized. No treatment, aeration, and treatment with aluminum sulfate (alum) were tested for the settling tank overflow. The settling tank removed the bulk of the solids. Alum treatment of the overflow was effective in reducing total solids to the point where it was nearly feasible to provide final treatment. In the second phase of the work a slow sand filter was tested under controlled conditions to determine its adaptability for final treatment of reclaimed water. Tests were run at three temperatures, 45 deg F, 70 deg F, and 100 deg F. Controlled amounts of organic material were added to the influent of the filter. The filter was easily managed and adaptable to a wide range of conditions. Its performance was better at 70 deg F than at 45 deg F or 100 deg F.
W69-05753

CONCENTRATION AND ACCUMULATION OF METALLIC IONS BY THE BACTERIUM ZOOGLOEA,
Ohio State Univ., Columbus.
Barry A. Friedman, and Patrick R. Dugan.
Develop. Industrial Microbiol. Vol 9, pp 381-388, 1968. 8 p, 4 fig, 1 tab, 10 ref.

Descriptors: *Zoogloea bacteria, *Flocs, Metal accumulation, Ion concentration, Pollution treatment, *Water treatment, Chemical removal.
Identifiers: Bacteria Zoogloea, Pollution abatement, Cation absorption, Water purification.

Zoogloea ramigera flocs concentrate high concentrations of Zn++, Co++, Cu++, Ni++ and Fe+++ from aqueous solution. The metal ions are adsorbed and bound to the gelatinous matrix material that surrounds the bacterial cells. These aquatic bacteria are indigenous to aerobic treatment systems and appear to remove metals from natural and contaminated water and have potential in tertiary water treatment.
W69-05767

NUTRIENT REMOVAL FROM SECONDARY EFFLUENT BY ALUM FLOCCULATION AND LIME PRECIPITATION,
Wisconsin Univ., Madison. Dept. of Civil Engineering.
S. K. Malhotra, G. Fred Lee, and G. A. Rohlich.
Int J Air Wat Poll, Vol 8, pp 487-500, 1964. 11 fig, 1 tab, 12 ref.

Descriptors: *Eutrophication, *Phosphorus compounds, *Nitrogen compounds, Alkylbenzene sulfonate, Ammonia, Chemical oxygen demand, Estimated costs, Flocculation, Nitrates, Nitrites, Sewage treatment, Tertiary treatment, Water chemistry, Water pollution control.
Identifiers: *Lime precipitation, *Alum flocculation, *Nutrient removal, *Secondary effluents, Alkalization, Alum, Jar tests, Precipitation treatment.

Conditions were studied for removal of phosphorus and nitrogen compounds from biochemically treated wastewater effluents by alum flocculation and lime precipitation. They flocculated or precipitated samples of secondary effluent according to conventional Jar Test procedures. Phosphorus removal was highly pH dependent with an optimum pH of 5.57 plus-or-minus 0.25. At this pH, an alum dose of 250 milligrams/liter removed 95% of total phosphorus, 55% of the chemical oxygen demand, 60% of the organic nitrogen, 25% of the nitrate-nitrogen and nitrite-nitrogen, 17% of the apparent alkylbenzene sulfonate, and none of the ammonia-nitrogen. A dose of 600 milligrams/liter of calcium hydroxide raised pH sample to 11 and removed 99% of total phosphorus. Estimated chemical costs for removal of 95% of total phosphorus by lime and alum were 32 and 73 dollars per million gallons, respectively. (Rohlich-Wis)
W69-05865

USE POLLUTION TO BENEFIT MANKIND,
Vitro/Hanford Engineering Services, Richland, Wash.
J. Leon Potter.
Ocean Ind, Vol 4, No 5, pp 94-97, May 1969. 4 p, 1 fig, 2 tab, 4 ref.

Descriptors: *Waste treatment, *Aquiculture, Algae, Yeasts, Bacteria, Fish, Proteins, Oil wastes, Oily water, Sulfite liquors, Ultimate disposal, Water reuse, Fish farming.
Identifiers: *Oil spills, Protein aquiculture.

Organic waste, heated water, sewage nutrients, oil wastes, and garbage may be used as nutrients for growing algae, bacteria, and yeasts to produce proteins. Waste low-grade petroleum is used in a plant at Lauera, France. A pound of bacteria, feeding on crude so worthless it is usually burned, can produce 10 lbs of protein a day. Waste effluents rich in carbohydrates, sugars and inorganic nutrients may be collected and separated into solids and liquids. The solids are good fertilizers and animal feed additives, while the soluble nutrients may be used by Torula yeast for protein production. Heated water discharges may be used to increase the production of fish. The cost of protein produced from wastes is about 3 cents per lb, compared with farm-grown protein prices of about 10 cents. Analyses of Torula yeast and algae are tabulated. (Knapp-USGS)
W69-05891

QUALITY STANDARDS FOR NATURAL WATERS,
For primary bibliographic entry see Field 05G.
W69-05934

5E. Ultimate Disposal of Wastes

USE POLLUTION TO BENEFIT MANKIND,
Vitro/Hanford Engineering Services, Richland, Wash.
For primary bibliographic entry see Field 05D.
W69-05891

HYDROGEOLOGIC DATA FROM FOUR LANDFILLS IN NORTHEASTERN ILLINOIS,
Illinois State Geological Survey, Urbana.
For primary bibliographic entry see Field 07C.
W69-05896

5F. Water Treatment and Quality Alteration

FACTORS INFLUENCING THE EFFECTIVENESS OF SWIMMING POOL BACTERICIDES,
Wisconsin Univ., Madison. Water Chemistry Lab.
G. P. Fitzgerald, and M. E. DerVartanian.
Appl Microbiol, Vol 15, No 3, pp 504-509, May 1967. 5 fig, disc, 13 ref.

Descriptors: *Water purification, *Water quality control, *Swimming pools, *Bactericides, Water chemistry, Water treatment, Streptococcus, Chlorine, Ammonia.
Identifiers: *Streptococcus faecalis, *Chlorine stabilization, *Cyanuric acid.

Techniques for culturing, harvesting, and testing bacteria to evaluate bactericidal chemicals for swimming pools are described. Concentrations of 25, 50, and 100 mg of the chlorine stabilizer cyanuric acid per liter increased the time required for a 99% kill of Streptococcus faecalis by 0.5 mg of chlorine per liter at pH 7.4 and 20 deg C from less than 0.25 min without cyanuric acid to 4, 6, and 12 min, respectively. The effect of concentrations of ammonia nitrogen in the range found in swimming pools on the rate of kill of 0.5 mg of chlorine per liter and of chlorine plus cyanuric acid was tested. At concentrations of ammonia nitrogen greater than 0.05 mg per liter, faster rates of kill of S faecalis were obtained with 100 mg of cyanuric acid per liter plus 0.5 mg of chlorine per liter than with 0.5 mg of chlorine per liter alone. When water samples from four swimming pools with low ammonia levels were used as test media, 0.5 mg of added chlorine per liter killed 99.9% of the added S faecalis in less than 2 min, but water from a pool with a large number of children required 60 to 180 min of treatment. (Fitzgerald-Wis.)
W69-05694

USE OF POTASSIUM PERMANGANATE FOR CONTROL OF PROBLEM ALGAE,
Wisconsin Univ., Madison. Hydraulic and Sanitary Lab.
George P. Fitzgerald.
J Amer Water Works Assoc, Vol 58, No 5, pp 609-614, 1966. 1 fig, 1 tab, 20 ref.

Descriptors: *Nuisance algae, *Algicides, *Copper sulfate, *Water quality control, Algal control, Slime, Taste-producing algae, Odor-producing algae, Diatoms, Cyanophyta, Chlorophyta, Iron, Manganese, Eutrophication, Water pollution control.
Identifiers: *Potassium permanganate, Algicidal tests, Algistatic tests, Slimeproducing algae, Photomicrographs, Microcystis aeruginosa, Anabaena circinalis, Gloeotrichia echinulate, Oscillatoria rubescens, Oscillatoria chalybia, Hydrodictyon reticulatum, Dictyosphaerium pulchellum, Gomphonema, Dinobryon.

Author treated following species of algae with various concentrations of potassium permanganate and copper sulfate to determine concentrations required to kill cells after 12 and 72 hours' treatment and to prevent growth: (bloomforming cyanophytes) Microcystis aeruginosa, Anabaena circinalis, Gloeotrichia echinulata, Oscillatoria rubescens; (filter-clogging cyanophyte) Oscillatoria chalybia; (filter-clogging chlorophytes) Hydrodictyon reticulatum, Dictyosphaerium pulchellum; (diatom) probably Gomphonema. Toxicity of copper sulfate was highly variable; cyanophytes except Oscillatoria were killed at concentrations of 0.1 ppm; O rubescens was killed after 4 hours at 0.4 ppm; growth of O chalybia and Hydrodictyon was inhibited by 0.1-0.2 ppm but algicide required 0.6-0.8 ppm for 72 hours; inhibition of Dictyosphaerium and the diatom required 0.4 ppm, while algicide required more than 8 ppm and 72 hours. With potassium permanganate, all species except Dictyosphaerium were killed by 1-5 ppm. Author speculates that variations in effectiveness of copper may result from variations in metabolic rates, metabolic processes, or rates of absorption among the several species. He suggests that potassium permanganate treatment of raw-water reservoirs may be multiply effective for algicide for elimination of tastes and odors resulting from decomposed algae and other sources and for removal of iron and manganese. (Eichhorn-Wis)
W69-05704

5G. Water Quality Control

IMPOUNDMENT AND TEMPERATURE EFFECT ON WASTE ASSIMILATION,
Vanderbilt Univ., Nashville, Tenn. Dept. of Sanitary and Water Resources Engineering.
For primary bibliographic entry see Field 05C.
W69-05637

REAERATION PREDICTION IN NATURAL STREAMS,
Vanderbilt Univ., Nashville, Tenn. Dept. of Sanitary and Water Resources Engineering.
For primary bibliographic entry see Field 05C.
W69-05638

RECOMMENDATIONS FOR WATER POLLUTION CONTROL IN RACCOON CREEK BASIN, OHIO.
Federal Water Pollution Control Administration, Washington, D. C.

Fed Water Pollut Contr Admin, Ohio Basin Reg Rep, Nov 1967. 81 p, 20 fig, 18 tab, 13 ref, 4 append.

Descriptors: *Water pollution sources, *Acid mine water, *Ohio, Mining, Acidic water, Mine acids, Mine drainage, Iron, Sulfates, Water pollution control, Non-structural alternatives, Pollution abatement, Reservoirs, Recreation.
Identifiers: Raccoon Creek Basin (Ohio).

Pollution of the Raccoon Creek basin, Ohio, by acid mine drainage was investigated and recommendations for pollution abatement are presented. The hilly, forested, sparsely-populated basin and surrounding area are considered by the State of Ohio as an ideal location for public recreation development. The outstanding hindrance to development is the degraded water quality and unsightly condition of many of the area streams caused by coal mine drainage. Aquatic life and fish production are acutely restricted, recreation is curtailed, economic growth is stifled, and aesthetic values are adversely affected. Seven subwatershed areas are the principal sources of acid mine drainage. A minimum reduction of 60% in net acid load through physical abatement efforts in the 7 watersheds would approximate alkaline conditions in the lower portion of Raccoon Creek. Pollution from inadequately treated sewage occurs in Indian Creek below Rio Grande, Ohio. Oil and brine wastes from several low production oil wells located in the northwestern corner of the basin enter the Raccoon drainage. Suspended sediments occur in harmful concentrations only periodically, usually during or immediately following periods of intense and prolonged rainfall. The Ohio Department of Natural Resources is studying the feasibility of a 1,000-acre, 20-mi long impoundment on lower Raccoon Creek for flood control, water supply, recreation, and pollution control. Because of the acid condition of the water to be impounded, recreational benefits would be exclusive of sport fishing activity. (Knapp-USGA)
W69-05661

LIST OF REFERENCES ON CONTROL OF AQUATIC PLANTS, INCLUDING ALGAE,
Chipman Chemical Co., Inc., Bound Brook, N. J. Research Div.
Margaret Greenwald.
(Internal Publication), Chipman Chemical Co, Inc, Bound Brook, NJ, Jan 1956. 22 p, 716 ref.

Descriptors: *Bibliographies, *Algal control, *Aquatic weed control, *Eutrophication, Aquatic plants, Herbicides, Pesticides, Harvesting, Water quality control, Water pollution control, Water pollution effects.
Identifiers: Biocides.

Although this bibliography comprises some 716 entries, in its preface the compiler states that it is neither complete nor selected. However, emphasis was placed on recent works. 263 of the dated works were published between 1950 and 1966. Earliest citation is dated 1896, and the list is almost exclusively from the literature in English. In most cases, biological and ecological studies were omitted, but some handbooks, general texts, and a few miscellaneous references are included where they have been useful in plant identification or the understanding of conditions associated with plant control or give information on problems related to plant control (e.g., toxicity of herbicides to animal organisms). (Eichhorn-Wis)
W69-05705

SUPPLEMENT TO THE LIST OF REFERENCES ON CONTROL OF AQUATIC PLANTS, INCLUDING ALGAE,
Chipman Chemical Co., Inc., Bound Brook, N. J. Research Div.
Margaret Greenwald.
(Internal Publication), Chipman Chemical Co, Inc, Bound Brook, N. J., Jan 1957. 12 p, 258 ref.

Descriptors: *Bibliographies, *Algal control, *Aquatic weed control, *Eutrophication, Aquatic plants, Herbicides, Pesticides, Harvesting, Water quality control, Water pollution control, Water pollution effects, Fungi, Aquatic Fungi.
Identifiers: Biocides.

This supplement records corrections to compiler's original bibliography, and adds 258 entries to the original 716. Original coverage of aquatic plants and algae is extended to include a few references to aquatic fungi. New citations are for literature published between 1922 and 1957, 134 havi been published during the period 1950-195 (Eichhorn-Wis)
W69-05706

THE RANGE OF CHOICE IN WATE MANAGEMENT. A STUDY OF DISSOLVE OXYGEN IN THE POTOMAC ESTUARY,
Resources For the Future, Washington, D.C.
R. K. Davis.
Baltimore, The Johns Hopkins Press, 1968. 196 22 fig, 28 tab, 100 ref, 4 append.

Descriptors: *Water management (Applied), *Ad ministrative decisions, *Water resources, Plannin Political constraints, Institutional constraint Water quality control, River basin developmen Political aspects, Mathematical models, Decisio making.
Identifiers: Potomac River.

The technical and institutional components c water resource planning were analyzed. Four majo questions were considered: (1) the number of cou ses of action technically open to solution of wate quality management problems; (2) the analytica problems involved in each alternative; (3) the in stitutional and procedural obstacles limiting alter natives offered to planners; and (4) the responsi bilities of political leaders. The Potomac Rive Basin report of the Corps of Engineers was ex amined, with special attention given to the alterna tive plans suggested for maintaining dissolved ox ygen in the estuary. It was concluded that severa alternatives for setting and achieving standard were not considered in detail. A model whic showed how the Potomac might have been studie was provided. Some of the implications of the stud for water resources planning in general were as sessed. (Gysi-Cornell)
W69-05715

WATER QUALITY MODELS OF THE ESTUA RY,
Federal Water Pollution Control Administration, Washington, D. C.
Leo J. Hetling.
Appendix A, The Range of Choice in Water Management: A Study of Dissolved Oxygen in the Potomac Estuary, The Johns Hopkins Press, pp 141-149, 1968. 9 p, 3 fig, 1 tab.

Descriptors: *Water quality, *Mathematical models, Dissolved oxygen, Water management (Applied), Oxygen sag, Optimization, Sewage treatment, Planning, *Estuaries, River systems.
Identifiers: Potomac Estuary.

Three water quality models of the Potomac Estuary which evolved in recent planning models were reviewed. The models described the causal connections between dissolved oxygen concentrations in the estuary and the natural and man-made forces which affected them. The models were then used to forecast the consequences of management activities at sewage treatment plants in the estuary. The results usually indicated optimum treatment levels to be used. Two of the models reviewed used empirical relationships based on observations in the estuary. The third used the theoretical relationship of the 'oxygen-sag' equation. A comparison of results from the three studies was graphed and briefly discussed. (Gysi-Cornell)
W69-05716

RESERVOIR SYSTEM SIMULATION,
Resources for the Future, Inc., Washington, D. C.
Robert M. Steinberg.
Appendix C, The Range of Choice in Water Management: A Study of Dissolved Oxygen in the Potomac Estuary, The Johns Hopkins Press, pp 161-177, 1968. 17 p, 7 fig.

Descriptors: *Simulation analysis, *River systems, Reservoir design, *Reservoir operation, *Planning, Water management (Applied), River regulation,

Computer models, Consumptive use, Hydrologic data, Estuaries, Water quality control, Standards, Dissolved oxygen, Probability.
Identifiers: Potomac Estuary.

A river basin simulation for the Potomac Estuary was described. The basic components of the simulation were: (1) Reservoirs: (a) size, (b) release rules, (c) consumptive losses; (2) Control Points; (a) target flows, (b) consumptive losses; (3) Hydrologic inputs; and (4) a DO model of the estuary. The objectives of the analysis were: (1) to study the performance of any reservoir system with respect to any DO quality standard in the estuary; (2) to check a trial-and-error method of scaling the system to meet certain target outputs; and (3) to describe the performance of the reservoir system in terms of probability of failure at a given level of performance. The methodology of the simulation was described and shown schematically. Typical output results were tabled and discussed. (Gysi-Cornell)
W69-05717

WATER QUALITY MANAGEMENT AND SOME POLICY MODELS,
Georgia Inst. of Tech., Atlanta; Clemson Univ., S. C.
William W. Hines, and Benjamin C. Dysart.
Pap, 1968 Region IV Conf, Amer Inst Ind Eng, Nov 8, 1968. 30 p, 3 fig, 25 ref.

Descriptors: *Dynamic programming, *Water quality control, *Water management (Applied), *River systems, Thermal pollution, Dissolved oxygen, Biochemical oxygen demand, Standards, Political constraints, Stream improvement, Wastewater treatment, Water cooling.

A dynamic programming water quality management model was presented. The objective was to determine the level of waste treatment and cooling required at sources of pollution along a river in order to minimize total regional treatment cost, subject to dissolved oxygen and temperature standards. Cost functions for treatment were assumed known. Transfer functions for temperature, BOD, and dissolved oxygen were based on exponential decay equations and the Streeter-Phelps equation respectively. The deoxygenation and reaeration coefficients of the Streeter-Phelps equation were assumed to be functions of stream temperature. It was concluded that the model could provide for more economic efficiency in regional water quality management if organizational cost sharing plans became politically acceptable. (Gysi-Cornell)
W69-05722

COLLECTIVE FACILITIES IN WATER QUALITY MANAGEMENT,
Ohio State Univ., Columbus; and Resources for the Future, Inc., Washington, D. C.
J. Hayden Boyd.
For main entry see Vol 2, No 11, W69-04578. Managing Water Quality: Economics, Technology, Institutions, pp 199-212, by Kneese and Bower, The Johns Hopkins Press, 1968. 14 p.

Descriptors: *Economics, *River basins, *Water quality, *Water management (Applied), Water policy, Waste assimilative capacity, Waste water treatment, River basin commissions, Water resources development, Optimization, Water allocation (Policy).

An economic maximization model was presented which treated the river basin as a multiple-product natural asset. The products were of two types, waste removal services or water quality services. It was assumed that the river basin asset was controlled by an authority wishing to invest a Pareto-optimal level of resources in river-basin capacity, and, given that capacity at any moment in time, to allocate the services in a Pareto-optimal fashion, amongst the firms in the basin. The model was solved by the method of La Grangian multipliers to find the optimal levels of inputs, discharges, investment in waste assimilative capacity and effluent charges, for the basin. (Gysi-Cornell)
W69-05726

DISSOLVED OXYGEN IN THE DELAWARE ESTUARY,
Resources for the Future, Inc., Washington, D. C.
Allen V. Kneese, and Blair T. Bower.
For main entry see Vol 2, No 11, W69-04578. Managing Water Quality: Economics, Technology, Institutions, pp 158-164, The Johns Hopkins Press, 1968. 7 p, 1 fig, 1 tab.

Descriptors: *Computer models, *Linear programming, *Water quality control, *Waste water treatment, Economic efficiency, Dissolved oxygen, Standards, Estuaries, *Water policy, Stream improvement, River systems, Administrative decisions, Political constraints, Delaware River.
Identifiers: *Effluent charges.

A study of effluent charges as a means of achieving a water quality standard in the Delaware Estuary was described. The basic tool of the study was a computer model used for forecasting dissolved oxygen conditions in the estuary. A linear programming cost opitmization model was superimposed on the physical model to check the effects of various treatment policies for the estuary. The following policies were compared: (1) Least Cost (LC); (2) Uniform Treatment (UT) throughout the estuary; (3) Single Effluent Charge (SECH) throughout the estuary; and (4) Zoned Effluent Charge (ZECH), or single charges within zones. Summarized results of the study were tabled. It was concluded that the effluent charge method was administratively feasible, and that it approached the (LC) method in economic efficiency. (Gysi-Cornell)
W69-05727

THE DELAWARE ESTUARY STUDY,
Resources for the Future, Inc., Washington, D. C.
Allen V. Kneese, and Blair T. Bower.
Managing Water Quality: Economics, Technology, Institutions, pp 224-235, The Johns Hopkins Press, 1968. 12 p, 1 fig, 4 tab.

Descriptors: *Linear programming, *Water quality control, *Water policy, Waste water treatment, *Administrative decisions, Dissolved oxygen, Standards, *Alternative costs, Public benefits, Computer models, Stream improvement, Estuaries, Delaware River.

A linear programming economic optimization model was combined with a physical (oxygen sag) model of the Delaware Estuary to permit comparison of alternative modes of water quality control with the least-cost solution. Five 'objective sets' were investigated, ranging from maintenance of 1964 quality conditions, up to considerable improvement in quality resulting in increased water contact recreation. The summarized results of the study, for uniform treatment, zoned treatment and least-cost treatment were tabled and discussed. Benefits which would result from the various objective levels were described and tabled. Other methods for stream improvement, such as regional collection, ocean disposal and mechanical reoxygenation were briefly discussed. (Gysi-Cornell)
W69-05728

MATHEMATICAL SIMULATION OF THE ESTUARINE BEHAVIOR AND ITS APPLICATIONS,
General Electric Co., Philadelphia, Pa; and Federal Water Pollution Control Administration, Philadelphia, Pa.
John M. Jeglic, and George D. Pence, Jr.
Pap, Annu Symp Appl Computers Problems Urban Soc, New York, N Y, Nov 1967. 63 p, 19 fig, 8 ref.

Descriptors: *Simulation analysis, *Water pollution control, Estuaries, River systems, Biochemical oxygen demand, Dissolved oxygen, Mathematical models, Digital computers, Analytical techniques, *Approximation method, Numerical analysis, Stream improvement, Delaware River.

A mathematical model was developed to simulate the response of dissolved oxygen to various inputs in a river system. The model was applied to a study of the Delaware Estuary. The objective was to forecast the results of proposed water pollution control schemes and to estimate their chances for success. A numerical approximation method was used to solve the differential equations for BOD and DO. The method used a special integration step size control procedure developed to optimize use of digital computer time. The application of the model to the Delaware study was described and results were graphed and discussed. (Gysi-Cornell)
W69-05732

CHICAGOLAND DEEP TUNNEL SYSTEM FOR POLLUTION AND FLOOD CONTROL: FIRST CONSTRUCTION ZONE, DEFINITE PROJECT REPORT.
Harza Engineering Co., Chicago, Ill.; and Bauer Engineering, Inc., Chicago, Ill.

Work performed for Metropolitan Sanitary District of Greater Chicago. Harza Engineering Co and Bauer Engineering, Inc, Chicago, Ill, May 1968, 199 pp, 10 map, 15 dwg, 26 tab, 14 chart.

Descriptors: *Multiple-purpose projects, *Pollution abatement, *Flood control, Project purposes, Overflow, Pumped storage, Generators, Operations, Sewerage, Water quality, Reservoir operation, Water treatment, Costs, Financing.
Identifiers: *Deep tunnel system, *Calumet Area (Illinois), *Chicago (Illinois).

The deep tunnel system is a multipurpose project to capture polluted storm overflows, treat them, and gradually return them to the waterways. The system, when not in use, pumps water to generate power. Chapter One briefly describes the program for the entire Chicago area. Selection of the Calumet area as the first construction zone is justified. The investigations program for the zone is described. Chapter Two gives the general concept of the plan, summarily describes project features, and discusses operation of the entire system. Chapter Three discusses existing waterflows. It examines the service area, waterways, the existing combined sewer system, flooding problems, hydrological aspects of combined sewer overflows, and quality of overflows. Chapter Four through Eight discusses project features at length; chapter Four covering the interception and conveyance structures, five, the mined storage reservoir; six, the pumping-generating station; seven, the surface reservoir and regulating facilities; and, eight, water treatment facilities and processes. Chapter Nine discusses overall system operation. Chapter Ten defines alternatives and provisions for expansion. Chapter Eleven outlines project implementation and cost estimates. The last two chapters summarize and justify the project, and discuss its financing. (Gossen-Chicago)
W69-05743

WATER QUALITY CONTROL: COMPREHENSIVE PLANNING,
James L. Agee.
Oregon State University, Seminar Proceedings: Water Quality Control, January 1965, pp 101-111. 11 p.

Descriptors: *Water pollution control, Programs, Water supply, Water utilization, Waste water (Pollution), Basins, Inter-agency cooperation, Benefits, Projects.
Identifiers: *Comprehensive planning, *Water Pollution Control Act.

Agee defines 'comprehensive' planning as all-inclusive planning. As such, it considers physical entities, such as land and water resources in an entire region or basin, and social patterns, political struc-

ture, economic background, and activities which characterize the area. Agee explains the need for comprehensive water management planning. He lists planning policies formulated by Congress in passing the Federal Water Pollution Control Act. Comprehensive water pollution control programs required by this Act involve six considerations: (1) amount of water available and its pattern of occurrence; (2) existing water uses and waste water discharges in the basin; (3) physical, chemical, and biological characteristics of basin waters; (4) existing and projected future population and industrial developments; (5) geographic and natural resource characteristics of the basin that affect or relate to water quality; and, (6) amounts, locations, and characteristics of the future waste water discharges to the stream. Agee explains how to prepare the final water quality control plan. The organization and cooperation of agencies necessary to undertake comprehensive program studies are outlined and the benefits of such studies are evaluated. Defined are criteria for selection of projects, and places where comprehensive water pollution control studies have been started. (Gossen-Chicago)
W69-05744

WATER QUALITY CONTROL: LEGAL AND ADMINISTRATIVE ASPECTS,
Curtiss M. Everts.
Oregon State University, Seminar Proceedings: Water Quality Control, January 1965, pp 112-120. 9 p.

Descriptors: *Legal aspects, *Administration, *Water pollution control, Water law, Oregon, Federal government, State governments, Research facilities, Planning, Training.

Everts divides laws governing water pollution control programs into two categories: basic statutes and laws designed for the special protection of specific waters or water users. He defines the first category and exemplifies the second with Oregon laws. Many of these laws have outlived their usefulness and inadequately protect water quality. Everts recommends periodical review of all state laws. He describes four early federal pollution laws: The Rivers and Harbors Act of 1899, the Public Health Service Act of 1912, the Oil Pollution Act of 1924, and the Federal Water Pollution Control Act of 1948. Provisions of the Federal Water Pollution Control Act of 1956 and its amendments in 1961 are listed. State and federal laws are compared and the responsibilities of each government are discussed. Once the laws are in effect, administering agencies must create programs. Seven requisites for production of effective programs are: (1) a highly qualified technical staff; (2) adequate facilities for research and planning; (3) collection and collation of data; (4) development of a comprehensive plan based on the data; (5) an aggressive public information program; (6) initiation of research; and (7) initiation of enforcement action when voluntary cooperation fails. Selection and training of staff, and development of public support are discussed. (Gossen-Chicago)
W69-05745

A STUDY OF GROUNDWATER CONTAMINATION DUE TO SALINE WATER DISPOSAL IN THE MORROW COUNTY OIL FIELDS,
Ohio State Univ., Columbus. Dept. of Geology.
For primary bibliographic entry see Field 05B.
W69-05749

A FEASIBILITY STUDY OF A LIVESTOCK WASTE DISPOSAL SYSTEM INVOLVING THE REUSE OF WATER,
North Dakota State Univ., Fargo
For primary bibliographic entry see Field 05D.
W69-05753

CREATION OF WATER AND SEWAGE DISPOSAL AGENCIES.
For primary bibliographic entry see Field 06E
W69-05788

OPERATIONAL HYDROLOGY USING RESIDUALS,
Federal Water Pollution Control Administration, Washington, D. C.
For primary bibliographic entry see Field 06A.
W69-05847

ANALOG COMPUTER -- A MODERN TOOL IN WATER POLLUTION CONTROL,
Du Pont de Nemours (E. I.) and Co., Wilmington, Del.
Lloyd L. Falk.
Proc, Amer Soc Civil Eng, Vol 88, No SA6, pp 31-59, Nov 1962. 20 p, 19 fig, 3 tab, 20 ref, 1 append.

Descriptors: *Analog computers, *Water pollution control, *Mathematical model, Streamflow, Computer programs, Oxygen sag, Biochemical oxygen demand, Thermal pollution, Dynamics, Kinetics.
Identifiers: Differential equations.

The applicability of digital and analog computers to the solution of water pollution mathematical model were compared. The suitability of the analog computer for the solution of differential equations and problems in kinetics not presently solvable by known mathematical techniques was described. Demonstration problems including first-order differential single and two-stage biochemical oxygen demand equations, the oxygen sag equation and the second order equation describing pollutant distribution in a tidal estuary were solved. A computer program was given for a variable cross section stream with multiple sources of organic pollution and heat loads, with continuously varying oxygen saturation values, deoxygenation and reaeration coefficients, and with continuously varying temperature corrections to those coefficients. (Gysi-Cornell)
W69-05854

DIGITAL COMPUTERS AND ENVIRONMENTAL CONTROL,
Cornell Univ., Ithaca, N. Y.
Gordon P. Fisher, and Walter R. Lynn.
Proc, Amer Soc Civil Eng, Vol 90, No PP1, pp 15-20, Jan 1964. 6 p.

Descriptors: *Digital computers, *Environmental engineering, Analytical techniques, Engineering education, Future planning (Projected).

Concepts of environment were presented and the limitations on the achievement of environmental control imposed by classical methods were examined. The particular aspects of environmental engineering and control were: (1) the role of the digital computer in manipulation of the environment; (2) the related techniques that have helped improve the generality and credibility of solutions to environmental problems; (3) the educational responses that engineers have made in order to use those techniques effectively; and (4) the promise held by those improved and powerful techniques. (Gysi-Cornell)
W69-05855

SIGNIFICANCE OF REDOX POTENTIAL IN NATURAL WATERS (IN FRENCH),
Paris Univ., St. Maur (France). Faculte des Sciences.
For primary bibliographic entry see Field 02K.
W69-05877

ECONOMICS OF POLLUTION CONTROL,
Resources for the Future, Inc., Washington, D. C.
For primary bibliographic entry see Field 05C.
W69-05880

WATER QUALITY IN HAWAII,
Hawaii Univ., Honolulu. School of Public Health.
Nathan C. Burbank.
J Amer Water Works Ass, Vol 61, No 4, pp 166-169, Apr 1969. 4 p, 3 photo.

Descriptors: *Water quality, *Standards, *Hawaii, Groundwater, Surface waters, Municipal water, Irrigation, Public health, Recreation, Tourism, Water quality control, Water pollution sources.
Identifiers: Sugar industry wastes.

Water quality in Hawaii is generally excellent, and extremely restrictive standards were set to maintain or improve it. Most of the State's public water sources are lenses of fresh groundwater above salt water in highly permeable volcanic rocks. Recharge areas are protected by prohibiting access and maintaining good surface conditions. The main pollution hazard of the State is its sugar industry which not only adds nutrients and insecticide residues to groundwater, but also adds turbidity and vegetable waste to surface discharges. These practices are now carefully regulated. Municipal waste discharge quality is carefully controlled to maintain the esthetic quality necessary in a State that depends on its beauty for its major source of income, tourism. (Knapp-USGS)
W69-05893

MICROBIAL SULFATE REDUCTION AND ITS POTENTIAL UTILITY AS AN ACID MINE WATER POLLUTION ABATEMENT PROCEDURE,
Ohio State Univ., Columbus. Dept. of Microbial and Cellular Biology.
Jon H. Tuttle, Patrick R. Dugan, and Chester I. Randles.
Appl Microbiol, Vol 17, No 2, pp 297-302, Feb 1969. 6 p, 3 fig, 4 tab, 8 ref. OWRR Grant No 14-01-0001-805-980.

Descriptors: *Water pollution control, *Biodegradation, *Sulfates, *Acid mine water, Reduction (Chemical), Bacteria, Hydrogen ion concentration, Oxidation-reduction potential, Nutrients, Fermentation.
Identifiers: *Sulfate reducing bacteria.

The presence of high concentrations of sulfate, iron, and hydrogen ions in drainage from coal mines and other areas containing waste pyritic materials is a serious water pollution problem. Sulfate can be removed from solution by microbial reduction to sulfide and subsequent precipitation as FeS. A mixed culture of microorganisms degraded wood dust cellulose, and the degradation products served as carbon and energy sources for sulfate-reducing bacteria. Metabolism of carbon compounds resulted in a net pH increase in the system. Oxidation-reduction potential (Eh) and temperature and carbon supplements were studied in an effort to accelerate the sulfate reduction process, with the ultimate objective of utilizing the process as a pollution abatement procedure. (Knapp-USGS)
W69-05898

MICROBIAL DISSIMILATORY SULFUR CYCLE IN ACID MINE WATER,
Ohio State Univ., Columbus. Dept. of Microbial and Cellular Biology.
For primary bibliographic entry see Field 05B.
W69-05899

QUALITY STANDARDS FOR NATURAL WATERS,
John J. Gannon.
Proc Nat Symp on Quality Stand for Natur Waters, July 1966, Mich Univ, 1967. 315 p.

Descriptors: *Water pollution control, *Water quality act, *Water quality control, *Standards, Water pollution effects, Water pollution sources, Water pollution treatment, Legislation, Governments, Waste treatment.
Identifiers: Water quality standards.

Quality standards for natural waters were discussed in a conference at University of Michigan, July 1966 to explore in a university setting, the issues involved in the establishment of standards on in-

terstate waters as required in the Water Quality Act of 1965. The symposium program was designed to be of interest to water pollution scientists, administrators, members of water pollution control boards, economists, and attorneys. The general topics discussed were developments in water quality control, meaning of water quality standards, streamflow regulation, water and wastewater treatment, quality requirements for specific uses, natural purification, water quality characterization, and management of pollution sources. A total of 35 papers were presented. (Knapp-USGS)
W69-05934

A FRAMEWORK FOR THE MULTIPLE USE OF MUNICIPAL WATER SUPPLY AREAS,
Cornell Univ., Ithaca, N. Y.
For primary bibliographic entry see Field 06D.
W69-05935

CITY OF MERIDIAN V TINGLE (RECOVERY OF DAMAGES AGAINST MUNICIPALITY FOR CREEK POLLUTION).

84 So 2d 388-391 (Miss 1956).

Descriptors: *Mississippi, *Water pollution, *Municipal wastes, Sewage effluents, Water pollution sources, Water pollution effects, Sewage, Damages, Path of pollutants, Legal aspects, Judicial decisions, Cities, Odor, Waste water (Pollution), Water quality, Public health, Property values, Remedies, Natural streams, Prescriptive rights, Riparian rights, Relative rights.
Identifiers: Nuisance (Public).

Plaintiff sued defendant municipality to recover special damages allegedly resulting from defendant's discharging sewage into creeks which ran through plaintiff's land. Plaintiff claimed damages for the loss of use and market value of his land. He also requested compensation for personal inconvenience and possible injury to the health of himself and his family brought about by foul odors and unhealthful conditions created by the maintenance of this public nuisance. The city admitted discharging the sewage, but claimed a prescriptive right to do so. The appellate court affirmed the jury verdict in favor of plaintiff. The court held that evidence supported the verdict that the method and manner used by the city constituted a public nuisance, and the city could not acquire by prescription the right to maintain such nuisance. The court ruled that it was not reversible error to allow the jury to decide whether the city had any prescriptive right, nor was it error to refuse to allow introduction into evidence of a water sample taken after the period of the suit. (Wheeler-Fla)
W69-05955

BEALS V ROBERTSON (MINE WATER RUNOFF).

159 Pa Super 325, 48 A 2d 56-57 (1946).

Descriptors: *Pennsylvania, *Riddance (Legal aspects), *Mine water, *Surface runoff, Drainage water, Repulsion (Legal aspects), Surface water, Reasonable use, Natural streams, Artificial watercourses, Watercourses (Legal), Mine drainage, Coal mines, Water pollution sources, Natural use, Water pollution, Flow augmentation, Legal aspects, Judicial decisions.
Identifiers: Upper landowners, Lower landowners.

Plaintiff seeks to enjoin defendant from the discharging of mine waters into a natural watercourse which flows from defendant's land uninterrupted across intervening land onto plaintiff's property. The court, denying the injunction, held that owners of upper land may have water flowing from their land discharged into a natural watercourse upon lower land. Upper landowners may not make new channels nor increase the flow by artificial means, but they may increase the flow by a natural and reasonable use of their land. (Helwig-Fla)
W69-05956

STATE V AMERICAN ALKYD INDUSTRIES (PENAL LIABILITY FOR WATER POLLUTION STRICTLY CONSTRUED).

32 N J Super 150, 107 A 2d 830-832 (1954).

Descriptors: *Water pollution, *Fishkill, *New Jersey, *Tidal waters, Judicial decisions, Water pollution effects, Water pollution sources, Fuels, Oily water, Pollutants, Legislation.
Identifiers: Penalties (Criminal).

Defendant was charged under a penal statute for allowing fuel oil to run into fresh or tidal waters, thereby causing destruction of wild life. The pollution occurred when the defendant's employee negligently permitted a 1,000 gallon receiving tank to overflow while he was absent from his duties in violation of the defendant's instructions. This court reversed a judgment of conviction. Where a law is both remedial and penal, those provisions which are remedial are to be liberally construed and those which are penal are to be strictly construed. The decision turned on construction of the word 'allow' as used in the statute, the court reasoning that a judgment of conviction must be supported by a finding that the defendant had actual or implied knowledge of, and acquiesced in or tolerated, the pollution. The defendant could not be said to have 'allowed' the pollution since he did not take any active part in it and did not acquiesce in, or approve the negligent and disobedient act to his employee. The act of pollution was an accident and was not a violation per se of the statute. (Blunt-Fla)
W69-05965

ELLER V BOARD OF EDUCATION OF BUNCOMBE COUNTY (WATER POLLUTION AS CONSTITUTING A 'TAKING' OF PROPERTY).

242 NC 584, 89 Se 2d 144-146 (1955).

Descriptors: *Water pollution, *North Carolina, *Eminent domain, *Damages, Pollutants, Pollution abatement, Local governments, Judicial decisions, Flooding, Water quality, Streams, Obstructions to flow, Septic tanks, Sewage disposal, Mud, Legal aspects, Sewage, Water pollution sources.

Plaintiffs sought to recover damages from the County Board of Education on account of a partial taking or appropriation of their property. The Board, which owned land adjacent to plaintiffs' land, impeded a natural watercourse, causing water and mud to back up onto plaintiffs' property, and allowed sewage from a septic tank to flow into the watercourse, thereby contaminating plaintiffs' water supply and making their dwelling house unfit for habitation. The Board moved to dismiss the complaint for failure to state a cause of action. The court held that the question whether the backing up of water constituted a taking turned upon whether the property value was substantially impaired by such backup. If plaintiffs' spring and dwelling house were rendered unfit for use because of the sewage inflow, there would be a 'taking' to the extent of any resulting impairment in value. Judgment overruling the demurrer was affirmed. (Kahle-Fla)
W69-05986

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

THE STRATEGY OF BUILDING MODELS OF COMPLEX ECOLOGICAL SYSTEMS,
Canadian Dept. of Forestry, Victoria (British Columbia).
Crawford S. Holling.
Systems Analysis in Ecology, K E F Watt (ed), Chap 8, pp 195-214, Academic Press, New York, 1966. 4 fig, 25 ref.

Descriptors: *Systems analysis, *Ecosystems, *Mathematical models, Ecology, Digital computers, Computer models, Predation, Insects.
Identifiers: Experimental component analysis, Praying mantis, Houseflies, Holling's invertebrate model, Difference equations.

Digital computers are suited to integrate pertinent relationships of components of complex ecosystems and to handle spatial effects, temporal influences, thresholds, limits, and discontinuities. Ideally, a systems model should be specific yet have adequate generality to handle diverse ecological systems. Such model can be formulated by 'experimental components analysis' developed on the conviction that the property of a complex process can be elucidated by consideration of the action and interaction of discrete components. Components existing in all examples of the process are considered basic, while those present in only some are called subsidiary. Identification of components involves general observations and experimentation. The operation and limitation of the experimental components analysis are illustrated by use of examples from predation studies. The 'invertebrate model' demonstrates the operation of the analysis. A full model can be constructed from difference equations derived from fragemental equations describing postulates about the isolated actions and interactions of the components. Generalization of some portions (ie, thresholds) of the model is necessary especially when only one species has been used in the critical experiments. Therefore, the universality of the thresholds can be maintained only by the inclusion of switching procedures in the computer program describing the attack cycle. (Watts-Wis)
W69-05713

THE ANALYSIS OF DETERMINATION IN POPULATION SYSTEMS,
Forest Service (USDA), New Haven, Conn. Northeastern Forest Experiment Station.
D. Gordon Mott.
Systems Analysis in Ecology, K E F Watt (ed), Chap 7, pp 179-194, Academic Press, New York, 1966. 4 tab, 12 ref.

Descriptors: *Regulation, *Systems analysis, *Population, *Analysis, Life history studies, Insects, Insect control, Ecology.
Identifiers: Gypsy moth, Variance analysis, Covariance analysis.

In understanding the structure and operation of a natural dynamic system, it is desirable to know what happens under natural regulation of the system other than what can happen under rigid experimental control of most of the variables. Adopting the hypothesis that variation in a (dependent) variable in the natural system must be traceable to variations among the determining (independent) variables, the natural system may be divided into sub-systems and the natural interactions between them may be resolved. An example of fluctuations in gypsy moth populations is used to illustrate the general method of analysis and to demonstrate the importance of considering both variance and covariance of indepent variables to determine the most important regulatory influences on the population. In general, the variance in the dependent variable in the natural system is equal to the sun of the variances in the independent variables plus twice the sum of the covariances between the independent variables. Covariances will be nonzero whenever variables are correlated. Such covariance may result from direct connection between variables or mutual connection of variables to an outside factor. (Watts-Wis)
W69-05714

THE RANGE OF CHOICE IN WATER MANAGEMENT. A STUDY OF DISSOLVED OXYGEN IN THE POTOMAC ESTUARY,
Resources For the Future, Washington, D.C.
For primary bibliographic entry see Field 05G.
W69-05715

WATER QUALITY MODELS OF THE ESTUARY,
Federal Water Pollution Control Administration, Washington, D. C.
For primary bibliographic entry see Field 05G.
W69-05716

RESERVOIR SYSTEM SIMULATION,
Resources for the Future, Inc., Washington, D. C.
For primary bibliographic entry see Field 05G.
W69-05717

MATHEMATICAL ANALYSIS: DESIGN OF THE SIMPLE VALLEY PROJECT,
Harvard Univ., Cambridge, Mass.
Robert Dorfman.
Economics of Watershed Planning, The Iowa State University Press, Ames, Chapter 14-B, pp 217-229, 1961. 13 p, 1 fig.

Descriptors: *Linear programming, Economic efficiency, Mathematical models, *River basin development, Multiple-purpose projects, Reservoir design, Irrigation design, Seasonal, Hydroelectric plants, Water demand, Water distribution (Applied), Benefits, Digital computers.
Identifiers: Deterministic hydrology, Trial and error, Quasi-linear programming.

A trial and error method was used to find the optimal reservoir sizes and energy and irrigation outputs for a linear programming model of a hypothetical river basin. The basin consisted of 2 reservoirs, an irrigation district and a power plant. Deterministic inflows for 2 reasons were assumed. Non-negativity, flow conservation and power constraints, (wet and dry season), were defined. The objective function was a function of 4 variables (the 2 reservoir sizes and annual irrigation and energy outputs). By trial and error, values for the reservoir sizes were assumed, the maximum net benefit from energy and irrigation releases was computed, and differentiated with respect to both reservoir sizes to check whether an increase or decrease in the respective dam sizes was required for the next trial. It was concluded that this 'quasi-linear programming' approach would require digital computors to solve complex basin problems. (See W69-05719). (Gysi-Cornell)
W69-05719

WATER QUALITY MANAGEMENT AND SOME POLICY MODELS,
Georgia Inst. of Tech., Atlanta; Clemson Univ., S. C.
For primary bibliographic entry see Field 05G.
W69-05722

OPTIMAL OPERATING RULES FOR MULTI-RESERVOIR SYSTEMS,
Massachusetts Inst. of Tech., Cambridge.
For primary bibliographic entry see Field 04A.
W69-05723

MATHEMATICAL PROGRAMMING MODELS APPLIED TO A WATER RESOURCE SYSTEM,
Massachusetts Inst. of Tech., Cambridge.
For primary bibliographic entry see Field 04A.
W69-05725

COLLECTIVE FACILITIES IN WATER QUALITY MANAGEMENT,
Ohio State Univ., Columbus; and Resources for the Future, Inc., Washington, D. C.
For primary bibliographic entry see Field 05G.
W69-05726

DISSOLVED OXYGEN IN THE DELAWARE ESTUARY,
Resources for the Future, Inc., Washington, D. C.
For primary bibliographic entry see Field 05G.
W69-05727

THE DELAWARE ESTUARY STUDY,
Resources for the Future, Inc., Washington, D. C.
For primary bibliographic entry see Field 05G.
W69-05728

DESIGN OF WATER-RESOURCE SYSTEMS,
Harvard Univ., Cambridge.
For primary bibliographic entry see Field 04A.
W69-05729

MATHEMATICAL MODELS: A STOCHASTIC SEQUENTIAL APPROACH,
Harvard Univ., Cambridge, Mass.
For primary bibliographic entry see Field 04A.
W69-05730

REGIONAL RAIN MODELS WITH SPACE- AND TIME-CORRELATED STRUCTURE,
Matson Research Corp., San Francisco, Calif.
For primary bibliographic entry see Field 02B.
W69-05731

MATHEMATICAL SIMULATION OF THE ESTUARINE BEHAVIOR AND ITS APPLICATIONS,
General Electric Co., Philadelphia, Pa; and Federal Water Pollution Control Administration, Philadelphia, Pa.
For primary bibliographic entry see Field 05G.
W69-05732

AN OPERATIONS RESEARCH APPROACH TO BASIN SEDIMENT CONTROL,
Johns Hopkins Univ., Baltimore, Md.
For primary bibliographic entry see Field 02J.
W69-05733

OPTIMUM MANAGEMENT OF A COMBINED PUMPED HYDRO AND IRRIGATION STORAGE FACILITY,
Stanford Research Inst., Menlo Park, Calif.
For primary bibliographic entry see Field 04A.
W69-05734

SYSTEMS ANALYSIS,
Harvard Univ., Cambridge, Mass. Harvard Water Program.
For primary bibliographic entry see Field 06B.
W69-05742

ECONOMIC EVALUATION OF WATER, PART V: MULTIREGIONAL INPUT-OUTPUT TECHNIQUES AND WESTERN WATER RESOURCES DEVELOPMENT,
California Univ., Berkeley.
For primary bibliographic entry see Field 06B.
W69-05754

EXPERIENCE WITH AND EVALUATION OF CRITICAL PATH METHODS,
Brown and Root, Inc, Houston, Tex.
For primary bibliographic entry see Field 08A.
W69-05817

OPERATIONAL HYDROLOGY USING RESIDUALS,
Federal Water Pollution Control Administration, Washington, D. C.
George K. Young, and William C. Pisano.
Proc, Amer Soc Civil Eng, Vol 94, No HY4, pp 909-923, July 1968. 15 p, 2 fig, 6 tab, 2 append.

Descriptors: *Simulation analysis, *Synthetic hydrology, Markov processes, Hydrologic equation, Correlation analysis, Data processing, Flow rates, Water quality.
Identifiers: Stationary residuals.

An algorithm for simulating multisite streamflow or water quality data for hydrologic management and planning studies was demonstrated. Multiple sit flow or quality data were operated on using scheme of Yevdjevich. Stationary residuals wer represented using a matrix representation a tributable to Matalas. Synthetic residuals wer generated which in turn were transformed int operational hydrology. The development presume a Markovian structure and considered serial an cross correlation between stations. It was con cluded that method for generating operationa hydrology was successful, that means, standard deviations, cross correlations and the Markovia structure in the residuals were preserved. It wa concluded that water quality as well as water quan tity could be simulated. (Gysi-Cornell)
W69-05847

HYDROLOGIC SIMULATION IN WATER-YIELD ANALYSIS,
Corps of Engineers, Sacramento, Calif.
For primary bibliographic entry see Field 02E.
W69-05849

USE OF INTERRELATED RECORDS TO SIMULATE STREAMFLOW,
Corps of Engineers, Sacramento, Calif.
For primary bibliographic entry see Field 02E.
W69-05850

DIGITAL COMPUTERS AND ENVIRONMENTAL CONTROL,
Cornell Univ., Ithaca, N. Y.
For primary bibliographic entry see Field 05G.
W69-05855

ANALOG MODELS FOR FLOOD CONTROL SYSTEMS,
California Univ., Berkeley.
For primary bibliographic entry see Field 04A.
W69-05856

WATER RESOURCE SYSTEMS ANALYSIS,
North Carolina Univ., Chapel Hill.
Maynard M. Hufschmidt.
Proc, 2nd Annu Amer Water Resources Conf, Chicago, pp 460-466, Nov 20-22, 1966. 7 p, 10 ref.

Descriptors: *Systems analysis, *Water resources, Simulation analysis, Economics, Leontief models, Rainfall simulators, Decision making, Social aspects, River systems.

The current (1966) status of systems analysis techniques in water-resource planning was reviewed. The use of computer-based simulation models in present studies, and the possibility of future integration of rainfall, surface flow, ground flow and estuarine models into a 'ground system', 'physical-technologic' model was discussed. 'Social Economic' models of the regional Leontief-type input-output form were described. Probable extensions of systems analysis techniques for improved decision-making were suggested. (Gysi-Cornell)
W69-05857

A NONLINEAR HYDROLOGIC SYSTEM RESPONSE MODEL,
Illinois Univ., Urbana.
For primary bibliographic entry see Field 02A.
W69-05858

SIMULATION OF THE EVOLUTION OF DRAINAGE-BASIN NETWORKS WITH A DIGITAL COMPUTER,
Clarkson Coll. of Technology, Potsdam, N. Y.
For primary bibliographic entry see Field 02E.
W69-05859

MATHEMATICAL MODEL FOR FLOOD RISK EVALUATION,
Cornell Univ., Ithaca, N. Y.
For primary bibliographic entry see Field 04A.

W69-05860

COMPUTER SIMULATION OF ESTUARIAL NETWORKS,
California Univ., Berkeley; Public Health Service, San Francisco, Calif.; and Water Resources Engineers, Inc., Lafayette, Calif.
For primary bibliographic entry see Field 02L.
W69-05861

LEAST SQUARES ESTIMATION OF MIXING COEFFICIENTS,
Vanderbilt Univ., Nashville, Tenn.; and Boeing Co., Huntsville, Ala.
Edward L. Thackston, James R. Hays, and Peter A. Krenkel.
Proc, Amer Soc Civil Eng, Vol 93, No SA3, pp 47-58, June 1967. 12 p, 1 tab, 15 ref.

Descriptors: *Mathematical models, *Least squares method, *Mixing, *Streamflow, Computer programs, Digital computers, Regression analysis, Sanitary engineering, Time of concentration, Parametric hydrology, Estimating.
Identifiers: Mixing coefficients, Travel times.

The principle of least squares estimation of nonlinear parameters as a general tool in mathematical modeling was shown to be applicable to many problems in sanitary engineering. A digital computer program for accomplishing the procedure was described, and results were illustrated for the example of estimating mixing coefficients and mean travel times for measured time-concentration curves. An examination of existing estimation procedures indicated their unreliability and inaccuracy. The results of comparative fit of several methods to several hundred curves were presented. A trial-and-error procedure, which could be used in the absence of a digital computer, was outlined. (Gysi-Cornell)
W69-05862

MECHANICS OF A MATHEMATICAL GROUND-WATER MODEL,
Wyoming Univ., Laramie; and Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 02F.
W69-05863

GROUNDWATER MANAGEMENT FOR THE NATION'S FUTURE--COMPUTER SIMULATION OF GROUNDWATER BASINS,
International Business Machines Corp., Los Angeles, Calif.; and California State Dept. of Water Resources, Los Angeles.
For primary bibliographic entry see Field 04B.
W69-05864

AN INVESTIGATION OF THE EMPLOYMENT OF MULTIPLE OBJECTIVES IN WATER RESOURCES PLANNING,
South Dakota State Univ., Brookings. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 06B.
W69-05882

RELIABILITY ESTIMATES FOR A STORAGE RESERVOIR WITH SEASONAL INPUT,
Slovak Academy of Sciences, Bratislava (Czechoslovakia). Inst. of Hydrology and Hydraulics.
Vit Klemes.
J Hydrol, Vol 7, No 2, pp 198-216, Jan 1969. 19 p, 7 fig, 1 tab, 6 ref.

Descriptors: *Water management (Applied), *Water storage, *Water supply, *Reliability, Statistical methods, Reservoir yield, Optimization, Probability, Reservoir operation, River forecasting, Usable storage, Computers, Digital computers.
Identifiers: Reservoir reliability, Water supply probability.

Reliability of storage reservoir operation may be judged from 3 different points of view. One may consider the number of failure years within a given period, or the total duration of failures, or the deficit of water not supplied to the consumer. According to the criterion adopted, 3 different characteristics of reliability can be used, in particular, the occurrence-, time-, and quantity-based 'certainty'. While certainty is represented by a single value if an unlimited period of time is considered, it has a distribution in case of a finite period. A method is presented for determining the distribution of certainty of any of the 3 above mentioned types, for a reservoir with seasonal input, constant or variable draft, and with mean annual inflows forming a random sequence. The method employs Moran's discrete approximation to a continuous distribution and Gould's approach to determination of transition probabilities.
W69-05906

MARKOV CHAIN STORAGE MODELS FOR STATISTICAL HYDROLOGY,
Cornell Univ., Ithaca, N. Y.
For primary bibliographic entry see Field 07C.
W69-05917

6B. Evaluation Process

ECONOMICS OF WATERSHED PLANNING,
G. S. Tolley, and F. E. Riggs.
Ames, Iowa State University Press, 1961. 339 p.

Descriptors: Watershed management, *Watersheds (Basins), *Economics, Evaluation, Costs, Cost sharing, Water management (Applied), River basis development, Water rights, Water law, Resource development.

While this book is concerned partly with how small watershed development can best fit into river basin and regional planning, its more general aim is to contribute to a variety of working-level planning decisions that concern technicians, administrators, and legislators in ongoing water-resources development. Examination of small watershed development gives an opportunity to build on the many improvements that have occurred in project formulation and evaluation. Procedures in natural resources planning that previously drew criticism have been improved by developing and enforcing a more adequate theoretical framework and by obtaining personnel well qualified to do planning. Watershed planning teams at once exemplify the merits of an interdisciplinary approach and call attention to problems involving communication between disciplines that still need to be worked on. In order to examine these problems, representatives of public agencies and universities assembled at Knoxville, Tennessee, in June, 1959, for the Symposium on the Economics of Watershed Planning. This book contains the proceedings of the Symposium.
W69-05718

WATER RESOURCES AND ECONOMIC DEVELOPMENT IN THE SOUTH,
Council of State Governments; and Southern Land Economics Research Committee.
Floyd L. Corty, Harold H. Ellis, Joseph J. Moylan, Clyde E. Murphee, and G. S. Tolley.
Conference held at Atlanta, Ga., March 1965. Water Resources and Economic Development in the South, Agr Policy Inst. Series No 16, North Carolina Univ, Aug 1965, 179 p.

Descriptors: *Conferences, *Water resources development, Water demand, Water supply, Legislation, Simulation analysis.

This report contains seventeen articles from the conference proceedings. The primary objectives of the conference were to delineate problems of economic development in the South as they relate to water resources, explore the potentialities for contribution of social science research to solving these problems, and consider how to organize for this contribution in an interdisciplinary setting. Those attending the conference represented university social scientists and physical scientists with experience or interest relating to water resources, legislators, state government personnel with interest in water resources, and other persons from universities and government with concern for the organization of water resources research. (Grossman-Rutgers)
W69-05737

THE FUTURE AGRICULTURAL USE OF WATER - SOUTHERN HUMID REGION,
Tennessee Valley Authority, Wilson Dam, Ala., Agricultural Development Div.
Roger C. Woodworth, and LeRoy Rogers.
In Water Resources and Economic Development in the South, Agr Policy Inst. Series No 16, North Carolina State Univ, Aug 1965, pp 17-24, 7 p, 4 ref.

Descriptors: *Irrigation, *Future planning (Projected), *Land management, *Management, *Agriculture, Water quality control, Feasibility, Economics.
Identifiers: *Southern humid region.

Water supplies originate as rainfall. Water management on land has a marked influence on the minimum flow of streams, as well as on the rate of runoff affecting the degree of flooding. Major categories of agricultural water uses are crop production from natural rainfall and irrigation, and livestock production, and rural home use. From the standpoint of water utilization, a major portion of the available water from rainfall is lost either through transpiration by plants or by evaporation. Most of the water used for agricultural purposes is not reusable. Projections have been made that indicate that the consumption of water for agriculture will be perhaps double that of 1960 by the year 2000, with irrigation being the largest contributor to the increase. (Grossman-Rutgers)
W69-05738

SOME ECONOMIC ASPECTS OF INDUSTRIAL WATER SUPPLY IN THE SOUTH,
Clemson Univ., S. C.
James J. Stepp.
Water Resources and Economic Development in the South, Agri Policy Inst. Series No 16, North Carolina State Univ, pp 25-41, Aug 1965. 17 p, 4 tab, 25 ref.

Descriptors: *Public rights, *Administrative decisions, *Water supply, *Industrial water, Water quality control.

Industrial development is an important factor in maintaining the economic growth of the South. The major industrial uses of water in the United States are steam - electric power production and manufacturing. The availability of usable water is a necessary but by no means a sufficient condition for selecting a site for a manufacturing plant regardless of its size or type. Since in many industrial processes the same water may be used over and over, it is not possible to say that certain specific amounts of water are necessary for the production of certain kinds of products. Most water-quality criteria are stated as minimum or limiting concentrations of various substances in the water. Legal and administrative factors in industrial water supply affect water quality, stream-flow patterns, the physical quantities of water in particular locations at particular times, and the number and quality of available wet-process industrial plant sites. (Grossman-Rutgers)
W69-05739

POTENTIALS OF WATER-BASED RECREATION,
Resources for the Future, Inc., Washington, D. C.
Jack L. Knetsch.

Water Resources and Economic Development in the South, Agr Policy Inst. Series No 16, North Carolina State Univ, pp 43-51, Aug 1965, 9 p, 8 ref.

Descriptors: *Values, *Investment, *Recreation demand, Planning, Expenditures.
Identifiers: Recreation facilities.

Primary values are obtained by the immediate users which are largely outside of the market mechanism. Market values are associated with recreation expenditures. Most figures available on the demand for recreation facilities are for zero and near-zero prices. It is desired that the relationship between demand and non-zero prices be examined. The demand curve has shifted to the right, but changes in the supply curve are unknown. In planning, both demand and supply must be taken into consideration. The characteristics of recreation expenditures, as to the distribution of expenditures among the local recreation areas, areas enroute to the recreation area, and the home areas of the recreationists, should be known when considering recreation investments. (Grossman-Rutgers)
W69-05740

CONTRIBUTIONS OF WATER RESOURCE DEVELOPMENT TO DEPRESSED AREAS DEVELOPMENT,
Appalachia Planning Group.
John C. H. Lee, Jr.
Water Resources and Economic Development in the South, Agr Policy Inst. Series No 16, North Carolina State Univ, Aug 1965, pp 67-79. 13 p, 1 tab.

Descriptors: *Cost-benefit analysis, *Planning, *Water resources development, *Investment, Governments.
Identifiers: *Appalachian Regional Development Act of 1965, *Corps of Engineers.

The Corps of Engineers designs and constructs multiple-purpose reservoirs and local protection projects, and improves streams for navigation. These projects are being carried out under the Appalachian Regional Development Act of 1965. The effect of such water resource investment on depressed areas is examined. Reports on proposed projects consider benefit-cost ratios which show that benefits exceed costs from a national point of view. Annual reports of the Chief of Engineers give statistics on how the projects are doing. Three case studies are discussed to show the effect of the projects on depressed areas. Procedures for the development of the projects and analyzing the resultant benefits are presented. (Grossman-Rutgers)
W69-05741

SYSTEMS ANALYSIS,
Harvard Univ., Cambridge, Mass. Harvard Water Program.
Maynard M. Hufschmidt.
Water Resources and Economic Development in the South, Agr Policy Inst. Series No 16, pp 81-90, Aug 1965, 10 p, 17 ref.

Descriptors: *Systems analysis, *Model studies, *Equipment, Project planning.

Systems analysis is the methodological study of the important relationships among the individual elements of a process, structure, or problem. The orderly study of, for example, dams, power plants, canals, aqueducts, pumping and treatment plants for the purposes of flood control, power development, navigation, water supply, and water quality improvement comprises a set of important relationships in water-resource systems analysis. Two approaches to the solution of water-resource design problems are (1) mathematical models and (2) simulation studies. Two types of mathematical models are examined. First is the study of the arithmetic relationships among stochastic inputs and non-stochastic outputs. Second is the study of non-stochastic inputs (e.g. streamflow) in the deterministic model. Simulation models are also discussed. Through the use of systems analysis and the computer water resource planning would converge on the optimal plan. (Grossman-Rutgers)
W69-05742

CHICAGOLAND DEEP TUNNEL SYSTEM FOR POLLUTION AND FLOOD CONTROL: FIRST CONSTRUCTION ZONE, DEFINITE PROJECT REPORT.
Harza Engineering Co., Chicago, Ill.; and Bauer Engineering, Inc., Chicago, Ill.
For primary bibliographic entry see Field 05G.
W69-05743

THE RIVER BASIN DEVELOPMENT CONCEPT, WATER RESOURCES PLANNING IN THE PACIFIC NORTHWEST,
Bonneville Power Administration, Portland, Oreg.
Warren Marple.
Oregon State University, Seminar proceedings, July 1965, pp 43-53. 11 p.

Descriptors: *River basin development, *Regional analysis, *Pacific Northwest U. S., *Planning, Coordination, Technology, Human population, Oregon, Conservation, Interagency cooperation, History.

The report describes the river basin concept of water resource planning which has been adopted in the Pacific Northwest with its comprehensive and coordinated approach; outlines the evolution of regional planning in the Pacific Northwest over the past thirty years; summarizes the current situation and planning needs; and, suggests direction for the region's planning efforts. The geographic planning unit is the river basin, including consideration of related land resources. 'Comprehensive' planning embraces all aspects and uses of water. 'Coordinated' planning includes all governmental and non-governmental agencies concerned with water. The organizational structure of planning must accommodate agencies and their functions, and provide for dialogue with the public. Comprehensive plans for all river basins in the U. S. will be completed in the early 1970's. The report describes present planning, planning needed, changing needs due to population growth, effects of science and technology on planning, expanding geographic scope due to technology and population pressures, and Oregon's conservation programs. It recommends: a Columbia River Basin Commission be established or CBIAC be strengthened; states share planning responsibilities; state research be increased; long-range objectives be formulated; and, that coordination exist between water resource planning and other planning. (Gossen-Chicago)
W69-05746

WATER LAW, POLITICS, AND ECONOMICS: IS OUR SYSTEM OF PUBLIC DISTRICTS OUTMODED,
Oregon State Legislature, Salem.
Cornelius Bateson.
Oregon State University, Seminar Proceedings, July 1965, pp 65-71. 7 p.

Descriptors: *Oregon, *Water districts, *Multiple purpose, History, Legislation, Watershed management, Local governments, Water utilization, Taxes, Ohio, Political aspects.
Identifiers: States water rights conflicts.

Oregon has a proliferation of taxing districts in the field of water. The history of the legislation that enacted them is described. The lack of an overall water law is discussed. The effect of this lack is an inefficient utilization of water. The report recognizes two alternative actions. The first is to expand the powers of one or more varieties of existing districts. The second is to create a new variety of districts based upon the multiple-use concept. The first alternative is proven unacceptable. The second is described. Local citizens should form the district, which would be subject to the State Water Resources Board and the general state law. The district must have a watershed approach. Its powers must include all ten beneficial water uses recognized by Oregon statute. It must have the power to build, develop, and operate engineering works and to supply water both within and without the boundaries of the district. It must maintain realistic taxing, assessment, rating, and bonding. Ohio was first to enact a multiple-purpose district. Its history is briefly described. Fear of taxation, opposition from established districts, and ignorance of the problem are three reasons that have prevented enactment of this special district; but if the district is not formulated, water will continue to be wasted and Oregon may lose part of its water rights to California. (Gossen-Chicago)
W69-05747

WATER LAW, POLITICS, AND ECONOMICS: WATER RESOURCES AND PUBLIC REGULATIONS OF THEIR USES,
Reed Coll., Portland, Oreg.
Charles McKinley.
Oregon State University, Seminar proceedings, July 1965, pp 83-99. 17 p, 20 ref.

Descriptors: *Water control, *Federal jurisdiction, *State jurisdiction, *Legal aspects, Legislation, Judicial decisions, Navigation, Flood control, Hydroelectric project licensing, Federal Power Act, Underground streams, Water rights, Water pollution control, Local governments, Flood plain zoning, Political aspects.
Identifiers: U. S. Army Corps of Engineers.

The report gives the history of the federal government's dominance over state and local governments in water resources control. Discussion includes the court case of Gibbons v. Ogden, the changing notion of navigation, activities of the Army Corps of Engineers, the flood control Act of June 1936, the development of the Federal Power Commission and its responsibility for regulation of navigation, development of public interest in federal hydroelectric policy, The Federal Power Act of 1920, the expansion of geographic jurisdiction of the Federal Power Commission and the federal government, and the FPC's uses and abuses of its licensing functions. The states regulate who shall use water for other purposes than navigation. Their jurisdiction also applies to underground waters. In most western states a state officer, rather than the courts, decides who has water rights. The history of these state privileges is given. State neglect of control of groundwater apportionment is documented. The Special Committee appointed by F. D. Roosevelt published a proposed model law for western states, which is summarized. Pollution legislation and shifting responsibility for pollution control from state to federal to local levels are described. The possibilities and the economic and political difficulties of zoning flood plains are suggested. (Gossen-Chicago)
W69-05748

ECONOMIC IMPACT OF WATER RESOURCE DEVELOPMENT,
North Dakota State Univ., Fargo.
Thor A. Hertsgaard.
Completion Report, March 26, 1969. 31 p, 5 tab, 5 ref. OWRR Project B-002-NDAK.

Descriptors: Economic impact, *Economic prediction, *Input-output analysis, Income, Resources, *Irrigation, North Dakota.
Identifiers: Garrison Diversion Irrigation Project, Dickinson (North Dakota).

Expenditures data were collected from a sample of farms, nonfarm firms, households, and local units of government in a seven-county area of southwestern North Dakota. These data were incorporated in an input-output analysis to obtain measures that can be used to estimate the economic impact of water resource development in an area. Thirty sectors were delineated and esti-

nates were made of the dollar volume of expenditures by the respective sectors to other sectors within each of four trade areas in the seven-county area. Estimates were also made of the expenditures of each of the sectors that went to the central city of the seven-county area and of the expenditures made outside the area. In addition to the use of conventional input-output analysis, regression analysis was employed to explore the relationship between gross income of the economic unit (firm or household) and the level of expenditure to each of the respective sectors. Although only cross-sectional data were available, the analysis provided statistically significant evidence that allocation of marginal changes in income of economic units can be predicted with a sufficient degree of accuracy to provide useful projections of the economic impact of water resource development.
W69-05751

ECONOMIC EVALUATION OF WATER, PART V: MULTIREGIONAL INPUT-OUTPUT TECHNIQUES AND WESTERN WATER RESOURCES DEVELOPMENT,
California Univ., Berkeley.
H. Craig Davis.
Calif Univ Water Resources Center Contribution No. 13, Berkeley: Sanitary Engineering Research Lab., February 1968. 142 p, 17 tab, 3 append, 148 ref. OWRR Project B-017-CAL.

Descriptors: *Economics, Water resources, Western U.S., *Regional input-output models, *Evaluation.
Identifiers: Multiregional water interdependencies.

The objectives of the study are (1) to set forth the methodology for and problems encountered in the construction of an interregional input-output table model based upon already existing Western state input-output tables, and (2) to examine the possible applications of the model to Western water resource development. Of the eleven continental Mountain and Pacific states, tables existed for six: Arizona, California, New Mexico, Oregon, Utah, and Washington. These tables were reprogrammed to effect conformability and two additional tables were constructed to represent the remaining states. The eight regions (Nevada, Idaho, Montana, and Wyoming were treated as one region) were then linked via the Leontief-Strout gravity flow model. A set of water coefficients was prepared for each of the regions and a multiregional water content matrix constructed. Applications of the matrix resulted in the calculation and/or discussion of (a) interregional water dependencies, (b) interregional water withdrawal multipliers, (c) interregional embodied water transfers, and (d) water-constrained projections. The study includes an elementary discussion of regional and interregional input-output and contains a bibliography of 148 references.
W69-05754

APPLICATION OF ELECTRONIC COMPUTERS TO IRRIGATION AND DRAINAGE SYSTEM PROBLEMS,
Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 02A.
W69-05803

WATER DISTRIBUTION SYSTEMS ANALYSIS,
Technion - Israel Inst. of Tech., Haifa; Massachusetts Inst. of Tech., Cambridge; and Maguire (Charles A.) and Associates, Boston, Mass.
Uri Shamir, and Charles D. D. Howard.
Proc, Amer Soc Civil Eng, Vol 94, No HY1, pp 219-234, Jan 1968. 16 p, 2 fig, 16 ref, 1 append.

Descriptors: *Water distribution (Applied), *Distribution systems, *Systems analysis, Hydraulic design, Networks, Hydraulic gradient, Flow resistance, Pumps, Valves, Pipes, Steady flow, Digital computers, Decision making, Water conveyance.
Identifiers: Newton-Raphson technique.

A generalized method was presented for solving nonlinear networks and studying their sensitivity under steady-state flow conditions. The network could contain elements other than pipes, such as pumps and valves, and unknowns could be combinations of heads, consumptions or element resistances. Conditions for convergence of the Newton-Raphson iterative scheme and the possibility of insolvable problems were discussed. The method's flexibility for handling changes in input data was used in a time-sharing environment as an on-line tool to assist engineering design and decision-making. It was concluded that for effective use, large capacity, high speed computers were necessary. (Gysi-Cornell)
W69-05848

FLOOD PROOFING IN A FLOOD PLAIN: A STOCHASTIC MODEL,
Engineering Construction Corp., Ltd, Bombay (India); and Carnegie Inst. of Tech., Pittsburgh, Pa.
For primary bibliographic entry see Field 04A.
W69-05851

MATHEMATICAL REPRESENTATION OF AN URBAN FLOOD PLAIN,
Carnegie Inst. of Technology, Pittsburgh, Pa.
For primary bibliographic entry see Field 04A.
W69-05852

GOVERNMENT AND WATER RESOURCES DEVELOPMENT,
Colorado State Univ., Fort Collins. Dept. of Economics.
For primary bibliographic entry see Field 06D.
W69-05878

AN INVESTIGATION OF THE EMPLOYMENT OF MULTIPLE OBJECTIVES IN WATER RESOURCES PLANNING,
South Dakota State Univ., Brookings. Dept. of Agricultural Economics.
Robert Rehm Werner.
Doctoral thesis, Department of Agricultural Economics, South Dakota State University, 1968. 161 p, 4 tab, 107 ref.

Descriptors: *Project planning, Economic efficiency, Administration.
Identifiers: *Susquehanna River Basin, *Multiple objective planning.

Water resources planning has adhered to the criteria of economic efficiency. The inclusion of multiple objectives simultaneously in water resources planning can result in plans that optimize the satisfactions of peoples' total desires. Involved is the determination of (1) the theoretical implications of employing multiple objectives; (2) the degree to which the employment of multiple objectives is compatible with quantitative analysis; and (3) the adequacy of the existing institutional structure to administer multiple objective planning. The contemporary planning efforts in the Susquehanna River Basin Study were reviewed. (Grossman-Rutgers)
W69-05882

THE VALUE OF WATER FOR IRRIGATION IN THE KANSAS RIVER VALLEY,
Kansas State Univ., Manhattan. Dept. of Agricultural Economics.
David M. Nelson, and Wilfred H. Pine.
Contrib No 20, Kans Water Resources Res Inst Proj Completion Rep, 1968. 45 p, 6 fig, 14 tab, 14 ref. OWRR Project No A-007-KAN.

Descriptors: *Irrigation efficiency, *Kansas, Crop response, Crop production, Cost-benefit analysis, Costs, Prices, Corn (Field), Corn belt, Productivity, Profit, Economic efficiency, Specialty crops.
Identifiers: Kansas River Valley, Irrigation costs.

The value of water for irrigation in the Kansas River Valley was studied to determine efficiency of use and for water allocation evaluations. In summer 1966, 27 of the 45 sampled farms irrigated 59 fields of corn. The average investment in irrigation equipment and facilities was $16,879 or $140 per irrigated acre. Fixed annual costs averaged $1,100 per farm and variable costs averaged $1,163 or $26 per acre at $2.07 per acre-in. Yields in 1966, a dry year, averaged 46.8 bushels per acre higher than non-irrigated corn, or $7.11 per acre added income. Estimated returns indicated that irrigation would have allowed increased profits during only 5 of the 15 yrs 1951-1956. From 1951-1966 irrigation was, on the average, marginal; at 1966 prices, irrigation water had zero average value for the average farmer. Irrigation of specialty crops would probably be more profitable. (Knapp-USGS)
W69-05919

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

CONSUMER RESPONSES TO PRICES OF RESIDENTIAL WATER,
Georgia Univ., Athens. Dept. of Agricultural Economics.
Ronald M. North.
AWRA Journal Series Paper No. 185, American Water Resources Conference, San Francisco, California, Nov 10, 1967. 19 p, 5 tab, 1 fig, 5 ref.

Descriptors: *Water demand, *Elasticity of demand, *Prices, *Income, Statistical methods, Investment, Sampling.
Identifiers: *Georgia.

Household water use was correlated with economic variables that were expected to affect the quantity of water used and the expenditure for water services. Cross sectional data was obtained from a stratified, random sample of households in Georgia. The important variables that affected the use of household water were found to be prices, family income, market value of residence, size of family, and irrigable lawn area. Price and income elasticities of the demand for water were estimated. The inelastic price elasticity implies that by increasing price, household water usage can be decreased without reducing total revenues. (Grossman-Rutgers)
W69-05881

COST OF MUNICIPAL AND INDUSTRIAL WELLS IN ILLINOIS, 1964-1966,
Illinois State Water Survey, Urbana.
J. P. Gibb, and E. W. Sanderson.
Ill State Water Surv Circ 98, 1969. 22 p, 12 fig, 8 ref.

Descriptors: *Water wells, *Cost analysis, *Water management (Applied), Regression analysis, Least squares method, Aquifers, Water yield, Costs, Construction costs, Estimated costs, Installation costs, Total costs, Pumps, Wells, Well casings, Drilling.
Identifiers: Cost-depth relationships (Water wells), Well drilling costs, Well installation costs.

The cost of water wells and pumps was determined from information obtained for 143 municipal and industrial water-supply wells drilled in Illinois during 1964-66. Regression analyses using the method of least squares show that the cost of wells is directly related to depth and the cost of pumps is directly related to capacity. A series of cost-depth relationships which plot as straight lines on log-log graph paper are developed for wells tapping sand and gravel aquifers; shallow sandstone, limestone, or dolomite aquifers; and deep sandstone aquifers. Similar graphs relating pump cost to capacity are also presented for various operating heads. Sample cost estimates are given for each type of well and pump. These data are intended to establish orders of magnitude for comparison purposes and do not substitute for more detailed engineering estimates. (Knapp-USGS)
W69-05910

COST OF RESERVOIRS IN ILLINOIS,
Illinois State Water Survey, Urbana.
J. H. Dawes, and Magne Wathne.
Ill State Water Surv Circ 96, 1968. 22 p, 4 fig, 10 ref.

Descriptors: *Reservoir construction, *Cost analysis, *Water management (Applied), Regression analysis, Least squares method, Streams, Streamflow, Water yield, Costs, Construction costs, Estimated costs, Installation costs, Total costs, Dams, Land, Reservoirs, Reservoir sites.
Identifiers: Reservoir costs, Reservoir construction costs.

The determination of reservoir cost is essential to the analysis of alternative costs in the development, use, and management of water resources. An analysis of single and multipurpose reservoir costs produced a relationship allowing rapid determination of the cost of stored water. The empirical expression for project cost of single or multipurpose reservoirs includes construction cost, engineering services, contingencies, and land costs. A complete development of a cost expression and a graphical solution are presented. The estimating of project costs of reservoirs is necessary to the examination of alternatives in water resource development, but this type of estimating does not take the place of detailed engineering studies and can be used only for screening alternatives. (Knapp-USGS)
W69-05915

UNITED STATES V 11.48 ACRES OF LAND, ETC (COMPENSATION FOR CONDEMNED RIPARIAN RIGHTS).

212 F 2d 853-855 (5th Cir 1954).

Descriptors: *Florida, *Condemnation, *Riparian rights, *Compensation, Judicial decisions, Condemnation value, Navigable waters, Ownership of beds, Severance, Riparian land, Eminent domain, Easements, Legal aspects, Right-of-way, United States, Federal government, Remedies, Rivers.

The federal government condemned certain river bottom lands adjacent to the plaintiff's riparian holdings. The condemnation of the fee simple ownership of the submerged lands included all easements and interests not specifically excepted from the taking. The lands taken included the river bed to the point of the high water mark touching the plaintiff's uplands. The plaintiff sought just compensation for the condemned riparian rights. In affirming a compensation award for the plaintiff, the court noted that the value of an easement to underwater lands cannot be ascertained without reference to the dominant estate to which it is attached. The dimunition in the value of the upland estate arises by reason of the taking of the riparian rights appurtenant thereto. The plaintiff's riparian rights were not simply subjected to the government's dominant servitude over navigable waters, but those rights were permanently and irrevocably taken. The Fifth Amendment guaranteed the appellee the right to just compensation for such an absolute taking. (Blunt-Fla)
W69-05964

6D. Water Demand

ASSESSING UPLAND RESERVOIRS USING A DAILY FLOW MODEL,
Federal Water Pollution Control Administration, Washington, D. C.
For primary bibliographic entry see Field 02E.
W69-05632

THE DEMAND FOR WATER: SOME EMPIRICAL EVIDENCE ON CONSUMERS' RESPONSE TO A COMMODITY UNCERTAIN IN SUPPLY,
Pennsylvania Univ., Philadelphia.
Stephen J. Turnovsky.
Water Resources Res, Vol 5, No 2, pp 350-361, Apr 1969. 12 p, 4 tab, 15 ref, 1 append. Sponsored by RFF and FWPCA.

Descriptors: *Water demand, *Mathematical models, Statistical models, Municipal water, Industrial water, Domestic water, Economics, Water distribution (Applied), Water management (Applied), Elasticity of demand, Massachusetts, Droughts.
Identifiers: Drought response (Water demand).

Based on a theoretical model that studies how individuals respond to a commodity uncertain in supply, demand functions are estimated for water in situations where supplies are known to be stochastic. The model is applied to data consisting of a sample of Massachusetts towns, separate functions being estimated for household and industrial demand. Two cross sections are estimated, one for 1962 and one for 1965, the beginning and the end, respectively, of the New England drought. As far as household demand is concerned, price, uncertainty, and particularly housing space are significant, whereas for industrial demand only the first 2 variables are significant. The results also indicate that firms are more responsive than households to both price and uncertainty and that their response to uncertainty lessened as a result of the drought, an implication that agrees with the theoretical model. (Knapp-USGS)
W69-05633

OUTDOOR RECREATION: POLICY ISSUES AND RESEARCH PROBLEMS,
Oregon State Univ., Corvallis. Dept. of Agricultural Economics.
Herbert H. Stoevener, and William G. Brown.
J of Farm Econ, Vol 49, No 5, pp 1295-1304, Dec 1967. 10 p, 1 tab, 2 fig, 12 ref.

Descriptors: *Recreation demand, *Statistical methods.
Identifiers: *Winch method, *Oregon Salmon - Steelhead study, Analytical issues.

Reliance on empirical studies is necessary for policy guidance. The discussion examines the arguments which challenge one idea of quantifying the demand for outdoor recreation. Second, attention is directed to some areas in which additional work appears necessary. Also, analytical issues are raised which appear to be relevant from a policy viewpoint. Empirical results of some available studies are presented. (Grossman-Rutgers)
W69-05736

WATER RESOURCES AND ECONOMIC DEVELOPMENT IN THE SOUTH,
Council of State Governments; and Southern Land Economics Research Committee.
For primary bibliographic entry see Field 06B.
W69-05737

COMMENTS ON WATER TRANSFERS AND RELATED URBAN PROBLEMS,
Idaho Univ., Moscow. Dept. of Hydrology.
Roy E. Williams.
Ground Water, Vol 6, No 6, Nov, pp 6-10, Dec, 1969. 5 p.

Descriptors: *Water transfers, *Social needs, Social mobility, *Social impact, Water resources, Transportation, *Urbanization.
Identifiers: Pacific Northwest.

Heavy development in certain portions of the United States and the growing shortage of additional, readily available water supplies therein have forced planners and hydrologists to resort progressively to more elaborate water supply systems. Among the most elaborate and most expensive systems proposed to date are the various plans for transferring water toward the south from northward flowing Arctic rivers. A considerable portion of this water would be utilized for the expansion of already heavily urbanized areas. Simultaneously, many of the densely populated areas experiencing water shortages are subjected to other, perhaps more complex problems which are, in part, a product of their increasing size. Therefore, the expenditure of large sums of money to supply the[m] with water for indefinite growth merits scrutino[us] study. An alternative approach designed [to] minimize both water diversion costs and problem[s] associated with over populated areas is the stimula[tion] of development in carefully selected region[s] well endowed with water and other natura[l] resources. An investigation of the resources of th[e] Pacific Northwest reveals that it is such an area.
W69-05766

GOVERNMENT AND WATER RESOURCE DEVELOPMENT,
Colorado State Univ., Fort Collins. Dept. o[f] Economics.
Stephen C. Smith.
For main entry see Field 06B, W69-05737. Wate[r] Resources and Econ. Develop. in the South, North Carolina Univ., API, Series 16, pp 135-142, Au[g] 1965. 8 p, 11 ref.

Descriptors: *Federal Government, *Resource development, Legislation, Supply, Demand, Waste disposal.

An emerging function of the government is the planning of water resources development. Usually market forces, through private capture of water have been the dominating element in water development. This trend has been reversed, especially in regard to the private release of wastes into water courses or evaporation or infiltration ponds. Around these two activities of capture and release of water, government services have increased. The court's definition of state-federal relationships is important, especially in regard to water rights issues. The government's roles in the areas of water disposal, water supply, water resources management, and defining the demand for water service are discussed. Two frames of reference in government's role in water resources development are national planning and planning via an heuristic process. (Grossman-Rutgers)
W69-05878

CONSUMER RESPONSES TO PRICES OF RESIDENTIAL WATER,
Georgia Univ., Athens. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 06C.
W69-05881

FORECASTING WATER DEMAND, AN INTER- AND INTRA-COMMUNITY STUDY,
West Virginia Univ., Morgantown. Bureau of Business Research.
Robert J. Saunders.
W Va Univ Bus and Econ Stud, Vol 11, No 2, Feb 1969. 30 p, 2 fig, 11 tab.

Descriptors: *Water demand, *Municipal water, *Water requirements, Statistical models, Water rates, Water supply, Economics, Costs, Elasticity of demand, Water costs, Water distribution (Applied), Urbanization, Water management (Applied), Regression analysis, Least squares method.
Identifiers: Water demand forecasts, Factor analysis.

A method is presented for forecasting urban water requirements taking into account probable changes in population, economic activity, water-related technology, and demand, based on possible water price changes. Water use data were collected from 75 cities in West Virginia, Ohio, Indiana, Illinois, and Michigan. Each city supplied data on water services, sales, production and population served in 1960. Economic and demographic data for the 75 cities and from 93 of the 124 largest cities of the U.S. were obtained from the U.S. Dept of Commerce. The water sales records of Louisville, Ky., were analyzed. The statistical methods used in the study were principal component analysis and least squares regression analysis. Predictions were made of 1975 water demand on the basis of predicted population, predicted median income, and predicted changes in water prices. (Knapp-USGS)

/69-05900

IUNICIPAL AND INDUSTRIAL WATER USE,
alifornia State Dept. of Water Resources, Sacra-ento.
arry P. Brown.
alifornia Dept Water Resources Bull No 166-1, ug 1968. 106 p, 11 fig, 6 illus, 11 tab, 3 append.

escriptors: *Water utilization, *California, *Data ollections, Municipal water, Industrial water, onsumptive use, Non-consumptive use, Irrigation, awns, Recirculated water, Recreation, Water pply, Parks, Urbanization.
entifiers: Water use trends.

verage monthly per capita water use, in Califor-a based generally on 1961-65 records from water encies serving 54% of the State's population, is ghest in June and lowest in January. Departures om the normal pattern were caused by the in-ence of manufacturing establishments on water e, the length of the growing season, and the sam-e not being large enough to mask out the unusual onthly values. Per capita water use during the owing season was found to be greatest in the San aquin Valley and lowest in the North Coastal ea. Residential water use is greater in a hot, arid mate than in a moist, cool climate, but climate s little effect on industrial and commercial water e. Of the 61 cities and areas in the State for which storic annual unit water use data are reported, r capita water use has shown essentially no ange in 44 cities and areas, has declined in 13, d has increased in 14. Areas of recent general in-ease in urban per capita water use are the North astal area, the San Francisco Bay area, the cramento River basin, the Delta--Central Sierra sin, and the San Joaquin River basin. Per capita ter use is approaching equilibrium in cities in the ntral Coastal area, the South Coastal area, and Tulare Lake basin. The data are summarized by drographic areas, counties, and cities. (Knapp-GS)
69-05916

FRAMEWORK FOR THE MULTIPLE USE OF UNICIPAL WATER SUPPLY AREAS,
rnell Univ., Ithaca, N. Y.
mmanuel Theodore Van Nierop.
ater Resources Center Pub, Cornell Univ, July 66. 153 p, 3 tab, 108 ref, 2 append.

scriptors: *Multiple purpose reservoirs, *Water pply, *Reservoirs, *Municipal water, *Recrea-n, Watershed management, Water management pplied), Water pollution control, Water treat-nt, Forest management, Water quality control.
ntifiers: *Public access to reservoirs.

e advantages and disadvantages of multiple use municipal water-supply reservoirs and tersheds are discussed, with particular attention en to recreational uses, including swimming and ting. Strong conflict exists between water-ply agencies, which want to prohibit access to er supplies to prevent contamination, and reationists, who want access to high-quality, nically unspoiled water. Recreation in water plies is a potential health hazard. All activities ch involve bodily contact with the water should prohibited because chlorination is not entirely ctive against pathogenic viruses. Timber nagement can provide both increased water d and increased revenues, but care must be d to prevent sediment and erosion problems. a on use, regulation, legal, and financial aspects multiple use of reservoirs were gathered by led questionnaires addressed to the water rds of 202 municipalities, interviews with water rks officials in 50 municipalities, and review of fessional water management literature. (Knapp-GS)
9-05935

6E. Water Law and Institutions

AN APPROACH TO ATTACKING HUMAN-SOCIAL PROBLEMS RETARDING IRRIGATION AND AGRICULTURAL DEVELOPMENT IN LATIN AMERICA,
Inter-American Center for the Integral Development of Land and Water Resources.
For primary bibliographic entry see Field 03F.
W69-05652

WATER RESOURCES AND ECONOMIC DEVELOPMENT IN THE SOUTH,
Council of State Governments; and Southern Land Economics Research Committee.
For primary bibliographic entry see Field 06B.
W69-05737

WATER QUALITY CONTROL: LEGAL AND ADMINISTRATIVE ASPECTS,
For primary bibliographic entry see Field 05G.
W69-05745

THE LEGAL IMPLICATIONS OF ATMOSPHERIC WATER RESOURCES DEVELOPMENT AND MANAGEMENT.
Arizona Univ., Tucson. Weather Modification Law Project Staff.
For primary bibliographic entry see Field 02B.
W69-05756

STATE PROGRAMS FOR ESTUARINE AREA CONSERVATION,
North Carolina Univ., Cahpel Hill. Inst. of Government.
For primary bibliographic entry see Field 02L.
W69-05776

COASTAL STATES GAS PRODUCING CO V STATE MINERAL BD (OWNERSHIP OF STREAM BED).

199 So 2d 554 (3rd Cir Ct App La 1967).

Descriptors: *Ownership of beds, *Louisiana, *Streambeds, Water conveyance, Navigable waters, Riparian rights, Prescriptive rights, State governments, Water law, Legal aspects, Civil law, Judicial decisions.
Identifiers: Inherent sovereignty, *Sovereignty lands.

The question presented is whether an 1885 deed of state lands, which contained a navigable stream, conveyed ownership of the stream bed. The trial court held that the descendants-in-title of the original transferee owned the stream bed contained in the original transfer. The Court of Appeals reversed holding that, in the absence of strong indicia to the contrary, water beds owned by the state by virtue of its inherent sovereignty are not included within conveyed property. After holding that the transfer was not protected by the prescriptive statute, the Court held that due to the doctrine of 'inherent sovereignty, beds of navigable waters are not susceptible of private ownership. Public policy requires that a conveyance including navigable water bottoms within the described area must be strictly construed against the grantee. Therefore a sale of lands would not include a conveyance of navigable water bottoms. (Horner-Fla)
W69-05777

EVOLUTION OF MICHIGAN WATER LAWS,
Michigan State Univ., East Lansing.
Allan A. Schmid.
Evolution of Michigan Water Laws, pp 3-34, 1960. 32 p, 102 ref.

Descriptors: *Michigan, *Riparian rights, *Public rights, *Groundwater, Navigable waters, Reasonable use, Ownership of beds, Legislation, State governments, Water rights, Relative rights, Competing uses, Damages, Remedies, Municipal water, Natural flow, Doctrine, Water quality, Alteration of flow.

Most of the Michigan law comes from court decisions rather than statutory law. In conflicts between water users the court decides what is reasonable between the parties involved. The basis for this reasonableness criterion is the focus of this paper. Generalizations from case law are less than complete since the cases are piecemeal. However, the purpose is not to generalize on the substantive content of all Michigan water law, but only to indicate in a general way how economic change affects the law and how consideration of maintaining economic growth affects the basis for the reasonable character of court decisions affecting the rights of competing users. This analysis is divided into major sections treating surface water law and ground water law. Surface water law is analyzed in terms of: (1), the relative rights of riparians and non-riparians; and (2), the relative rights among riparian owners. Drainage and the laws of pollution are treated only incidentally. (Smith-Fla)
W69-05778

EVOLUTION OF MICHIGAN WATER LAWS-SURFACE WATER: RIGHTS OF RIPARIANS AND NON-RIPARIANS.
Michigan State Univ., East Lansing.
Allan A. Schmid.
Evolution of Michigan Water Laws, pp 3-20, 1960. 18 p, 55 ref.

Descriptors: Water rights, *Michigan, Navigable waters, Dams, Mill dams, Legislation, State governments, *Riparian rights, Riparian land, Municipal water, Industrial water, Recreation, Irrigation water, *Public rights, Ownership of beds, Reasonable use.

The public has certain rights in navigable streams in Michigan. These rights of the public are important because they define the relative rights of riparian owners and non-riparians. A public stream is one where the rights of the private riparian owners are restricted in some manner. To justify such restriction the privileged use must be in the public interest. The question is not what is a private purpose over against a public purpose but is the purpose also public or merely private. This raises the problem of evaluating the degree of public interest in any activity, rather than merely drawing a line between public and private. Today when there are many conflicting but important uses of water such as municipal, industrial, agricultural, and recreational, it is not accurate to say that any one of them may be typified as public while the others are private. The real question is the reasonableness of one use as against another; and this depends on the public interest in the various uses, which should be determined directly and not by any formula for navigability.
W69-05779

EVOLUTION OF MICHIGAN WATER LAWS - SURFACE WATER: RIGHTS AMONG RIPARIAN OWNERS.
Michigan State Univ., East Lansing.
Allan A. Schmid.
Evolution of Michigan Water Laws, pp 20-26, 1960. 7 p, 18 ref.

Descriptors: *Riparian rights, *Reasonable use, *Michigan, Natural flow doctrine, Riparian land, Water rights, State governments, Relative rights, *Remedies, Water utilization, Water pollution, Damages, Alteration of flow, Municipal water, Obstruction to flow, Riparian waters, Competing uses.

The prevailing rule of water rights in Michigan is the riparian doctrine of reasonable use. This is the rule which governs the relative rights of riparian owners. It is important to distinguish between the riparian doctrine modified by the rule of reasonable use and what is often referred to as the natural

flow doctrine. The natural flow doctrine would guarantee riparians the right to have the water pass by unaltered in quantity and quality. Such language is not found in Michigan court decisions, which specifically deny that water must be passed by undiminished in quantity and quality. All riparians have a right to some depleting use of the water, but each use must be reasonable when related to the use of other riparians. The remedies available to the riparian owners have a marked effect on the substantive law. The Michigan courts in granting remedies seem to treat a non-user as not entitled to more than nominal damages for past interference, or to any injunctive relief.
W69-05780

EVOLUTION OF MICHIGAN WATER LAWS-GROUND WATER.
Michigan State Univ., East Lansing.
Allan A. Schmid.
Evolution of Michigan Water Laws, pp 26-34, 1960. 9 p, 29 ref.

Descriptors: *Groundwater, *Michigan, Legislation, Municipal water, Percolating waters, Public rights, Water quality, Groundwater movement, Reasonable use, *Wells.

Use of ground water on the property from which it is taken is favored over the transportation of ground water for use at another site. This is similar to the surface water concept of restricting water use to riparian land. In the case of surface water, use on non-riparian land is prohibited even if great public benefit might result. However, in Michigan ground-water decisions the courts do not let private property rights prevent public benefit, such as city use. The courts allow damages to the owner's investment but do not allow the owner to prevent the higher use from being made. The court does not always allow injunctions in the case of surface water, but the principle of allowing damages and providing for shifts to higher use is better established in ground water cases.
W69-05781

WATER AND WATERCOURSES--NAVIGABILITY OF STREAMS IN MISSOURI.
Missouri Univ., Columbia. School of Law.
Robert S. Gardner.
Mo L Rev, Vol 19, No 4, pp 401-412, Nov 1954. 12 p, 59 ref.

Descriptors: *Easements, *Ownership of beds, Riparian rights, *Missouri, *Navigable rivers, Stream beds, Riverbeds, Riparian waters, Eminent domain.

The determination of navigability has two different applications, that which is sufficient for state retention of the title to the river bed, and that which is sufficient to subject private riparian ownership to a public easement. The English common law was that a stream is navigable only as far as the ebb and flow of the tide can be felt. This rule is not suited to America with its great inland streams and rivers. According to the Missouri courts the legislature cannot by statute declare non-navigable streams to be navigable. This is based on the Constitutional prohibition against taking private property without eminent domain proceedings. The test of navigability used to determine state ownership of the river bed is whether the stream in its natural state and with an ordinary volume of water, either constant or regularly recurring with the seasons, is capable of floatage useful to the public. Where navigability is not sufficient to give the state title to the river bed, the riparian owner may be subject to a public easement if the water is periodically capable of floatage to be of sufficient beneficial use. (Batchelor-Fla)
W69-05782

SECTION OF MINERAL AND NATURAL RESOURCES LAW--REPORT OF THE COMMITTEE ON WATER RESOURCES.
American Bar Association, Chicago, Ill. Committee on Water Resources.

Section of Mineral and Natural Resources Law, 1964 Committee Reports, pp 186-210, 1964. 25 p.

Descriptors: *Water law, *Legislation, Judicial decisions, *Administrative decisions, Minnesota, Water resources, Federal-state water rights conflicts, Federal government, State governments, River basin development, Water management (Applied).
Identifiers: Water Pollution Control Act, Water resources research.

The report is divided into three parts, the first dealing with legal developments in the field of water resources in various states and the federal government for the period May 1963 through April 1964. These developments are discussed under the headings of legislation, judicial decisions and administrative action. Although the states reporting are primarily in the western U S, Minnesota is included. Federal developments in the legislative area include pending matters such as the Pacific Southwest Water Plan, the Pacific Northwest-Pacific Southwest Intertie, Federal Water Pollution Control Act amendments, recreation proposals, Small Reclamation Project Act amendments, river basin planning projects, and a water resources research project. Significant federal cases, and administrative actions on Colorado River salinity and the U S-Canada Columbia River Treaty, are also set forth. The second part consists of the report of the Ground Water Management Subcommittee, and the third announces American Bar Association and Congressional action relating to federal-state jurisdictional conflicts in water resources development. (Patterson-Fla)
W69-05783

RES IPSA LOQUITUR AS APPLICABLE IN ACTIONS FOR DAMAGE TO PROPERTY BY THE OVERFLOW OR ESCAPE OF WATER.
J. E. Macy.
11 ALR 2d 1179-1194 (1950).

Descriptors: *Relative rights, *Water law, *Flooding, *Flood damage, Judicial decisions, Legal aspects, Water rights, Adjudication procedure, Water, Water control, Water injury, Water works, Inflow, Seepage, Seepage water, Dams, Flood water, Drains, Sewers, Embankments, Levees, Water management.
Identifiers: Res ipsa loquitur, Rebuttable presumption, Permissible inference.

This annotation collects cases in which a plaintiff sought to recover damages for injury to his property by the incursion of water from some place or container within the defendant's possession or control, where the gravamen of the action was negligence and an issue was whether the doctrine of res ipsa loquitur applied. Only negligence cases are included because it is only in such cases that the doctrine is relevant. After briefly examining the general evidentiary rule of res ipsa loquitur, the annotation deals specifically with cases involving: (1) seepage or inflow of water from an adjacent apartment or building, (2) inflow from a break in a water main or connection, (3) flooding from sewers and drains, (4) flooding from a broken embankment or levee, (5) flooding from a broken dam, (6) flooding as a result of management of gates in a dam. (Carruthers-Fla)
W69-05784

FEDERAL LAW AND SEASHORE ACCRETION.
Michael P. Hebert.
La L Rev, Vol 28, No 4, pp 655-662, June 1968. 8 p, 43 ref.

Descriptors: *Accretion, *Alluvion, *Washington, *Riparian land, Federal jurisdiction, Riparian rights, Seashores, High water mark, Low wat mark, Judicial decisions, Littoral legal aspec State jurisdiction.

This is a case note on Hughes v Washington, 88 Ct 438 (1967). In Hughes, the plaintiff brought a tion to quiet title to alluvion formed after 1889, t date of Washington's statehood. The Washingt Supreme Court held that state law applied and th all alluvion inured to the state. The case was a pealed to the United States Supreme Court whi held that federal law governs the ownership accretion gradually deposited by the ocean on a joining upland property conveyed by United Stat patent prior to statehood. Under federal law, t plaintiff had a right to the alluvion. The auth notes that accretion or erosion had been common considered a problem of riparian or littoral right Under the rule of this case, however, where there a federal patent issued before statehood is grante the boundary is not a fixed unchanging line; it shif with the movement of the mean high water mar The rule set forth in Hughes seems to conflict wi the line of cases holding that the sale of the state to govern for lands bounded on streams or oth waters. Prior to Hughes the question of rights to li toral alluvion had never been put squarely befo the Supreme Court. (Heckerling-Fla)
W69-05785

VICTOR A HARDER REALTY AND CON STRUCTION CO V CITY OF NEW YOR (DAMAGES CAUSED BY EXCAVATION AN GROUNDWATER REMOVAL).
64 NYS 2d 310-323 (Sup Ct 1946).

Descriptors: *New York, *Excavation, *Land sub sidence, *Deformation, Damages, Pumps, Judici decisions, Drainage engineering, Building code Soil compaction, Settlement (Structural), Retain ing walls, Cost repayment, Cities, Local gover ments, Legislation, Groundwater, Movemen Buildings, Property values.
Identifiers: Strict liability, Absolute liability, Statu tory liability, Restoration, Ordinances.

Plaintiff building owner sued defendant city fo damages to his building as a result of excavation and drainage of ground water. Soil subsidenc which resulted from defendant's activity cause lateral movement of plaintiff's building. The defen dants claimed that their construction merel caused the plaintiff's structures, which were al ready leaning, to settle evenly. Evidence showed lateral movement of other buildings in the vicinity There was no finding of negligence on either defen dants' part. The court held the city liable for th damage under a city ordinance. The ordinance pro vided that any party who caused excavations to ex tend more than 10 feet below curb level would b strictly liable for damages suffered by adjoinin structures. This holding was in line with the court finding that the excavations and removal of un derground water, though done without negligence were the responsible and proximate causes of th damage. The measure of damages was the diminu tion of the market value of the property, but, since as the restoration costs were less than the loss i market value, the plaintiff received only the cost o repairs actually necessitated by the defendants acts. (Blunt-Fla)
W69-05786

AMERICAN POLICY OPTIONS IN THE DEVELOPMENT OF UNDERSEA MINERAL RESOURCES.
American Bar Association, Chicago, Ill. Section o Natural Resources Law.
Northcutt Ely.
Natural Resources Lawyer, Vol 1, No 1, pp 91-95, Jan 1968. 5 p.

Descriptors: *Continental shelf, *Continental slope, *Ownership of beds, *Exploitation, *Law of the sea, *Political aspects, Research and development, International commissions, Oceans, Competing uses, Adjudication procedure, Relative rights,

ternational waters, Water resources develop-
ent, Federal government, Judicial decisions.
dentifiers: International conventions, Lateral
oundaries, 200 meter isobath, Convention on
ontinental Shelf.

he article discusses two policy problems in the
velopment of undersea mineral resources: (1)
mitation of a coastal nation's exclusive jurisdic-
on over the seabed. (2) Selection of a regime to
vern exploration and exploitation of mineral
sources lying beyond the defined limits of na-
nal jurisdiction. The definition of the Conven-
on on the Continental Shelf which limits national
risdiction to a depth of 200 meters, or beyond, to
here the depth of the water admits of exploitation
mineral resources has two defects. The 200
eter isobath ignores the interests of coastal na-
ons in their continental slopes beyond the con-
ental shelf, and the exploitability test is am-
guous. He proposes that the exploitability test
ould be abandoned and a uniform lateral boun-
ry of the state's seabed employed, perhaps in
njunction with the 200 meter isobath. As to the
cond problem no international agency is
esently needed to administer exploitation of the
ep seabed beyond national jurisdiction. Seabed
sources should be open to exploitation and ap-
opriation under the laws of the nation of the
scovering expedition. Disputes between compet-
g national interests may be resolved through ac-
mmodation and the development of adversary
se law. (Storace-Fla)
69-05787

REATION OF WATER AND SEWAGE SPOSAL AGENCIES.

J Stat Ann secs 40:14B-2, 40:14B-34, 40:14B-35
40:14B-40, 40:14B-60 (1967).

scriptors: *New Jersey, *Pollution abatement,
ewage treatment, *Treatment facilities, Legisla-
n, Water pollution control, Public health, Water
rification, Local governments, Waste treatment,
poundments, Administrative agencies, Con-
mnation, Eminent domain, Public utilities, Cost
ocation.

e policy of this act is to provide an adequate
ter supply and to prevent pollution of state
ters. To implement this policy, agencies of local
vernments are authorized to operate water works
l sewage treatment facilities at the expense of
users of such services. These agencies may
quire property by condemnation. The act
ablishes the procedures for condemning proper-
and compensating the former owner. The local
vernment agencies are empowered to make
sonable regulations for operating a utility
tem. The discharge of sewage which may cause
lution is forbidden. (Childs-Fla)
69-05788

GSDON V ANDERSON (SUIT TO ORDER OPENING OF DIVERSION DITCH).

NW 2d 787-793 (Iowa 1948).

scriptors: *Iowa, *Artificial watercourses, *Ob-
uction to flow, *Diversion structures, Water law,
icial decisions, Watercourses (Legal), Flow,
ches, Controlled drainage, Relative rights,
passes, Routing, Alteration of flow, Streamflow,
ersion, Overflow, Flood damage, Prescriptive
hts, Natural streams, Legal aspects.
ntifiers: Injunctions (Mandatory).

intiff, while tenant of land which defendant later
uired, opened a ditch to divert surface water.
e ditch prevented water from flowing along an
stream bed traversing the tract. After plaintiff
uired the adjacent tract, the ditch became
gged; thereafter, rains caused overflow onto
intiff's land. Plaintiff brought suit for injunctive
ef, praying that the defendant be ordered to
pen the ditch and to compensate plaintiff for
nages suffered. Defendant alleged that plaintiff's grantor shared prior clearing expenses. Since this was so, defendant contended that the court should order both parties to be responsible for maintenance of the ditch. The lower court ruled that there was no proof of any mutual agreement for maintenance; nevertheless, judgment was for the defendant due to the fact that the ditch became a natural watercourse through acquiescence. The appellate court reversed, holding that, although defendant may divert water, he is responsible for maintenance of the ditch in such a state as to prevent harm to his neighbors. The court held that an artificial watercourse can become natural through prescription, but only as to parties through whose lands it flows. Surrounding property owners are not prevented from complaining when the diversion ditch causes damage. The case was remanded for a determination of damages. (Wheeler-Fla)
W69-05789

KENNEBUNK, KENNEBUNKPORT AND WELLS WATER DIST V MAINE TURNPIKE AUTHORITY (DAMAGES FROM TURBIDITY OF BROOK).

71 A 2d 520-533 (Me 1950).

Descriptors: *Maine, *Riparian rights, *Turbidity, *Water supply, Damages, Relative rights, Reasonable use, Streams, Water law, Preferences (Water rights), Proprietary power, Judicial decisions, Road construction, Impaired water quality, Watersheds (Basins), Water sources, Administrative agencies, Damages.

Plaintiff, a water supplier, sued for damages for injury to its claimed property right to take water from a brook and to distribute the water to the public. Plaintiff alleged that defendant's construction of a turnpike across the brook and its watershed had made it so turbid as to render the water from it unfit for distribution. The lower court rejected the referee's finding for plaintiff. The appellate court remanded to determine whether plaintiff had riparian right to take the water. The court noted that plaintiff's claim in the lower court had been based upon its right as a quasi municipal corporation under a legislative charter to distribute water from the brook. A determination of whether plaintiff's ownership of land gave it the right to use the brook as a source of supply for public distribution must be made. The court also remanded for determination whether defendant's use of the land, as upper riparian owner, was for reasonable purposes. This question depends not only on the use of upper owner, but also upon use being made by lower owner. The court dismissed plaintiff's contention regarding nuisance since there were no special damages to plaintiff. (Wheeler-Fla)
W69-05790

THE CONVENTION ON FISHING AND LIVING RESOURCES OF THE HIGH SEAS.

James A. Crutchfield.
Nat Resources Lawyer, Vol 1, No 2, pp 114-124, June 1968. 11 p, 7 ref.

Descriptors: *International law, *Marine fisheries, *Fish management, Fish conservation, Fish reproduction, Fishing gear, Law of the sea, International waters, Oceans, Oceanography, Marine fish, Legal aspects, Water law, Conservation, Resource allocation.
Identifiers: *Coastal states.

The wording of the Convention on Fishing and Living Resources suggests that there are no effective restraints on the extension of the power of the coastal state over living resources of the sea. The objectives of the Convention are not clearly defined. 'Optimal' use is the broad theme of the undertaking, however, this theme fails to recognize the inevitable tendency toward overcapacity and inefficiency in a common property resource. No guide to the treatment of new entrants is offered. The Convention has articulated the problem of fishery conservation primarily in terms of scientific benefits and detriments. It should be noted that, of the coastal states, the smallest states have led the fight for special privileges. The convention allows for permissive multilateral agreements covering exploitation of living resources, but the lack of a concrete objective detracts from any incentive for such agreements. The author suggests establishing a system of national marine lakes. The Convention offered no effective means of limiting future pressure on marine fisheries. Only procedures for alleviating current problems were suggested; no governing principles were laid down. The author suggests guidelines which would restrict entry and promote the economic efficiency of future marine fisheries. (Holt-Fla)
W69-05791

HARBISON-WALKER REFRACTORIES CO V SMITH (FLOOD DAMAGE DUE TO CLOGGED CULVERT).

194 F 2d 530-531 (6th Cir 1952).

Descriptors: *Kentucky, *Flood damage, *Rainfall, *Culverts, Damages, Excessive precipitation, Overflow, Floods, Runoff, Judicial decisions, Legal aspects, Obstruction to flow.
Identifiers: Negligence, Debris.

This action was brought to recover for injuries to plaintiff's property when a clogged culvert on defendant's land caused flooding. The court in a per curiam opinion, held that where there was floatable debris on defendant's property and in the vicinity, it might reasonably have been foreseen that rainfall might cause fresh debris to clog the culvert resulting in an overflow onto plaintiff's property. Failure of defendant to remedy such situation was negligence creating liability to plaintiff. (Heckerling-Fla)
W69-05792

ADAMS V GREENWICH WATER CO (DIVERSION OF RIVER FOR PUBLIC WATER SUPPLY).

138 Conn 205, 83 A 2d 177-184 (1951).

Descriptors: *Connecticut, *Diversion, *Public benefits, *Water supply, Eminent domain, Judicial decisions, Cities, Local governments, Relative rights, Riparian land, Riparian rights, Alteration of flow, Rivers, Public rights, Social needs, Community development, Interstate rivers, Natural flow, Appropriation, Islands, Legal aspects.
Identifiers: Injunctions (Prohibitory).

Plaintiffs owned land along a certain river. Some of the plaintiffs had created artificial ponds and islands in the river. They all used the river for swimming, fishing, and skating and drew water from it for their lawns, gardens, and livestock. Defendant had a franchise to furnish water for public and domestic use. It purchased its water from a nearby city. During a period of extreme drought in the summer of 1949, the defendant began pumping water from the river. At no time did the pumping cut off the flow of the river completely, however, at the height of the drought the defendant was diverting more than half the flow. The water was not 'taken' by eminent domain proceedings. Plaintiffs brought this suit to enjoin defendant from diverting the river except as permitted by agreement. The court denied injunctive relief, holding that it is well within the court's discretion to deny an injunction against the infringement of riparian rights if to grant such relief would adversely affect the public interest. (Heckerling-Fla)
W69-05793

WHITE V PENNSYLVANIA RR (DAMAGES FOR OBSTRUCTION OF STREAM).

354 Pa 397, 47 A 2d 200-204 (1946).

Descriptors: *Pennsylvania, *Railroads, *Obstruction to flow, *Landfills, Alteration of flow, Judicial decisions, Damages, Floods, Flood damage, Riparian land, Riparian rights, Culverts, Diversion, Natural flow doctrine, Stream flow, Ditches, Natural streams, Legal aspects, Diversion structures.

Plaintiff owned about 40 acres of fertile muckland situated in a valley. About 100 years ago, defendant's predecessor in title built an elevated embankment, as a roadbed for its tracks, immediately to the west of, and extending the entire length of, the mucklands. The embankment was constructed in the channel of a creek which flowed naturally along the valley. At the same time, defendant's predecessor in title diverted the creek into a substituted channel and constructed a culvert under its tracks to afford a nearby run an outlet into the creek. Until about 15 years prior to initiation of this suit, defendant and its predecessor maintained the creek in good condition. Since then, defendant failed to keep the creek reasonably free from obstructions. This condition caused the waters of the creek to be forced onto parts of the muckland, rendering such land untillable. The court held that if a new watercourse is made, different from that which nature has provided, and the discharge is thereby made to fall upon a different place and in a different manner, causing damage to the owner of the servient tenement, the owner of the superior or dominant tenement is liable. (Heckerling-Fla)
W69-05794

BILLERIO V FOTI (FLOOD DAMAGE DUE TO DAMMING OF STREAM).
97 NYS 2d 860-861 (S Ct 1950).

Descriptors: *New York, *Natural streams, *Damages, *Obstruction to flow, Dams, Streams, Riparian rights, Flood damage, Riddance (Legal aspects), Conservation, Overflow, Surface runoff, Natural flow, Streamflow, Relative rights, Judicial decisions, Ditches, Repulsion (Legal aspects).
Identifiers: Injunctions (Mandatory).

Plaintiffs brought suit to avoid a nuisance which plaintiffs claim was caused by defendants and to recover damages for flooding. The plaintiffs purchased the property by deed. Defendants' premises adjoined the property. After plaintiffs took possession, they decided to develop a new vineyard on a portion of their land which had previously been devoted to other farming purposes. Plaintiffs, on the advice of conservation experts, took certain steps to rid the area of excessive moisture and dampness. These steps included the digging of a new ditch and the removal of brush from existing ditches and from what they claimed was the body of a stream. Defendants claim that no such stream existed and that excess water came onto their property due to the ditching. The defendants dammed up the stream to exclude the flow from their property. The court found that the water coming onto the plaintiff's property was in the bed of or part of a well-defined stream that previously existed and that the flow was such as to constitute no extra burden on defendants' tract. Damages were awarded to plaintiffs, and a mandatory injunction commanding removal of the dam was issued. (Heckerling-Fla)
W69-05795

SMITH V UNITED STATES (DAMAGES FOR FILLING OF RESERVOIR).

113 F Supp 131-136 (D Del 1953).

Descriptors: *Delaware, *Stream erosion, *Federal government, Judicial decisions, Running waters, Natural streams, Sedimentation, Riparian rights, Construction, Reservoirs, Sediments, Water pollution effects, Water pollution sources, Sands, Gravels, Banks, Dams, Erosion.
Identifiers: Federal Tort Claims Act, Demurrers, Upstream owner.

Plaintiff leased a three-acre tract of land, the northerly boundary of which was a free running stream. The stream ran through defendant's air base which was located up stream from plaintiff's land. Prior to the construction of the air base, plaintiff maintained his dwelling house, a store and apartment building on his property. Five ponds, fed from the creek water collected behind a dam he had built across the creek, were also located on the land. Plaintiff alleged that defendant, in constructing the base, had changed the grade and contour of the upstream land so as to increase the drainage of surface waters. This increased flow washed sand and gravel downstream, eventually filling plaintiff's reservoir. The bed of the creek was raised so that only a trickle of water ran through plaintiff's land. Plaintiff sought damages measured by loss of profits in his business, the value of destroyed fish and aquatic plants, the deprivation of the normal flow of water, and the expense incurred in removal of his home and business to other land. The suit was brought under the Federal Tort Claims Act. Defendant moved to dismiss the complaint for failure to state a cause of action. The court held that under Delaware law the complaint stated a cause of action. (Heckerling-Fla)
W69-05796

ANNIN V STATE (DAMAGE CAUSED BY FILLING OF CHANNEL).

206 Misc 24, 132 NYS 2d 471-475 (Ct Cl 1954).

Descriptors: *New York, *Landfills, *Riparian rights, *Channel flow, Channel improvements, Channels, Open channel flow, Flumes, Overflow, Damages, Judicial decisions, Construction, Streams, Obstruction to flow, Diversion, State governments, Relative rights, Fish hatcheries, Cost repayment.
Identifiers: Proximate cause.

Plaintiff and the State owned and operated adjoining fish hatcheries on a creek which flowed past plaintiff's property. Before certain construction work by the state, the stream divided naturally into two channels at the state's property, creating an island on which the main buildings of the state hatchery were located. The state, in order to increase the capacity of its hatchery, filled in the east channel and constructed a new flume in the west channel. It was plaintiff's contention that the filling of the east channel raised the level in the creek as it flowed past his property, thereby impairing the operation of his facilities and rendering necessary certain structural changes for which he sought compensation. The court held that the state may not fill existing channels in such a way as to hold back waters and thereby overflow or damage the property of an adjacent riparian owner; however, to impose liability, it must appear that the damage complained of is the proximate result of the act of the state in obstructing the channel. The evidence presented failed to establish this fact. (Heckerling-Fla)
W69-05797

ALLEN V STATE (FLOOD DAMAGE DUE TO CONSTRUCTION OF DIKE).

208 Misc 385, 143 NYS 2d 867-873 (Ct Cl 1955).

Descriptors: *New York, *Dikes, *Flood control, *State governments, Flood damage, Judicial decisions, Community development, Federal government, Riparian rights, Rivers, Riparian land, River regulation, Engineering structures, Flood protection, Currents (Water), Erosion, Floods, Cities, Relative rights, Backwater.

Plaintiffs sued for damages caused by a defective flood control plan. Plaintiffs' land was bounded by a river. In connection with a federal flood control project, a dike along the river was rebuilt. In addition, a cross dike was constructed to prevent water from backing into the town of South Corning. Corning had improved flood protection. Becuase of the new structures, plaintiffs' land, in time of flood was exposed to the river current, and the cross dike tended to impound the back water and increase its depth. The result was a washing away of plaintiffs' land, flooding of their cellars, and damage to certain buildings and personal property. The question was whether claimants had stated any cause of action against the state. The court held that a riparian owner may not construct a dike if such dike, in times of ordinary floods, will cause waters to damage lands of another. Judgment was entered for plaintiff. (Heckerling-Fla)
W69-05798

MONTELEONE V BOH BROS CONSTRUCTION CO (LIABILITY FOR DAMAGE CAUSED BY PILE DRIVER VIBRATIONS).
217 So 2d 754-757 (4th CCA La 1969).

Descriptors: *Vibrations, *Subsidence, *Marinas, *Louisiana, Judicial decisions, Land subsidence, Compaction, Pile driving, Foundation failure, Foundations, Flexible foundations, Pile foundations, Construction, Damages, Water table.

Plaintiff sought $24,749 for damage caused during construction of defendant's marina. The construction entailed use of pile drivers which caused vibrations allegedly damaging plaintiff's house. Defendant contended that plaintiff's damages were due to natural soil subsidence accelerated by the lowering of the water table by subsurface drainage work previously installed and to the overall unsuitability of the house foundations for use on the type of land involved. This court amended and affirmed a verdict for the plaintiff. The court found it impossible to determine with any degree of certainty that portion of the damages attributable to soil subsidence and that portion traceable to acceleration of subsidence due to the construction. Where there are at least two concurrent causes which contributed to plaintiff's injury and defendant was responsible for only one of the causes, damages should be assessed against the defendant in an amount equal to 1/2 the total damage figure. (Blunt-Fla)
W69-05799

ANDERSON V CITY OF JEFFERSON (SUIT FOR DAMAGES RESULTING FROM DISCHARGE OF WATERS UPON PRIVATE PROPERTY).
262 SW 2d 169-172 (Ct App Mo 1953).

Descriptors: *Kansas, *Watercourses (Legal), *Drainage water, *Surface waters, Judicial decisions, Legal aspects, Natural streams, Cities, Banks, Channels, Beds, Ditches, Surface runoff, Repulsion (Legal aspects), Watersheds.

Plaintiff brought action against defendant city for damages resulting from discharge of surface waters onto plaintiff's property and to enjoin defendant from constructing an additional drain into a ditch running across plaintiff's property. The court discussed two issues: (1) Whether the ditch on plaintiff's property was a 'watercourse'; (2) Whether the common enemy doctrine prohibited defendant's actions. First, the court defined 'watercourse' as a living stream of water which has well defined banks, a channel and a bed; it is fed from more permanent sources than mere surface water. The court found that the ditch was not a watercourse. As to the second issue, while the court found that surface water is a common enemy which owner of a dominant tenement may direct upon a servient tenement, the dominant owner may not artificially impound or collect surface water and cast it in increased and destructive quantities upon the servient estate. The court granted the relief sought by the plaintiff. (Logan-Fla)
W69-05800

GOVERNMENT AND WATER RESOURCES DEVELOPMENT,
Colorado State Univ., Fort Collins. Dept. of Economics.
For primary bibliographic entry see Field 06D.

69-05878

ATER RIGHTS AND LEGISLATION IN THE ASTERN STATES,
conomic Research Service, Washington, D. C.
esource Development Economics Div.
rold H. Ellis.
r main entry see Field 06B, W69-05737. Water sources and Econ. Develop. in the South, North rolina Univ., API, Series 16, pp 109-133, Aug 65 - 25 p, 72 ref.

scriptors: *Water rights, *Legislation, Natural eams, Surface runoff, Groundwater, Unrground streams.

ater supplies are classified by the courts and hts to use them vary according to their particular signation. Some common classifications of natu- water supplies include natural water courses, fused surface water, percolating ground water, d underground streams. Water rights rules with pect to each of the classifications are discussed. gislative developments are explored. Nineteen ure issues of water rights are summarized. Nurous references to specific laws and cases are ed. (Grossman-Rutgers)
9-05879

TY OF MERIDIAN V TINGLE (RECOVERY DAMAGES AGAINST MUNICIPALITY FOR EEK POLLUTION).
r primary bibliographic entry see Field 05G.
9-05955

ALS V ROBERTSON (MINE WATER RUFF).
primary bibliographic entry see Field 05G.
9-05956

LEY V FICKEL (DIVERSION OF WATER BY VEE).
primary bibliographic entry see Field 04A.
9-05957

Y-NOOJIN DEV CO V KINZER (SURFACE TERS AND THE NATURAL FLOW DOCINE).
primary bibliographic entry see Field 04A.
9-05958

NAMA CITY V YORK (SURFACE WATERS D THEIR NATURAL FLOW).
primary bibliographic entry see Field 04A.
9-05959

AMS V LAWLER (SURFACE WATERS AND E NATURAL FLOW DOCTRINE).
primary bibliographic entry see Field 04A.
9-05960

WTON COCA COLA BOTTLING CO V RPHREY (DIVERSION OF SURFACE TERS).
primary bibliographic entry see Field 04A.
9-05961

NADI V HOMESTEAD COUNTRY HOMES RFACE WATERS AND THE NATURAL OW DOCTRINE).
primary bibliographic entry see Field 04A.
9-05962

SKOTTEN V DRENTEN (ARTIFICIAL AINAGE OF SURFACE WATERS).
primary bibliographic entry see Field 04A.
9-05963

UNITED STATES V 11.48 ACRES OF LAND, ETC (COMPENSATION FOR CONDEMNED RIPARIAN RIGHTS).
For primary bibliographic entry see Field 06C.
W69-05964

STATE V AMERICAN ALKYD INDUSTRIES (PENAL LIABILITY FOR WATER POLLUTION STRICTLY CONSTRUED).
For primary bibliographic entry see Field 05G.
W69-05965

UPPER GREENWOOD LAKE PROPERTY OWNERS ASS'N V GROZING (CONTROLLED USE OF LAKE WATERS).
For primary bibliographic entry see Field 04A.
W69-05966

VINSON V TURNER (INJUNCTION AGAINST CONCENTRATION OF SURFACE WATER RIDDANCE).
For primary bibliographic entry see Field 04A.
W69-05967

ATCHISON T AND S F RY V TAYLOR (FLOOD DAMAGE DUE TO RAILWAY EMBANKMENT).
For primary bibliographic entry see Field 04A.
W69-05968

KECK V HAFLEY (DIVERSION OF STREAM FLOW).
For primary bibliographic entry see Field 04A.
W69-05969

COMMONWEALTH V KELLEY (NEGLIGENT OBSTRUCTION TO FLOW).
For primary bibliographic entry see Field 04A.
W69-05970

MOWREY V COLEMAN (QUESTIONED VALIDITY OF WATER DISTRICT).
277 SW 2d 481-482 (Ark 1955).

Descriptors: *Arkansas, *Assessments, *Water districts, *Evaluation, Public benefits, Estimated benefits, Legislation, Judicial decisions, Legal aspects, Financing, Remedies, Relative rights.
Identifiers: *Res judicata, Affirmative defenses.

Property owners brought suit attacking an entire assessment of benefits in a suburban water improvement district. Plaintiffs asserted that the assessed benefits were so excessive that a reassessment should be ordered. Defendants, who were commissioners of the district, admitted that the assessed benefits were in fact excessive and proposed that a decree be entered by which the assessment would be set aside and a new assessment ordered. Plaintiffs filed objections to the decree and questioned the validity of the district itself. The chancellor over-ruled the objections and entered the decree. Plaintiffs appealed. The court held that plaintiffs' attack upon the district came too late. The suburban improvement district law provides that an appeal from the order creating the district must be taken within thirty days; if an appeal is not so taken, the judgment shall be conclusive. Plaintiffs' charge (that the water improvement district was illegally organized) was made over two years after the order creating the district was filed; the issue had become res judicata. Therefore, the chancellor's ruling was affirmed. (Reed-Fla)
W69-05971

INJURING HIGHWAY BOUNDARY, PIER, SEAWALL, DOCK, ROCK, BUOY, LANDMARK, MILE-BOARD, PIPE, MAIN, SEWER, MACHINE, TELEGRAPH, OR OTHER PROPERTY.

N Y Penal Law secs 1423.2, 1423.3, 1423.8, 1423.12 (McKinney 1968).

Descriptors: *New York, *Damages, *Dams, *Docks, Piers, Quays, Jetties, Gates, Piles (Foundations), Coastal structures, Sea-walls, Shore protection, Locks, Rivers, Pipes, Drains, Sewers, Banks, Bank protection, Buoys, Legislation, Highways, Bridges, Public lands.
Identifiers: Boom, Main, Beacons, Penalty (Criminal).

Anyone who wilfully or maliciously displaces, removes, injures, or destroys: a bridge; or, a pier, boom, or dam lawfully erected or maintained on any water of the state or places any gate in or about such dam; or, a pile, or other material, in the ground which is used for securing any sea-bank or sea-walls or the bank or dam of any river, or any dock, quay, jetty, or lock; or, a sewer plant, sewer or drain, or a pipe or main connected with or forming part of a sewer or drain, is punishable by imprisonment for not more than two years. A person who, wilfully or maliciously removes or destroys a buoy or beacon, lawfully placed on any water within the state, is punishable by imprisonment for not more than two years. (Shevin-Fla)
W69-05972

FINDLEY LAKE PROPERTY OWNERS, INC V TOWN OF MINA (MAINTENANCE AND CONTROL OF WATER LEVEL OF LAKE).
For primary bibliographic entry see Field 04A.
W69-05973

THE GENEVA CONVENTIONS ON THE LAW OF THE SEA: SOME SUGGESTIONS FOR THEIR REVISION,
American Bar Association, Chicago, Ill. Section of Mineral and Natural Resources Law.
Shigeru Oda.
Natural Resources Lawyer, Vol 1, No 2, pp 103-113, June 1968. 11 p.

Descriptors: *International law, *Water resources, *Continental shelf, Oceans, Mineralogy, Shellfishing, Commercial fishing, Legal aspects, Publications, Conferences, Surveys, Water law, Law of the sea, Governments, Legislation, Treaties.
Identifiers: Geneva Conventions, Territorial sea, Contiguous zone, Superadjacent waters, Fishery zone.

Various suggestions are made regarding the law of the sea. First, the concept of 'continental shelf resources' as embodied in the Convention on the continental shelf should be specifically limited to include only mineral resources. Second, any recommendations on a new regime of deep sea mining should derive from an understanding that, since the Convention already covers the deep sea, the relevant provisions on the outer limit of the shelf should be amended. Third, the superadjacent waters of the continental shelf should be given the status of a contiguous zone. Fourth, the provision concerning the contiguous zones should be redrafted so as to enable the coastal states to exercise control over foreign vessels in the contiguous zones which encroach upon the interests of the coastal state. The protection of such interests was, after all, a compelling reason for establishing contiguous zones. Fifth, the 12-mile fishery zone should be universally adopted lest the coastal states continue to extend unilaterally their fishery jurisdiction. (Childs-Fla)
W69-05974

DI GIACINTO V NEW JERSEY ZINC COMPANY (DIVERSION OF SUBTERRANEAN WATERCOURSE).
For primary bibliographic entry see Field 04B.
W69-05975

SHELLFISH.

N J Stat Ann secs 50:1-1 to 50:1-4, 50:1-37, 50:1-38 (1967).

Descriptors: *Legislation, *New Jersey, *Leases, *Shellfish, Oysters, Mollusks, Permits, State governments, Legal aspects, Administrative agencies, Submerged lands, Beds under water, Tidal waters, Exploitation, Regulation, Fish management.
Identifiers: Penalties (Criminal).

The state has the power to control the distribution and removal of shellfish from underwater lands leased from the state. The lessee may be required to post bond to insure faithful observance of the promulgated regulations. The planting of oysters, seed oysters, or mollusks native to a foreign country may be commenced only after permission has been obtained from the state. Failure to obtain such permission subjects one to a fine of one thousand dollars, revocation of his license, and cancellation of his lease. Permission is not required for the planting of oysters, seed oysters, or mollusks, commonly known as American or Eastern oysters. Nothing in this statute affects the catching of floating fish in tidal waters. (Logan-Fla)
W69-05976

COATES V UNITED STATES (DIKES AS THE PROXIMATE CAUSE OF FLOODING).
For primary bibliographic entry see Field 04A.
W69-05978

BOROUGH OF AUSTIN V A AND P CORRUGATED BOX CORPORATION (FLOODING BELOW A DAM).
For primary bibliographic entry see Field 04A.
W69-05979

CLARK V TODD (INVALIDATION OF OYSTER DREDGING LICENSES).

64 A 2d 547-549 (Md 1949).

Descriptors: *Maryland, *Tidal waters, *Oysters, *Dredging, Commercial fishing, Boats, Fisheries, Statutes, Legislation, Tributaries, Permits, Administrative agencies, Legislation, Fish conservation, Rivers, Regulation.
Identifiers: Injunctions (Mandatory), Injunctions (Prohibitory).

The Fisheries Commission brought action to invalidate oyster dredging licenses and to restrain defendants from dredging oysters. From decrees sustaining demurrers and dismissing the bills, the commission appealed. The main issue on appeal was whether violations of the state statute which restricted the size of boats for dredging oysters in tidewaters could be attacked by way of injunction. The court pointed out that rivers affected by the ebb and flow of the tide are public rivers or arms of the sea and that the land under such tidewaters became vested in the state by charter. It is well established that oysters, like fish and game generally, are originally the property of the state, and no individual has any property rights in them, other than such as the state may permit him to acquire. Even when oysters are taken and reduced to possession by an individual, his rights of ownership may be regulated and altered by appropriate legislation. The court held that, since the right of dredging in these tidewaters is a valuable natural resource, the state has authority, by virtue of its police powers, to inact protective legislation regulating such rights. The court reversed and remanded for further proceedings. (Reed-Fla)
W69-05980

UNITED STATES V 1,096.84 ACRES IN MARION COUNTY (AUTHORIZATION OF FEDERAL DAMS AND RESERVOIRS).

99 F Supp 544-548 (W D Ark 1951).

Descriptors: *Compensation, *Arkansas, *Eminent domain, *Federal project policy, Condemnation, Federal Government, Dams, Reservoirs, Judical decisions, Legal aspects, Remedies, Flood control, Flooding, Public benefits, Public rights.

Defendant objected to the taking of that portion of her land within a reservoir area, but which lay above the maximum elevation subject to innundation. The Secretary of the Army had selected the land under his authority to acquire lands necessary for a dam and reservoir project for flood control. The court found for the defendant, holding that condemnation of land for the purpose of building a dam and reservoir was condemnation for a 'public use' and therefore, was not subject to judicial review. (Gabrielson-Fla)
W69-05981

CRARY V STATE HIGHWAY COMM'N (EMINENT DOMAIN).
68 So 2d 468-472 (Miss 1953).

Descriptors: *Mississippi, *Eminent domain, *Public land, *Navigable waters, Bridges, Shores, Oysters, Navigation, State governments, Riparian rights, Compensation, Ownership of beds, Riparian land, Permits, Legislation, Water law, Judicial decisions, Legal aspects, Condemnation, Low water mark, Public rights, Public benefits.
Identifiers: Revocable license.

Plaintiffs were riparian owners of property on navigable waters. A state statute gave riparian owners so situated the sole right to plant and gather oysters and to erect bath houses in front of their lands up to 500 yards from the average low water mark. Defendant state constructed a bridge across part of the waters extending 500 yards in front of plaintiff's property. Plaintiffs asserted that, by erecting the bridge, the state had taken their property for public use and that they were entitled to compensation. The court held that navigable waters, and the beds thereof, were owned by the state as trustee for the people of the state. The statute granting the right to raise oysters and to build bath houses merely gave a revocable license, a privilege, to do so. The privilege was subject to the superior right of the state to subject land already set aside for public pruposes to an addition servitude for the public benefit. This being so, plaintiff had no property right which could be the subject of state appropriation and, therefore, was not entitled to compensation. (Helwig-Fla)
W69-05982

STATE V LEMAR (TITLE TO TIDAL BEDS).

87 A 2d 886-888 (Me 1952).

Descriptors: *Permits, *Maine, *Navigable waters, *Ownership of beds, Cities, Beds under water, River beds, Beds, Water law, Legal aspects, Judicial decisions, Legislation, Local governments, State governments, Shores, Bloodworms, Tidal waters, Claims, Regulation.
Identifiers: *Constitutional law.

Defendant was convicted of digging bloodworms within city limits without a license. His action was in violation of a municipal ordinance requiring a license to engage in such activity and providing that no license may be granted to a person who is not a resident of the town. Defendant was a non-resident of the town. Defendant attacked the statute on constitutional grounds. The court held that unless the state has parted with title, it owns the bed of all tidal waters within its jurisdiction and has power to regulate fishing therein. The state legislature has the power to delegate to the municipality this power of regulation. It is not unreasonable or arbitrary for a municipality to give preference to town residents over non-residents in digging bloodworms. (Helwig-Fla)
W69-05983

UNITED STATES V 2973 ACRES OF LAND (CONDEMNATION OF FLOWAGE EASEMENTS).

218 F 2d 524-526 (4th Cir 1955).

Descriptors: *Virginia, *Eminent domain, *Ea ments, *Condemnation value, Condemnation, P perty values, Evaluation, Compensation, Fede government, Legal aspects, Electric power, El tric power industry, Flood control, Projects, Mu ple-purpose projects, Flooding, Damages, Judic decisions, Legal aspects.
Identifiers: Servitudes, Flowage easements.

A power company held flowage easements o certain land. The government filed condemnati proceedings with respect to this land, intending use the tract as part of a flood control project. T land owner conveyed her interest to the gover ment for one dollar. The trial court held the pow company was entitled to recover the fee simp value of the land. The government appealed, co tending: (1) That there can be no recovery agai the government for rights which have value o because of the development of power on a navig ble stream, and (2) That the government is liab only for a sum equal the decrease in value of t land where the servitude to be extinguished. T appellate court overruled the government's fi contention. As to the second question, the cou held that the value of the flowage rights was equ to the difference between the value of the land wi the servitude as compared with the value witho the servitude. Since the flowage rights of the pow company rendered the land valueless to the fe owner, the company was entitled to the fee simp value of the land without the easement. (Helwi Fla)
W69-05984

GOWING V LEHMANN (WATER USE EASEMENT).

101 A 2d 463-466 (NH 1953).

Descriptors: *New Hampshire, *Easement *Water supply, *Pumps, Judicial decisions, Wate sources, Artesian wells, Developed waters, Dis tribution systems, Pipelines, Relative rights.
Identifiers: Covenants, Equitable servitudes.

Plaintiff and defendant purchased adjoining lan from a common grantor. An artesian well situate on defendant's land supplied water to a pipelin serving buildings on plaintiff's land as well as defen dant's land. Plaintiff's deed specifically granted a easement to take water from the well and made ad ditional provision for a right of entry to repair th pipeline. No mention was made of the pump. Sub sequently, defendant developed a new source o water supply which by-passed the lines supplying the plaintiff's property. Plaintiff sought to require defendant to continue operation of the pump. The court held that defendant was under no duty t continue pump operation. The easement did no extend to the right to use the pump, and the discon tinuance of pump operation was not an inter ference with plaintiff's rights under the easement. (Molica-Fla)
W69-05985

ELLER V BOARD OF EDUCATION OF BUNCOMBE COUNTY (WATER POLLUTION AS CONSTITUTING A 'TAKING' OF PROPERTY).
For primary bibliographic entry see Field 05G.
W69-05986

AVERY V BEALE (CONSTITUTIONALITY OF RIPARIAN PRIORITY TO ERECT DUCK BLINDS).

195 Va 690, 80 SE 2d 584-593 (1954).

Descriptors: *Virginia, *Riparian rights, *Legislation, *Public rights, Legal aspects, Migratory birds, Waterfowl, Wildlife conservation, State governments, Judicial decisions, Hunting, Permits, Rela-

ve rights, Navigable waters, Non-navigable aters, Public benefits, Riparian land, Riparian aters.
entifiers: *Duck blinds, *Constitutionality, Class gislation, Injunctions (Prohibitory), Injunctions Mandatory).

Virginia statute gave riparian owners the prior d exclusive right to erect shooting blinds in blic waters adjoining their property after com- iance with certain licensing requirements. Failure elect this privilege opened the area to whoever quired a license. A riparian brought action to en- in the use of a duck blind constructed by non- arian within the prohibited 500 yard range of the arian's blinds. The non-riparian filed a cross bill r an injunction and for damages for infringement his right to use his blind. The circuit court en- ned maintenance of the blind by the non-riparian r the entire hunting season. On appeal by the n-riparian, the supreme court of appeals held at the state may license and regulate duck blinds der its power over public waters. In classifying ensees, however, there must exist a reasonable sis for the class definition selected. The classifi- tion scheme is presumed to be reasonable. The ck blind statutes are designed to provide riparian ctuaries for migratory fowl, to protect hunters, d to create better sport and recreational facili- s. The privilege conferred on the riparian owners a class is not absolute; the privilege is a condi- nal one and is based on prior rights of riparians. ch a classification offends neither the federal nor te constitution. (Harris-Fla)
69-05987

OLTION V STATE (FLOODING ABOVE A AM).
r primary bibliographic entry see Field 04A.
69-05988

LACK V STATE (FLOODING OF LAND BY IE STATE).
r primary bibliographic entry see Field 04A.
69-05989

ANCOCK V STULL (OBSTRUCTION TO ATURAL FLOW OF SURFACE WATER).
r primary bibliographic entry see Field 04A.
69-05990

IE V CITY OF NEW YORK (CITY'S BLIGATION TO MAINTAIN SUBSTITUTE GHWAYS).

5 App Div 922, 137 N Y S 2d 605-606 (Sup Ct 55).

scriptors: *New York, *Reservoir construction, /ater supply, *Highway icing, Highways, Ice, et, Road construction, Snow, Snow removal, Ju- ial decisions, Legal aspects, Cities, Local vernments, Legislation, Operation and main- ance.

e City of New York had constructed a large ter supply reservoir in Delaware County and had proved the constuction of substitute highways. e statute authorizing the highways directed the y to construct, repair, and forever maintain such ditional highways. After the construction of the hways, a dispute arose between the city and two arby towns concerning the duty of the city to intain the highways free from snow and ice. The preme Court is authorized to correct, at any e, any defect in any pleading or proceeding ought in connection with the construction of the ter supply reservoir. The court found no defect he orders setting forth the city's duties in regard he highways. The motion by the towns to amend prior order was not the proper procedure to fol- in this situation. (Shevin-Fla)
69-05991

INDIAN GRAVE DRAINAGE DIST V CONDRON (SUIT TO ESTABLISH RIGHTS OF PERSON OUTSIDE DRAINAGE DISTRICT).
For primary bibliographic entry see Field 04A.
W69-05993

GROBART V NORTH JERSEY DIST WATER SUPPLY COMMISSION (DIVERSION OF FLOW).
For primary bibliographic entry see Field 04A.
W69-05994

JENNINGS V LEAGUE OF CIVIC ORGANIZATIONS (BREACH OF CONTRACT TO PRODUCE WATER).
For primary bibliographic entry see Field 04A.
W69-05995

GEORGIA POWER CO V DREESE (NEGLIGENT WATER DISCHARGE).
For primary bibliographic entry see Field 04A.
W69-05996

LEVIN V MYERS (DISCHARGE OF SURFACE WATERS).
For primary bibliographic entry see Field 04A.
W69-05997

LOCH SHELDRAKE ASSOCIATES, INC V EVANS (RESERVATION OF REASONABLE USE).
For primary bibliographic entry see Field 04A.
W69-05998

HALSRUD V BRODALE (PRIVATE DRAINAGE EASEMENT AGREEMENTS).
For primary bibliographic entry see Field 04A.
W69-05999

STATE V BROWNS, INC (OBSTRUCTION OF DRAINAGE EASEMENTS).
For primary bibliographic entry see Field 04A.
W69-06000

6F. Nonstructural Alternatives

FLOOD PLAIN INFORMATION, CONLEY CREEK-SOUTH RIVER, METROPOLITAN ATLANTA, GEORGIA.
Corps of Engineers, Savannah, Ga.
For primary bibliographic entry see Field 04A.
W69-05913

FLOOD PLAIN INFORMATION, CASEY CANAL SOUTH, SAVANNAH AND CHATHAM COUNTY, GEORGIA.
Corps of Engineers, Savannah, Ga.
For primary bibliographic entry see Field 04A.
W69-05914

A FRAMEWORK FOR THE MULTIPLE USE OF MUNICIPAL WATER SUPPLY AREAS,
Cornell Univ., Ithaca, N. Y.
For primary bibliographic entry see Field 06D.
W69-05935

6G. Ecologic Impact of Water Development

THE STRATEGY OF BUILDING MODELS OF COMPLEX ECOLOGICAL SYSTEMS,
Canadian Dept. of Forestry, Victoria (British Columbia).
For primary bibliographic entry see Field 06A.
W69-05713

THE ANALYSIS OF DETERMINATION IN POPULATION SYSTEMS,
Forest Service (USDA), New Haven, Conn. Northeastern Forest Experiment Station.
For primary bibliographic entry see Field 06A.
W69-05714

07. RESOURCES DATA

7A. Network Design

DETERMINING MAXIMUM RELIABILITY AND EFFICIENCY OF HYDROMETEOROLOGICAL SYSTEMS AND INSTRUMENTS,
State Hydrological Inst., Leningrad (USSR).
A. M. Dimaksyan, and V. P. Petrov.
Trans from Trudy Gos Gidrol Inst, No 149, 1967, pp 114-132. Soviet Hydrol, Selec Pap, No 6, pp 569-584, 1967. 16 p, 8 fig, 4 ref.

Descriptors: *Network design, *Reliability, *Probability, Hydrologic data, Meteorological data, Data collections, Specifications, Standards, Optimization, Economics, Efficiencies, Design criteria, Networks, Evaluation, Systems analysis.
Identifiers: Hydrometeorological networks.

Methods are given for determining the reliability of hydrometeorological data instruments and networks. Optimum network reliabilities for which the overall costs of development and operation are minimum, may be calculated by simple formulas using graphical methods for obtaining results quickly. Several examples of solutions of network reliability optimization problems are given. (Knapp-USGS)
W69-05658

POTOMAC RIVER WATER QUALITY NETWORK, 1968 WATER YEAR.
Interstate Commission on the Potomac River Basin, Washington, D. C.
For primary bibliographic entry see Field 05B.
W69-05920

ACCURACY IN DETERMINING THE MEAN PRECIPITATION DEPTH OVER AN AREA,
Main Geophysical Observatory, Leningrad (USSR).
For primary bibliographic entry see Field 02B.
W69-05948

THE ECONOMIC APPROACH TO THE PLANNING OF A NETWORK OF METEOROLOGICAL STATIONS,
Main Geophysical Observatory, Leningrad (USSR).
L. S. Gandin, and R. L. Kagan.
Trans from Trudy GGO, No 208, 1967, pp 120-131. Soviet Hydrol, Selec Pap, No 6, pp 597-606, 1967. 10 p, 3 fig, 2 tab, 7 ref.

Descriptors: *Network design, *Optimization, *Economic efficiency, Hydrologic data, Climatic data, Data collections, Statistical methods, Economics, Efficiencies, Standards, Evaluation, Systems analysis.
Identifiers: Hydrologic data networks, Error estimates.

A method is proposed for determining optimum meteorological network density for maximum economic efficiency. This requires simplifying assumptions about benefits which range from direct economic savings to water users and others who are directly involved in using data, to the intangible benefits of having a large data base for scientific work. Observation error is assumed to be identical at all stations. Formulas for computing network efficiency are listed and an example is worked using aerological data station efficiencies. (Knapp-USGS)
W69-05949

7B. Data Acquisition

INSTALLATION AND FIELD CALIBRATION OF NEWTRON-SCATTER EQUIPMENT FOR HYDROLOGIC RESEARCH IN HETEROGENEOUS AND STONY SOILS,
Department of Agriculture, University Park Pa. Northeast Watershed Research Center.
Ernest Rawitz.
Water Resources Res, Vol 5, No 2, pp 519-523, Apr 1969. 5 p, 3 fig, 9 ref.

Descriptors: *Soil moisture meters, *Nuclear moisture meters, Calibrations, On-site tests, Boreholes, Instrumentation, Equipment.
Identifiers: Neutron-scatter moisture meters, Access tubes, Stony soils.

The commonly used methods of access tube installation and neutron depth probe calibration were impractical in the stony soils of an agricultural watershed in eastern Pennsylvania. Modification of a portable power-driven drilling machine made it possible to drill straight boreholes to a depth of 24 ft through the soil and the underlying shale beds. Backfilling oversize holes around the access tubes with fine soil material gave satisfactory results. Reasonable correspondence was found between calibration curves from heterogeneous, stony sites and more precise data obtained at a site with alluvial, stone-free soil derived from the stony residual soils upstream. The field calibration curves were roughly parallel to the calibration curve supplied by the manufacturer of the probe but were displaced upward by approximately 4000 counts per minute. Use of the factory calibration curve would be adequate for determining relative changes in soil moisture content but would result in serious error if used for calculating the absolute moisture content. (Knapp-USGS)
W69-05626

AQUIFER STORAGE DETERMINATION BY RADIOTRACER TECHNIQUES,
Federal Water Pollution Control Administration, Ada, Okla.
Jack W. Keeley, and Marion R. Scalf.
Ground Water, Vol 7, No 1, pp 17-22, Jan-Feb 1969. 6 p, 9 fig, 1 tab, 10 ref.

Descriptors: *Tritium, Groundwater basins, Groundwater, *Underground water storage, *Aquifers, *Groundwater recharge, *Recharge wells, Aquifer characteristics, Recharge, *Tracers, Groundwater movement, Storage capacity, *Storage coefficient, Field tests.
Identifiers: Groundwater management, Aquifer tests, *Radioactive tracers, Ogallala formation, Groundwater hydrology.

A new method of determining aquifer storage coefficients has been developed for ground-water recharge operations through wells. Tritiated water, used as a tracer, was injected into the recharge stream continuously, rather than on a slug basis. The theory of tracer behavior is discussed and mathematical formulas are given to provide a graphical solution for the detention time. The storage coefficient is calculated from the detention time. Results from a field study on the Ogallala formation and verification by an experimental pilot test are given. The field studies give a coefficient of storage 1.4 to 2.4 times greater than reported for pumping tests in the same area. Regarding water table conditions, the method promises to produce more reliable storage values than have been obtained from pumping tests. The significance of this report lies in determining an apparent aquifer storage capacity of almost twice the volume previously estimated. (USBR)
W69-05814

CABLE AND CLAMP MODIFICATIONS FOR MODEL 104 MOISTURE PROBES,
Forest Service (USDA), Logan. Intermountain Forest and Range Experiment Station.
Bland Z. Richardson.
U. S. Forest Service Research Note INT-76 (1968): 4 p.

Descriptors: *Water levels, *Instrumentation, *Nuclear moisture meters, *Performance, *Reliability, Observation wells, Water table, Equipment, Materials, Construction, Design standards, Design.
Identifiers: *Cable clamp, *Modification, Repair, Accuracy.

Two depth moisture gages equipped with Troxler Model 104 probes were of little value in a hydrology study in north Idaho because of repeated cable failure. During the first 240 hours of operation, 200 hours were lost. The author developed a modification to remove strain from the cable wires and a new type clamp to lock the cable and probe into the standard, or to meter it out, as the case may be. Following modifications, more than 15,000 soil moisture readings were taken with these two gages without a cable failure. (Packer-Forest Service)
W69-05883

INSTALLATION OF SOIL MOISTURE ACCESS TUBES IN ROCKY SOILS,
Forest Service (USDA), Logan, Utah. Intermountain Forest and Range Experiment Station.
Bland Z. Richardson.
Journal of Soil and Water Conservation, Volume 21, No 4, (July-August, 1966): 143-145.

Descriptors: *Drilling equipment, *Boreholes, *Moisture content, *Soil moisture meters, *Radioactivity, Neutron absorption, Wells, Soil types, Rocks, Rock properties, Rock excavation, Equipment.
Identifiers: *Access tubes, Wagon drill, Hand-held drill.

Drilling holes for soil moisture access tubes in a rocky soil mantle can, without proper planning and equipment, be the most costly, inefficient phase of soil moisture studies that employ neutron scattering methods. This paper discusses requirements for drilling satisfactory access tube holes in rocky soils. It describes and illustrates problems of drilling adequate holes with hand-held rock drills, tractor-mounted drills, and crawler-mounted drills; and compares the efficiency and cost of these methods. The most satisfactory access tube holes can be obtained by using a wagon-type rock drill mounted either on a tractor or self-propelled crawler. Their cost is only about one-sixth the cost of drilling holes with hand-held equipment. (Packer-Forest Service)
W69-05887

A TOOL FOR REPAIRING INSTALLED SOIL MOISTURE ACCESS TUBES,
Forest Service (USDA), Logan, Utah. Intermountain Forest and Range Experiment Station.
Bland Z. Richardson.
Journal of Soil and Water Conservation, Volume 21, No 5, (September-October, 1966): 184.

Descriptors: *Soil moisture meters, *Tubes, *Equipment, *Construction, Maintenance, Materials, Design standards, Reliability, Performance, Materials testing, Replacement cost, Design.
Identifiers: *Access tubing, *Resize, Repair.

Frequently, when thin-walled steel or aluminum access tubes for neutron soil moisture probes are installed in the soil mantle, they become creased or dented. Snow movement downslope during the winter also dents these tubes by pressing them laterally against rocks in the upper part of the soil mantle. This paper describes and presents illustrated specifications for a resizing tool, developed by the author, to remove creases and dents from access tubes without removing the tubes from their installed positions in the soil mantle. This tool can also be used to check access tubes in place f damage. These features provide substantial savin in cost, time, and quality of soil moisture da Without this tool, damaged access tubes wou have to be replaced in newly drilled holes and t continuity of data would be interrupted. (Packe Forest Service)
W69-05888

THE USE OF THE GEOELECTRIC METHO FOR INVESTIGATING GEOLOGIC AN HYDROLOGIC CONDITIONS IN SANT CLARA COUNTY, CALIFORNIA,
Santa Clara Valley Water Conservation Distric Calif.
Leo M. Page.
J Hydrol, Vol 7, No 2, pp 167-177, Jan 1969. 11 8 fig, 1 tab, 5 ref.

Descriptors: *Electrical studies, *Resistivity, *Su veys, *Groundwater, Geophysics, Aquifers, Wat table, Water levels, Water level fluctuation Porosity, Permeability, Transmissivity, Water yiel Discharge (Water).
Identifiers: *Santa Clara County (Calif).

The basic procedures used in electric resistivity e ploration of geologic and hydrologic conditions Santa Clara County, California are described. Typ cal examples of resistivity information checke against drilling and well testing are included. Th advantages of the resistivity method are low cos ease of operation, speed, accuracy, and ease training operations. The initial cost of the equi ment used was about $1,000 and the maintenanc cost was about $100 per yr. Since 1964, over 80 electric soundings to depth of 200-500 ft and ov 10,000 shallow profiles were made. The Wenne and Schlumberger electrode configurations a used. The usual procedure is to run a grid profiles to learn the general geological properti of an area and then to make several probes to lea the vertical extent of the major geohydrologi zones. Recent water level conditions in the count are mapped. (Knapp-USGS)
W69-05904

CHLORIDE CONCENTRATION IN GROUND WATER, RECHARGE RATE AND RATE O DEPOSITION OF CHLORIDE IN THE ISRAE COASTAL PLAIN,
Stockholm Univ. (Sweden). Internationa Meteorological Inst.; and Department of Natura Resources, Bangkok (Thailand).
For primary bibliographic entry see Field 02F.
W69-05905

SOIL WATER MEASUREMENT WITH AN Am 241 Be NEUTRON SOURCE AND AN APPLICA TION TO EVAPORIMETRY,
Agricultural Research Service, Phoenix, Ariz Water Conservation Lab.
For primary bibliographic entry see Field 02G.
W69-05926

SEEPAGE FLOW ANALYSIS OF A SMALL POLDER IN THE SOUTHWESTERN PART OF THE NETHERLANDS,
Institute for Land and Water Management Research, Wageningen (Netherlands).
For primary bibliographic entry see Field 02F.
W69-05927

A RECORDING FIELD TENSIOMETER WITH RAPID RESPONSE CHARACTERISTICS,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 02G.
W69-05931

7C. Evaluation, Processing and Publication

ENSITIVITY ANALYSIS METHOD OF YSTEM IDENTIFICATION AND ITS POTEN-IAL IN HYDROLOGIC RESEARCH,
nvironmental Dynamics, Inc., Los Angeles, Calif.; nd Banaras Hindu Univ., Varanasi (India).
'enkateswararao Vemuri, John A. Dracup, and R. . Erdmann.
/ater Resources Res, Vol 5, No 2, pp 341-349, pr 1969. 9 p, 1 fig, 7 ref, 2 append.

escriptors: *Simulation analysis, *Synthetic ydrology, *Mathematical models, *Computer odels, Hydrologic data, Analog models, Analog mputers, Digital computers, Systems analysis, arametric hydrology, Statistical methods.
entifiers: *Sensitivity analysis.

nsitivity analysis should be an integral part of early every hydrologic study. At an elementary vel, sensitivity analysis is useful in studying the lative sensitivity of the result to the data input. udying the sensitivity of a hydrologic system to anges in its parameters and initial conditions akes it possible not only to gain insight into a stem's behavior but to derive simple computa-onal algorithms for the identification of unknown arameters. The fact that sensitivity analysis leads simple initial-value problems makes it ideal for echanization on an analog computer. The com-tational steps involved in implementing identifi-tion algorithms based on sensitivity analysis are latively simpler than those based on such other ethods as quasilinearization. The applicability of is method to identify both lumped and distributed drologic systems with deterministic or statistical put-output data is demonstrated. (Knapp-USGS) 69-05603

MULATION OF EVAPORATION FROM CON-'ANT SOURCE WITH FINITE AREAS,
lifornia Univ., Los Angeles.
iau Shih, and John A. Dracup.
ater Resources Res, Vol 5, No 1, pp 281-290, b 1969. 10 p, 8 fig, 1 tab, 9 ref. OWRR A-028-AL, WRC No. W198.

escriptors: *Evaporation, *Computer models, ass transfer, Simulation analysis, Heat budget, drologic budget, Digital computers, Analog mputers, Resistance networks, Mathematical odels, Convection, Diffusion, Lakes, Reservoirs, inds, Solar radiation.
entifiers: *Hybrid computer methods.

aporation from finite areas with constant sources letermined by simulating the mass transfer equa-n. The equation of mass transfer in a turbulent nosphere describes the movement of mass, water por, and momentum. The process of transferring ter vapor by evaporation from a constant source n be analyzed by the solution of this diffusion uation. A hydrid computer simulation method to ve the three-dimensional nonuniform diffusion uation is described. The proposed technique can ndle any geometric configuration of lakes and ervoirs. Using a finite difference method, the rtial differential equation is transformed into a of algebraic equations. The analogy between se algebraic equations and the node equations a passive resistance network plane makes the brid computer simulation technique applicable solve problems of this type. A vertical plane, per-ndicular to the direction of the wind, is simulated a passive resistance network. The problem is ved by moving the vertical plane in the direction the wind. Obtaining the solution using a simula-n technique involves a repetitive process of ob-ving voltages on the simulation network. The en-process is performed in the hybrid computer tem using the digital computer as the control. is is a general method available to analyze the aporation phenomena using a mathematical solu-n of the diffusion equation. (Knapp-USGS)

W69-05636

MATHEMATICAL MODEL AND FORTRAN IV PROGRAM FOR COMPUTER SIMULATION OF DELTAIC SEDIMENTATION,
Stanford Univ., Calif.; and Canterbury Univ., Christchurch (New Zealand).
G. F. Bonham-Carter, and Alex J. Sutherland.
Kans State Geol Surv Computer Contrib 24, Kans Univ, 1968. 56 p, 16 fig, 12 tab, 21 ref, 2 append. N00014-67-A-0112-004. Tech No. NR388-081.

Descriptors: *Computer programs, *Sedimentation, *Estuaries, *Deltas, Computer models, Alluvium, Statistical models, Mathematical models, Simulation analysis, Sediment transport.
Identifiers: *FORTRAN programs.

A FORTRAN IV program for simulating deltaic sedimentation at a single river-channel mouth is presented. A sediment-laden river flowing into a tideless, currentless marine basin is modeled as a plane jet discharging horizontally at the ocean surface. A velocity field is calculated using equations for open-channel and plane-jet flow. Sediment behavior is treated statistically; nominal sediment particles are traced along trajectories from the mouth as they spread laterally and settle vertically. The rate of sediment accumulation is calculated for each cell of a horizontal accounting grid. Input parameters include channel dimensions, water and sediment discharge, grain-size distribution and bottom topography. Experiments with a static simulation model illustrate the depositional variation produced by changes in grain size, river depth, and slope. The depositional area is narrow in plan view; in elevation, foreset slopes are a function of grain-size and hydraulic parameters, and are normally less than 1 deg. A dynamic model permits a delta platform to build forward during several time increments, nominal particle trajectories adjusting automatically to the position of the delta lip. Experiments illustrate the formation of bars building transversely across the river mouth and the development of submerged levees close to the mouth at the margins of the main flow. The FORTRAN flow chart and program listing for IBM 360 are included with test computation inputs and results. (Knapp-USGA)
W69-05657

THE FITTING OF GROWTH AND ALLIED CURVES OF THE ASYMPTOTIC REGRESSION TYPE BY STEVENS'S METHOD,
London Univ. (England). Dept. of Statistics.
R. W. Hiorns.
Tracts for Computers, No XXVIII, M S Bartlett (ed) Cambridge Univ Press, England, 1965. 52 p, 19 ref.

Descriptors: *Data processing, *Regression analysis, *Statistical methods, Population, Biology, Digital computers, Computers, Mathematical models.
Identifiers: *Growth curves, *Asymptotic regression curves, *Stevens' method, F-values, Mice, Physiology, Psychology, Learning curves, Mitscherlich's law, Compertz law, Life tables, Logistic curve, Demography, Maximum-likelihood estimators, Computation.

The problem of fitting asymptotic regression curve (FORTRAN notation) y= ALPHA+ BETA * RHO ** x, where x takes integral values 0,1,2,... (N-1), frequently occurs in practice (eg, in population studies). Report's tables facilitate fitting of this curve by W L Stevens' method, providing Stevens' F-values for ranges N= 5 (1)30 and r-sub-0= 0.10 (0.01)0.90, where r-sub-0 is a first estimate of RHO. The calculations, explained in introduction of report, may be rapidly made on a desk calculator or can be easily programmed for a digital computer. Author provides example in which growth data for mice are fitted. Method can be used for alternative models including y= ALPHA+ BETA * e ** (-GAMMA * x), growth curve of physiology and biology or learning curve of psychology; y= y-sub-0+ d * (1 - 10 ** (-k * x)), Mitscherlich's law describing fertilizer response in agriculture, and its alternative form, y= A * (1 - 10 ** (c-prime * (x+b-prime))); z= e ** (ALPHA+ BETA * RHO ** x), Gompertz law used in preparation of life tables and in economic predictions; and z= 1/ (ALPHA+ RHO ** x), logistic curve used for description of population growth in demographic studies. Author procedures for extension of method to large and small values of r, the maximum-likelihood estimate of RHO. (Eichhorn-Wis) W69-05711

THE STRATEGY OF BUILDING MODELS OF COMPLEX ECOLOGICAL SYSTEMS,
Canadian Dept. of Forestry, Victoria (British Columbia).
For primary bibliographic entry see Field 06A.
W69-05713

THE ANALYSIS OF DETERMINATION IN POPULATION SYSTEMS,
Forest Service (USDA), New Haven, Conn. Northeastern Forest Experiment Station.
For primary bibliographic entry see Field 06A.
W69-05714

OPERATIONAL HYDROLOGY USING RESIDUALS,
Federal Water Pollution Control Administration, Washington, D. C.
For primary bibliographic entry see Field 06A.
W69-05847

LEAST SQUARES ESTIMATION OF MIXING COEFFICIENTS,
Vanderbilt Univ., Nashville, Tenn.; and Boeing Co., Huntsville, Ala.
For primary bibliographic entry see Field 06A.
W69-05862

THRESHOLD PREDICTION AND CHARACTERISTICS OF LOG-NORMAL PHENOMENA,
Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.
Edward R. Hermann.
Environ Res, Vol 1, No 4, pp 359-369, Dec 1967. 7 fig, 1 tab, 7 ref.

Descriptors: *Estimating equations, *Statistical methods, *Statistical models, Analytical techniques, Data processing, Environmental effects, Epidemics, Eutrophication, Radioecology, Streptococcus, Toxicity.
Identifiers: *Environmental health, *Log-normal distributions, *Statistical distributions, *Threshold prediction, Biological effects, Blood pressure, Chemical effects, Carcinogenesis, Data presentation, Data transformation, Gaussian distribution, Geometric mean, Industrial health, Median, Mode, Particle kinetics, Pearson's beta distribution, Psychophysical effects, Radiation effects, Toxicology, Hearing.

Measurements of many phenomena of interest in environmental health may be distributed in a log-normal manner. The zero point of occurrence (threshold) of such phenomena is important. A simple equation is derived for determining the point of origin of such distributions, based on their geometric mean, standard deviation of geometric mean, and median. Statistical methods for analyzing data and applying the equation are presented for three general cases: distributions in which (1) the origin and zero reference of measurement coincide, (2) the origin and zero reference of measurement do not coincide, and (3) the parameter of measurement is a log function and has an arbitrarily selected positive value for its reference point which is relative, not absolute. Three diverse sets of log-normal data were used to illustrate application to above cases: incubation periods observed during an epidemic of streptococcal sore throat, systolic blood pressure measurements among middle-aged industrial employees, and thresholds of hearing

among high school students. The procedures detailed can be applied to data analysis arising from research into toxicology, radiation exposure, physical or chemical stimulus responses in biological or psychophysical systems, carcinogenesis, particle kinetics, and other phenomena yielding log-normal data sets. (Eichhorn-Wisc)
W69-05871

THE ROLE OF SOME STATISTICAL AND MATHEMATICAL METHODS IN THE INTERPRETATION OF REGIONAL GEOCHEMICAL DATA,
Royal School of Mines, London (England); and Imperial Coll. of Science and Technology, London (England). Dept. of Geology.
For primary bibliographic entry see Field 02J.
W69-05895

HYDROGEOLOGIC DATA FROM FOUR LANDFILLS IN NORTHEASTERN ILLINOIS,
Illinois State Geological Survey, Urbana.
G. M. Hughes, R. A. Landon, and R. N. Farvolden.
Environ Geol Note No 26, Ill State Geol Surv, Mar 1969. 42 p, 5 fig, 8 tab, 2 ref. Grant No. 5-D01-01-00006-02.

Descriptors: *Data collections, *Land fills, *Disposal, *Illinois, Garbage dumps, Waste disposal, Leaching, Water quality, Hydrogeology, Water levels, Chemical analysis, Path of pollutants, Neutron activation analysis, Piezometers, Clays, Boreholes.
Identifiers: *Sanitary landfills, Garbage leaching.

Sanitary landfills at 4 sites in Illinois were drilled and samples of water and solid materials were analyzed to determine the hydrogeologic conditions and effects of waste disposal in glaciated terrain. The tabulated data include sites of piezometers and samples, drillers logs, sieve analyses of earth materials, clay mineral analyses, chemical analyses of leachate and groundwater, and neutron activation analyses. The landfill maps include piezometer locations, locations of cross sections, and water table contours. (Knapp-USGS)
W69-05896

MARKOV CHAIN STORAGE MODELS FOR STATISTICAL HYDROLOGY,
Cornell Univ., Ithaca, N. Y.
William H. Kirby.
Water Resources Center Pub, Cornell Univ, 1968. 155 p, 19 fig, 38 ref.

Descriptors: *Statistical models, *Mathematical models, *Markov processes, *Streamflow forecasting, Stochastic processes, Time series analysis, Reservoir storage, Water management (Applied), Probability, Unit hydrographs, Hydrograph analysis, Runoff forecasting, Digital computers, Synthetic hydrology.
Identifiers: Reservoir reliability.

The basic theory of finite Markov chains is reviewed and its application to reservoir storage problems is given. The theory provides a simple but detailed mathematical model for the serial dependence observed in hydrological phenomena, particularly when used in conjunction with time series analysis. Markov chains may be applied to reservoir design problems. Computation time is not long, making Markov models particularly useful in the preliminary stages of design. (Knapp-USGS)
W69-05917

NUMERICAL MODELING OF UNSATURATED GROUND WATER FLOW,
Kansas Univ., Lawrence.
For primary bibliographic entry see Field 02F.
W69-05918

CLIMATIC ATLAS OF THE UNITED STATES,
Environmental Science Services Administration, Washington, D. C.
For primary bibliographic entry see Field 02B.
W69-05922

A COUNTRY-WIDE STUDY OF INTENSE RAINFALL FOR THE UNITED KINGDOM,
Hydrological Research Unit, Wallingford (England).
For primary bibliographic entry see Field 02B.
W69-05925

COMPUTATION OF ANNUAL NORMAL FLOW OF INTERMITTENT WATERCOURSES AND MOUNTAIN RIVERS IN THE UKRAINIAN CARPATHIANS,
Ukrainskii Nauchno-Issledovatelskii Gidro-Meteorologicheskii Institut, Kiev (USSR).
For primary bibliographic entry see Field 02E.
W69-05950

COMPUTATIONS OF LEVEL CHANGES AND RUNOFF DISTRIBUTION IN A DELTA BASED ON OBSERVATIONAL DATA (DANUBE DELTA AS AN EXAMPLE),
State Oceanographic Institute, Moscow (USSR).
For primary bibliographic entry see Field 02E.
W69-05951

08. ENGINEERING WORKS

8A. Structures

SEDIMENT CONTROL METHODS, INTRODUCTION AND WATERSHED AREA,
American Chemical Society, New York. Hydraulics Div.
For primary bibliographic entry see Field 02J.
W69-05620

THE UDA WALAWE RESERVOIR PROJECT,
Department of Irrigation, Colombo (Ceylon). Div. of Planning, Research and Designs.
For primary bibliographic entry see Field 04A.
W69-05653

FLUID MECHANICS OF DOWNSTREAM FISH PASSAGE STRUCTURES,
Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 08I.
W69-05667

REEVALUATION AND RECONSTRUCTION OF CALIFORNIA DAMS,
California State Dept. of Water Resources, Sacramento.
Clifford J. Cortright.
Prepr 771, Amer Soc Civ Eng Annu Meet, New Orleans, La, Feb 1969. 38 p.

Descriptors: *Dams, *Earth dams, *Concrete dams, Hydraulic-fill dams, Surveys, *Dam failure, Arch dams, Gravity dams, Safety, California, Dam design, Spillways, Hydraulic structures, *Rehabilitation.
Identifiers: Surveys (Data collection), *Remedial treatment.

The State of California, effectively administering a dam safety law since 1929, has found it advisable in more recent years to continuously reevaluate existing structures as experience sheds more light on dam behavior. By means of this critical inquiry, essential improvements needed in structures can be made to better ensure the growing population of the state against the consequences of dam failures. About 90 of the nearly 1100 dams in California have been identified as meriting a structural design reevaluation. Of this number, evaluation has been completed on 33 dams and a detailed investigation found necessary. Evaluation has been completed on 15 additional dams and the adequacy of the structural design has been verified. Corrective action has been ordered on 17 other dams. To da
spillway capacity reevaluation has been advised f
80 dams. Studies have been completed for 33 da
and so far corrective action has been found nec
sary for 18 of those dams. Several examples
findings resulting from reevaluation studies a
corrective action, either completed, scheduled,
determined advisable, are given. (USBR)
W69-05804

DEVELOPMENT OF TUNNELING METHO AND CONTROLS FOR WATER RESOURC PROJECTS,
Bureau of Reclamation, Salt Lake City, Utah.
Ellis L. Armstrong.
Pap, Amer Soc Civ Eng Water Resour Eng Co
New Orleans, La, Feb 1969. 33 p, 16 fig, 2 tab,
ref.

Descriptors: *Tunnel construction, Tunnel failu
*Tunneling, Safety, *Tunneling machines, Tunn
linings, Tunnels, Cost comparisons, Laser, C
trends, Overbreak, Rock bolts, Supports, Surve
ing.
Identifiers: Tunnel supports, Cost savings, Blastin

Improvements in equipment and methods duri
the past 15 yr have kept tunnel excavation co
from appreciable increases while the general co
struction cost index has doubled. Tunnel drilli
rates have increased from 20 ft/wk 100 yr ago
100 ft/wk 50 yr ago and to about 300 ft/wk toda
A milestone in tunnel driving was the 3-1/2-mi-lo
Fucinus Tunnel (19 ft wide and 9 ft high) started
A.D. 41 and requiring 30,000 slaves 11 yr
complete. The concept of boring machines to dr
tunnels goes back to 1882, but the greatest advan
has been made in the last 5 yr. A table lists th
major completed mole tunneling projects. Co
savings up to 40% over conventional drill-shoo
muck cycle methods can be proven. The requir
ment for and types of tunnel supports being use
are discussed. Improvements and advances are e
pected in tunnel linings because the excavation ra
has surpassed the lining rate. A laser beam is an e
cellent control method for precision drilling with
boring machine. Tunneling safety has progressed
a satisfactory level. During a million man-hours
Blanco Tunnel, Colo, only 6 minor lost-time a
cidents occurred. (USBR)
W69-05815

EXPERIENCE WITH AND EVALUATION O CRITICAL PATH METHODS,
Brown and Root, Inc, Houston, Tex.
Eric Jenett.
Chem Eng, Vol 76, No 3, pp 96-106, Feb 1969. 1
p, 3 fig, 1 tab.

Descriptors: *Critical path method, Administra
tion, Management, Design, *Scheduling, Construc
tion, Purchasing, *Evaluation, Flow diagrams, Log
ic, Computers, Resource allocation, Estimating
Mathematics, Costs, Contracts, Planning.
Identifiers: Bar graphs.

Ten yr experience with critical path method
(CPM) for scheduling the design, equipmen
purchase, and construction of major chemical
process plants is evaluated, including pertinen
comments on pitfalls and successes with thes
methods. This experience covers worldwide pro
jects of all types and sizes under a variety of condi
tions. General subjects discussed include: objec
tives of CPM, experiences from other areas, CPM
and the contract, use of computers, standard CPM
logic outlines, irrefutable vs desirable logic
resources and CPM, cost and CPM level of detail
coding, updating, scheduling to resources, miscon
struing and limiting float, and comments on
precedence diagramming. Where effective prac
tices vary, differences are pointed out. (USBR)
W69-05817

WATER DISTRIBUTION SYSTEMS ANALYSIS,
Technion - Israel Inst. of Tech., Haifa; Massachusetts Inst. of Tech., Cambridge; and Maguire (Charles A.) and Associates, Boston, Mass.
For primary bibliographic entry see Field 06B.
W69-05848

8B. Hydraulics

SEDIMENT CONTROL METHODS, INTRODUCTION AND WATERSHED AREA,
American Chemical Society, New York. Hydraulics Div.
For primary bibliographic entry see Field 02J.
W69-05620

TRANSLATIONS OF FOREIGN LITERATURE IN HYDRAULICS.
American Society of Civil Engineers, New York. Committee on Hydromechanics.

ASCE Proc, J Hydraul Div, Vol 94, No HY6, Pap 6211, pp 1375-1382, Nov 1968. 8 p, 106 ref.

Descriptors: *Translations, *Information retrieval, Technical writing, *Hydraulics, Water distribution (Applied), Foreign research, Turbulent flow, Hydrodynamics, Hydraulic engineering.
Identifiers: *Foreign literature, ASCE Committee on Hydromechanics.

To bring to hydraulic engineers and various water development people an up-to-date list of foreign literature translations on hydraulics, the ASCE Committee on Hydromechanics set up a task committee on translations which will from time to time issue progress reports with appropriate items. The second list is the first one issued since the new ASCE Manual 35, 'A list of translations of foreign literature on hydraulics', was compiled on 1967. This list which contains 106 items including author, title, location data, and file number where the report can be obtained, is considered an addendum to Manual 35. The Manual will be revised periodically. (Lang-USGS)
W69-05655

REEVALUATION AND RECONSTRUCTION OF CALIFORNIA DAMS,
California State Dept. of Water Resources, Sacramento.
For primary bibliographic entry see Field 08A.
W69-05804

DIVERSION WORKS FOR CONSTRUCTION,
U S Army Corps of Engineers, Vicksburg, Miss.
For primary bibliographic entry see Field 04A.
W69-05816

ON STANDING WAVES IN A CURVED CANAL,
Reading Univ. (England).
Johns, and A. M. O. Hamzah.
Fluid Mech, Vol 34, Part 4, pp 759-768, Dec 68. 10 p, 2 fig, 1 tab, 6 ref.

Descriptors: *Standing waves, *Canals, *Curves, Hydraulics, Estuaries, Canal design, Tsunamis, Waves (Water), *Bends, Oscillation.
Identifiers: Tidal waves.

The dynamics of long water waves are considered in a curved geometry representing a canal bend. The presence of the bend produces a spectrum of transverse oscillations in the canal. Associated dominant amplitudes are evaluated for tidal periods and higher frequencies representative of tsunamis. Low-frequency waves do not lead to significant transverse amplitudes. For tsunamis, the presence of the bend may result in considerable changes in the local wave amplitude. (USBR)
W69-05827

SURGE FLOW: A MODEL OF THE WALL LAYER,
Florida State Univ., Tallahassee. Dept. of Geology.
William F. Tanner.
Southeastern Geol, Vol 10, No 2, pp 93-110, Apr 1969. 18 p, 2 fig, 1 tab, 13 ref.

Descriptors: *Unsteady flow, *Waves (Water), *Boundary layers, Currents (Water), Erosion, Ripple marks, Sedimentary structures, Reynolds number, Froude number, Laminar flow, Turbulent flow, Hydraulic models.
Identifiers: *Kinematic waves, Surge flow.

Thin sheets of flowing water were studied on various inclined surfaces, including smooth glass, asphalt, concrete, wood, loose sand and fixed sand grains. Flow was accompanied by more-or-less regular surges. Controlled variables were slope angle, discharge, surface roughness, surface tension and viscosity. Surges initially constitute an almost-random phenomenon; they are quickly modified by surface tension and other effects and become regular in geometry and speed. Similar features have been studied in the thin wall layer in a smooth-bottomed tilting flume. The very low shear ridges, which actually appear under water on sand beds before individual grain motion is visible, are thought to be caused by the wall layer equivalent of thin sheet surge flow. Such ridges, once formed, require rapid development of bottom eddies, which shape the ridges into ordinary sub-aqueous ripple marks. If this is correct, a form of surge flow in the wall layer is responsible for initiation of sediment particle motion. Work with tracers also indicates that the regime in the wall layer is laminar but rapid, and that initiation of sediment motion is a Froude phenomenon; once subaqueous ripple marks develop, continuation of sediment transport is a Reynolds phenomenon. Observation of natural thin sheet flow, over mobile granular beds, shows that any one of the several Froude regimes can form preservable sand surface markings which are not ripple marks. (Knapp-USGS)
W69-05892

8C. Hydraulic Machinery

COMPARATIVE MODEL TURBINE TESTS,
Demers (George), Consulting Engineers (Quebec).
Ronald E. Passmore.
Water Power, Vol 21, No 1, pp 26-30, Jan 1969. 5 p, 4 ref.

Descriptors: *Hydraulic turbines, *Efficiencies, *Model tests, Losses, *Specifications, Acceptance testing, Laboratory tests, Test facilities, Francis turbines, Structural design, Mechanical properties, Prototypes, Foreign research, Models, Pelton turbines, *Test procedures, Hydraulic design, Bids, Design standards, Manufacturing, *Hydraulic models.
Identifiers: Canada, Procedures, Test results.

Many points are taken into consideration when preparing specifications for selecting turbines on the basis of comparative model tests. When drafting specifications of this type, various items should be discussed with as many prospective bidders as possible to obtain a concensus and avoid later controversy. Where differences of opinion remain, the purchaser or consulting engineer should seek the advice of the laboratory, but must be guided by his own judgment. Those parts of the specification that are solely within the province of the laboratory can be dealt with only after the performing laboratory has been identified. Completeness is essential and cannot be overemphasized. Even then there will be bids that are noncompliant either by stipulating conditions different from those specified by the purchaser, or by containing contrived or accidental ambiguities and conflicting statements. These must be resolved before the contract is awarded if later disputes are to be avoided. A well-planned program of comparative testing automatically eliminates such areas of uncertainty. (USBR)
W69-05806

DAMPING OF SWITCHING OVERVOLTAGES IN EHV-NETWORKS--NEW ECONOMIC ASPECTS AND SOLUTIONS,
Brown, Boveri and Co. Ltd., Baden (Switzerland).
P. A. Baltensperger, and P. Djurdjevic.
Trans Pap No 69 TP 36-PWR, Inst Elec Electron Eng Winter Power Meet, New York, N Y, Jan 1969. 12 p, 11 fig, 3 tab, 5 ref.

Descriptors: *Extra high voltage, *Circuit breakers, Thermal stress, *Resistors, Costs, Lightning arresters, Transmission lines, Economics, *Closing, Damping, Capacitors, Foreign research, *Electric insulation.
Identifiers: *Switching surges, Shunt reactors, Spark gaps, Switching, *Overvoltage, Switzerland.

Insulation is important in ehv networks having nominal voltages of 765 kv and above. An upper physical limit exists for the insulation strength that cannot be increased by reasonable technical methods. Costs of achieving an insulation level near this limit are high. Limiting overvoltages from all sources to an acceptable value by some method other than insulation is necessary. Closing resistors on circuit breakers is an effective way of damping closing overvoltages. This report discusses the use of closing resistors and presents a new application that separates resistors from breakers. Technical and economic advantages of separate resistors are given. One attractive feature of the scheme permits limiting closing overvoltages and damping voltage oscillations on the line upon interruption, avoiding a trapped charge.
W69-05809

CORONA MEASURING TECHNIQUES FOR POWER TRANSFORMERS,
Westinghouse Electric Corp., Muncie, Ind.; and Westinghouse Electric Corp., Pittsburgh, Pa.
H. R. Moore, V. L. Boaz, and T. W. Dakin.
Conf Pap 69 CP 34-PWR, Inst Elec Electron Eng Winter Power Meet, New York, N Y, Jan 1969. 10 p, 11 fig, 1 tab, 7 ref.

Descriptors: *Power transformers, *Electrical coronas, Attenuation, Electrical equipment, Radio interference, Quality control, *Measurement, Characteristics, Electric insulation, Electric potential, Oscillographs, Faults (Electrical), Instrumentation, Pulses, Voids, Calibrations, Laboratory tests.
Identifiers: Dielectric properties, *Electric discharges.

Factors influencing the observed level of corona or partial discharge measurements on large power transformers are discussed. Corona measurements are usually made with 1-megahertz radio influence voltage meters coupled to the potential tap of condenser-type bushings. This is a worthwhile method for quality control corona tests if sufficient data and experience are available to interpret test results. Measuring picocoulomb pulse magnitudes with an integrating-type detector offers hope for achieving more accurate comparison of discharges in different transformer windings and with insulation models, considering the coupling factor from the discharge site to the measurement terminal. Principles involved in the picocoulomb pulse magnitude method are discussed. (USBR)
W69-05810

A NEW SURGE-LIMITING DEVICE FOR HIGH VOLTAGE STATIONS,
Duke Power Co., Charlotte, N.C.
Herman B. Wolf.
Conf Pap No 69 CP 93-PWR, Inst Elec Electron Eng Winter Power Meet, New York, N Y, Jan 1969. 6 p, 5 fig.

Descriptors: *Resistors, *Capacitors, Lightning arresters, *Surges, Electrical equipment, Field tests, Lightning, Switchyards (Electrical), Transmission (Electrical), Capacitance, Failures, Electric insulation, Laboratory tests.
Identifiers: *Switching surges, *Spark gaps, *Overvoltage, *Protection (Electrical), *Switching, Flashover, Lightning protection.

A new device is described for limiting the surge voltage rise on a high-voltage bus to a predetermined maximum value, without chopping action. Experience based on 11 yr operation of four 3-phase protective capacitor installations (2 on 100-kv buses and 2 on 44-kv buses) provided background data for developing the surge-limiting device. Power laboratory tests indicate that desired surge protection can be realized with no 60-hertz follow current. The device will limit surge voltage from lightning and switching surges on high-voltage buses to a predetermined maximum value so that equipment having reduced BIL may be safely used. When this device is used with such equipment, the protection ratio will be as great or greater than the protection ratio achieved when full BIL equipment is used with modern lightning arresters. The device will reduce the rate of voltage rise of a surge appearing on the high-voltage bus; continuously connected capacitors add kvac to the system. (USBR)
W69-05811

INFLUENCE OF SHUNT REACTORS ON SWITCHING SURGES,
Centro Elettrotecnico Sperimentale Italiano, Milan.
A. Clerici, G. Ruckstuhl, and A. Vian.
Conf Pap No 69 CP 116-PWR, Inst Elec Electron Eng Winter Power Meet, New York, N Y, Jan 1969. 14 p, 14 fig, 1 tab, 7 ref, append.

Descriptors: Extra high voltage, *Circuit breakers, Resistors, Faults (Electrical), *Transmission lines, Closing, Transmission (Electrical), *Surges, Electric insulation, *Transients, Oscillation, Losses, Foreign research, Analysis, Inductance.
Identifiers: Italy, *Switching surges, *Shunt reactors, *Overvoltage, Switching.

On the basis of transient network analyzer studies, the influence of ehv shunt reactors on overvoltages occurring during breaker operations on transmission systems is discussed. The comparative importance of line losses and reactor losses on the decay of trapped charge voltages oscillating at frequencies governed by line capacitances and shunt reactor inductances is analyzed. Emphasis is placed on the influence on these trapped charge voltage oscillations of different types of faults and line asymmetries. Overvoltages following closing and reclosing operations on different ehv systems with and without shunt compensation are studied. A detailed investigation on two 500-kv lines permits conclusions to be drawn about the effect of shunt reactors in reducing maximum overvoltages and their cumulative frequency distribution, and about the influence of shunt compensation on optimization of preinsertion resistors. Some reduction in reclosing surges on shunt-compensated lines is evidenced. (USBR)
W69-05812

EXPERIENCES ON STARTUP AND TRIAL OPERATION AT YARDS CREEK PUMPED STORAGE PROJECT,
Jersey Central Power and Light Co., Morristown, N. J.; and Tippetts-Abbett-McCarthy-Stratton, New York.
R. J. Swed, and K. H. Yang.
Pap No 68-WA/FE-14, Amer Soc Mech Eng, Winter Annu Meet, New York, N Y, Dec 1968. 9 p, 9 fig.

Descriptors: *Pumped storage, *Operation and maintenance, Water hammer, Pump turbines, Automatic control, Supervisory control (Power), Pumping, Generators, Electric motors, Hydraulic machinery, Electrical equipment, *Vibrations, Instrumentation, Acceptance testing, Field tests, *Noise.
Identifiers: *Yards Creek Project (Del), Pump-generators, Load rejection, Generator-motors.

Startup and trial operation problems encountered at Yards Creek Pumped Storage Project, Del, are discussed; solution methods are given. The Yards Creek installation consists of 3 vertical reversible pump turbine units rated 150,500 hp each as turbines under 656-ft minimum net head. As a pump, each unit will require an input of 186,000 hp at 691-ft minimum total dynamic head for a discharge of 2175 cfs. Initially, Unit 3 was operated as a pump, and balanced in this mode of operation until runout readings of the shaft were acceptable. After sufficient water was stored in the upper reservoir, the unit was run in the generating mode; shaft runout was excessive and rebalancing was required, resulting in a need to compromise the balance for both modes of operation. This is only one problem encountered with these pumped storage units. Other problems are covered to stimulate exchanging experiences as a help in developing the art of pumped storage. (USBR)
W69-05824

8D. Soil Mechanics

SURVEY OF WATER INDUCED LAND-INSTABILITY HAZARDS IN THE PORTLAND, OREGON REGION,
Portland State Coll., Oreg. Dept. of Earth Science; and Oregon State Univ., Corvallis.
Leonard Palmer.
Water Resources Res Center Final Rep, Jan 1, 1969. 8 p, 1 map. OWRR Project A-004-OREG.

Descriptors: *Landslides, *Hydrologic aspects, *Oregon, Debris avalanches, Mud flows, Mass wasting, Disasters, Earthquake engineering, Land subsidence.
Identifiers: Land instability hazard, Portland (Ore).

A survey of water induced land-instability hazards in the Portland, Oregon region was conducted from January through June, 1968. Existing information on such hazards was compiled from government, industrial and private sources. Hazards were found to be more extensive than previously recognized. Problem areas were surveyed during severe storm periods to observe hazards, and during fair weather to learn recognition of potential hazards. It was found that land-instability hazards occur predominantly in the winter rainy season and are directly related to hydrologic conditions, and urban expansion increases the severity of most types of hazards by disturbing the natural hydrologic and physiographic processes. Debris flooding and earth sliding are intensified by increased run-off and by disrupted subsurface water conditions following construction of structures in hazard areas. The study of distribution of hazards can allow remedial zoning and building control to reduce the hazard potential. The mechanisms and natural conditions in hazard areas are only generally recognized, but they appear to be related to surface processes and subsurface materials as affected by water conditions. The geohydrologic conditions which allowed most of the property damage in the Alaskan Good Friday earthquake of Mar 27, 1964 show great similarity to conditions in Portland. Densely populated areas, hospitals, dams and civic buildings are located in Portland's hazard potential sites. Urban expansion causes disruption of the natural hydrologic conditions by sewage and run-off changes which activate serious hazards to life and property. (Knapp-USGS)
W69-05640

VICTOR A HARDER REALTY AND CONSTRUCTION CO V CITY OF NEW YORK (DAMAGES CAUSED BY EXCAVATION AND GROUNDWATER REMOVAL).
For primary bibliographic entry see Field 06E.
W69-05786

MONTELEONE V BOH BROS CONSTRUCTION CO (LIABILITY FOR DAMAGE CAUSED BY PILE DRIVER VIBRATIONS).
For primary bibliographic entry see Field 06E.
W69-05799

SETTLEMENT JOINTS IN BAIGUL DA SPILLWAY,
A. N. Harkauli, M. M. L. Khanna, and H. S. S. Singhal.
Irrig Power, India, Vol 25, No 3, pp 281-289, Jul 1968. 9 p, 3 fig, 4 ref.

Descriptors: *Earth dams, *Settlement, *Spillways, *Joints, Foundation investigations, *Differential settlement, Bearing capacities, Unconfined compression, Consolidation, Foreign design practices, Internal friction, Cohesion, Water stops, Rigid foundations, Dam foundations, Hydraulic structures.
Identifiers: Bearing pressure, Foundation modulus, Baigul Dam (India), India.

The magnitude of anticipated settlement under the piers, crests, and wingwalls of Baigul Dam spillway required dividing the structure by settlement joints. Baigul is a homogeneous earth dam with a maximum height of 36 ft. The upper 10-15 ft of the foundation is loose sandy silt or silty clay with a penetration resistance of less than 10. Large differential settlements between various parts of the structure were expected because of differences in bearing pressures (2 tons/sq ft for wingwalls and 1.5 tons/sq ft for piers). Using a load of 2 tons/sq ft and an average thickness of 20 ft, the clay layer could consolidate 7 in. with 50% of this settlement occurring in 1 yr. Unconfined compression tests determined the allowable bearing capacity of the clay layer. The depth of foundation concrete was kept to a value that allowed it to behave as a rigid foundation. Settlement joints utilized copper seals containing loops to take the differential settlements. The length of the loop was 2-3 in. more than the calculated total settlement. Details of various settlement joints are given. (USBR)
W69-05819

EXPERIMENTAL INVESTIGATION OF THE ACTIVE PRESSURE OF A CLAY SOIL ON A RETAINING WALL,
B. L. Tarasov.
Soil Mech Found Eng, No 2, pp 78-80, Mar-Apr 1968. 3 p, 4 fig, 4 ref.

Descriptors: *Active pressures, Lateral forces, *Earth pressure, Model studies, Eluvium, Foreign research, *Retaining walls, Density, Pressure gages, Soil mechanics, Wall friction, Poisson ratio, Cohesive soils, Clays, Displacements.
Identifiers: *At rest pressure, USSR, Rigid structures, Coulomb theory.

Lateral pressure of an eluvial soil on a rigid retaining wall is appreciably greater than the so-called active pressure. Lateral pressure of 2 types of eluvial soil on rigid and movable retaining walls was studied. Design of the test apparatus allowed lateral wall movement and rotation around the upper or lower edge. Soil pressure was measured with resistance gages and lever tensiometers. Greased artificial parchment paper was used to reduce friction between the soil and the tank's side walls. An increase of 7% in dry bulk density of loose soil produced a 35% increase in lateral pressure. Pressure exerted by dense filling agrees with at rest pressure calculated from the lateral pressure coefficient corresponding to Poisson's ratio. Lateral pressure on a rigid wall varies linearly with height, except at the bottom where there is a marked pressure reduction. A slight movement of the wall (0.5-1.0 mm) causes a sharp reduction and vertical redistribution of pressure. Active pressure must not be used to calculate thrust on a retaining wall that cannot move appreciably or is attached rigidly to other immovable structures. (USBR)
W69-05820

SHRINKAGE CHARACTERISTICS OF SOIL-CEMENT MIXTURES,
Mississippi Univ., University.
Kalankamary P. George.
Highw Res Rec, No 255, pp 42-58, 1968. 17 p, 11 fig, 4 tab, 18 ref.

escriptors: *Soil cement, *Shrinkage, Clay inerals, Montmorillonite, Soil moisture, Soil trength, Optimum moisture content, Cracks, Denity, Swelling, Kaolinite, Latticework, Measuring nstruments, Bibliographies, Compaction, Moisture ontent, Capillary action, Adsorption, Curing, Soil echanics.
lentifiers: Soil suction, Cement content, Capillary ension.

en soil samples representing a range in grain size, radation, and mineralogy were studied to provide nformation on factors affecting shrinkage and the echanism of shrinkage cracking. Linear shrinkge of 3- by 3- by 11-1/4-in. molded soil-cement eams at different cement contents was measured prescribed intervals. For the soils studied, rinkage varied with the cement content such that n optimum content can be found giving the least nount of shrinkage and providing satisfactory rength. Total shrinkage appears to be a function f the amount and kind of clay, with montmorilnite contributing more than other types. Shrinkge of soil-cement can be considerably reduced by mpacting to higher densities. Molding moisture as the most influence on shrinkage caused by loss moisture. Increasing the mixing temperature om 75 to 100 deg F tends to increase shrinkage. rinkage forces set up by the tension in capillary ater account for the volume change at fairly high midities. The liquid-adsorption phenomenon retes shrinkage and swelling to the interaction etween soil grains and water. Changes in lattice acing of the clay minerals with moisture is a third echanism affecting shrinkage. (USBR)
69-05825

LE TESTS GUIDE FOUNDATION DESIGN,
owry and Associates, Sacramento, Calif.
homas S. Wallace.
ound Fact, Vol 4, No 2, pp 8-11, 1968. 4 p, 6 fig, tab.

escriptors: Foundations, Buildings, *Foundation vestigations, *Pile foundations, Pile bearing apacities, Pile driving, Pile friction, Piles (Foundaons), Settlement, Tapers, Steel piles, *Friction les, Soil properties, Rebound, Penetration reistance, Water table.
entifiers: *Pile tests.

les having capacities up to 100 tons real load ere recommended for a 12-story building in ockton, Calif, as a result of on-site pile load tests. ltimate interior column loadings will exceed 1400 ps dead-plus-live load; an equivalent uniform essure throughout the building will be 4500 to 00 psf. The foundation is highly stratified alluvial eposits of silty clays, clayey silts, silty sands, and ear sands. The cohesionless soils are mediumense to dense; the cohesive soils are stiff to very ff. The ground-water table is 54 to 56 ft below ound surface. Laboratory tests indicated that les embedded approximately 50 ft would develop e design capacity through frictional resistance of least 80 tons. The pile test program included 2 ep-taper piles, an H pile, and a pipe pile. All piles ere driven with a differential steam hammer hav- an 8000-lb ram and a rated energy of 24,450 ft-. Driving records for each pile are given. Test ads were applied in 37.5- and 50-ton increments th intermediate rebound points. Load settlement rves are given for test piles. The best performing le was a step-taper pile with an 11-1/4-in.-dia tip. is pile was embedded 50.3 ft and sustained a 24- loading of 300 tons with a deflection of 0.88 in. USBR)
69-05843

ABORATORY LOAD TESTS ON BURIED LEXIBLE PIPE - PROGRESS REPORT NO 1,
ureau of Reclamation, Denver, Colo.
K. Howard.
ur Reclam Rep No EM-763, June 1968. 62 p, 44 , 6 tab, 7 ref, append.

escriptors: *Pipelines, Backfill, Soil mechanics, ohesive soils, Underground structures, Pressure measuring instruments, Test procedures, Laboratory tests, *Soil pressure, Strain gages, Embankments, Deflection, Lateral forces, Pressure sensors, *Steel pipes, Pipes, Deformation.
Identifiers: *Flexible pipes, Reinforced plastic mortar pipe, *Buried pipes, Pressure cells, Progress reports, Loading tests.

As part of a study on soil factors affecting the behavior of buried pipe, the Bureau of Reclamation is conducting research on the soil-structure interaction of buried flexible pipe. The main items of investigation on flexible pipe are soil pressures on the pipe and load-deflection relationships. Five load tests were performed on bare steel pipe and one test on reinforced-plastic mortar pipe. Pipes are buried in a portable soil container 7 ft deep, 6 ft wide, and 7 ft long, with surcharge applied to the surface of the soil by a large universal testing machine. Measurements of soil pressures on the pipe and soil container walls, changing dimensions of the pipe, soil movement around the pipe, and strain on the inner surface of the pipe are made during a 1-day loading sequence. The program eventually will cover tests on 18-, 24-, and 30-in.-dia steel pipe with wall thickness of 7, 10, and 14 gage. Further tests on reinforced-plastic mortar pipe will be included. (USBR)
W69-05845

GENERAL REPORT ON SHALLOW FOUNDATIONS, DEEP FOUNDATIONS WITHOUT PILES, PILE FOUNDATIONS,
Duke Univ., Durham, N. C.
Aleksandar S. Vesic.
Pap, Soil Mech Ser No 9, Duke Univ, Durham, N C, 1967. 33 p, 1 fig, 1 tab, 29 ref.

Descriptors: *Foundations, Foundation bearing tests, Preconsolidation, Pressure distribution, *Settlement, Consolidation, Bibliographies, *Pile foundations, Differential settlement, Expansive soils, Soil properties, Elasticity modulus, Elastic deformation, Footings, Soil mechanics, Pile friction, Penetration resistance, Bearing capacities.
Identifiers: Foundation modulus, In situ tests, Loading tests, Elastic foundations, Deformation modulus.

This report discusses 5 topics: (1) settlement of shallow foundations, (2) site preparation by preloading, (3) contact pressure distribution under foundations, (4) theory of deep foundations, and (5) tests on deep foundations. The conventional method of predicting consolidation settlement, based on confined compression tests in the laboratory, has been perfected to the point where an expected accuracy of plus or minus 20% can be claimed. Parameters from in situ tests should be used for the settlement analysis of foundations resting on cohesionless soils. Most analyses of pressure distribution at the contact between the foundation and the bearing soil layer are being made using the assumption that the soil behaves elastically. Effects of superstructure rigidity and variations in soil compressibility on contact pressure distribution are discussed. In some cases, expansive soils contribute more to differential settlement than deformation from newly imposed loading. An assessment of principal trends in the field of deep foundations is given. A new improvement in load test procedures of deep foundations is the constant-rate-of-penetration procedure, offering definite practical advantages over the established quasi-long term constant-stress-increment procedure. (USBR)
W69-05846

8E. Rock Mechanics and Geology

SURVEY OF WATER INDUCED LAND-INSTABILITY HAZARDS IN THE PORTLAND, OREGON REGION,
Portland State Coll., Oreg. Dept. of Earth Science; and Oregon State Univ., Corvallis.
For primary bibliographic entry see Field 08D.
W69-05640

MONTELEONE V BOH BROS CONSTRUCTION CO (LIABILITY FOR DAMAGE CAUSED BY PILE DRIVER VIBRATIONS).
For primary bibliographic entry see Field 06E.
W69-05799

SURGE FLOW: A MODEL OF THE WALL LAYER,
Florida State Univ., Tallahassee. Dept. of Geology.
For primary bibliographic entry see Field 08B.
W69-05892

8F. Concrete

BUREAU OF RECLAMATION EXPERIENCE WITH FROST ACTION ON CONCRETE,
Bureau of Reclamation, Denver, Colo.
Graydon E. Burnett, and Leland C. Porter.
Prepr, RILEM Int Symp Durability Concr, Prague, Czech, Sept 1969. 19 p, 10 fig, 12 ref.

Descriptors: Concretes, *Concrete testing, *Concrete technology, Frost action, Concrete mixes, Durability, *Freeze-thaw tests, Freezing, Test procedures, Laboratory equipment, Laboratory tests, Air entrainment, Air void ratio, Reviews, Test specimens.
Identifiers: Concrete properties, Freeze-thaw cycle, Frost resistance, *Freeze-thaw durability, Testing equipment, Concrete deterioration.

The development of freezing and thawing tests for concrete by the Bureau of Reclamation over the past 35 yr is reviewed. Tests were conducted manually from 1934 to 1946. Effects of varying temperatures and freezing cycles were evaluated and methods for evaluating concrete durability were studied. By the mid-1940's, freeze-thaw testing of concrete was adopted as an acceptance test for concrete aggregates and automatically controlled equipment was built. The apparatus tests 3-in.-dia specimens contained in rubber tubes and covered with tap water. Test specimens are alternately frozen and thawed by recirculating refrigerated brine and heated brine systems. A large walk-in air-freeze and water-thaw apparatus was built in 1956 to achieve greater flexibility for testing large or unusually shaped specimens and for varying the period of freezing and thawing. Results of freeze-thaw studies are summarized on air entrainment, effects from fineness of grinding portland cement, correlation with sodium sulfate soundness tests, and correlation with field performance. Exact correlation between laboratory tests and field performance has not been achieved because of the many variables that cannot be fully evaluated. (USBR)
W69-05801

CONCRETE--A NON-ELASTIC MATERIAL IN THE LABORATORY AND IN STRUCTURES,
Leeds Univ. (England).
Adam M. Neville.
Stanton Walker Lect No 6, Univ Maryland, College Park, Nov 1968. 20 p, 14 fig, 18 ref.

Descriptors: Concretes, *Concrete structures, Concrete technology, Concrete testing, Reinforced concrete, *Creep, Strength of materials, Brittle failures, Ductility, Elastic deformation, *Deformation, Stress, Elasticity modulus, Inelastic action, Foreign research, Design criteria, Strain, Bibliographies.
Identifiers: *Concrete properties, Great Britain, Cyclic loads, Design assumptions, Design practices, Stanton Walker Lectures.

Nonelastic properties of concrete as a structural material are reviewed in the 1968 Stanton Walker Lecture. Concrete is not a brittle material in the sense that materials are so considered when only a small strain develops before fracturing. Large strains may develop in concrete prior to fracturing, resulting in comparatively ductile failures in reinforced concrete columns and beams. If concrete were purely elastic and brittle, structural concrete failures would be too sudden and catastrophic for

use in highly statically indeterminate structures. The ductile behavior of concrete has contributed to the success of concrete as a structural material and is attributed to the ability to undergo creep. To determine whether actual properties of concrete differ significantly from assumed properties, 4 topics are discussed: nonelasticity of concrete in design; modulus of elasticity variations with time and stress; behavior of concrete under cyclic loading and under combined cyclic and sustained loads; and creep and creep Poisson's ratio under triaxial compression. There are no major discrepancies between design assumptions and reality because nonelasticity of concrete permits adjustment and accommodation so that dangerous unrelieved stresses are not induced. (USBR)
W69-05822

NONDESTRUCTIVE CONCRETE TESTS--GRAND COULEE SPILLWAY BRIDGE,
Bureau of Reclamation, Denver, Colo.
G. G. Hoagland.
Bur Reclam Rep No C-1299, Nov 1968. 30 p, 20 fig, 8 tab, 3 ref.

Descriptors: *Non-destructive tests, *Concrete testing, *Impact tests, Concrete structures, Wave velocity, Core drilling, Compressive strength, Arch bridges, Elasticity modulus, Keyways, Field tests, Deterioration, Concretes, Bridges, Ultrasonics.
Identifiers: Grand Coulee Spillway Bridge (Wash), *Sonic velocity tests, Soniscopes, Schmidt test hammer, *Impact hammers, Concrete properties.

Nondestructive sonic pulse velocity and impact hammer tests were conducted on the Grand Coulee Spillway bridge. Results were correlated with those from a small number of 6-in.-dia cores from noncritical areas to evaluate the bridge concrete. Additional tests were performed on concrete in areas showing minor distress. The concrete in the bridge is in excellent condition, having a compressive strength of 8700 psi (612 kg/sq cm) in the deck and 7630 psi (536 kg/sq cm) in the vertical walls. Pulse velocities indicate that the arch concrete is high quality and that concrete in the deck is slightly lower in quality, probably because of minor deterioration of the surface caused by traffic. (USBR)
W69-05823

CONCRETE-POLYMER MATERIALS, FIRST TOPICAL REPORT,
Brookhaven National Laboratory, Upton, N. Y.; Bureau of Reclamation, Denver, Colo.
M. Steinberg, J. T. Dikeou, L. E. Kukacka, J. E. Backstrom, and P. Colombo.
Brookhaven Nat Lab Rep BNL 50134 (T-509) and Bur Reclam Gen Rep 41, Dec 1968. 83 p, 43 fig, 55 tab, 14 ref. Available from Clearinghouse as BNL 50 134 at $3.00 in paper copy and $0.65 in microfiche.

Descriptors: *Concrete technology, Concrete mixes, Concrete testing, *Concretes, *Composite materials, Concrete structures, *Impregnation, Building materials, Materials, Materials engineering, Polymers, Chemical properties, Physical properties, Construction materials.
Identifiers: *Polymerization, *Concrete-polymer materials, Polymethyl methacrylate, Concrete properties, Corrosion resistance, Polystyrene.

The preparation, testing, and development of composite concrete-polymer construction materials are under investigation by a joint program of the Brookhaven National Laboratory and the Bureau of Reclamation, with the assistance of the Atomic Energy Commission and Office of Saline Water. Preformed air-entrained concrete and mortar can be fully impregnated with a monomer polymerized in situ either by radiation or thermalcatalytic techniques. Tests of polymethyl-methacrylate and polystyrene-impregnated concrete show improvements of (1) 285% increase in compressive strength, (2) 292% increase in tensile strength, (3) 80% increase in modulus of elasticity, (4) 256% increase in modulus of rupture, (5) 44% increase in flexural modulus, (6) over 300% increase in freeze-thaw resistance, (7) 73% increase in impact hammer test values, (8) decrease in water permeability to negligible values, (9) up to 95% decrease in water absorption, and (10) negligible corrosion in distilled water and sulfate brines. Potential applications of concrete-polymer include: sewer and pressure pipe, building materials for housing and underwater structures, corrosion-resistant concrete for desalting plants, and antifragmentation concrete. (USBR)
W69-05835

8G. Materials

APPLICATION TECHNIQUES, PHYSICAL PROPERTIES, AND CHEMICAL RESISTANCE OF CHLORINATED RUBBER COATINGS.
National Association of Corrosion Engineers, Houston, Tex.

Mater Prot, Vol 8, No 1, pp 48-51, Jan 1969. 4 p, 3 tab.

Descriptors: Coatings, Corrosion control, Chemical properties, *Paints, *Protective coatings, *Painting, Physical properties, Rubber, Primers (Painting), Maintenance, Application methods, Operation and maintenance, Formulation.
Identifiers: *Chlorinated rubber, Corrosion environments, Film coverage, Chemical resistance, *Corrosion resistance, Surface preparation.

Chlorinated rubber coatings are reviewed by the National Association of Corrosion Engineers, Task Group T-6B-9, to provide information on performance and limitations of various organic materials used in these coatings. The report defines chlorinated rubber and discusses formulation for maximum chemical resistance. Properties of the paint and applied coatings are summarized. Resistance to various chemicals and exposure conditions is discussed; a table presents recommendations for exposure to many chemicals. Ratings are based on 2-wk immersion tests and field experiences. Shipping data and safety precautions are included. Recommendations are provided for surface preparation, priming, and application methods. Film thickness, weight of applied coatings, and coverage are given. Coatings of a specific generic type and different manufacture will vary in corrosion resistance, depending on the modifiers, type of pigment, and other formulation variables. This report considers average properties only. (USBR)
W69-05808

CONCRETE-POLYMER MATERIALS, FIRST TOPICAL REPORT,
Brookhaven National Laboratory, Upton, N. Y.; Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 08F.
W69-05835

8H. Rapid Excavation

VICTOR A HARDER REALTY AND CONSTRUCTION CO V CITY OF NEW YORK (DAMAGES CAUSED BY EXCAVATION AND GROUNDWATER REMOVAL).
For primary bibliographic entry see Field 06E.
W69-05786

FORMATION OF UNDERGROUND CAVITIES BY THE USE OF EXPLOSIVES,
A. S. Dobina, and N. A. Evstropov.
Transp Stroit, No 4, pp 47-49, 1966. Transl from Russ, Bur Reclam Transl 800, Feb 1969. 9 p, 1 fig, 1 ref.

Descriptors: *Foreign construction, Charges (Explosives), Field tests, Explosives, Engineering geology, Excavation, Soil mechanics, Clays, Soil structure, *Underground, *Underground explosions, Blasts, Delay elements (Explosives), *Underground storage, Storage, Methodology, Soil physical properties, Time, Depth, Drill holes, Plasticity, Explosions.
Identifiers: USSR, *Underground cavities, *Explosive construction, *Construction methods, Stemming, Spacing, Rapid excavation.

Researchers in the USSR used triple-stage conventional underground explosions in drill holes to construct underground storage cavities. This method is quantitatively and qualitatively satisfactory for storage of fuels, and would be applicable to other types of storage and construction, such as tunnels, canals and trenches, and large-volume excavation work. Plastic clay soils can be compacted by explosions to prevent seepage of stored material provided the clays contain no inclusions that might contaminate the stored media. Maximum increase in soil density approached 40% of initial density; initial mechanical properties, such as unconfined compressive strength and cohesion, increased 4 times. The technology and formulas for enlarging original drill holes by successive explosions after preliminary soil-cement grouting of the overlying area are discussed. The size of resulting strong watertight cavities depends on the size of explosive charges and soil compressibility. Cavities can be constructed singly or simultaneously in groups, using the information and formulas given. Field tests were conducted in Scythian and Cambrian clays and morainic clayey soils. (USBR)
W69-05818

8I. Fisheries Engineering

FLUID MECHANICS OF DOWNSTREAM FISH PASSAGE STRUCTURES,
Washington Univ., Seattle. Dept. of Civil Engineering.
E. P. Richey.
Proj Completion Rep, Charles W. Harris Hydraul Lab Tech Rep No 22, Sept 1967. 7 p, 3 ref. OWRR Project A-004-WASH.

Descriptors: *Fish guiding, *Open channel flow, *Hydraulic models, Fish behavior, Fish migration, Fish ladders, Fish passages, Fish management, Model studies, Unsteady flow, Supercritical flow, Turbulent flow, Non-uniform flow.
Identifiers: Spatially varied flow.

The hydraulic characteristics of flow over an inclined, porous plane of a type used as a fish passage facility, and the hydraulic indices of guidance stimuli associated with a converging channel were studied as 2 phases of the downstream fish passage problem. In the first phase, an analytical method, augmented by experimental data, was developed for predicting discharge, length, velocity, etc., of the flow over the plate, given an initial flow rate and plate inclination and porosity. Experimental data covered a range in porosity from 0.2 to 0.33, two types of openings, and positive plate angles up to 15 deg. Results were obtained for the supercritical case only. In the second phase, the behavior of fish to flow conditions caused by a channel convergence was studied in hydraulic experiments. Wedges of about 7 deg placed with a relative spacing of 0.5 had shown positive guidance effects; those of about 3 deg showed none. A hydraulic index (acceleration, pressure or velocity change) for the large angle was about 7 times that for the smaller angle. For the 7 deg wedges, it is predicted that an increase in the relative spacing from 0.5 to 0.8 would eliminate any guidance effect. (Knapp-USGS)
W69-05667

9. MANPOWER, GRANTS AND FACILITIES

A. Education (Extramural)

HE SOIL AND WATER CONSERVATIONIST F TOMORROW,
oil Conservation Service, Washington, D. C.; and ornell Univ., Ithaca, N. Y.
orman A. Berg, Paul J. Zwerman, and Gilbert evine.
Soil Water Conserv, Vol 23, No 6, pp 203-223, ov-Dec 1968. 21 p, 7 photo, 19 ref.

escriptors: *Conservation, *Soil conservation, Water conservation, Soil science, Training, Water sources, Education, Economics, Plants, Management, Administration, Forest management, ibliographies, Fish and wildlife, Forecasting.
dentifiers: Continuing education, Biological iences, Managerial skills, Water resources anagement.

his collection of 7 papers describes the tasks and ture educational and training needs facing a reer conservationist in the next 2 decades. hange is occurring so fast in every field that on-th-b technical training will be needed continually. he 7 fields discussed are: (1) the soil and water nservationist, (2) the soil scientist, (3) the source manager, (4) the resource economist, (5) e resource administrator, (6) the plant scientist, d (7) the fish and wildlife biologist. Tomorrow's nservationist will be required to take a broad ew of the whole field. His formal education must ovide a foundation in the natural and social iences. Then he must take advantage of all availa-e assistance to remain current in his field. JSBR)
69-05842

D. Grants, Contracts, and Research Act Allotments

NNUAL REPORT FOR FISCAL YEAR 1968. ATER RESOURCES RESEARCH CENTER.
assachusetts Univ., Amherst.

assachusetts Univ Report to OWRR, 1968. 98 p.

Descriptors: *Massachusetts, *Research projects, Ponds, Animal wastes, Hydrology, Eutrophication, Pesticides, Cranberry bogs, Industrial wastes, Estuaries, Fisheries, Regional planning, Watersheds, Institutions and law.

This report describes activity on 16 projects conducted during the period July 1, 1967 to June 30, 1968. These projects cover research on lakes, rivers, groundwaters, and estuaries and coastal waters. The research involves the efforts of 26 faculty members and 43 students representing 14 University components. Areas under study include recreational use of small artificial ponds; watershed response to hydrologic variables; biological treatment and subsurface disposal of animal wastes; arrest of eutrophication processes in lakes by (1) removal of dissolved phosphates by special ion exchange resins, (2) control of benthic desposits, (3) intervention in microbial decomposition processes, and (4) nutrient removal by entrappment in vascular aquatic plants; evaluation of the fate and behavior of pesticides in soil, water and fish; recharge and groundwater management; manipulation of microbial communities in treatment of industrial waste; economic optimization of water uses in small watersheds, and analysis of evolving institutional processes. (Berger-Mass)
W69-05764

FOURTH ANNUAL REPORT, FISCAL YEAR 1967-1968.
Nevada Univ., Reno. Desert Research Inst.

Nevada Univ Center for Water Resources Research, Report to OWRR, September 1968. 81 p.

Descriptors: *Research facilities, *Training, *Education, *Water Resources Research Act, Arid lands, Nevada.

Due to the expanding population of the nation and of the state of Nevada, great pressure is being put on water supply. Therefore, the Center's research efforts, as shown in its 20 projects, act mainly as tools for the research workers' use in keeping pace with the demand for water of acceptable quality and quantity, as well as aiding the scientist in such areas as water resources planning and management, and the geochemical aspects of ground and surface waters. During the past year, 19 graduate and 24 undergraduate students were employed on research projects, which provided them with training in their major fields, and allowed for student association with senior scientists. Ten research associates engaged in projects of the Center are also teaching courses at the University of Nevada at Reno, thus exposing numerous students to new ideas as they are developed by the research staff. Members of the Center's staff are active in various local, state, federal, and international organizations. The recent establishment of a research facility in Las Vegas will enable the Center to meet the growing research responsibilities in Southern Nevada, with emphasis on the problems of water supply for urban areas in arid zones, of which the city of Las Vegas is a prime example. (Pincolini-Nev)
W69-05765

CONNECTICUT INSTITUTE OF WATER RESOURCES, ANNUAL REPORT 1967-68,
Connecticut Univ., Storrs.
W. C. Kennard.
Connecticut Institute of Water Resources, Unnumbered Report, 1968. 73 p (unpublished).

Descriptors: *Activities report, Research, *Annual report, Administration, Coordination, Publications.

Eighteen research projects were in effect covering the engineering, biological, physical, chemical agricultural and social sciences. Eight seminars were held around the theme 'Water Quality Control.' Five special seminars were given by University staff members. Nine journal articles, two Institute Reports, two M.S. and two Ph.D. dissertations were issued. Seven state financed graduate assistantships were awarded and two professorial appointments made, one in hydrology engineering and one in aquatic biology. The Institute director participated in planning regional cooperative research and cooperative symposia in the New England area.
W69-05773

10. SCIENTIFIC AND TECHNICAL INFORMATION

TRANSLATIONS OF FOREIGN LITERATURE ON HYDRAULICS.
American Society of Civil Engineers, New York. Committee on Hydromechanics.
For primary bibliographic entry see Field 08B.
W69-05655

SUBJECT INDEX

ABSORPTION
STOMATAL OPENING IN ISOLATED EPIDERMAL STRIPS OF VICIA FABA. II. RESPONSES TO KCL CONCENTRATION AND THE ROLE OF POTASSIUM ABSORPTION,
W69-05681 02I

ABSORPTION COEFFICIENTS
ABSORPTION COEFFICIENTS OF CHLOROPHYLL DERIVATIVES,
W69-05695 02H

ACACIA
MEASUREMENTS OF PRECIPITATION INTERCEPTION BY AN ARID ZONE PLANT COMMUNITY (ACACIA ANEURA F. MUELL),
W69-05689 02I

ACCESS TUBES
INSTALLATION OF SOIL MOISTURE ACCESS TUBES IN ROCKY SOILS,
W69-05887 07B

ACCESS TUBING
A TOOL FOR REPAIRING INSTALLED SOIL MOISTURE ACCESS TUBES,
W69-05888 07B

ACCRETION
FEDERAL LAW AND SEASHORE ACCRETION.
W69-05785 06E

ACID MINE WATER
RECOMMENDATIONS FOR WATER POLLUTION CONTROL IN RACCOON CREEK BASIN, OHIO.
W69-05661 05G

MICROBIAL SULFATE REDUCTION AND ITS POTENTIAL UTILITY AS AN ACID MINE WATER POLLUTION ABATEMENT PROCEDURE,
W69-05898 05G

MICROBIAL DISSIMILATORY SULFUR CYCLE IN ACID MINE WATER,
W69-05899 05B

ACIDIC WATER
RATE OF SULFURIC ACID FORMATION IN YELLOWSTONE NATIONAL PARK,
W69-05635 02K

ACIDS
BACTERIAL ORIGIN OF SULFURIC ACID IN SULFUROUS HOT SPRINGS,
W69-05654 02K

ACROPOL
STUDIES WITH ANTITRANSPIRANTS ON GRAPEVINES (VITIS VINIFERA VAR. SULTANA),
W69-05675 02D

ACTIVE PRESSURES
EXPERIMENTAL INVESTIGATION OF THE ACTIVE PRESSURE OF A CLAY SOIL ON A RETAINING WALL,
W69-05820 08D

ACTIVITIES REPORT
CONNECTICUT INSTITUTE OF WATER RESOURCES, ANNUAL REPORT 1967 68,
W69-05773 09D

ADMINISTRATION
WATER QUALITY CONTROL LEGAL AND ADMINISTRATIVE ASPECTS,
W69-05745 05G

ADMINISTRATIVE DECISIONS
THE RANGE OF CHOICE IN WATER MANAGEMENT. A STUDY OF DISSOLVED OXYGEN IN THE POTOMAC ESTUARY,
W69-05715 05G

THE DELAWARE ESTUARY STUDY,
W69-05728 05G

SOME ECONOMIC ASPECTS OF INDUSTRIAL WATER SUPPLY IN THE SOUTH,
W69-05739 06B

SECTION OF MINERAL AND NATURAL RESOURCES LAW--REPORT OF THE COMMITTEE ON WATER RESOURCES.
W69-05783 06E

AFRICA
AN AGROCLIMATOLOGY SURVEY OF A SEMIARID AREA IN AFRICA SOUTH OF THE SAHARA,
W69-05684 02I

AGGRADATION
BEHAVIOR OF MIDDLE LOUP RIVER CHANNEL AS INFLUENCED BY MILBURN DIVERSION DAM.
W69-05841 02J

AGRICULTURE
THE FUTURE AGRICULTURAL USE OF WATER - SOUTHERN HUMID REGION,
W69-05738 06B

AGROCLIMATOLOGY
AN AGROCLIMATOLOGY SURVEY OF A SEMIARID AREA IN AFRICA SOUTH OF THE SAHARA,
W69-05684 02I

AGRONOMIC CROPS
THE STABILITY OF NORMAL ANNUAL RUNOFF AND SEASONAL RIVER DISCHARGES UNDER CONDITIONS OF DEVELOPMENT OF AGROTECHNICAL ENTERPRISES IN THEIR DRAINAGE AREAS (RUSSIAN),
W69-05938 04A

AIR TEMPERATURE
CONSUMPTIVE USE ESTIMATES FROM SOLAR RADIATION AND TEMPERATURE,
W69-05686 02I

RELATIONSHIP OF AIR TEMPERATURE TO THE OCCURRENCE OF FRAZIL ICE AND ICE FLOW IN RIVERS,
W69-05923 02C

ALABAMA
KAY-NOOJIN DEV CO V KINZER (SURFACE WATERS AND THE NATURAL FLOW DOCTRINE).
W69-05958 04A

VINSON V TURNER (INJUNCTION AGAINST CONCENTRATION OF SURFACE WATER RIDDANCE).
W69-05967 04A

ALGAE
THE EFFECTS OF ALGAE ON WATER QUALITY,
W69-05697 05C

DEATH OF A LAKE,
W69-05844 05C

ALGAL CONTROL
LIST OF REFERENCES ON CONTROL OF AQUATIC PLANTS, INCLUDING ALGAE,
W69-05705 05G

SUPPLEMENT TO THE LIST OF REFERENCES ON CONTROL OF AQUATIC PLANTS, INCLUDING ALGAE,
W69-05706 05G

DEATH OF A LAKE,
W69-05844 05C

ALGAL GROWTH
AVAILABILITY OF IRON AND MANGANESE IN SOUTHERN WISCONSIN LAKES FOR THE GROWTH OF MICROCYSTIS AERUGINOSA,
W69-05867 05C

ALGICIDES
USE OF POTASSIUM PERMANGANATE FOR CONTROL OF PROBLEM ALGAE,
W69-05704 05F

ALLUVION
FEDERAL LAW AND SEASHORE ACCRETION.
W69-05785 06E

ALTERATION OF FLOW
GROBART V NORTH JERSEY DIST WATER SUPPLY COMMISSION (DIVERSION OF FLOW).
W69-05994 04A

ALTERNATIVE COSTS
THE DELAWARE ESTUARY STUDY,
W69-05728 05G

ALUM FLOCCULATION
NUTRIENT REMOVAL FROM SECONDARY EFFLUENT BY ALUM FLOCCULATION AND LIME PRECIPITATION,
W69-05865 05D

AMINO ACIDS
A SIMPLE STEAM DISTILLATION METHOD OF ESTIMATING (BETA-HYDROXY-ALPHA-AMINO) ACIDS,
W69-05875 05A

AMMONIA
STEAM DISTILLATION METHODS FOR DETERMINATION OF AMMONIUM, NITRATE AND NITRITE,
W69-05709 05A

AMMONIUM
DETERMINATION AND ISOTOPE-RATIO ANALYSIS OF DIFFERENT FORMS OF NITROGEN IN SOILS 3. EXCHANGEABLE AMMONIUM, NITRATE, AND NITRITE BY EXTRACTION-DISTILLATION METHODS,
W69-05700 05A

ANALOG COMPUTERS
ANALOG COMPUTER -- A MODERN TOOL IN WATER POLLUTION CONTROL,
W69-05854 05G

ANALOG MODELS FOR FLOOD CONTROL SYSTEMS,
W69-05856 04A

A NONLINEAR HYDROLOGIC SYSTEM RESPONSE MODEL,
W69-05858 02A

GROUNDWATER MANAGEMENT FOR THE NATION'S FUTURE--COMPUTER SIMULATION OF GROUNDWATER BASINS,
W69-05864 04B

ANALYSIS
THE ANALYSIS OF DETERMINATION IN POPULATION SYSTEMS,
W69-05714 06A

ANALYTICAL TECHNIQUES
DETERMINATION AND ISOTOPE-RATIO ANALYSIS OF DIFFERENT FORMS OF NITROGEN IN SOILS 6. MINERALIZABLE NITROGEN,
W69-05699 05A

DETERMINATION AND ISOTOPE-RATIO ANALYSIS OF DIFFERENT FORMS OF NITROGEN IN SOILS 3. EXCHANGEABLE AMMONIUM, NITRATE,

AND NITRITE BY EXTRACTION-DISTILLATION METHODS,
W69-05700 05A

DETERMINATION AND ISOTOPE-RATIO ANALYSIS OF DIFFERENT FORMS OF NITROGEN IN SOILS 4. EXCHANGEABLE AMMONIUM, NITRATE, AND NITRITE BY DIRECT-DISTILLATION METHODS,
W69-05701 05A

STEAM DISTILLATION METHODS FOR DETERMINATION OF AMMONIUM, NITRATE AND NITRITE,
W69-05709 05A

DETERMINATION AND ISOTOPE-RATIO ANALYSIS OF DIFFERENT FORMS OF NITROGEN IN SOILS 7. UREA,
W69-05872 05A

CALCULATION OF MAXIMUM WATER DISCHARGES ORIGINATING FROM RAIN AND SNOW (IN RUSSIAN),
W69-05943 02E

ANNUAL REPORT
CONNECTICUT INSTITUTE OF WATER RESOURCES, ANNUAL REPORT 1967 68,
W69-05773 09D

ANTITRANSPIRANTS
STUDIES WITH ANTITRANSPIRANTS ON GRAPEVINES (VITIS VINIFERA VAR. SULTANA),
W69-05675 02D

APPALACHIAN REGIONAL DEVELOPMENT ACT OF 1965
CONTRIBUTIONS OF WATER RESOURCE DEVELOPMENT TO DEPRESSED AREAS DEVELOPMENT,
W69-05741 06B

APPROXIMATION METHOD
MATHEMATICAL SIMULATION OF THE ESTUARINE BEHAVIOR AND ITS APPLICATIONS,
W69-05732 05G

AQUATIC BACTERIA
MICROBIAL DISSIMILATORY SULFUR CYCLE IN ACID MINE WATER,
W69-05899 05B

AQUATIC ENVIRONMENT
FOOD AND FEEDING HABITS OF JUVENILE COHO SALMON AND STEELHEAD TROUT IN WORTHY CREEK, WASHINGTON,
W69-05890 02L

AQUATIC WEED CONTROL
LIST OF REFERENCES ON CONTROL OF AQUATIC PLANTS, INCLUDING ALGAE,
W69-05705 05G

SUPPLEMENT TO THE LIST OF REFERENCES ON CONTROL OF AQUATIC PLANTS, INCLUDING ALGAE,
W69-05706 05G

AQUICULTURE
USE POLLUTION TO BENEFIT MANKIND,
W69-05891 05D

AQUIFERS
NEW THRUSTS IN GROUND WATER,
W69-05677 02F

STEP-DRAWDOWN TEST NEEDS CRITICAL REVIEW,
W69-05813 04B

AQUIFER STORAGE DETERMINATION BY RADIOTRACER TECHNIQUES,
W69-05814 07B

ARID CLIMATES
SOIL INVESTIGATIONS IN ARID REGIONS,
W69-05692 02G

ARID LANDS
PLANT ECOLOGY OF AN ARID BASIN, TRES ALAMOS-REDINGTON AREA, SOUTHEASTERN ARIZONA,
W69-05634 02I

THE CONTRIBUTION OF RESEARCH TO THE EFFICIENT USE OF WATER IN AGRICULTURE,
W69-05650 03F

SOIL AND CROP MANAGEMENT FOR MAXIMUM WATER-USE EFFICIENCY ON ARID AND SEMIARID LANDS,
W69-05669 03F

AN ANALYSIS OF WATER NEEDS FOR ARID AND SEMI-ARID LANDS,
W69-05673 03E

ARIZONA
PLANT ECOLOGY OF AN ARID BASIN, TRES ALAMOS-REDINGTON AREA, SOUTHEASTERN ARIZONA,
W69-05634 02I

PRELIMINARY WATER YIELDS AFTER TIMBER HARVEST ON CASTLE CREEK, ARIZONA WATERSHEDS,
W69-05642 03B

ARKANSAS
MOWREY V COLEMAN (QUESTIONED VALIDITY OF WATER DISTRICT).
W69-05971 06E

UNITED STATES V 1,096.84 ACRES IN MARION COUNTY (AUTHORIZATION OF FEDERAL DAMS AND RESERVOIRS).
W69-05981 06E

ARTIFICIAL RECHARGE
RIVER WATER QUALITY FOR ARTIFICIAL RECHARGE,
W69-05894 05B

ARTIFICIAL WATERCOURSES
LOGSDON V ANDERSON (SUIT TO ORDER REOPENING OF DIVERSION DITCH).
W69-05789 06E

NEWTON COCA COLA BOTTLING CO V MURPHREY (DIVERSION OF SURFACE WATERS).
W69-05961 04A

MISKOTTEN V DRENTEN (ARTIFICIAL DRAINAGE OF SURFACE WATERS
W69-05963 04A

HANCOCK V STULL (OBSTRUCTION TO NATURAL FLOW OF SURFACE WATER).
W69-05990 04A

ASPHALT
THE INFLUENCE OF SUBSURFACE ASPHALT BARRIERS ON THE WATER PROPERTIES AND THE PRODUCTIVITY OF SAND SOILS,
W69-05802 02G

ASPHALT MEMBRANES
THE INFLUENCE OF SUBSURFACE ASPHALT BARRIERS ON THE WATER PROPERTIES AND THE PRODUCTIVITY OF SAND SOILS,
W69-05802 02G

ASSESSMENTS
MOWREY V COLEMAN (QUESTIONED VALIDITY OF WATER DISTRICT).
W69-05971 06E

ASYMPTOTIC REGRESSION CURVES
THE FITTING OF GROWTH AND ALLIED CURVES OF THE ASYMPTOTIC REGRESSION TYPE BY STEVENS'S METHOD,
W69-05711 07C

AT REST PRESSURE
EXPERIMENTAL INVESTIGATION OF THE ACTIVE PRESSURE OF A CLAY SOIL ON A RETAINING WALL,
W69-05820 08D

ATMOMETERS
USE OF ATMOMETERS IN ESTIMATING EVAPOTRANSPIRATION,
W69-05685 02D

ATMOSPHERIC PHYSICS
AN INVESTIGATION OF METEOROLOGICAL CONDITIONS DURING A CALIFORNIA RAINFALL PERIOD,
W69-05933 02B

ATMOSPHERIC SEDIMENTATION
INORGANIC NITROGEN IN PRECIPITATION AND ATMOSPHERIC SEDIMENTS,
W69-05712 05B

AUSTRALIA
STUDIES ON PRESOWING DROUGHT HARDENING OF WHEAT,
W69-05672 02I

THE INFILTRATION COMPONENT OF A PASTORAL EXPERIMENTAL CATCHMENT, PARTS 1 AND 2,
W69-05901 02G

THE EVAPOTRANSPIRATION COMPONENT OF A PASTORAL EXPERIMENTAL CATCHMENT,
W69-05902 02D

AUTOCORRELATION
THE STATISTICAL MEASURE OF HYDROLOGIC TIME SERIES,
W69-05775 02E

AUTOMATIC CONTROL
AUTOMATION AND SEMI-AUTOMATION OF SURFACE IRRIGATION,
W69-05829 03F

AUTOMATIC SPRINKLER IRRIGATION AND ITS FUTURE IN THE MIDWEST,
W69-05831 03F

DEVELOPMENT OF AUTOMATION ON THE SALT RIVER PROJECT,
W69-05832 03F

AUTOMATION OF IRRIGATION,
W69-05834 03F

AUTOMATION
AUTOMATION AND SEMI-AUTOMATION OF SURFACE IRRIGATION,
W69-05829 03F

AUTOMATIC SPRINKLER IRRIGATION AND ITS FUTURE IN THE MIDWEST,
W69-05831 03F

DEVELOPMENT OF AUTOMATION ON THE SALT RIVER PROJECT,
W69-05832 03F

AUTOMATION OF IRRIGATION,
W69-05834 03F

BACTERICIDES
FACTORS INFLUENCING THE EFFECTIVENESS OF SWIMMING POOL BACTERICIDES,
W69-05694 05F

BAROMETER WATERSHEDS
SANTA YNEZ BAROMETER WATERSHED,
W69-05644 03B

BARRIER FILMS
THE INFLUENCE OF SUBSURFACE ASPHALT BARRIERS ON THE WATER

PROPERTIES AND THE PRODUCTIVITY OF SAND SOILS,
W69-05802 02G

BASE FLOW
DETERMINATION OF THE GROUND-WATER COMPONENT OF PEAK DISCHARGE FROM THE CHEMISTRY OF TOTAL RUNOFF,
W69-05628 02F

BEACH EROSION
FORMATION OF A RIVER MOUTH BAR WHERE MARINE FACTORS PLAY AN IMPORTANT ROLE (EXEMPLIFIED BY THE LIELUPE RIVER),
W69-05952 02J

BELOIT(WIS)
FLOOD PLAIN INFORMATION, ROCK RIVER AT BELOIT, WISCONSIN.
W69-05646 04A

BENEFICIAL USE
AN ANALYSIS OF WATER NEEDS FOR ARID AND SEMI-ARID LANDS,
W69-05673 03E

BETA-HYDROXY-ALPHA-AMINO ACIDS
A SIMPLE STEAM DISTILLATION METHOD OF ESTIMATING (BETA-HYDROXY-ALPHA-AMINO) ACIDS,
W69-05875 05A

BIBLIOGRAPHIES
REFERENCES FOR WELL DATA AND WATER LEVELS IN CALIFORNIA BY THE GEOLOGICAL SURVEY,
W69-05623 02F

LIST OF REFERENCES ON CONTROL OF AQUATIC PLANTS, INCLUDING ALGAE,
W69-05705 05G

SUPPLEMENT TO THE LIST OF REFERENCES ON CONTROL OF AQUATIC PLANTS, INCLUDING ALGAE,
W69-05706 05G

RUSSIAN RADIOECOLOGY, A BIBLIOGRAPHY OF SOVIET PUBLICATIONS WITH CITATIONS OF ENGLISH TRANSLATIONS AND ABSTRACTS,
W69-05708 05C

BIODEGRADATION
MICROBIAL SULFATE REDUCTION AND ITS POTENTIAL UTILITY AS AN ACID MINE WATER POLLUTION ABATEMENT PROCEDURE,
W69-05898 05G

MICROBIAL DISSIMILATORY SULFUR CYCLE IN ACID MINE WATER,
W69-05899 05B

BIOMASS
SOME OBSERVATIONS ON THE DEPENDENCE OF ZOOPLANKTON GRAZING ON THE CELL SIZE AND CONCENTRATION OF PHYTOPLANKTON BLOOMS,
W69-05696 02L

BOREHOLES
INSTALLATION OF SOIL MOISTURE ACCESS TUBES IN ROCKY SOILS,
W69-05887 07B

BOUNDARY LAYERS
SURGE FLOW A MODEL OF THE WALL LAYER,
W69-05892 08B

BROOK TROUT
GROWTH AND RESISTANCE TO STRESS IN BROOK TROUT FED SUBLETHAL LEVELS OF DDT,
W69-05770 05C

REPRODUCTION IN BROOK TROUT (SALVELINUS FONTINALIS) FED SUBLETHAL CONCENTRATIONS OF DDT,
W69-05771 05C

BURIED PIPES
LABORATORY LOAD TESTS ON BURIED FLEXIBLE PIPE - PROGRESS REPORT NO 1,
W69-05845 08D

BUTTE VALLEY(NEV)
WATER-RESOURCES APPRAISAL OF BUTTE VALLEY, ELKO AND WHITE PINE COUNTIES, NEVADA,
W69-05656 02F

CABLE CLAMP
CABLE AND CLAMP MODIFICATIONS FOR MODEL 104 MOISTURE PROBES,
W69-05883 07B

CALIFORNIA
REFERENCES FOR WELL DATA AND WATER LEVELS IN CALIFORNIA BY THE GEOLOGICAL SURVEY,
W69-05623 02F

MUNICIPAL AND INDUSTRIAL WATER USE,
W69-05916 06D

AN INVESTIGATION OF METEOROLOGICAL CONDITIONS DURING A CALIFORNIA RAINFALL PERIOD,
W69-05933 02B

CALUMET AREA(ILLINOIS)
CHICAGOLAND DEEP TUNNEL SYSTEM FOR POLLUTION AND FLOOD CONTROL FIRST CONSTRUCTION ZONE, DEFINITE PROJECT REPORT.
W69-05743 05G

CANALS
LONG STANDING WAVES IN A CURVED CANAL,
W69-05827 08B

CAPACITORS
A NEW SURGE-LIMITING DEVICE FOR HIGH VOLTAGE STATIONS,
W69-05811 08C

CELL SIZE
SOME OBSERVATIONS ON THE DEPENDENCE OF ZOOPLANKTON GRAZING ON THE CELL SIZE AND CONCENTRATION OF PHYTOPLANKTON BLOOMS,
W69-05696 02L

CENTRAL ARIZONA PROJECT
THE PHREATOPHYTE PROBLEM IN ARIZONA,
W69-05645 03B

CENTRAL ASIA
IMMENSE LANDSLIDE OBSTRUCTION OF ZERAVSHAN RIVER, APRIL 24, 1964 (IN RUSSIAN),
W69-05946 02E

CENTRALIA(WASH)
FLOOD PLAIN INFORMATION, CHEHALIS AND SKOOKUMCHUCK RIVERS, CENTRALIA-CHEHALIS, WASHINGTON.
W69-05649 04A

CEYLON
THE UDA WALAWE RESERVOIR PROJECT,
W69-05653 04A

ANALYTICAL METHOD OF COMPUTING MONSOON FLOODS (KELANI GANGA RIVER BASINS AS AN EXAMPLE) (IN RUSSIAN),
W69-05947 02E

CHANNEL FLOW
ANNIN V STATE (DAMAGE CAUSED BY FILLING OF CHANNEL).
W69-05797 06E

CHANNEL MORPHOLOGY
THE EFFECTS OF BENDS ON DISPERSION IN STREAMS,
W69-05609 02E

DOWNSTREAM VARIATIONS IN THE HYDRAULIC GEOMETRY OF STREAMS SPECIAL EMPHASIS ON MEAN VELOCITY,
W69-05639 02E

ANALYTICAL METHOD OF COMPUTING MONSOON FLOODS (KELANI GANGA RIVER BASINS AS AN EXAMPLE) (IN RUSSIAN),
W69-05947 02E

CHARLOTTE(NC)
FLOOD PLAIN INFORMATION, IRWIN, LONG AND PAW CREEKS, CHARLOTTE, NORTH CAROLINA (VOLUME 1).
W69-05647 04A

CHEMICAL ANALYSIS
CHARACTERIZATION OF MINERALIZABLE NITROGEN IN SOILS,
W69-05703 05A

CELL CONTENTS OF NITROGEN AND PHOSPHORUS AS A MEASURE OF THEIR AVAILABILITY FOR GROWTH OF MICROCYSTIS AERUGINOSA,
W69-05868 05C

USE OF THE COLEMAN MODEL 29A ANALYZER FOR TOTAL NITROGEN ANALYSIS OF SOILS,
W69-05874 05A

CHEMICAL COMPOSITION
CELL CONTENTS OF NITROGEN AND PHOSPHORUS AS A MEASURE OF THEIR AVAILABILITY FOR GROWTH OF MICROCYSTIS AERUGINOSA,
W69-05868 05C

CHEMICAL REACTIONS
CREATING HYDROPHOBIC SOIL FOR WATER HARVESTING,
W69-05676 03B

CHICAGO(ILLINOIS)
CHICAGOLAND DEEP TUNNEL SYSTEM FOR POLLUTION AND FLOOD CONTROL FIRST CONSTRUCTION ZONE, DEFINITE PROJECT REPORT.
W69-05743 05G

CHLORINATED RUBBER
APPLICATION TECHNIQUES, PHYSICAL PROPERTIES, AND CHEMICAL RESISTANCE OF CHLORINATED RUBBER COATINGS.
W69-05808 08G

CHLORINE STABILIZATION
FACTORS INFLUENCING THE EFFECTIVENESS OF SWIMMING POOL BACTERICIDES,
W69-05694 05F

CHLOROPHYLL
ABSORPTION COEFFICIENTS OF CHLOROPHYLL DERIVATIVES,
W69-05695 02H

CHLOROPHYLL DERIVATIVES
ABSORPTION COEFFICIENTS OF CHLOROPHYLL DERIVATIVES,
W69-05695 02H

CIRCUIT BREAKERS
DAMPING OF SWITCHING OVERVOLTAGES IN EHV-NETWORKS--NEW ECONOMIC ASPECTS AND SOLUTIONS,
W69-05809 08C

INFLUENCE OF SHUNT REACTORS ON SWITCHING SURGES,
W69-05812 08C

CLEAR-CUTTING
PRELIMINARY WATER YIELDS AFTER TIMBER HARVEST ON CASTLE CREEK, ARIZONA WATERSHEDS,
W69-05642 03B

CLIMATIC ATLAS
CLIMATIC ATLAS OF THE UNITED STATES,
W69-05922 02B

CLIMATIC DATA

AN AGROCLIMATOLOGY SURVEY OF A SEMIARID AREA IN AFRICA SOUTH OF THE SAHARA,
W69-05684 02I

CONSUMPTIVE USE ESTIMATES FROM SOLAR RADIATION AND TEMPERATURE,
W69-05686 02I

CLIMATIC ATLAS OF THE UNITED STATES,
W69-05922 02B

CLOSING
DAMPING OF SWITCHING OVERVOLTAGES IN EHV-NETWORKS--NEW ECONOMIC ASPECTS AND SOLUTIONS,
W69-05809 08C

CLOUD MODIFICATION
ATTACK ON CUMULUS CLOUDS BY MAN-MADE VERTICAL ASCENDING CURRENTS,
W69-05821 03B

CLOUD SEEDING
THE LEGAL IMPLICATIONS OF ATMOSPHERIC WATER RESOURCES DEVELOPMENT AND MANAGEMENT.
W69-05756 02B

COACHELLA VALLEY
SALT AND WATER BALANCE, COACHELLA VALLEY, CALIFORNIA,
W69-05670 02G

COASTAL STATES
THE CONVENTION ON FISHING AND LIVING RESOURCES OF THE HIGH SEAS.
W69-05791 06E

COASTS
SOME PATTERNS OF FORMATION OF A RIVER MOUTH BAR WHERE RIVER FACTORS PLAY AN IMPORTANT ROLE (EXEMPLIFIED BY THE VISTULA DELTA),
W69-05953 02J

COHO SALMON
FOOD AND FEEDING HABITS OF JUVENILE COHO SALMON AND STEELHEAD TROUT IN WORTHY CREEK, WASHINGTON,
W69-05890 02L

COLEMAN NITROGEN ANALYZER
USE OF THE COLEMAN MODEL 29A ANALYZER FOR TOTAL NITROGEN ANALYSIS OF SOILS,
W69-05874 05A

COLORADO RIVER
WATER CONSUMPTION IN THE LOWER COLORADO RIVER VALLEY,
W69-05678 02E

COMPACTION
EFFECTS OF SEEDING AND GRAZING ON INFILTRATION CAPACITY AND SOIL STABILITY OF A SUBALPINE RANGE IN CENTRAL UTAH,
W69-05889 04D

COMPARATIVE STUDIES
A COMPARATIVE STUDY IN EUTROPHICATION,
W69-05869 05C

COMPENSATION
UNITED STATES V 11.48 ACRES OF LAND, ETC (COMPENSATION FOR CONDEMNED RIPARIAN RIGHTS).
W69-05964 06C

COMMONWEALTH V KELLEY (NEGLIGENT OBSTRUCTION TO FLOW).
W69-05970 04A

UNITED STATES V 1,096.84 ACRES IN MARION COUNTY (AUTHORIZATION OF FEDERAL DAMS AND RESERVOIRS).
W69-05981 06E

COMPOSITE MATERIALS
CONCRETE-POLYMER MATERIALS, FIRST TOPICAL REPORT,
W69-05835 08F

COMPREHENSIVE PLANNING
WATER QUALITY CONTROL COMPREHENSIVE PLANNING,
W69-05744 05G

COMPUTER MODELS
SENSITIVITY ANALYSIS METHOD OF SYSTEM IDENTIFICATION AND ITS POTENTIAL IN HYDROLOGIC RESEARCH,
W69-05603 07C

SIMULATION OF EVAPORATION FROM CONSTANT SOURCE WITH FINITE AREAS,
W69-05636 07C

DISSOLVED OXIGEN IN THE DELAWARE ESTUARY,
W69-05727 05G

COMPUTER PROGRAMS
MATHEMATICAL MODEL AND FORTRAN IV PROGRAM FOR COMPUTER SIMULATION OF DELTAIC SEDIMENTATION,
W69-05657 07C

NUMERICAL SIMULATION OF UNCONFINED FLOW INTO A SINGLE PUMPING WATER-WELL USING TWO-PHASE FLOW THEORY,
W69-05755 02F

CONCRETE DAMS
REEVALUATION AND RECONSTRUCTION OF CALIFORNIA DAMS,
W69-05804 08A

DIVERSION WORKS FOR CONSTRUCTION,
W69-05816 04A

CONCRETE PROPERTIES
CONCRETE--A NON-ELASTIC MATERIAL IN THE LABORATORY AND IN STRUCTURES,
W69-05822 08F

CONCRETE STRUCTURES
CONCRETE--A NON-ELASTIC MATERIAL IN THE LABORATORY AND IN STRUCTURES,
W69-05822 08F

CONCRETE TECHNOLOGY
BUREAU OF RECLAMATION EXPERIENCE WITH FROST ACTION ON CONCRETE,
W69-05801 08F

CONCRETE-POLYMER MATERIALS, FIRST TOPICAL REPORT,
W69-05835 08F

CONCRETE TESTING
BUREAU OF RECLAMATION EXPERIENCE WITH FROST ACTION ON CONCRETE,
W69-05801 08F

NONDESTRUCTIVE CONCRETE TESTS--GRAND COULEE SPILLWAY BRIDGE,
W69-05823 08F

CONCRETES
CONCRETE-POLYMER MATERIALS, FIRST TOPICAL REPORT,
W69-05835 08F

CONCRETE-POLYMER MATERIALS
CONCRETE-POLYMER MATERIALS, FIRST TOPICAL REPORT,
W69-05835 08F

CONDEMNATION
UNITED STATES V 11.48 ACRES OF LAND, ETC (COMPENSATION FOR CONDEMNED RIPARIAN RIGHTS).
W69-05964 06C

CONDEMNATION VALUE
UNITED STATES V 2973 ACRES OF LAND (CONDEMNATION OF FLOWAGE EASEMENTS).
W69-05984 06E

CONFERENCES
WATER RESOURCES AND ECONOMIC DEVELOPMENT IN THE SOUTH,
W69-05737 06B

CONFINED AQUIFERS
FLOW RATES IN TWO-DIMENSIONAL, UNSTEADY, CONFINED GROUNDWATER FLOW,
W69-05617 02F

CONNECTICUT
ADAMS V GREENWICH WATER CO (DIVERSION OF RIVER FOR PUBLIC WATER SUPPLY).
W69-05793 06E

CONSERVATION
INVESTIGATION OF SURFACE AND UNDERGROUND RUNOFF (RUSSIAN).
W69-05659 02A

STATE PROGRAMS FOR ESTUARINE AREA CONSERVATION,
W69-05776 02L

THE SOIL AND WATER CONSERVATIONIST OF TOMORROW,
W69-05842 09A

CONSTITUTIONAL LAW
STATE PROGRAMS FOR ESTUARINE AREA CONSERVATION,
W69-05776 02L

STATE V LEHAR (TITLE TO TIDAL BEDS).
W69-05983 06E

CONSTITUTIONALITY
AVERY V BEALE (CONSTITUTIONALITY OF RIPARIAN PRIORITY TO ERECT DUCK BLINDS).
W69-05987 06E

CONSTRUCTION
A TOOL FOR REPAIRING INSTALLED SOIL MOISTURE ACCESS TUBES,
W69-05888 07B

CONSTRUCTION METHODS
FORMATION OF UNDERGROUND CAVITIES BY THE USE OF EXPLOSIVES,
W69-05818 08H

CONSUMPTIVE USE
THE PHREATOPHYTE PROBLEM IN ARIZONA,
W69-05645 03B

STUDIES WITH ANTITRANSPIRANTS ON GRAPEVINES (VITIS VINIFERA VAR. SULTANA),
W69-05675 02D

CONSUMPTIVE USE ESTIMATES FROM SOLAR RADIATION AND TEMPERATURE,
W69-05686 02I

CONTINENTAL SHELF
AMERICAN POLICY OPTIONS IN THE DEVELOPMENT OF UNDERSEA MINERAL RESOURCES.
W69-05787 06E

THE GENEVA CONVENTIONS ON THE LAW OF THE SEA SOME SUGGESTIONS FOR THEIR REVISION,
W69-05974 06E

CONTINENTAL SLOPE

AMERICAN POLICY OPTIONS IN THE DEVELOPMENT OF UNDERSEA MINERAL RESOURCES.
W69-05787 06E

CONTROL SYSTEMS
REMOTE CONTROL OF IRRIGATION WATER FACILITIES,
W69-05833 03F

CONVECTION
ATTACK ON CUMULUS CLOUDS BY MAN-MADE VERTICAL ASCENDING CURRENTS,
W69-05821 03B

COOLING WATER
EVAPORATIVE COOLING OF HEATED IRRIGATION WATER BY SPRINKLER APPLICATION,
W69-05606 03C

COPPER SULFATE
USE OF POTASSIUM PERMANGANATE FOR CONTROL OF PROBLEM ALGAE,
W69-05704 05F

CORES
LAKE SEDIMENTS THE BOTTOM DEPOSITS OF THE NORTH BASIN OF WINDERMERE, WITH SPECIAL REFERENCE TO THE DIATOM SUCCESSION,
W69-05707 02H

CORPS OF ENGINEERS
CONTRIBUTIONS OF WATER RESOURCE DEVELOPMENT TO DEPRESSED AREAS DEVELOPMENT,
W69-05741 06B

CORRELATION ANALYSIS
RELATIONSHIP OF TEXTURE TO SOME IMPORTANT SOIL MOISTURE CONSTANTS,
W69-05679 02G

CORROSION RESISTANCE
APPLICATION TECHNIQUES, PHYSICAL PROPERTIES, AND CHEMICAL RESISTANCE OF CHLORINATED RUBBER COATINGS.
W69-05808 08G

COST ANALYSIS
COST OF MUNICIPAL AND INDUSTRIAL WELLS IN ILLINOIS, 1964-1966,
W69-05910 06C

COST OF RESERVOIRS IN ILLINOIS,
W69-05915 06C

COST-BENEFIT ANALYSIS
CONTRIBUTIONS OF WATER RESOURCE DEVELOPMENT TO DEPRESSED AREAS DEVELOPMENT,
W69-05741 06B

COVER DENSITY
EFFECTS OF SEEDING AND GRAZING ON INFILTRATION CAPACITY AND SOIL STABILITY OF A SUBALPINE RANGE IN CENTRAL UTAH,
W69-05889 04D

CREEP
CONCRETE--A NON-ELASTIC MATERIAL IN THE LABORATORY AND IN STRUCTURES,
W69-05822 08F

CRITICAL PATH METHOD
EXPERIENCE WITH AND EVALUATION OF CRITICAL PATH METHODS,
W69-05817 08A

CROP PRODUCTION
ON THE RELATION BETWEEN TRANSPIRATION, SOIL PHYSICAL PROPERTIES AND CROP PRODUCTION AS A BASIS FOR WATER SUPPLY PLANS,
W69-05613 02I

SOIL AND CROP MANAGEMENT FOR MAXIMUM WATER-USE EFFICIENCY ON ARID AND SEMIARID LANDS,
W69-05669 03F

STUDIES ON PRESOWING DROUGHT HARDENING OF WHEAT,
W69-05672 02I

PREDICTING EFFECTS OF WATER SHORTAGE ON CROP YIELD,
W69-05674 03F

AN AGROCLIMATOLOGY SURVEY OF A SEMIARID AREA IN AFRICA SOUTH OF THE SAHARA,
W69-05684 02I

SOIL MOISTURE RESPONSE TO RANGE IMPROVEMENT IN THE NORTHERN GREAT PLAINS,
W69-05693 02I

THE INFLUENCE OF SUBSURFACE ASPHALT BARRIERS ON THE WATER PROPERTIES AND THE PRODUCTIVITY OF SAND SOILS,
W69-05802 02G

CROP RESPONSE
ON THE RELATION BETWEEN TRANSPIRATION, SOIL PHYSICAL PROPERTIES AND CROP PRODUCTION AS A BASIS FOR WATER SUPPLY PLANS,
W69-05613 02I

CROPS
AERODYNAMIC AND SURFACE FACTORS IN EVAPORATION,
W69-05631 02I

CULTIVATION EFFECTS
EFFECT OF CULTIVATION ON THE NITROGEN DISTRIBUTION IN SOILS,
W69-05710 02K

CULVERTS
HARBISON-WALKER REFRACTORIES CO V SMITH (FLOOD DAMAGE DUE TO CLOGGED CULVERT).
W69-05792 06E

CUMULUS CLOUDS
ATTACK ON CUMULUS CLOUDS BY MAN-MADE VERTICAL ASCENDING CURRENTS,
W69-05821 03B

CURRENTS(WATER)
SOME PATTERNS OF FORMATION OF A RIVER MOUTH BAR WHERE RIVER FACTORS PLAY AN IMPORTANT ROLE (EXEMPLIFIED BY THE VISTULA DELTA),
W69-05953 02J

CURVES
LONG STANDING WAVES IN A CURVED CANAL,
W69-05827 08B

CYANURIC ACID
FACTORS INFLUENCING THE EFFECTIVENESS OF SWIMMING POOL BACTERICIDES,
W69-05694 05F

DAM FAILURE
REEVALUATION AND RECONSTRUCTION OF CALIFORNIA DAMS,
W69-05804 08A

DAMAGES
BILLERIO V FOTI (FLOOD DAMAGE DUE TO DAMMING OF STREAM).
W69-05795 06E

INJURING HIGHWAY BOUNDARY, PIER, SEA-WALL, DOCK, ROCK, BUOY, LANDMARK, MILE-BOARD, PIPE, MAIN, SEWER, MACHINE, TELEGRAPH, OR OTHER PROPERTY.
W69-05972 06E

ELLER V BOARD OF EDUCATION OF BUNCOMBE COUNTY (WATER POLLUTION AS CONSTITUTING A 'TAKING' OF PROPERTY).
W69-05986 05G

DAMS
REEVALUATION AND RECONSTRUCTION OF CALIFORNIA DAMS,
W69-05804 08A

INJURING HIGHWAY BOUNDARY, PIER, SEA-WALL, DOCK, ROCK, BUOY, LANDMARK, MILE-BOARD, PIPE, MAIN, SEWER, MACHINE, TELEGRAPH, OR OTHER PROPERTY.
W69-05972 06E

FINDLEY LAKE PROPERTY OWNERS, INC V TOWN OF MINA (MAINTENANCE AND CONTROL OF WATER LEVEL OF LAKE).
W69-05973 04A

BOROUGH OF AUSTIN V A AND P CORRUGATED BOX CORPORATION (FLOODING BELOW A DAM).
W69-05979 04A

MOLTION V STATE (FLOODING ABOVE A DAM).
W69-05988 04A

GEORGIA POWER CO V DREESE (NEGLIGENT WATER DISCHARGE).
W69-05996 04A

DANUBE RIVER
COMPUTATIONS OF LEVEL CHANGES AND RUNOFF DISTRIBUTION IN A DELTA BASED ON OBSERVATIONAL DATA (DANUBE DELTA AS AN EXAMPLE),
W69-05951 02E

DATA COLLECTIONS
REFERENCES FOR WELL DATA AND WATER LEVELS IN CALIFORNIA BY THE GEOLOGICAL SURVEY,
W69-05623 02F

RIVER WATER QUALITY FOR ARTIFICIAL RECHARGE,
W69-05894 05B

HYDROGEOLOGIC DATA FROM FOUR LANDFILLS IN NORTHEASTERN ILLINOIS,
W69-05896 07C

FLOODS IN NEW YORK- 1967,
W69-05912 02E

MUNICIPAL AND INDUSTRIAL WATER USE,
W69-05916 06D

CLIMATIC ATLAS OF THE UNITED STATES,
W69-05922 02B

DATA PROCESSING
THE FITTING OF GROWTH AND ALLIED CURVES OF THE ASYMPTOTIC REGRESSION TYPE BY STEVENS'S METHOD,
W69-05711 07C

DEEP TUNNEL SYSTEM
CHICAGOLAND DEEP TUNNEL SYSTEM FOR POLLUTION AND FLOOD CONTROL FIRST CONSTRUCTION ZONE, DEFINITE PROJECT REPORT.
W69-05743 05G

DEFORMATION
VICTOR A HARDER REALTY AND CONSTRUCTION CO V CITY OF NEW YORK (DAMAGES CAUSED BY EXCAVATION AND GROUNDWATER REMOVAL).
W69-05786 06E

CONCRETE--A NON-ELASTIC MATERIAL IN THE LABORATORY AND IN STRUCTURES,
W69-05822 08F

DEGRADATION
BEHAVIOR OF MIDDLE LOUP RIVER CHANNEL AS INFLUENCED BY MILBURN DIVERSION DAM.
W69-05841 02J

DEGRADATION(STREAM)
BEHAVIOR OF MIDDLE LOUP RIVER CHANNEL AS INFLUENCED BY MILBURN DIVERSION DAM.
W69-05841 02J

DELAWARE
SMITH V UNITED STATES (DAMAGES FOR FILLING OF RESERVOIR).
W69-05796 06E

DELTAS
MATHEMATICAL MODEL AND FORTRAN IV PROGRAM FOR COMPUTER SIMULATION OF DELTAIC SEDIMENTATION,
W69-05657 07C

COMPUTER SIMULATION OF ESTUARIAL NETWORKS,
W69-05861 02L

COMPUTATIONS OF LEVEL CHANGES AND RUNOFF DISTRIBUTION IN A DELTA BASED ON OBSERVATIONAL DATA (DANUBE DELTA AS AN EXAMPLE),
W69-05951 02E

FORMATION OF A RIVER MOUTH BAR WHERE MARINE FACTORS PLAY AN IMPORTANT ROLE (EXEMPLIFIED BY THE LIELUPE RIVER),
W69-05952 02J

SOME PATTERNS OF FORMATION OF A RIVER MOUTH BAR WHERE RIVER FACTORS PLAY AN IMPORTANT ROLE (EXEMPLIFIED BY THE VISTULA DELTA),
W69-05953 02J

DEPTH-AREA-DURATION ANALYSIS
A COUNTRY-WIDE STUDY OF INTENSE RAINFALL FOR THE UNITED KINGDOM,
W69-05925 02B

DESALINATION PROCESSES
DESALINIZATION OF SOILS UNDER CONTROLLED UNSATURATED FLOW CONDITIONS,
W69-05687 02G

DESERT PLANTS
USE OF VEGETATION AS AN INDICATOR FOR SOIL PROPERTIES UNDER DESERT CONDITIONS,
W69-05682 02G

ROOT SYSTEM OF FOUR DESERT TREE SPECIES,
W69-05690 02I

DETERGENTS
INFLUENCE OF CHRONIC EXPOSURE TO ANIONIC DETERGENTS ON TOXICITY OF PESTICIDES TO GOLDFISH,
W69-05768 05C

DIAGENESIS
ABSORPTION COEFFICIENTS OF CHLOROPHYLL DERIVATIVES,
W69-05695 02H

DIASTERS
MUD FLOWS IN THE TRANSILIAN ALA-TAU AND THE MUD FLOW CATASTROPHE OF 7 JULY, 1963 IN THE ISSYK RIVER BASIN (IN RUSSIAN),
W69-05944 02E

DIATOMS
LAKE SEDIMENTS - THE BOTTOM DEPOSITS OF THE NORTH BASIN OF WINDERMERE, WITH SPECIAL REFERENCE TO THE DIATOM SUCCESSION,
W69-05707 02H

A PRELIMINARY REPORT OF THE FOSSIL DIATOM FLORA FROM LAKE HURON SEDIMENTS,
W69-05762 02H

DIFFERENTIAL SETTLEMENT
SETTLEMENT JOINTS IN BAIGUL DAM SPILLWAY,
W69-05819 08D

DIFFUSED SURFACE WATER
KAY-NOOJIN DEV CO V KINZER (SURFACE WATERS AND THE NATURAL FLOW DOCTRINE).
W69-05958 04A

DIFFUSION
UNIFIED VIEW OF DIFFUSION AND DISPERSION,
W69-05619 01B

DIFFUSION-DISPERSION RELATIONS
UNIFIED VIEW OF DIFFUSION AND DISPERSION,
W69-05619 01B

DIGITAL COMPUTERS
USE OF INTERRELATED RECORDS TO SIMULATE STREAMFLOW,
W69-05850 02E

DIGITAL COMPUTERS AND ENVIRONMENTAL CONTROL,
W69-05855 05G

SIMULATION OF THE EVOLUTION OF DRAINAGE-BASIN NETWORKS WITH A DIGITAL COMPUTER,
W69-05859 02E

COMPUTER SIMULATION OF ESTUARIAL NETWORKS,
W69-05861 02L

GROUNDWATER MANAGEMENT FOR THE NATION'S FUTURE--COMPUTER SIMULATION OF GROUNDWATER BASINS,
W69-05864 04B

DIKES
ALLEN V STATE (FLOOD DAMAGE DUE TO CONSTRUCTION OF DIKE).
W69-05798 06E

DIRECT-DISTILLATION METHODS
DETERMINATION AND ISOTOPE-RATIO ANALYSIS OF DIFFERENT FORMS OF NITROGEN IN SOILS 7. UREA,
W69-05872 05A

DISCHARGE
IMMENSE LANDSLIDE OBSTRUCTION OF ZERAVSHAN RIVER, APRIL 24, 1964 (IN RUSSIAN),
W69-05946 02E

LEVIN V MYERS (DISCHARGE OF SURFACE WATERS).
W69-05997 04A

DISCHARGE(WATER)
DOWNSTREAM VARIATIONS IN THE HYDRAULIC GEOMETRY OF STREAMS SPECIAL EMPHASIS ON MEAN VELOCITY,
W69-05639 02E

SEEPAGE FLOW ANALYSIS OF A SMALL POLDER IN THE SOUTHWESTERN PART OF THE NETHERLANDS,
W69-05927 02F

GEORGIA POWER CO V DREESE (NEGLIGENT WATER DISCHARGE).
W69-05996 04A

DISPERSION
THE EFFECTS OF BENDS ON DISPERSION IN STREAMS,
W69-05609 02E

UNIFIED VIEW OF DIFFUSION AND DISPERSION,
W69-05619 01B

DISPOSAL
HYDROGEOLOGIC DATA FROM FOUR LANDFILLS IN NORTHEASTERN ILLINOIS,
W69-05896 07C

DISTRIBUTION SYSTEMS
WATER DISTRIBUTION SYSTEMS ANALYSIS,
W69-05848 06B

DISTURBED FOREST
FOREST TREATMENT EFFECTS ON WATER QUALITY,
W69-05885 04D

DIVERSION
ADAMS V GREENWICH WATER CO (DIVERSION OF RIVER FOR PUBLIC WATER SUPPLY).
W69-05793 06E

DIVERSION WORKS FOR CONSTRUCTION,
W69-05816 04A

PANAMA CITY V YORK (SURFACE WATERS AND THEIR NATURAL FLOW).
W69-05959 04A

NEWTON COCA COLA BOTTLING CO V MURPHREY (DIVERSION OF SURFACE WATERS).
W69-05961 04A

KECK V HAFLEY (DIVERSION OF STREAM FLOW).
W69-05969 04A

DIVERSION STRUCTURES
LOGSDON V ANDERSON (SUIT TO ORDER REOPENING OF DIVERSION DITCH).
W69-05789 06E

DIVERSION WORKS FOR CONSTRUCTION,
W69-05816 04A

DI GIACINTO V NEW JERSEY ZINC COMPANY (DIVERSION OF SUBTERRANEAN WATERCOURSE).
W69-05975 04B

DIVERSION WORKS
DIVERSION WORKS FOR CONSTRUCTION,
W69-05816 04A

DOCKS
INJURING HIGHWAY BOUNDARY, PIER, SEA-WALL, DOCK, ROCK, BUOY, LANDMARK, MILE-BOARD, PIPE, MAIN, SEWER, MACHINE, TELEGRAPH, OR OTHER PROPERTY.
W69-05972 06E

DOMESTIC WATER
NEW THRUSTS IN GROUND WATER,
W69-05677 02F

DRAINAGE
HYDROLOGY, SOIL PROPERTIES, CROP GROWTH AND LAND DRAINAGE,
W69-05607 02F

DRAINAGE DISTRICTS
INDIAN GRAVE DRAINAGE DIST V CONDRON (SUIT TO ESTABLISH RIGHTS OF PERSON OUTSIDE DRAINAGE DISTRICT).
W69-05993 04A

DRAINAGE EFFECTS
SALT AND WATER BALANCE, COACHELLA VALLEY, CALIFORNIA,
W69-05670 02G

ANALYSIS OF FLOOD PROCESSES IN DRAINAGE AREAS OF VARYING SEEPAGE CHARACTER (RUSSIAN),
W69-05940 02E

DRAINAGE PRACTICES
THE INFLUENCE OF ROADS ON WATER QUALITY CHARACTERISTICS,
W69-05886 04D

DRAINAGE SYSTEMS
SALT BALANCE, IRRIGATION EFFICIENCY, AND DRAINAGE DESIGN,
W69-05671 03F

APPLICATION OF ELECTRONIC COMPUTERS TO IRRIGATION AND DRAINAGE SYSTEM PROBLEMS,
W69-05803 02A

SIMULATION OF THE EVOLUTION OF DRAINAGE-BASIN NETWORKS WITH A DIGITAL COMPUTER,
W69-05859 02E

FOREST TREATMENT EFFECTS ON WATER QUALITY,
W69-05885 04D

ANALYSIS OF FLOOD PROCESSES IN DRAINAGE AREAS OF VARYING SEEPAGE CHARACTER (RUSSIAN),
W69-05940 02E

MISKOTTEN V DRENTEN (ARTIFICIAL DRAINAGE OF SURFACE WATERS).
W69-05963 04A

HALSRUD V BRODALE (PRIVATE DRAINAGE EASEMENT AGREEMENTS).
W69-05999 04A

DRAINAGE WATER
ANDERSON V CITY OF JEFFERSON (SUIT FOR DAMAGES RESULTING FROM DISCHARGE OF WATERS UPON PRIVATE PROPERTY).
W69-05800 06E

STATE V BROWNS, INC (OBSTRUCTION OF DRAINAGE EASEMENTS).
W69-06000 04A

DRAWDOWN
STEP-DRAWDOWN TEST NEEDS CRITICAL REVIEW,
W69-05813 04B

DREDGING
CLARK V TODD (INVALIDATION OF OYSTER DREDGING LICENSES).
W69-05980 06E

DRIFTING(AQUATIC)
SEA-ICE DYNAMICS,
W69-05921 02C

DRILLING EQUIPMENT
INSTALLATION OF SOIL MOISTURE ACCESS TUBES IN ROCKY SOILS,
W69-05887 07B

DROPS
FLUCTUATIONS IN WATER DROPLET EVAPORATION RATES,
W69-05750 02D

DROUGHT HARDENING
STUDIES ON PRESOWING DROUGHT HARDENING OF WHEAT,
W69-05672 02I

DROUGHT RESISTANCE
STUDIES ON PRESOWING DROUGHT HARDENING OF WHEAT,
W69-05672 02I

DROWNING
GEORGIA POWER CO V DREESE (NEGLIGENT WATER DISCHARGE).
W69-05996 04A

DUCK BLINDS
AVERY V BEALE (CONSTITUTIONALITY OF RIPARIAN PRIORITY TO ERECT DUCK BLINDS).
W69-05987 06E

DUMAS PROCEDURE
USE OF THE COLEMAN MODEL 29A ANALYZER FOR TOTAL NITROGEN ANALYSIS OF SOILS,
W69-05874 05A

DUNES
EVOLUTION OF A DUNED BED UNDER OSCILLATORY FLOW,
W69-05662 02J

DURATION CURVES
MATHEMATICAL MODEL FOR FLOOD RISK EVALUATION,
W69-05860 04A

DYE RELEASE
TRAVEL OF SOLUTES IN THE LOWER MISSOURI RIVER,
W69-05909 05B

DYE RELEASES
AN IMPROVEMENT SCHARDAKOW DYE TECHNIQUE FOR THE MEASUREMENT OF PLANT WATER POTENTIALS,
W69-05688 02I

DYERSBURG(TENN)
FLOOD PLAIN INFORMATION, FORKED DEER RIVERS, AND LEWIS CREEK, DYERSBURG, TENNESSEE.
W69-05648 04A

DYNAMIC PROGRAMMING
WATER QUALITY MANAGEMENT AND SOME POLICY MODELS,
W69-05722 05G

AN OPERATIONS RESEARCH APPROACH TO BASIN SEDIMENT CONTROL,
W69-05733 02J

OPTIMUM MANAGEMENT OF A COMBINED PUMPED HYDRO AND IRRIGATION STORAGE FACILITY,
W69-05734 04A

EARTH DAMS
REEVALUATION AND RECONSTRUCTION OF CALIFORNIA DAMS,
W69-05804 08A

DIVERSION WORKS FOR CONSTRUCTION,
W69-05816 04A

SETTLEMENT JOINTS IN BAIGUL DAM SPILLWAY,
W69-05819 08D

EARTH PRESSURE
EXPERIMENTAL INVESTIGATION OF THE ACTIVE PRESSURE OF A CLAY SOIL ON A RETAINING WALL,
W69-05820 08D

EASEMENTS
WATER AND WATERCOURSES--NAVIGABILITY OF STREAMS IN MISSOURI.
W69-05782 06E

UNITED STATES V 2973 ACRES OF LAND (CONDEMNATION OF FLOWAGE EASEMENTS).
W69-05984 06E

GOWING V LEHMANN (WATER USE EASEMENT).
W69-05985 06E

LOCH SHELDRAKE ASSOCIATES, INC V EVANS (RESERVATION OF REASONABLE USE).
W69-05998 04A

HALSRUD V BRODALE (PRIVATE DRAINAGE EASEMENT AGREEMENTS).
W69-05999 04A

STATE V BROWNS, INC (OBSTRUCTION OF DRAINAGE EASEMENTS).
W69-06000 04A

ECOLOGY
PLANT ECOLOGY OF AN ARID BASIN, TRES ALAMOS-REDINGTON AREA, SOUTHEASTERN ARIZONA,
W69-05634 02I

ECONOMIC EFFICIENCY
THE ECONOMIC APPROACH TO THE PLANNING OF A NETWORK OF METEOROLOGICAL STATIONS,
W69-05949 07A

ECONOMIC PREDICTION
ECONOMIC IMPACT OF WATER RESOURCE DEVELOPMENT,
W69-05751 06B

METHODS FOR WORKING OUT A NATIONAL WATER BALANCE (RUSSIAN),
W69-05936 04A

ECONOMICS
ECONOMICS OF WATERSHED PLANNING,
W69-05718 06B

COLLECTIVE FACILITIES IN WATER QUALITY MANAGEMENT,
W69-05726 05G

DESIGN OF WATER-RESOURCE SYSTEMS,
W69-05729 04A

ECONOMIC EVALUATION OF WATER, PART V MULTIREGIONAL INPUT-OUTPUT TECHNIQUES AND WESTERN WATER RESOURCES DEVELOPMENT,
W69-05754 06B

ECOSYSTEMS
THE STRATEGY OF BUILDING MODELS OF COMPLEX ECOLOGICAL SYSTEMS,
W69-05713 06A

EDUCATION
AN APPROACH TO ATTACKING HUMAN-SOCIAL PROBLEMS RETARDING IRRIGATION AND AGRICULTURAL DEVELOPMENT IN LATIN AMERICA,
W69-05652 03F

FOURTH ANNUAL REPORT, FISCAL YEAR 1967-1968.
W69-05765 09D

EFFICIENCIES
COMPARATIVE MODEL TURBINE TESTS,
W69-05806 08C

EFFLUENT CHARGES
DISSOLVED OXYGEN IN THE DELAWARE ESTUARY,
W69-05727 05G

ELASTICITY OF DEMAND
CONSUMER RESPONSES TO PRICES OF RESIDENTIAL WATER,
W69-05881 06C

ELECTRIC CURRENTS
EVALUATION OF THE RATE OF FLOW THROUGH POROUS MEDIA USING ELECTROKINETIC PHENOMENA,
W69-05611 02F

ELECTRIC DISCHARGES
CORONA MEASURING TECHNIQUES FOR POWER TRANSFORMERS,
W69-05810 08C

ELECTRIC INSULATION
DAMPING OF SWITCHING OVERVOLTAGES IN EHV-NETWORKS--NEW ECONOMIC ASPECTS AND SOLUTIONS,
W69-05809 08C

ELECTRICAL CORONAS
CORONA MEASURING TECHNIQUES FOR POWER TRANSFORMERS,
W69-05810 08C

ELECTRICAL PROPERTIES
EVALUATION OF THE RATE OF FLOW THROUGH POROUS MEDIA USING ELECTROKINETIC PHENOMENA,
W69-05611 02F

ELECTRICAL STUDIES
THE USE OF THE GEOELECTRIC METHOD FOR INVESTIGATING GEOLOGIC AND HYDROLOGIC CONDITIONS IN SANTA CLARA COUNTY, CALIFORNIA,
W69-05904 07B

EMBANKMENT
ADAMS V LAWLER (SURFACE WATERS AND THE NATURAL FLOW DOCTRINE).
W69-05960 04A

EMBANKMENTS
ATCHISON T AND S F RY V TAYLOR (FLOOD DAMAGE DUE TO RAILWAY EMBANKMENT).
W69-05968 04A

EMINENT DOMAIN
KECK V HAPLEY (DIVERSION OF STREAM FLOW).
W69-05969 04A

UNITED STATES V 1,096.84 ACRES IN MARION COUNTY (AUTHORIZATION OF FEDERAL DAMS AND RESERVOIRS).
W69-05981 06E

CRARY V STATE HIGHWAY COMM'N (EMINENT DOMAIN).
W69-05982 06E

UNITED STATES V 2973 ACRES OF LAND (CONDEMNATION OF FLOWAGE EASEMENTS).
W69-05984 06E

ELLER V BOARD OF EDUCATION OF BUNCOMBE COUNTY (WATER POLLUTION AS CONSTITUTING A 'TAKING' OF PROPERTY).
W69-05986 05G

ENERGY BUDGET
THERMAL STRATIFICATION IN LAKES ANALYTICAL AND LABORATORY STUDIES,
W69-05610 02H

ENVIRONMENTAL ENGINEERING
DIGITAL COMPUTERS AND ENVIRONMENTAL CONTROL,
W69-05855 05G

ENVIRONMENTAL HEALTH
THRESHOLD PREDICTION AND CHARACTERISTICS OF LOG-NORMAL PHENOMENA,
W69-05871 07C

EPIDERMIS
STOMATAL OPENING IN ISOLATED EPIDERMAL STRIPS OF VICIA FABA. II. RESPONSES TO KCL CONCENTRATION AND THE ROLE OF POTASSIUM ABSORPTION,
W69-05681 02I

EQUATIONS
SOME APPROXIMATE SOLUTIONS OF RADIAL FLOW PROBLEMS,
W69-05903 02F

EQUIPMENT
SYSTEMS ANALYSIS,
W69-05742 06B

A TOOL FOR REPAIRING INSTALLED SOIL MOISTURE ACCESS TUBES,
W69-05888 07B

EROSION
SEDIMENT CONTROL METHODS, INTRODUCTION AND WATERSHED AREA,
W69-05620 02J

THE DEVELOPMENT, USE AND EFFICIENCY OF INDICES OF SOIL ERODIBILITY,
W69-05826 02J

EROSION CONTROL
SEDIMENT CONTROL METHODS, INTRODUCTION AND WATERSHED AREA,
W69-05620 02J

CRITERIA FOR DESIGNING AND LOCATING LOGGING ROADS TO CONTROL SEDIMENT,
W69-05884 04D

EROSION INDEX
THE DEVELOPMENT, USE AND EFFICIENCY OF INDICES OF SOIL ERODIBILITY,
W69-05826 02J

ESTIMATING EQUATIONS
THRESHOLD PREDICTION AND CHARACTERISTICS OF LOG-NORMAL PHENOMENA,
W69-05871 07C

ESTONIA
A CHANGE OF GROUNDWATER REGIME AS A METHOD OF CONTROLLING THE INCURSIONS OF SEA WATER (RUSSIAN),
W69-05939 04B

ESTUARIES
MATHEMATICAL MODEL AND FORTRAN IV PROGRAM FOR COMPUTER SIMULATION OF DELTAIC SEDIMENTATION,
W69-05647 07C

COMPUTER SIMULATION OF ESTUARIAL NETWORKS,
W69-05661 02L

EUTROPHICATION
THE EFFECTS OF ALGAE ON WATER QUALITY,
W69-05697 05C

LIST OF REFERENCES ON CONTROL OF AQUATIC PLANTS, INCLUDING ALGAE,
W69-05705 05G

SUPPLEMENT TO THE LIST OF REFERENCES ON CONTROL OF AQUATIC PLANTS, INCLUDING ALGAE,
W69-05706 05G

DEATH OF A LAKE,
W69-05844 05C

NUTRIENT REMOVAL FROM SECONDARY EFFLUENT BY ALUM FLOCCULATION AND LIME PRECIPITATION,
W69-05865 05D

AVAILABILITY OF IRON AND MANGANESE IN SOUTHERN WISCONSIN LAKES FOR THE GROWTH OF MICROCYSTIS AERUGINOSA,
W69-05867 05C

A COMPARATIVE STUDY IN EUTROPHICATION,
W69-05869 05C

EVALUATION
EXPERIENCE WITH AND EVALUATION OF CRITICAL PATH METHODS,
W69-05817 08A

MOWREY V COLEMAN (QUESTIONED VALIDITY OF WATER DISTRICT).
W69-05971 06E

EVAPORATION
RELATION OF WATER LOSS TO MOISTURE CONTENT OF HYDROPHYTES IN A NATURAL POND,
W69-05622 02D

AERODYNAMIC AND SURFACE FACTORS IN EVAPORATION,
W69-05631 02I

SIMULATION OF EVAPORATION FROM CONSTANT SOURCE WITH FINITE AREAS,
W69-05636 07C

USE OF ATMOMETERS IN ESTIMATING EVAPOTRANSPIRATION,
W69-05685 02D

FLUCTUATIONS IN WATER DROPLET EVAPORATION RATES,
W69-05750 02D

THE EFFECTS OF WAVES ON EVAPORATION FROM A FREE WATER SURFACE,
W69-05840 02D

EVAPORATION CONTROL
ANALYSIS OF AN EVAPORATION CONTROL SYSTEM ON THE SEA OF GALILEE,
W69-05601 03F

EFFECT OF SMALL SURFACE WAVES ON EVAPORATION THROUGH MONOLAYERS,
W69-05604 02D

EVAPORATION PANS
USE OF ATMOMETERS IN ESTIMATING EVAPOTRANSPIRATION,
W69-05685 02D

EVAPOTRANSPIRATION
RELATION OF WATER LOSS TO MOISTURE CONTENT OF HYDROPHYTES IN A NATURAL POND,
W69-05622 02D

AERODYNAMIC AND SURFACE FACTORS IN EVAPORATION,
W69-05631 02I

USE OF ATMOMETERS IN ESTIMATING EVAPOTRANSPIRATION,
W69-05685 02D

CONSUMPTIVE USE ESTIMATES FROM SOLAR RADIATION AND TEMPERATURE,
W69-05686 02I

THE EVAPOTRANSPIRATION COMPONENT OF A PASTORAL EXPERIMENTAL CATCHMENT,
W69-05902 02D

EVAPOTRANSPIRATION CONTROL
CONTROLLING TRANSPIRATION IN ASPEN WITH PHENYLMERCURIC ACETATE,
W69-05627 03F

EXCAVATION
VICTOR A HARDER REALTY AND CONSTRUCTION CO V CITY OF NEW YORK (DAMAGES CAUSED BY EXCAVATION AND GROUNDWATER REMOVAL).
W69-05786 06E

EXCHANGEABLE AMMONIUM-NITROGEN
DETERMINATION AND ISOTOPE-RATIO ANALYSIS OF DIFFERENT FORMS OF NITROGEN IN SOILS 6. MINERALIZABLE NITROGEN,
W69-05699 05A

EXPERIMENTAL LIMNOLOGY
NATURAL AND ARTIFICIALLY (AIR-PLOUGHING) INDUCED MOVEMENT OF RADIOACTIVE PHOSPHORUS FROM THE MUDS OF LAKES,
W69-05698 02H

ARTIFICIALLY INDUCED CIRCULATION OF LAKES BY MEANS OF COMPRESSED AIR,
W69-05866 05C

MOVEMENTS OF RADIOSODIUM (NA-24) WITHIN AN ICE-COVERED LAKE,

W69-05870 02H

EXPERIMENTAL POPULATIONS
INTERACTION OF FOOD LEVEL AND EXPLOITATION IN EXPERIMENTAL FISH POPULATIONS,
W69-05873 05C

EXPLOITATION
AMERICAN POLICY OPTIONS IN THE DEVELOPMENT OF UNDERSEA MINERAL RESOURCES.
W69-05787 06E

INTERACTION OF FOOD LEVEL AND EXPLOITATION IN EXPERIMENTAL FISH POPULATIONS,
W69-05873 05C

EXPLORATION
THE ROLE OF SOME STATISTICAL AND MATHEMATICAL METHODS IN THE INTERPRETATION OF REGIONAL GEOCHEMICAL DATA,
W69-05895 02J

EXPLOSIVE CONSTRUCTION
FORMATION OF UNDERGROUND CAVITIES BY THE USE OF EXPLOSIVES,
W69-05818 08H

EXTRA HIGH VOLTAGE
DAMPING OF SWITCHING OVERVOLTAGES IN EHV-NETWORKS--NEW ECONOMIC ASPECTS AND SOLUTIONS,
W69-05809 08C

EXTRACTION-DISTILLATION METHODS
DETERMINATION AND ISOTOPE-RATIO ANALYSIS OF DIFFERENT FORMS OF NITROGEN IN SOILS 7. UREA,
W69-05872 05A

FAR EAST(USSR)
ANALYSIS OF FLOOD PROCESSES IN DRAINAGE AREAS OF VARYING SEEPAGE CHARACTER (RUSSIAN),
W69-05940 02E

FARM WASTES
A FEASIBILITY STUDY OF A LIVESTOCK WASTE DISPOSAL SYSTEM INVOLVING THE REUSE OF WATER,
W69-05753 05D

FEASIBILITY STUDIES
CREATING HYDROPHOBIC SOIL FOR WATER HARVESTING,
W69-05676 03B

FEDERAL GOVERNMENT
SMITH V UNITED STATES (DAMAGES FOR FILLING OF RESERVOIR).
W69-05796 06E

GOVERNMENT AND WATER RESOURCES DEVELOPMENT,
W69-05878 06D

FEDERAL JURISDICTION
WATER LAW, POLITICS, AND ECONOMICS WATER RESOURCES AND PUBLIC REGULATIONS OF THEIR USES,
W69-05748 06B

FEDERAL PROJECT POLICY
UNITED STATES V 1,096.84 ACRES IN MARION COUNTY (AUTHORIZATION OF FEDERAL DAMS AND RESERVOIRS).
W69-05981 06E

FIELD CAPACITY
RELATIONSHIP OF TEXTURE TO SOME IMPORTANT SOIL MOISTURE CONSTANTS,
W69-05679 02G

FILMS
STUDIES WITH ANTITRANSPIRANTS ON GRAPEVINES (VITIS VINIFERA VAR. SULTANA),
W69-05675 02D

FISH DIETS
FOOD AND FEEDING HABITS OF JUVENILE COHO SALMON AND STEELHEAD TROUT IN WORTHY CREEK, WASHINGTON,
W69-05890 02L

FISH GUIDING
FLUID MECHANICS OF DOWNSTREAM FISH PASSAGE STRUCTURES,
W69-05667 08I

FISH MANAGEMENT
THE CONVENTION ON FISHING AND LIVING RESOURCES OF THE HIGH SEAS.
W69-05791 06E

FISH MORTALITY
INFLUENCE OF CHRONIC EXPOSURE TO ANIONIC DETERGENTS ON TOXICITY OF PESTICIDES TO GOLDFISH,
W69-05768 05C

FISH POPULATIONS
INTERACTION OF FOOD LEVEL AND EXPLOITATION IN EXPERIMENTAL FISH POPULATIONS,
W69-05873 05C

FISHKILL
STATE V AMERICAN ALKYD INDUSTRIES (PENAL LIABILITY FOR WATER POLLUTION STRICTLY CONSTRUED).
W69-05965 05G

FLEXIBLE PIPES
LABORATORY LOAD TESTS ON BURIED FLEXIBLE PIPE - PROGRESS REPORT NO 1,
W69-05845 08D

FLOCS
CONCENTRATION AND ACCUMULATION OF METALLIC IONS BY THE BACTERIUM ZOOGLOEA,
W69-05767 05D

FLOOD CONTROL
CHICAGOLAND DEEP TUNNEL SYSTEM FOR POLLUTION AND FLOOD CONTROL FIRST CONSTRUCTION ZONE, DEFINITE PROJECT REPORT.
W69-05743 05G

ALLEN V STATE (FLOOD DAMAGE DUE TO CONSTRUCTION OF DIKE).
W69-05798 06E

ANALOG MODELS FOR FLOOD CONTROL SYSTEMS,
W69-05856 04A

FLOOD DAMAGE
FLOOD PLAIN INFORMATION, ROCK RIVER AT BELOIT, WISCONSIN.
W69-05646 04A

FLOOD PLAIN INFORMATION, IRWIN, LONG AND PAW CREEKS, CHARLOTTE, NORTH CAROLINA (VOLUME 1).
W69-05647 04A

FLOOD PLAIN INFORMATION, FORKED DEER RIVERS, AND LEWIS CREEK, DYERSBURG, TENNESSEE.
W69-05648 04A

FLOOD PLAIN INFORMATION, CHEHALIS AND SKOOKUMCHUCK RIVERS, CENTRALIA-CHEHALIS, WASHINGTON.
W69-05649 04A

RES IPSA LOQUITUR AS APPLICABLE IN ACTIONS FOR DAMAGE TO PROPERTY BY THE OVERFLOW OR ESCAPE OF WATER.
W69-05784 06E

HARBISON-WALKER REFRACTORIES CO V SMITH (FLOOD DAMAGE DUE TO CLOGGED CULVERT).
W69-05792 06E

MATHEMATICAL REPRESENTATION OF AN URBAN FLOOD PLAIN,
W69-05852 04A

FLOOD PLAIN INFORMATION, CONLEY CREEK-SOUTH RIVER, METROPOLITAN ATLANTA, GEORGIA.
W69-05913 04A

FLOOD PLAIN INFORMATION, CASEY CANAL SOUTH, SAVANNAH AND CHATHAM COUNTY, GEORGIA.
W69-05914 04A

MOLTION V STATE (FLOODING ABOVE A DAM).
W69-05988 04A

FLOOD PLAINS
FLOOD PROOFING IN A FLOOD PLAIN A STOCHASTIC MODEL,
W69-05851 04A

MATHEMATICAL REPRESENTATION OF AN URBAN FLOOD PLAIN,
W69-05852 04A

ANALYSIS OF FLOOD PROCESSES IN DRAINAGE AREAS OF VARYING SEEPAGE CHARACTER (RUSSIAN),
W69-05940 02E

FLOODING
RES IPSA LOQUITUR AS APPLICABLE IN ACTIONS FOR DAMAGE TO PROPERTY BY THE OVERFLOW OR ESCAPE OF WATER.
W69-05784 06E

COATES V UNITED STATES (DIKES AS THE PROXIMATE CAUSE OF FLOODING).
W69-05978 04A

BOROUGH OF AUSTIN V A AND P CORRUGATED BOX CORPORATION (FLOODING BELOW A DAM).
W69-05979 04A

BLACK V STATE (FLOODING OF LAND BY THE STATE).
W69-05989 04A

FLOODPROOFING
FLOOD PROOFING IN A FLOOD PLAIN A STOCHASTIC MODEL,
W69-05851 04A

FLOODS
FLOOD PLAIN INFORMATION, ROCK RIVER AT BELOIT, WISCONSIN.
W69-05646 04A

FLOOD PLAIN INFORMATION, IRWIN, LONG AND PAW CREEKS, CHARLOTTE, NORTH CAROLINA (VOLUME 1).
W69-05647 04A

FLOOD PLAIN INFORMATION, FORKED DEER RIVERS, AND LEWIS CREEK, DYERSBURG, TENNESSEE.
W69-05648 04A

FLOOD PLAIN INFORMATION, CHEHALIS AND SKOOKUMCHUCK RIVERS, CENTRALIA-CHEHALIS, WASHINGTON.
W69-05649 04A

MATHEMATICAL MODEL FOR FLOOD RISK EVALUATION,
W69-05860 04A

FLOODS IN BEECHER EAST QUADRANGLE, NORTHEASTERN ILLINOIS,
W69-05911 02E

FLOODS IN NEW YORK- 1967,
W69-05912 02E

FLOOD PLAIN INFORMATION, CONLEY CREEK-SOUTH RIVER, METROPOLITAN ATLANTA, GEORGIA.

W69-05913 04A

FLOOD PLAIN INFORMATION, CASEY CANAL SOUTH, SAVANNAH AND CHATHAM COUNTY, GEORGIA.
W69-05914 04A

ANALYSIS OF THE FORMATION OF RAIN FLOODS IN SMALL BASINS (IN RUSSIAN),
W69-05942 02E

ANALYTICAL METHOD OF COMPUTING MONSOON FLOODS (KELANI GANGA RIVER BASINS AS AN EXAMPLE) (IN RUSSIAN),
W69-05947 02E

FLOODWATER
ANALYSIS OF FLOOD PROCESSES IN DRAINAGE AREAS OF VARYING SEEPAGE CHARACTER (RUSSIAN),
W69-05940 02E

ALLEY V PICKEL (DIVERSION OF WATER BY LEVEE).
W69-05957 04A

FLORIDA
PANAMA CITY V YORK (SURFACE WATERS AND THEIR NATURAL FLOW).
W69-05959 04A

UNITED STATES V 11.48 ACRES OF LAND, ETC (COMPENSATION FOR CONDEMNED RIPARIAN RIGHTS).
W69-05964 06C

FLOW
MOVEMENT OF WATER THROUGH SOIL AS INFLUENCED BY OSMOTIC PRESSURE AND TEMPERATURE GRADIENTS,
W69-05683 02G

FLOW MEASUREMENT
EVALUATION OF THE RATE OF FLOW THROUGH POROUS MEDIA USING ELECTROKINETIC PHENOMENA,
W69-05611 02F

WATER CONSUMPTION IN THE LOWER COLORADO RIVER VALLEY,
W69-05678 02E

FLUORIDES
A FIELD AND LABORATORY STUDY OF FLUORIDE UPTAKE BY OYSTERS,
W69-05752 05C

FOOD ABUNDANCE
INTERACTION OF FOOD LEVEL AND EXPLOITATION IN EXPERIMENTAL FISH POPULATIONS,
W69-05873 05C

FOREIGN CONSTRUCTION
FORMATION OF UNDERGROUND CAVITIES BY THE USE OF EXPLOSIVES,
W69-05818 08H

FOREIGN LITERATURE
TRANSLATIONS OF FOREIGN LITERATURE ON HYDRAULICS.
W69-05655 08B

FORTRAN PROGRAMS
MATHEMATICAL MODEL AND FORTRAN IV PROGRAM FOR COMPUTER SIMULATION OF DELTAIC SEDIMENTATION,
W69-05657 07C

FOUNDATION INVESTIGATIONS
PILE TESTS GUIDE FOUNDATION DESIGN,
W69-05843 08D

FOUNDATIONS
GENERAL REPORT ON SHALLOW FOUNDATIONS, DEEP FOUNDATIONS WITHOUT PILES, PILE FOUNDATIONS,
W69-05846 08D

FRACTURES(GEOLOGY)
ON THE TEMPERATURE OF WATER FLOWING THROUGH FRACTURES,
W69-05624 02F

FRAZIL ICE
RELATIONSHIP OF AIR TEMPERATURE TO THE OCCURRENCE OF FRAZIL ICE AND ICE FLOW IN RIVERS,
W69-05923 02C

FREEZE-THAW DURABILITY
BUREAU OF RECLAMATION EXPERIENCE WITH FROST ACTION ON CONCRETE,
W69-05801 08F

FREEZE-THAW TESTS
BUREAU OF RECLAMATION EXPERIENCE WITH FROST ACTION ON CONCRETE,
W69-05801 08F

FUTURE PLANNING(PROJECTED)
THE FUTURE AGRICULTURAL USE OF WATER - SOUTHERN HUMID REGION,
W69-05738 06B

GATE CONTROL
DEVELOPMENT OF AUTOMATION ON THE SALT RIVER PROJECT,
W69-05832 03F

REMOTE CONTROL OF IRRIGATION WATER FACILITIES,
W69-05833 03F

GEOCHEMISTRY
A COMPARATIVE STUDY IN EUTROPHICATION,
W69-05869 05C

SIGNIFICANCE OF REDOX POTENTIAL IN NATURAL WATERS (IN FRENCH),
W69-05877 02K

THE ROLE OF SOME STATISTICAL AND MATHEMATICAL METHODS IN THE INTERPRETATION OF REGIONAL GEOCHEMICAL DATA,
W69-05895 02J

GEOHYDROLOGICAL UNITS
FLUID FLOW IN THE WESTERN CANADA SEDIMENTARY BASIN. 2. EFFECT OF GEOLOGY,
W69-05602 02F

GEOMORPHIC SOIL GROUPINGS
GEOMORPHIC GROUPING OF SOILS IN WATERSHED ENGINEERING,
W69-05907 02G

GEORGIA
CONSUMER RESPONSES TO PRICES OF RESIDENTIAL WATER,
W69-05881 06C

FLOOD PLAIN INFORMATION, CONLEY CREEK-SOUTH RIVER, METROPOLITAN ATLANTA, GEORGIA.
W69-05913 04A

FLOOD PLAIN INFORMATION, CASEY CANAL SOUTH, SAVANNAH AND CHATHAM COUNTY, GEORGIA.
W69-05914 04A

GEORGIA POWER CO V DREESE (NEGLIGENT WATER DISCHARGE).
W69-05996 04A

LEVIN V MYERS (DISCHARGE OF SURFACE WATERS).
W69-05997 04A

GHYBEN-HERZBERG LENS
A STEP IN OPTIMIZING THE DEVELOPMENT OF THE BASAL WATER LENS OF SOUTHERN OAHU, HAWAII,
W69-05663 02F

GLACIATION
SYNOPTIC TEMPERATURE MEASUREMENTS OF A GLACIER LAKE AND ITS ENVIRONMENT,
W69-05665 02C

GLACIERS
MASS BALANCES OF SOME NORTH CASCADE GLACIERS AS DETERMINED BY HYDROLOGIC PARAMETERS 1920-65,
W69-05664 02C

CALCULATIONS OF SLIP OF NISQUALLY GLACIER ON ITS BED NO SIMPLE RELATION OF SLIDING VELOCITY TO SHEAR STRESS,
W69-05924 02C

GOVERNMENTS
THE LEGAL IMPLICATIONS OF ATMOSPHERIC WATER RESOURCES DEVELOPMENT AND MANAGEMENT.
W69-05756 02B

GRAPEVINES
STUDIES WITH ANTITRANSPIRANTS ON GRAPEVINES (VITIS VINIFERA VAR. SULTANA),
W69-05675 02D

GRAVITY DAMS
DIVERSION WORKS FOR CONSTRUCTION,
W69-05816 04A

GRAZING
SOME OBSERVATIONS ON THE DEPENDENCE OF ZOOPLANKTON GRAZING ON THE CELL SIZE AND CONCENTRATION OF PHYTOPLANKTON BLOOMS,
W69-05696 02L

EFFECTS OF SEEDING AND GRAZING ON INFILTRATION CAPACITY AND SOIL STABILITY OF A SUBALPINE RANGE IN CENTRAL UTAH,
W69-05889 04D

GROUND WATER MOVEMENT
GROUND WATER FLOW SYSTEMS AND THE ORIGIN OF EVAPORITE DEPOSITS,
W69-05758 02F

GROUNDWATER
ON THE TEMPERATURE OF WATER FLOWING THROUGH FRACTURES,
W69-05624 02F

SUMMARY OF WATER RESOURCES DEVELOPMENT IN IRAN,
W69-05651 02E

WATER-RESOURCES APPRAISAL OF BUTTE VALLEY, ELKO AND WHITE PINE COUNTIES, NEVADA,
W69-05656 02F

A STEP IN OPTIMIZING THE DEVELOPMENT OF THE BASAL WATER LENS OF SOUTHERN OAHU, HAWAII,
W69-05663 02F

NEW THRUSTS IN GROUND WATER,
W69-05677 02F

NUMERICAL SIMULATION OF UNCONFINED FLOW INTO A SINGLE PUMPING WATER-WELL USING TWO-PHASE FLOW THEORY,
W69-05755 02F

EVOLUTION OF MICHIGAN WATER LAWS,
W69-05778 06E

EVOLUTION OF MICHIGAN WATER LAWS-GROUND WATER.
W69-05781 06E

THE USE OF THE GEOELECTRIC METHOD FOR INVESTIGATING GEOLOGIC AND HYDROLOGIC CONDITIONS IN SANTA CLARA COUNTY, CALIFORNIA,
W69-05904 07B

CHLORIDE CONCENTRATION IN GROUNDWATER, RECHARGE RATE AND RATE OF DEPOSITION OF CHLORIDE IN THE ISRAEL COASTAL PLAIN, W69-05905 02F

A CHANGE OF GROUNDWATER REGIME AS A METHOD OF CONTROLLING THE INCURSIONS OF SEA WATER (RUSSIAN), W69-05939 04B

SALT ACCUMULATION PROCESSES IN THE GROUND WATERS OF THE KIROVABAD-KAZAKH MASSIF, W69-05954 02F

GROUNDWATER BASIN
A CHANGE OF GROUNDWATER REGIME AS A METHOD OF CONTROLLING THE INCURSIONS OF SEA WATER (RUSSIAN), W69-05939 04B

GROUNDWATER BASINS
MECHANICS OF A MATHEMATICAL GROUND-WATER MODEL, W69-05863 02F

GROUNDWATER MANAGEMENT FOR THE NATION'S FUTURE--COMPUTER SIMULATION OF GROUNDWATER BASINS, W69-05864 04B

GROUNDWATER CONTAMINATION
A STUDY OF GROUNDWATER CONTAMINATION DUE TO SALINE WATER DISPOSAL IN THE MORROW COUNTY OIL FIELDS, W69-05749 05B

GROUNDWATER MOVEMENT
FLOW RATES IN TWO-DIMENSIONAL, UNSTEADY, CONFINED GROUNDWATER FLOW, W69-05617 02F

SOME APPROXIMATE SOLUTIONS OF RADIAL FLOW PROBLEMS, W69-05903 02F

CHLORIDE CONCENTRATION IN GROUNDWATER, RECHARGE RATE AND RATE OF DEPOSITION OF CHLORIDE IN THE ISRAEL COASTAL PLAIN, W69-05905 02F

A CHANGE OF GROUNLWATER REGIME AS A METHOD OF CONTROLLING THE INCURSIONS OF SEA WATER (RUSSIAN), W69-05939 04B

GROUNDWATER RECHARGE
AQUIFER STORAGE DETERMINATION BY RADIOTRACER TECHNIQUES, W69-05814 07B

GROWTH CURVES
THE FITTING OF GROWTH AND ALLIED CURVES OF THE ASYMPTOTIC REGRESSION TYPE BY STEVENS'S METHOD, W69-05711 07C

HAWAII
WATER QUALITY IN HAWAII, W69-05893 05G

HEATED WATER
EVAPORATIVE COOLING OF HEATED IRRIGATION WATER BY SPRINKLER APPLICATION, W69-05606 03C

HIGHWAY ICING
HUIE V CITY OF NEW YORK (CITY'S OBLIGATION TO MAINTAIN SUBSTITUTE HIGHWAYS). W69-05991 06E

HIGHWAYS
STATE V BROWNS, INC (OBSTRUCTION OF DRAINAGE EASEMENTS). W69-06000 04A

HOT SPRINGS
RATE OF SULFURIC ACID FORMATION IN YELLOWSTONE NATIONAL PARK, W69-05635 02K

BACTERIAL ORIGIN OF SULFURIC ACID IN SULFUROUS HOT SPRINGS, W69-05654 02K

HYBRID COMPUTER METHODS
SIMULATION OF EVAPORATION FROM CONSTANT SOURCE WITH FINITE AREAS, W69-05636 07C

HYDRAULIC MODELS
SURFACE TENSION IN FROUDE MODELS, W69-05621 02E

EVOLUTION OF A DUNED BED UNDER OSCILLATORY FLOW, W69-05662 02J

FLUID MECHANICS OF DOWNSTREAM FISH PASSAGE STRUCTURES, W69-05667 08I

COMPARATIVE MODEL TURBINE TESTS, W69-05806 08C

HYDRAULIC PROPERTIES
COMPUTER SIMULATION OF ESTUARIAL NETWORKS, W69-05861 02L

HYDRAULIC SIMILITUDE
SURFACE TENSION IN FROUDE MODELS, W69-05621 02E

HYDRAULIC TURBINES
COMPARATIVE MODEL TURBINE TESTS, W69-05806 08C

HYDRAULICS
TRANSLATIONS OF FOREIGN LITERATURE ON HYDRAULICS. W69-05655 08B

GENERALIZED EXPRESSION FOR THE CONNECTION BETWEEN THE KINEMATIC AND MORPHOLOGIC ELEMENTS OF RIVER FLOW (IN RUSSIAN), W69-05941 02E

HYDROELECTRIC PLANTS
OPTIMUM MANAGEMENT OF A COMBINED PUMPED HYDRO AND IRRIGATION STORAGE FACILITY, W69-05734 04A

HYDROGEOLOGY
FLUID FLOW IN THE WESTERN CANADA SEDIMENTARY BASIN. 2. EFFECT OF GEOLOGY, W69-05602 02F

HYDROGRAPH ANALYSIS
THE INFILTRATION COMPONENT OF A PASTORAL EXPERIMENTAL CATCHMENT, PARTS 1 AND 2, W69-05901 02G

HYDROLOGIC ASPECTS
SURVEY OF WATER INDUCED LAND-INSTABILITY HAZARDS IN THE PORTLAND, OREGON REGION, W69-05640 08D

GEOMORPHIC GROUPING OF SOILS IN WATERSHED ENGINEERING, W69-05907 02G

HYDROLOGIC BUDGET
MASS BALANCES OF SOME NORTH CASCADE GLACIERS AS DETERMINED BY HYDROLOGIC PARAMETERS 1920-65, W69-05664 02C

THE EVAPOTRANSPIRATION COMPONENT OF A PASTORAL EXPERIMENTAL CATCHMENT, W69-05902 02D

HYDROLOGIC DATA
REFERENCES FOR WELL DATA AND WATER LEVELS IN CALIFORNIA BY THE GEOLOGICAL SURVEY, W69-05623 02F

HYDROLOGIC EQUATION
A NONLINEAR HYDROLOGIC SYSTEM RESPONSE MODEL, W69-05858 02A

HYDROLOGY
THE STATISTICAL MEASURE OF HYDROLOGIC TIME SERIES, W69-05775 02E

HYDROPHOBIC SOILS
CREATING HYDROPHOBIC SOIL FOR WATER HARVESTING, W69-05676 03B

ICEBERGS
RELATIONSHIP OF AIR TEMPERATURE TO THE OCCURRENCE OF FRAZIL ICE AND ICE FLOW IN RIVERS, W69-05923 02C

ILLINOIS
HYDROGEOLOGIC DATA FROM FOUR LANDFILLS IN NORTHEASTERN ILLINOIS, W69-05896 07C

FLOODS IN BEECHER EAST QUADRANGLE, NORTHEASTERN ILLINOIS, W69-05911 02E

INDIAN GRAVE DRAINAGE DIST V CONDRON (SUIT TO ESTABLISH RIGHTS OF PERSON OUTSIDE DRAINAGE DISTRICT). W69-05993 04A

IMPACT TESTS
NONDESTRUCTIVE CONCRETE TESTS--GRAND COULEE SPILLWAY BRIDGE, W69-05823 08F

IMPERVIOUS MEMBRANES
THE INFLUENCE OF SUBSURFACE ASPHALT BARRIERS ON THE WATER PROPERTIES AND THE PRODUCTIVITY OF SAND SOILS, W69-05802 02G

IMPOUNDED WATERS
BOROUGH OF AUSTIN V A AND P CORRUGATED BOX CORPORATION (FLOODING BELOW A DAM). W69-05979 04A

IMPOUNDMENT EFFECTS
IMPOUNDMENT AND TEMPERATURE EFFECT ON WASTE ASSIMILATION, W69-05637 05C

IMPOUNDMENTS
IMPOUNDMENT AND TEMPERATURE EFFECT ON WASTE ASSIMILATION, W69-05637 05C

LOCH SHELDRAKE ASSOCIATES, INC V EVANS (RESERVATION OF REASONABLE USE). W69-05998 04A

IMPREGNATION
CONCRETE-POLYMER MATERIALS, FIRST TOPICAL REPORT, W69-05835 08F

INCOME
CONSUMER RESPONSES TO PRICES OF RESIDENTIAL WATER, W69-05881 06C

INDEXES

THE DEVELOPMENT, USE AND EFFICIENCY OF INDICES OF SOIL ERODIBILITY,
W69-05826 02J

INDIA
RELATIONSHIP OF TEXTURE TO SOME IMPORTANT SOIL MOISTURE CONSTANTS,
W69-05679 02G

INDUSTRIAL WATER
AN ANALYSIS OF WATER NEEDS FOR ARID AND SEMI-ARID LANDS,
W69-05673 03E

SOME ECONOMIC ASPECTS OF INDUSTRIAL WATER SUPPLY IN THE SOUTH,
W69-05739 06B

INFILTRATION
THE VERTICAL MOVEMENT OF WATER IN STRATIFIED POROUS MATERIAL. 1. INFILTRATION.
W69-05630 02G

INFILTRATION STUDIES ON NON-WETTABLE SOILS,
W69-05760 02G

NUMERICAL MODELING OF UNSATURATED GROUND WATER FLOW,
W69-05918 02F

INFILTROMETER
INFILTRATION STUDIES ON NON-WETTABLE SOILS,
W69-05760 02G

INFORMATION RETRIEVAL
TRANSLATIONS OF FORRIGN LITERATURE ON HYDRAULICS.
W69-05655 08B

INPUT-OUTPUT ANALYSIS
ECONOMIC IMPACT OF WATER RESOURCE DEVELOPMENT,
W69-05751 06B

INSTRUMENTATION
CABLE AND CLAMP MODIFICATIONS FOR MODEL 104 MOISTURE PROBES,
W69-05883 07B

INTERACTION
INTERACTION OF FOOD LEVEL AND EXPLOITATION IN EXPERIMENTAL FISH POPULATIONS,
W69-05873 05C

INTERCEPTION
MEASUREMENTS OF PRECIPITATION INTERCEPTION BY AN ARID ZONE PLANT COMMUNITY (ACACIA ANEURA F. MUELL),
W69-05689 02I

INTERNATIONAL LAW
THE CONVENTION ON FISHING AND LIVING RESOURCES OF THE HIGH SEAS.
W69-05791 06E

THE GENEVA CONVENTIONS ON THE LAW OF THE SEA SOME SUGGESTIONS FOR THEIR REVISION,
W69-05974 06E

INVESTMENT
POTENTIALS OF WATER-BASED RECREATION,
W69-05740 06B

CONTRIBUTIONS OF WATER RESOURCE DEVELOPMENT TO DEPRESSED AREAS DEVELOPMENT,
W69-05741 06B

IOWA
LOGSDON V ANDERSON (SUIT TO ORDER REOPENING OF DIVERSION DITCH).
W69-05789 06E

ALLEY V FICKEL (DIVERSION OF WATER BY LEVEE).
W69-05957 04A

HALSRUD V BRODALE (PRIVATE DRAINAGE EASEMENT AGREEMENTS).
W69-05999 04A

IRAN
SUMMARY OF WATER RESOURCES DEVELOPMENT IN IRAN,
W69-05651 02E

IRON
AVAILABILITY OF IRON AND MANGANESE IN SOUTHERN WISCONSIN LAKES FOR THE GROWTH OF MICROCYSTIS AERUGINOSA,
W69-05867 05C

IRRIGATED LAND
SALT AND WATER BALANCE, COACHELLA VALLEY, CALIFORNIA,
W69-05670 02G

IRRIGATION
OPTIMUM MANAGEMENT OF A COMBINED PUMPED HYDRO AND IRRIGATION STORAGE FACILITY,
W69-05734 04A

THE FUTURE AGRICULTURAL USE OF WATER - SOUTHERN HUMID REGION,
W69-05738 06B

ECONOMIC IMPACT OF WATER RESOURCE DEVELOPMENT,
W69-05751 06B

IRRIGATION CANALS
DESIGN OF AN AUTOMATED SURFACE IRRIGATION SYSTEM WITH REUSE SYSTEM,
W69-05830 03F

DEVELOPMENT OF AUTOMATION ON THE SALT RIVER PROJECT,
W69-05832 03F

REMOTE CONTROL OF IRRIGATION WATER FACILITIES,
W69-05833 03F

IRRIGATION DESIGN
DESIGN OF AN AUTOMATED SURFACE IRRIGATION SYSTEM WITH REUSE SYSTEM,
W69-05830 03F

IRRIGATION EFFICIENCY
THE CONTRIBUTION OF RESEARCH TO THE EFFICIENT USE OF WATER IN AGRICULTURE,
W69-05650 03F

SALT BALANCE, IRRIGATION EFFICIENCY, AND DRAINAGE DESIGN,
W69-05671 03F

THE VALUE OF WATER FOR IRRIGATION IN THE KANSAS RIVER VALLEY,
W69-05919 06B

IRRIGATION PRACTICES
THE CONTRIBUTION OF RESEARCH TO THE EFFICIENT USE OF WATER IN AGRICULTURE,
W69-05650 03F

IRRIGATION SYSTEMS
APPLICATION OF ELECTRONIC COMPUTERS TO IRRIGATION AND DRAINAGE SYSTEM PROBLEMS,
W69-05803 02A

AUTOMATION AND SEMI-AUTOMATION OF SURFACE IRRIGATION,
W69-05829 03F

DESIGN OF AN AUTOMATED SURFACE IRRIGATION SYSTEM WITH REUSE SYSTEM,
W69-05830 03F

AUTOMATIC SPRINKLER IRRIGATION AND ITS FUTURE IN THE MIDWEST,
W69-05831 03F

DEVELOPMENT OF AUTOMATION ON THE SALT RIVER PROJECT,
W69-05832 03F

REMOTE CONTROL OF IRRIGATION WATER FACILITIES,
W69-05833 03F

AUTOMATION OF IRRIGATION,
W69-05834 03F

ISOTOPE-RATIO ANALYSIS
DETERMINATION AND ISOTOPE-RATIO ANALYSIS OF DIFFERENT FORMS OF NITROGEN IN SOILS 6. MINERALIZABLE NITROGEN,
W69-05699 05A

DETERMINATION AND ISOTOPE-RATIO ANALYSIS OF DIFFERENT FORMS OF NITROGEN IN SOILS 4. EXCHANGEABLE AMMONIUM, NITRATE, AND NITRITE BY DIRECT-DISTILLATION METHODS,
W69-05701 05A

DETERMINATION AND ISOTOPE-RATIO ANALYSIS OF DIFFERENT FORMS OF NITROGEN IN SOILS 7. UREA,
W69-05872 05A

ISRAEL
ANALYSIS OF AN EVAPORATION CONTROL SYSTEM ON THE SEA OF GALILEE,
W69-05601 03F

THE CONTRIBUTION OF RESEARCH TO THE EFFICIENT USE OF WATER IN AGRICULTURE,
W69-05650 03F

USE OF VEGETATION AS AN INDICATOR FOR SOIL PROPERTIES UNDER DESERT CONDITIONS,
W69-05682 02G

CHLORIDE CONCENTRATION IN GROUNDWATER, RECHARGE RATE AND RATE OF DEPOSITION OF CHLORIDE IN THE ISRAEL COASTAL PLAIN,
W69-05905 02F

JENSEN-HAISE METHOD
CONSUMPTIVE USE ESTIMATES FROM SOLAR RADIATION AND TEMPERATURE,
W69-05686 02I

JOINTS
SETTLEMENT JOINTS IN BAIGUL DAM SPILLWAY,
W69-05819 08D

KANSAS
ANDERSON V CITY OF JEFFERSON (SUIT FOR DAMAGES RESULTING FROM DISCHARGE OF WATERS UPON PRIVATE PROPERTY).
W69-05800 06E

THE VALUE OF WATER FOR IRRIGATION IN THE KANSAS RIVER VALLEY,
W69-05919 06B

KENTUCKY
HARBISON-WALKER REFRACTORIES CO V SMITH (FLOOD DAMAGE DUE TO CLOGGED CULVERT).
W69-05792 06E

KECK V HAFLEY (DIVERSION OF STREAM FLOW).
W69-05969 04A

COMMONWEALTH V KELLEY (NEGLIGENT OBSTRUCTION TO FLOW).
W69-05970 04A

INEMATIC WAVES
SURGE FLOW A MODEL OF THE WALL LAYER,
W69-05892 08B

IROVABAD-KAZAKH MASSIF
SALT ACCUMULATION PROCESSES IN THE GROUND WATERS OF THE KIROVABAD-KAZAKH MASSIF,
W69-05954 02F

AKE HURON
A PRELIMINARY REPORT OF THE FOSSIL DIATOM FLORA FROM LAKE HURON SEDIMENTS,
W69-05762 02H

AKE MICHIGAN
NEARSHORE PHYTOPLANKTON POPULATIONS IN THE GRAND HAVEN, MICHIGAN VICINITY DURING THERMAL BAR CONDITIONS,
W69-05763 02H

AKE WINDERMERE
LAKE SEDIMENTS THE BOTTOM DEPOSITS OF THE NORTH BASIN OF WINDERMERE, WITH SPECIAL REFERENCE TO THE DIATOM SUCCESSION,
W69-05707 02H

AKES
THERMAL STRATIFICATION IN LAKES ANALYTICAL AND LABORATORY STUDIES,
W69-05610 02H

CIRCULATION IN SHALLOW HOMOGENEOUS LAKES,
W69-05618 02H

SYNOPTIC TEMPERATURE MEASUREMENTS OF A GLACIER LAKE AND ITS ENVIRONMENT,
W69-05665 02C

NATURAL AND ARTIFICIALLY (AIR-PLOUGHING) INDUCED MOVEMENT OF RADIOACTIVE PHOSPHORUS FROM THE MUDS OF LAKES,
W69-05698 02H

DEATH OF A LAKE,
W69-05844 05C

ARTIFICIALLY INDUCED CIRCULATION OF LAKES BY MEANS OF COMPRESSED AIR,
W69-05866 05C

AVAILABILITY OF IRON AND MANGANESE IN SOUTHERN WISCONSIN LAKES FOR THE GROWTH OF MICROCYSTIS AERUGINOSA,
W69-05867 05C

MOVEMENTS OF RADIOSODIUM (NA-24) WITHIN AN ICE-COVERED LAKE,
W69-05870 02H

QUALITY OF WATER IN SELECTED LAKES OF EASTERN SOUTH DAKOTA,
W69-05932 02H

UPPER GREENWOOD LAKE PROPERTY OWNERS ASS'N V GROZING (CONTROLLED USE OF LAKE WATERS).
W69-05966 04A

LOCH SHELDRAKE ASSOCIATES, INC V EVANS (RESERVATION OF REASONABLE USE).
W69-05998 04A

AND FILLS
HYDROGEOLOGIC DATA FROM FOUR LANDFILLS IN NORTHEASTERN ILLINOIS,
W69-05896 07C

AND MANAGEMENT
THE FUTURE AGRICULTURAL USE OF WATER - SOUTHERN HUMID REGION,
W69-05738 06B

AND SUBSIDENCE
VICTOR A HARDER REALTY AND CONSTRUCTION CO V CITY OF NEW YORK (DAMAGES CAUSED BY EXCAVATION AND GROUNDWATER REMOVAL).
W69-05786 06E

AND TENURE
GROBART V NORTH JERSEY DIST WATER SUPPLY COMMISSION (DIVERSION OF FLOW).
W69-05994 04A

ANDFILLS
WHITE V PENNSYLVANIA RR (DAMAGES FOR OBSTRUCTION OF STREAM).
W69-05794 06E

ANNIN V STATE (DAMAGE CAUSED BY FILLING OF CHANNEL).
W69-05797 06E

ANDSLIDES
SURVEY OF WATER INDUCED LAND-INSTABILITY HAZARDS IN THE PORTLAND, OREGON REGION,
W69-05640 08D

IMMENSE LANDSLIDE OBSTRUCTION OF ZERAVSHAN RIVER, APRIL 24, 1964 (IN RUSSIAN),
W69-05946 02E

ATIN AMERICA
AN APPROACH TO ATTACKING HUMAN-SOCIAL PROBLEMS RETARDING IRRIGATION AND AGRICULTURAL DEVELOPMENT IN LATIN AMERICA,
W69-05652 03F

AW OF THE SEA
AMERICAN POLICY OPTIONS IN THE DEVELOPMENT OF UNDERSEA MINERAL RESOURCES.
W69-05787 06E

LEACHING
CALCULATION OF PARAMETERS FOR THE EVALUATION OF THE LEACHING OF SALTS UNDER FIELD CONDITIONS, ILLUSTRATED BY NITRATE,
W69-05616 02G

SALT AND WATER BALANCE, COACHELLA VALLEY, CALIFORNIA,
W69-05670 02G

SALT BALANCE, IRRIGATION EFFICIENCY, AND DRAINAGE DESIGN,
W69-05671 03F

DESALINIZATION OF SOILS UNDER CONTROLLED UNSATURATED FLOW CONDITIONS,
W69-05687 02G

LEACHING EFFICIENCY
SALT BALANCE, IRRIGATION EFFICIENCY, AND DRAINAGE DESIGN,
W69-05671 03F

LEASES
SHELLFISH.
W69-05976 06E

LEAST SQUARES METHOD
LEAST SQUARES ESTIMATION OF MIXING COEFFICIENTS,
W69-05862 06A

LEAVES
STUDIES WITH ANTITRANSPIRANTS ON GRAPEVINES (VITIS VINIFERA VAR. SULTANA),
W69-05675 02D

AN IMPROVEMENT SCHARDAKOW DYE TECHNIQUE FOR THE MEASUREMENT OF PLANT WATER POTENTIALS,
W69-05688 02I

LEGAL ASPECTS
WATER QUALITY CONTROL LEGAL AND ADMINISTRATIVE ASPECTS,
W69-05745 05G

WATER LAW, POLITICS, AND ECONOMICS WATER RESOURCES AND PUBLIC REGULATIONS OF THEIR USES,
W69-05748 06B

THE LEGAL IMPLICATIONS OF ATMOSPHERIC WATER RESOURCES DEVELOPMENT AND MANAGEMENT.
W69-05756 02B

LEGISLATION
SECTION OF MINERAL AND NATURAL RESOURCES LAW--REPORT OF THE COMMITTEE ON WATER RESOURCES.
W69-05783 06E

WATER RIGHTS AND LEGISLATION IN THE EASTERN STATES,
W69-05879 06E

ATCHISON T AND S F RY V TAYLOR (FLOOD DAMAGE DUE TO RAILWAY EMBANKMENT).
W69-05968 04A

SHELLFISH.
W69-05976 06E

AVERY V BEALE (CONSTITUTIONALITY OF RIPARIAN PRIORITY TO ERECT DUCK BLINDS).
W69-05987 06E

LEVEES
ALLEY V FICKEL (DIVERSION OF WATER BY LEVEE).
W69-05957 04A

LIABILITIES
THE LEGAL IMPLICATIONS OF ATMOSPHERIC WATER RESOURCES DEVELOPMENT AND MANAGEMENT.
W69-05756 02B

LIELUPE RIVER(USSR)
FORMATION OF A RIVER MOUTH BAR WHERE MARINE FACTORS PLAY AN IMPORTANT ROLE (EXEMPLIFIED BY THE LIELUPE RIVER),
W69-05952 02J

LIME PRECIPITATION
NUTRIENT REMOVAL FROM SECONDARY EFFLUENT BY ALUM FLOCCULATION AND LIME PRECIPITATION,
W69-05865 05D

LIMNOLOGY
DEATH OF A LAKE,
W69-05844 05C

LINEAR PORGRAMMING
MATHEMATICAL MODELS A STOCHASTIC SEQUENTIAL APPROACH,
W69-05730 04A

LINEAR PROGRAMMING
MATHEMATICAL ANALYSIS DESIGN OF THE SIMPLE VALLEY PROJECT,
W69-05719 06A

OPTIMAL OPERATING RULES FOR MULTI-RESERVOIR SYSTEMS,
W69-05723 04A

MATHEMATICAL PROGRAMMING MODELS APPLIED TO A WATER RESOURCE SYSTEM,
W69-05725 04A

DISSOLVED OXYGEN IN THE DELAWARE ESTUARY,
W69-05727 05G

THE DELAWARE ESTUARY STUDY,
W69-05728 05G

LINSLEY POND(CONN)
A COMPARATIVE STUDY IN EUTROPHICATION,
W69-05869 05C

LOCATION
CRITERIA FOR DESIGNING AND LOCATING LOGGING ROADS TO CONTROL SEDIMENT,
W69-05884 04D

LOG-NORMAL DISTRIBUTIONS
THRESHOLD PREDICTION AND CHARACTERISTICS OF LOG-NORMAL PHENOMENA,
W69-05871 07C

LOUISIANA
COASTAL STATES GAS PRODUCING CO V STATE MINERAL BD (OWNERSHIP OF STREAM BED).
W69-05777 06E

MONTELFONE V BOH BROS CONSTRUCTION CO (LIABILITY FOR DAMAGE CAUSED BY PILE DRIVER VIBRATIONS).
W69-05799 06E

LOWER LANDOWNERS
KAY-NOOJIN DEV CO V KINZER (SURFACE WATERS AND THE NATURAL FLOW DOCTRINE).
W69-05958 04A

YONADI V HOMESTEAD COUNTRY HOMES (SURFACE WATERS AND THE NATURAL FLOW DOCTRINE).
W69-05962 04A

LOWLAND PROPRIETORS
PANAMA CITY V YORK (SURFACE WATERS AND THEIR NATURAL FLOW).
W69-05959 04A

ADAMS V LAWLER (SURFACE WATERS AND THE NATURAL FLOW DOCTRINE).
W69-05960 04A

MAINE
KENNEBUNK, KENNEBUNKPORT AND WELLS WATER DIST V MAINE TURNPIKE AUTHORITY (DAMAGES FROM TURBIDITY OF BROOK).
W69-05790 06E

STATE V LEMAR (TITLE TO TIDAL BEDS).
W69-05983 06E

MANAGEMENT
THE FUTURE AGRICULTURAL USE OF WATER - SOUTHERN HUMID REGION,
W69-05738 06B

MANGANESE
AVAILABILITY OF IRON AND MANGANESE IN SOUTHERN WISCONSIN LAKES FOR THE GROWTH OF MICROCYSTIS AERUGINOSA,
W69-05867 05C

MARINAS
MONTELEONE V BOH BROS CONSTRUCTION CO (LIABILITY FOR DAMAGE CAUSED BY PILE DRIVER VIBRATIONS).
W69-05799 06E

MARINE FISHERIES
THE CONVENTION ON FISHING AND LIVING RESOURCES OF THE HIGH SEAS.
W69-05791 06E

MARKOV PROCESSES
MARKOV CHAIN STORAGE MODELS FOR STATISTICAL HYDROLOGY,
W69-05917 07C

MARYLAND
CLARK V TODD (INVALIDATION OF OYSTER DREDGING LICENSES).
W69-05980 06E

HANCOCK V STULL (OBSTRUCTION TO NATURAL FLOW OF SURFACE WATER).
W69-05990 04A

MASSACHUSETTS
ANNUAL REPORT FOR FISCAL YEAR 1968. WATER RESOURCES RESEARCH CENTER.
W69-05764 09D

MATHEMATICAL MODEL
NUMERICAL SIMULATION OF UNCONFINED FLOW INTO A SINGLE PUMPING WATER-WELL USING TWO-PHASE FLOW THEORY,
W69-05755 02F

ANALOG COMPUTER -- A MODERN TOOL IN WATER POLLUTION CONTROL,
W69-05854 05G

MATHEMATICAL MODELS
SENSITIVITY ANALYSIS METHOD OF SYSTEM IDENTIFICATION AND ITS POTENTIAL IN HYDROLOGIC RESEARCH,
W69-05693 07C

LINEAR TIME-VARYING MODEL OF A RAINFALL-RUNOFF RELATION,
W69-05698 02A

THERMAL STRATIFICATION IN LAKES ANALYTICAL AND LABORATORY STUDIES,
W69-05610 02H

THE DEMAND FOR WATER SOME EMPIRICAL EVIDENCE ON CONSUMERS' RESPONSE TO A COMMODITY UNCERTAIN IN SUPPLY,
W69-05611 06D

THE STRATEGY OF BUILDING MODELS OF COMPLEX ECOLOGICAL SYSTEMS,
W69-05713 06A

WATER QUALITY MODELS OF THE ESTUARY,
W69-05716 05G

MATHEMATICAL PROGRAMMING MODELS APPLIED TO A WATER RESOURCE SYSTEM,
W69-05725 04A

DESIGN OF WATER-RESOURCE SYSTEMS,
W69-05729 04A

FLOOD PROOFING IN A FLOOD PLAIN A STOCHASTIC MODEL,
W69-05851 04A

MATHEMATICAL REPRESENTATION OF AN URBAN FLOOD PLAIN,
W69-05852 04A

MATHEMATICAL MODEL FOR FLOOD RISK EVALUATION,
W69-05860 04A

LEAST SQUARES ESTIMATION OF MIXING COEFFICIENTS,
W69-05862 06A

MECHANICS OF A MATHEMATICAL GROUND-WATER MODEL,
W69-05863 02F

SOME APPROXIMATE SOLUTIONS OF RADIAL FLOW PROBLEMS,
W69-05903 02F

MARKOV CHAIN STORAGE MODELS FOR STATISTICAL HYDROLOGY,
W69-05917 07C

NUMERICAL MODELING OF UNSATURATED GROUND WATER FLOW,
W69-05918 02F

A COMPARISON OF MEASURED AND THEORETICAL SNOWPACK TEMPERATURES,
W69-05929 02C

MATHEMATICAL STUDIES
GENERALIZED EXPRESSION FOR THE CONNECTION BETWEEN THE KINEMATIC AND MORPHOLOGIC ELEMENTS OF RIVER FLOW (IN RUSSIAN),
W69-05941 02E

MEANDERS
THE EFFECTS OF BENDS ON DISPERSION IN STREAMS,
W69-05609 02E

MEASUREMENT
AN IMPROVEMENT SCHARDAKOW DYE TECHNIQUE FOR THE MEASUREMENT OF PLANT WATER POTENTIALS,
W69-05688 02I

MEASUREMENTS OF PRECIPITATION INTERCEPTION BY AN ARID ZONE PLANT COMMUNITY (ACACIA ANEURA F. MUELL),
W69-05689 02I

CORONA MEASURING TECHNIQUES FOR POWER TRANSFORMERS,
W69-05810 08C

MICHIGAN
EVOLUTION OF MICHIGAN WATER LAWS,
W69-05778 06E

EVOLUTION OF MICHIGAN WATER LAWS- SURFACE WATER RIGHTS OF RIPARIANS AND NON-RIPARIANS.
W69-05779 06E

EVOLUTION OF MICHIGAN WATER LAWS - SURFACE WATER RIGHTS AMONG RIPARIAN OWNERS.
W69-05780 06E

EVOLUTION OF MICHIGAN WATER LAWS-GROUND WATER.
W69-05781 06E

MISKOTTEN V DRENTEN (ARTIFICIAL DRAINAGE OF SURFACE WATERS).
W69-05963 04A

MICROCYSTIS AERUGINOSA
AVAILABILITY OF IRON AND MANGANESE IN SOUTHERN WISCONSIN LAKES FOR THE GROWTH OF MICROCYSTIS AERUGINOSA,
W69-05867 05C

CELL CONTENTS OF NITROGEN AND PHOSPHORUS AS A MEASURE OF THEIR AVAILABILITY FOR GROWTH OF MICROCYSTIS AERUGINOSA,
W69-05868 05C

MILBURN DIVERSION DAM(NEBR)
BEHAVIOR OF MIDDLE LOUP RIVER CHANNEL AS INFLUENCED BY MILBURN DIVERSION DAM.
W69-05841 02J

MINE WATER
BEALS V ROBERTSON (MINE WATER RUNOFF).
W69-05956 05G

MINERAL WATER
GROUND WATER FLOW SYSTEMS AND THE ORIGIN OF EVAPORITE DEPOSITS,
W69-05758 02F

MINERALIZABLE NITROGEN
CHARACTERIZATION OF MINERALIZABLE NITROGEN IN SOILS,
W69-05703 05A

MISSISSIPPI

CITY OF MERIDIAN V TINGLE (RECOVERY OF DAMAGES AGAINST MUNICIPALITY FOR CREEK POLLUTION).
W69-05955 05G

NEWTON COCA COLA BOTTLING CO V MURPHREY (DIVERSION OF SURFACE WATERS).
W69-05961 04A

CRARY V STATE HIGHWAY COMM'N (EMINENT DOMAIN).
W69-05982 06E

MISSOURI
WATER AND WATERCOURSES--NAVIGABILITY OF STREAMS IN MISSOURI.
W69-05782 06E

ATCHISON T AND S F RY V TAYLOR (FLOOD DAMAGE DUE TO RAILWAY EMBANKMENT).
W69-05968 04A

COATES V UNITED STATES (DIKES AS THE PROXIMATE CAUSE OF FLOODING).
W69-05978 04A

MISSOURI RIVER
THE EFFECTS OF BENDS ON DISPERSION IN STREAMS,
W69-05609 02E

TRAVEL OF SOLUTES IN THE LOWER MISSOURI RIVER,
W69-05909 05B

MIXING
LEAST SQUARES ESTIMATION OF MIXING COEFFICIENTS,
W69-05862 06A

MODEL STUDIES
ASSESSING UPLAND RESERVOIRS USING A DAILY FLOW MODEL,
W69-05632 02E

SYSTEMS ANALYSIS,
W69-05742 06B

MODEL TESTS
COMPARATIVE MODEL TURBINE TESTS,
W69-05806 08C

MODIFICATION
CABLE AND CLAMP MODIFICATIONS FOR MODEL 104 MOISTURE PROBES,
W69-05883 07B

MOISTURE
PLANT ECOLOGY OF AN ARID BASIN, TRES ALAMOS-REDINGTON AREA, SOUTHEASTERN ARIZONA,
W69-05634 02I

MOISTURE AVAILABILITY
WATER AVAILABILITY AND GRASS ROOT DISTRIBUTION IN SELECTED SOILS,
W69-05759 02G

MOISTURE CONTENT
STUDIES ON PRESOWING DROUGHT HARDENING OF WHEAT,
W69-05672 02I

RELATIONSHIP OF TEXTURE TO SOME IMPORTANT SOIL MOISTURE CONSTANTS,
W69-05679 02G

INSTALLATION OF SOIL MOISTURE ACCESS TUBES IN ROCKY SOILS,
W69-05887 07B

MOISTURE STRESS
SOIL MOISTURE RESPONSE TO RANGE IMPROVEMENT IN THE NORTHERN GREAT PLAINS,
W69-05693 02I

MOLAR ABSORPTION COEFFICIENTS
ABSORPTION COEFFICIENTS OF CHLOROPHYLL DERIVATIVES,
W69-05695 02H

MONOMOLECULAR FILMS
ANALYSIS OF AN EVAPORATION CONTROL SYSTEM ON THE SEA OF GALILEE,
W69-05601 03F

MONOMOLECULOR FILMS
EFFECT OF SMALL SURFACE WAVES ON EVAPORATION THROUGH MONOLAYERS,
W69-05604 02D

MONSOONS
ANALYTICAL METHOD OF COMPUTING MONSOON FLOODS (KELANI GANGA RIVER BASINS AS AN EXAMPLE) (IN RUSSIAN),
W69-05947 02E

MOVEMENT
THE BEHAVIOR OF LARGE PARTICLES FALLING IN QUIESCENT LIQUIDS,
W69-05625 02J

CALCULATIONS OF SLIP OF NISQUALLY GLACIER ON ITS BED NO SIMPLE RELATION OF SLIDING VELOCITY TO SHEAR STRESS,
W69-05924 02C

MUDFLOW CONTROL
METHODS OF PREVENTING MUDFLOWS (IN RUSSIAN),
W69-05945 04A

MUDFLOWS
MUD FLOWS IN THE TRANSILIAN ALA-TAU AND THE MUD FLOW CATASTROPHE OF 7 JULY, 1963 IN THE ISSYK RIVER BASIN (IN RUSSIAN),
W69-05944 02E

METHODS OF PREVENTING MUDFLOWS (IN RUSSIAN),
W69-05945 04A

MULTIPLE OBJECTIVE PLANNING
AN INVESTIGATION OF THE EMPLOYMENT OF MULTIPLE OBJECTIVES IN WATER RESOURCES PLANNING,
W69-05882 06B

MULTIPLE PURPOSE
WATER LAW, POLITICS, AND ECONOMICS IS OUR SYSTEM OF PUBLIC DISTRICTS OUTMODED,
W69-05747 06B

MULTIPLE PURPOSE RESERVOIRS
A FRAMEWORK FOR THE MULTIPLE USE OF MUNICIPAL WATER SUPPLY AREAS,
W69-05935 06D

MULTIPLE-PURPOSE PROJECTS
THE UDA WALAWE RESERVOIR PROJECT,
W69-05653 04A

CHICAGOLAND DEEP TUNNEL SYSTEM FOR POLLUTION AND FLOOD CONTROL FIRST CONSTRUCTION ZONE, DEFINITE PROJECT REPORT.
W69-05743 05G

MULTI-RESERVOIR SYSTEM
OPTIMAL OPERATING RULES FOR MULTI-RESERVOIR SYSTEMS,
W69-05723 04A

MUNICIPAL WASTES
CITY OF MERIDIAN V TINGLE (RECOVERY OF DAMAGES AGAINST MUNICIPALITY FOR CREEK POLLUTION).
W69-05955 05G

MUNICIPAL WATER
FORECASTING WATER DEMAND, AN INTER-AND INTRA-COMMUNITY STUDY,
W69-05900 06D

A FRAMEWORK FOR THE MULTIPLE USE OF MUNICIPAL WATER SUPPLY AREAS,
W69-05935 06D

NATIONAL WATER BALANCE
A MEANING OF NATIONAL WATER BALANCE IN RATIONAL USE OF WATER RESOURCES (RUSSIAN),
W69-05937 04A

NATURAL FLOW
PANAMA CITY V YORK (SURFACE WATERS AND THEIR NATURAL FLOW).
W69-05959 04A

YONADI V HOMESTEAD COUNTRY HOMES (SURFACE WATERS AND THE NATURAL FLOW DOCTRINE).
W69-05962 04A

KECK V HAFLEY (DIVERSION OF STREAM FLOW).
W69-05969 04A

NATURAL FLOW DOCTRINE
KAY-NOOJIN DEV CO V KINZER (SURFACE WATERS AND THE NATURAL FLOW DOCTRINE).
W69-05958 04A

ADAMS V LAWLER (SURFACE WATERS AND THE NATURAL FLOW DOCTRINE).
W69-05960 04A

NATURAL STREAMS
BILLERIO V FOTI (FLOOD DAMAGE DUE TO DAMMING OF STREAM).
W69-05795 06E

NAVIGABLE RIVERS
WATER AND WATERCOURSES--NAVIGABILITY OF STREAMS IN MISSOURI.
W69-05782 06E

COATES V UNITED STATES (DIKES AS THE PROXIMATE CAUSE OF FLOODING).
W69-05978 04A

NAVIGABLE WATERS
CRARY V STATE HIGHWAY COMM'N (EMINENT DOMAIN).
W69-05982 06E

STATE V LEMAR (TITLE TO TIDAL BEDS).
W69-05983 06E

NEGEV DESERT
USE OF VEGETATION AS AN INDICATOR FOR SOIL PROPERTIES UNDER DESERT CONDITIONS,
W69-05682 02G

NERNST EQUATION
SIGNIFICANCE OF REDOX POTENTIAL IN NATURAL WATERS (IN FRENCH),
W69-05877 02K

NETHERLANDS
HYDROLOGY, SOIL PROPERTIES, CROP GROWTH AND LAND DRAINAGE,
W69-05607 02F

SEEPAGE FLOW ANALYSIS OF A SMALL POLDER IN THE SOUTHWESTERN PART OF THE NETHERLANDS,
W69-05927 02F

NETWORK DESIGN
DETERMINING MAXIMUM RELIABILITY AND EFFICIENCY OF HYDROMETEOROLOGICAL SYSTEMS AND INSTRUMENTS,

W69-05658 07A

ACCURACY IN DETERMINING THE MEAN PRECIPITATION DEPTH OVER AN AREA,
W69-05948 02B

THE ECONOMIC APPROACH TO THE PLANNING OF A NETWORK OF METEOROLOGICAL STATIONS,
W69-05949 07A

NETWORKS
SIMULATION OF THE EVOLUTION OF DRAINAGE-BASIN NETWORKS WITH A DIGITAL COMPUTER,
W69-05859 02E

NEW HAMPSHIRE
GOWING V LEHMANN (WATER USE EASEMENT).
W69-05985 06E

NEW JERSEY
CREATION OF WATER AND SEWAGE DISPOSAL AGENCIES.
W69-05788 06E

YONADI V HOMESTEAD COUNTRY HOMES (SURFACE WATERS AND THE NATURAL FLOW DOCTRINE).
W69-05962 04A

STATE V AMERICAN ALKYD INDUSTRIES (PENAL LIABILITY FOR WATER POLLUTION STRICTLY CONSTRUED).
W69-05965 05G

UPPER GREENWOOD LAKE PROPERTY OWNERS ASS'N V GROZING (CONTROLLED USE OF LAKE WATERS).
W69-05966 04A

SHELLFISH.
W69-05976 06E

GROBART V NORTH JERSEY DIST WATER SUPPLY COMMISSION (DIVERSION OF FLOW).
W69-05994 04A

STATE V BROWNS, INC (OBSTRUCTION OF DRAINAGE EASEMENTS).
W69-06000 04A

NEW YORK
VICTOR A HARDER REALTY AND CONSTRUCTION CO V CITY OF NEW YORK (DAMAGES CAUSED BY EXCAVATION AND GROUNDWATER REMOVAL).
W69-05786 06E

BILLERIO V FOTI (FLOOD DAMAGE DUE TO DAMMING OF STREAM).
W69-05795 06E

ANNIN V STATE (DAMAGE CAUSED BY FILLING OF CHANNEL).
W69-05797 06E

ALLEN V STATE (FLOOD DAMAGE DUE TO CONSTRUCTION OF DIKE).
W69-05798 06E

FLOODS IN NEW YORK- 1967,
W69-05912 02E

INJURING HIGHWAY BOUNDARY, PIER, SEA-WALL, DOCK, ROCK, BUOY, LANDMARK, MILE-BOARD, PIPE, MAIN, SEWER, MACHINE, TELEGRAPH, OR OTHER PROPERTY.
W69-05972 06E

FINDLEY LAKE PROPERTY OWNERS, INC V TOWN OF MINA (MAINTENANCE AND CONTROL OF WATER LEVEL OF LAKE).
W69-05973 04A

MOLTION V STATE (FLOODING ABOVE A DAM).
W69-05988 04A

BLACK V STATE (FLOODING OF LAND BY THE STATE).
W69-05989 04A

HUIE V CITY OF NEW YORK (CITY'S OBLIGATION TO MAINTAIN SUBSTITUTE HIGHWAYS).
W69-05991 06E

LOCH SHELDRAKE ASSOCIATES, INC V EVANS (RESERVATION OF REASONABLE USE).
W69-05998 04A

NEW YORK STATE BARGE CANAL
MOLTION V STATE (FLOODING ABOVE A DAM).
W69-05988 04A

BLACK V STATE (FLOODING OF LAND BY THE STATE).
W69-05989 04A

NISQUALLY GLACIER(WASH)
CALCULATIONS OF SLIP OF NISQUALLY GLACIER ON ITS BED NO SIMPLE RELATION OF SLIDING VELOCITY TO SHEAR STRESS,
W69-05924 02C

NITRATES
DETERMINATION AND ISOTOPE-RATIO ANALYSIS OF DIFFERENT FORMS OF NITROGEN IN SOILS 3. EXCHANGEABLE AMMONIUM, NITRATE, AND NITRITE BY EXTRACTION-DISTILLATION METHODS,
W69-05700 05A

STEAM DISTILLATION METHODS FOR DETERMINATION OF AMMONIUM, NITRATE AND NITRITE,
W69-05709 05A

NITRATE-NITROGEN
DETERMINATION AND ISOTOPE-RATIO ANALYSIS OF DIFFERENT FORMS OF NITROGEN IN SOILS 6. MINERALIZABLE NITROGEN,
W69-05699 05A

NITRITES
DETERMINATION AND ISOTOPE-RATIO ANALYSIS OF DIFFERENT FORMS OF NITROGEN IN SOILS 3. EXCHANGEABLE AMMONIUM, NITRATE, AND NITRITE BY EXTRACTION-DISTILLATION METHODS,
W69-05700 05A

STEAM DISTILLATION METHODS FOR DETERMINATION OF AMMONIUM, NITRATE AND NITRITE,
W69-05709 05A

NITRITE-NITROGEN
DETERMINATION AND ISOTOPE-RATIO ANALYSIS OF DIFFERENT FORMS OF NITROGEN IN SOILS 6. MINERALIZABLE NITROGEN,
W69-05699 05A

NITROGEN
EFFECT OF CULTIVATION ON THE NITROGEN DISTRIBUTION IN SOILS,
W69-05710 02K

INORGANIC NITROGEN IN PRECIPITATION AND ATMOSPHERIC SEDIMENTS,
W69-05712 05B

CELL CONTENTS OF NITROGEN AND PHOSPHORUS AS A MEASURE OF THEIR AVAILABILITY FOR GROWTH OF MICROCYSTIS AERUGINOSA,
W69-05868 05C

USE OF THE COLEMAN MODEL 29A ANALYZER FOR TOTAL NITROGEN ANALYSIS OF SOILS,
W69-05874 05A

NITROGEN COMPOUNDS
DETERMINATION AND ISOTOPE-RATIO ANALYSIS OF DIFFERENT FORMS OF NITROGEN IN SOILS 6. MINERALIZABLE NITROGEN,
W69-05699 05A

DETERMINATION AND ISOTOPE-RATIO ANALYSIS OF DIFFERENT FORMS OF NITROGEN IN SOILS 3. EXCHANGEABLE AMMONIUM, NITRATE, AND NITRITE BY EXTRACTION-DISTILLATION METHODS,
W69-05700 05A

DETERMINATION AND ISOTOPE-RATIO ANALYSIS OF DIFFERENT FORMS OF NITROGEN IN SOILS 4. EXCHANGEABLE AMMONIUM, NITRATE, AND NITRITE BY DIRECT-DISTILLATION METHODS,
W69-05701 05A

CHARACTERIZATION OF MINERALIZABLE NITROGEN IN SOILS,
W69-05703 05A

STEAM DISTILLATION METHODS FOR DETERMINATION OF AMMONIUM, NITRATE AND NITRITE,
W69-05709 05A

EFFECT OF CULTIVATION ON THE NITROGEN DISTRIBUTION IN SOILS,
W69-05710 02K

NUTRIENT REMOVAL FROM SECONDARY EFFLUENT BY ALUM FLOCCULATION AND LIME PRECIPITATION,
W69-05865 05D

DETERMINATION AND ISOTOPE-RATIO ANALYSIS OF DIFFERENT FORMS OF NITROGEN IN SOILS 7. UREA,
W69-05872 05A

NON-DESTRUCTIVE TESTS
NONDESTRUCTIVE CONCRETE TESTS--GRAND COULEE SPILLWAY BRIDGE,
W69-05823 08F

NON-WETTABLE SOILS
INFILTRATION STUDIES ON NON-WETTABLE SOILS,
W69-05760 02G

NORTH CAROLINA
STATE PROGRAMS FOR ESTUARINE AREA CONSERVATION,
W69-05776 02L

ELLER V BOARD OF EDUCATION OF BUNCOMBE COUNTY (WATER POLLUTION AS CONSTITUTING A 'TAKING' OF PROPERTY).
W69-05986 05G

NORTH CASCADES(WASH)
MASS BALANCES OF SOME NORTH CASCADE GLACIERS AS DETERMINED BY HYDROLOGIC PARAMETERS 1920-65,
W69-05664 02C

NUCLEAR MOISTURE METERS
INSTALLATION AND FIELD CALIBRATION OF NEUTRON-SCATTER EQUIPMENT FOR HYDROLOGIC RESEARCH IN HETEROGENEOUS AND STONY SOILS,
W69-05626 07B

CABLE AND CLAMP MODIFICATIONS FOR MODEL 104 MOISTURE PROBES,
W69-05883 07B

SOIL WATER MEASUREMENT WITH AN AM-241 BE NEUTRON SOURCE AND AN APPLICATION TO EVAPORIMETRY,
W69-05926 02G

NUISANCE
KAY-NOOJIN DEV CO V KINZER (SURFACE WATERS AND THE NATURAL FLOW DOCTRINE).
W69-05958 04A

NUISANCE ALGAE
USE OF POTASSIUM PERMANGANATE FOR CONTROL OF PROBLEM ALGAE,
W69-05704 05F

NUMERICAL SIMULATION
NUMERICAL SIMULATION OF UNCONFINED FLOW INTO A SINGLE PUMPING WATER-WELL USING TWO-PHASE FLOW THEORY,

W69-05755 02F

NUTRIENT AVAILABILITY
AVAILABILITY OF IRON AND MANGANESE IN SOUTHERN WISCONSIN LAKES FOR THE GROWTH OF MICROCYSTIS AERUGINOSA,
W69-05867 05C

CELL CONTENTS OF NITROGEN AND PHOSPHORUS AS A MEASURE OF THEIR AVAILABILITY FOR GROWTH OF MICROCYSTIS AERUGINOSA,
W69-05868 05C

NUTRIENT REMOVAL
NUTRIENT REMOVAL FROM SECONDARY EFFLUENT BY ALUM FLOCCULATION AND LIME PRECIPITATION,
W69-05865 05D

NUTRIENT REQUIREMENTS
SOIL WATER CONTENT IN RELATION TO NUTRIENT UPTAKE BY THE PLANT,
W69-05615 02I

OBSTRUCTION TO FLOW
LOGSDON V ANDERSON (SUIT TO ORDER REOPENING OF DIVERSION DITCH).
W69-05789 06E

WHITE V PENNSYLVANIA RR (DAMAGES FOR OBSTRUCTION OF STREAM).
W69-05794 06E

BILLERIO V POTI (FLOOD DAMAGE DUE TO DAMMING OF STREAM).
W69-05795 06E

IMMENSE LANDSLIDE OBSTRUCTION OF ZERAVSHAN RIVER, APRIL 24, 1964 (IN RUSSIAN),
W69-05946 02E

COMMONWEALTH V KELLEY (NEGLIGENT OBSTRUCTION TO FLOW).
W69-05970 04A

HANCOCK V STULL (OBSTRUCTION TO NATURAL FLOW OF SURFACE WATER).
W69-05990 04A

GROBART V NORTH JERSEY DIST WATER SUPPLY COMMISSION (DIVERSION OF FLOW).
W69-05994 04A

OCEAN CURRENTS
SEA-ICE DYNAMICS,
W69-05921 02C

OHIO
RECOMMENDATIONS FOR WATER POLLUTION CONTROL IN RACCOON CREEK BASIN, OHIO.
W69-05661 05G

OIL FIELD WASTES
A STUDY OF GROUNDWATER CONTAMINATION DUE TO SALINE WATER DISPOSAL IN THE MORROW COUNTY OIL FIELDS,
W69-05749 05B

OIL SPILLS
USE POLLUTION TO BENEFIT MANKIND,
W69-05891 05D

OPEN CHANNEL FLOW
FLUID MECHANICS OF DOWNSTREAM FISH PASSAGE STRUCTURES,
W69-05667 08I

OPERATING RULES
OPTIMAL OPERATING RULES FOR MULTI-RESERVOIR SYSTEMS,
W69-05723 04A

OPERATION AND MAINTENANCE
EXPERIENCES ON STARTUP AND TRIAL OPERATION AT YARDS CREEK PUMPED STORAGE PROJECT,
W69-05824 08C

OPTICAL PROPERTIES
ABSORPTION COEFFICIENTS OF CHLOROPHYLL DERIVATIVES,
W69-05695 02H

FLUCTUATIONS IN WATER DROPLET EVAPORATION RATES,
W69-05750 02D

OPTIMIZATION
THE ECONOMIC APPROACH TO THE PLANNING OF A NETWORK OF METEOROLOGICAL STATIONS,
W69-05949 07A

OREGON
SURVEY OF WATER INDUCED LAND-INSTABILITY HAZARDS IN THE PORTLAND, OREGON REGION,
W69-05640 08D

WATER LAW, POLITICS, AND ECONOMICS IS OUR SYSTEM OF PUBLIC DISTRICTS OUTMODED,
W69-05747 06B

OREGON SALMON - STEELHEAD STUDY
OUTDOOR RECREATION POLICY ISSUES AND RESEARCH PROBLEMS,
W69-05736 06D

OSCILLATORY WATER FLOW
EVOLUTION OF A DUNED BED UNDER OSCILLATORY FLOW,
W69-05662 02J

OSMOTIC PRESSURE
MOVEMENT OF WATER THROUGH SOIL AS INFLUENCED BY OSMOTIC PRESSURE AND TEMPERATURE GRADIENTS,
W69-05683 02G

OVERVOLTAGE
DAMPING OF SWITCHING OVERVOLTAGES IN EHV-NETWORKS--NEW ECONOMIC ASPECTS AND SOLUTIONS,
W69-05809 08C

A NEW SURGE-LIMITING DEVICE FOR HIGH VOLTAGE STATIONS,
W69-05811 08C

INFLUENCE OF SHUNT REACTORS ON SWITCHING SURGES,
W69-05812 08C

OWNERSHIP OF BEDS
COASTAL STATES GAS PRODUCING CO V STATE MINERAL BD (OWNERSHIP OF STREAM BED).
W69-05777 06E

WATER AND WATERCOURSES--NAVIGABILITY OF STREAMS IN MISSOURI.
W69-05782 06E

AMERICAN POLICY OPTIONS IN THE DEVELOPMENT OF UNDERSEA MINERAL RESOURCES.
W69-05787 06E

UPPER GREENWOOD LAKE PROPERTY OWNERS ASS'N V GROZING (CONTROLLED USE OF LAKE WATERS).
W69-05966 04A

STATE V LEMAR (TITLE TO TIDAL BEDS).
W69-05983 06E

OXIDATION-REDUCTION POTENTIAL
SIGNIFICANCE OF REDOX POTENTIAL IN NATURAL WATERS (IN FRENCH),
W69-05877 02K

OYSTERS
A FIELD AND LABORATORY STUDY OF FLUORIDE UPTAKE BY OYSTERS,
W69-05752 05C

CLARK V TODD (INVALIDATION OF OYSTER DREDGING LICENSES).
W69-05980 06E

PACIFIC NORTHWEST U
THE RIVER BASIN DEVELOPMENT CONCEPT, WATER RESOURCES PLANNING IN THE PACIFIC NORTHWEST,
W69-05746 06B

PAINTING
APPLICATION TECHNIQUES, PHYSICAL PROPERTIES, AND CHEMICAL RESISTANCE OF CHLORINATED RUBBER COATINGS.
W69-05808 08G

PAINTS
APPLICATION TECHNIQUES, PHYSICAL PROPERTIES, AND CHEMICAL RESISTANCE OF CHLORINATED RUBBER COATINGS.
W69-05808 08G

PALEOLIMNOLOGY
LAKE SEDIMENTS THE BOTTOM DEPOSITS OF THE NORTH BASIN OF WINDERMERE, WITH SPECIAL REFERENCE TO THE DIATOM SUCCESSION,
W69-05707 02H

PARAMETRIC HYDROLOGY
GENERALIZED EXPRESSION FOR THE CONNECTION BETWEEN THE KINEMATIC AND MORPHOLOGIC ELEMENTS OF RIVER FLOW (IN RUSSIAN),
W69-05941 02E

PATH OF POLLUTANTS
TRAVEL OF SOLUTES IN THE LOWER MISSOURI RIVER,
W69-05909 05B

PENNSYLVANIA
WHITE V PENNSYLVANIA RR (DAMAGES FOR OBSTRUCTION OF STREAM).
W69-05794 06E

BEALS V ROBERTSON (MINE WATER RUNOFF).
W69-05956 05G

ADAMS V LAWLER (SURFACE WATERS AND THE NATURAL FLOW DOCTRINE).
W69-05960 04A

DI GIACINTO V NEW JERSEY ZINC COMPANY (DIVERSION OF SUBTERRANEAN WATERCOURSE).
W69-05975 04B

BOROUGH OF AUSTIN V A AND P CORRUGATED BOX CORPORATION (FLOODING BELOW A DAM).
W69-05979 04A

JENNINGS V LEAGUE OF CIVIC ORGANIZATIONS (BREACH OF CONTRACT TO PRODUCE WATER).
W69-05995 04A

PERCOLATING WATER
DI GIACINTO V NEW JERSEY ZINC COMPANY (DIVERSION OF SUBTERRANEAN WATERCOURSE).
W69-05975 04B

PERFORMANCE
CABLE AND CLAMP MODIFICATIONS FOR MODEL 104 MOISTURE PROBES,
W69-05883 07B

PERMEABILITY
EFFECTS OF SEEDING AND GRAZING ON INFILTRATION CAPACITY AND SOIL STABILITY OF A SUBALPINE RANGE IN CENTRAL UTAH,
W69-05889 04D

PERMITS

STATE V LEMAR (TITLE TO TIDAL BEDS).
W69-05983 06E

PESTICIDES
INFLUENCE OF CHRONIC EXPOSURE TO ANIONIC DETERGENTS ON TOXICITY OF PESTICIDES TO GOLDFISH,
W69-05768 05C

PHOSPHORUS
CELL CONTENTS OF NITROGEN AND PHOSPHORUS AS A MEASURE OF THEIR AVAILABILITY FOR GROWTH OF MICROCYSTIS AERUGINOSA,
W69-05868 05C

PHOSPHORUS COMPOUNDS
NUTRIENT REMOVAL FROM SECONDARY EFFLUENT BY ALUM FLOCCULATION AND LIME PRECIPITATION,
W69-05865 05D

PHOSPHORUS RADIOISOTOPES
NATURAL AND ARTIFICIALLY (AIR-PLOUGHING) INDUCED MOVEMENT OF RADIOACTIVE PHOSPHORUS FROM THE MUDS OF LAKES,
W69-05698 02H

ARTIFICIALLY INDUCED CIRCULATION OF LAKES BY MEANS OF COMPRESSED AIR,
W69-05866 05C

PHREATOPHYTES
RELATION OF WATER LOSS TO MOISTURE CONTENT OF HYDROPHYTES IN A NATURAL POND,
W69-05622 02D

THE PHREATOPHYTE PROBLEM IN ARIZONA,
W69-05645 03B

PHYTOPLANKTON
SOME OBSERVATIONS ON THE DEPENDENCE OF ZOOPLANKTON GRAZING ON THE CELL SIZE AND CONCENTRATION OF PHYTOPLANKTON BLOOMS,
W69-05696 02L

NEARSHORE PHYTOPLANKTON POPULATIONS IN THE GRAND HAVEN, MICHIGAN VICINITY DURING THERMAL BAR CONDITIONS,
W69-05763 02H

PILE FOUNDATIONS
PILE TESTS GUIDE FOUNDATION DESIGN,
W69-05843 08D

GENERAL REPORT ON SHALLOW FOUNDATIONS, DEEP FOUNDATIONS WITHOUT PILES, PILE FOUNDATIONS,
W69-05846 08D

PILE TESTS
PILE TESTS GUIDE FOUNDATION DESIGN,
W69-05843 08D

PIPELINES
LABORATORY LOAD TESTS ON BURIED FLEXIBLE PIPE - PROGRESS REPORT NO 1,
W69-05845 08D

PITTING
SOIL MOISTURE RESPONSE TO RANGE IMPROVEMENT IN THE NORTHERN GREAT PLAINS,
W69-05693 02I

PLANNING
SANTA YNEZ BAROMETER WATERSHED,
W69-05644 03B

PREDICTING EFFECTS OF WATER SHORTAGE ON CROP YIELD,
W69-05674 03F

RESERVOIR SYSTEM SIMULATION,
W69-05717 05G

CONTRIBUTIONS OF WATER RESOURCE DEVELOPMENT TO DEPRESSED AREAS DEVELOPMENT,
W69-05741 06B

PLANT PIGMENTS
ABSORPTION COEFFICIENTS OF CHLOROPHYLL DERIVATIVES,
W69-05695 02H

PLANT TISSUES
AN IMPROVEMENT SCHARDAKOW DYE TECHNIQUE FOR THE MEASUREMENT OF PLANT WATER POTENTIALS,
W69-05688 02I

PLANTING MANAGEMENT
SOIL AND CROP MANAGEMENT FOR MAXIMUM WATER-USE EFFICIENCY ON ARID AND SEMIARID LANDS,
W69-05669 03F

POLAND
RELATIONSHIP OF AIR TEMPERATURE TO THE OCCURRENCE OF FRAZIL ICE AND ICE FLOW IN RIVERS,
W69-05923 02C

POLDER SEEPAGE
SEEPAGE FLOW ANALYSIS OF A SMALL POLDER IN THE SOUTHWESTERN PART OF THE NETHERLANDS,
W69-05927 02F

POLITICAL ASPECTS
AMERICAN POLICY OPTIONS IN THE DEVELOPMENT OF UNDERSEA MINERAL RESOURCES.
W69-05787 06E

POLLUTION ABATEMENT
CHICAGOLAND DEEP TUNNEL SYSTEM FOR POLLUTION AND FLOOD CONTROL FIRST CONSTRUCTION ZONE, DEFINITE PROJECT REPORT.
W69-05743 05G

CREATION OF WATER AND SEWAGE DISPOSAL AGENCIES.
W69-05788 06E

POLYCOTE
STUDIES WITH ANTITRANSPIRANTS ON GRAPEVINES (VITIS VINIFERA VAR. SULTANA),
W69-05675 02D

POLYMERIZATION
CONCRETE-POLYMER MATERIALS, FIRST TOPICAL REPORT,
W69-05835 08F

POPULATION
THE ANALYSIS OF DETERMINATION IN POPULATION SYSTEMS,
W69-05714 06A

POROUS MEDIA
EVALUATION OF THE RATE OF FLOW THROUGH POROUS MEDIA USING ELECTROKINETIC PHENOMENA,
W69-05611 02F

SOIL MOISTURE TRANSPORT DUE TO THERMAL GRADIENTS PRACTICAL ASPECTS,
W69-05691 02G

POTASSIUM
STOMATAL OPENING IN ISOLATED EPIDERMAL STRIPS OF VICIA FABA. II. RESPONSES TO KCL CONCENTRATION AND THE ROLE OF POTASSIUM ABSORPTION,
W69-05681 02I

POTASSIUM PERMANGANATE
USE OF POTASSIUM PERMANGANATE FOR CONTROL OF PROBLEM ALGAE,
W69-05704 05F

POTOMAC RIVER BASIN
POTOMAC RIVER WATER QUALITY NETWORK, 1968 WATER YEAR.
W69-05920 05B

POWER TRANSFORMERS
CORONA MEASURING TECHNIQUES FOR POWER TRANSFORMERS,
W69-05810 08C

PRECIPITATION
INORGANIC NITROGEN IN PRECIPITATION AND ATMOSPHERIC SEDIMENTS,
W69-05712 05B

PRECIPITATION EXCESS
IMMENSE LANDSLIDE OBSTRUCTION OF ZERAVSHAN RIVER, APRIL 24, 1964 (IN RUSSIAN),
W69-05946 02E

PRECIPITATION(ATMOSPHERIC)
ACCURACY IN DETERMINING THE MEAN PRECIPITATION DEPTH OVER AN AREA,
W69-05948 02B

PRESCRIPTIVE RIGHT
FINDLEY LAKE PROPERTY OWNERS, INC V TOWN OF MINA (MAINTENANCE AND CONTROL OF WATER LEVEL OF LAKE).
W69-05973 04A

PRESCRIPTIVE RIGHTS
BLACK V STATE (FLOODING OF LAND BY THE STATE).
W69-05989 04A

PRESOWING
STUDIES ON PRESOWING DROUGHT HARDENING OF WHEAT,
W69-05672 02I

PRICES
CONSUMER RESPONSES TO PRICES OF RESIDENTIAL WATER,
W69-05881 06C

PROBABILITY
CONDITIONAL PROBABILITIES OF FAILURES IN RESERVOIR OPERATION FOR THE MORAN-GOULD MODEL,
W69-05612 02E

DETERMINING MAXIMUM RELIABILITY AND EFFICIENCY OF HYDROMETEOROLOGICAL SYSTEMS AND INSTRUMENTS,
W69-05658 07A

MATHEMATICAL MODEL FOR FLOOD RISK EVALUATION,
W69-05860 04A

PROBABLE MAXIMUM PRECIPITATION
A COUNTRY-WIDE STUDY OF INTENSE RAINFALL FOR THE UNITED KINGDOM,
W69-05925 02B

PROJECT PLANNING
AN INVESTIGATION OF THE EMPLOYMENT OF MULTIPLE OBJECTIVES IN WATER RESOURCES PLANNING,
W69-05882 06B

PROTECTION(ELECTRICAL)
A NEW SURGE-LIMITING DEVICE FOR HIGH VOLTAGE STATIONS,
W69-05811 08C

PROTECTIVE COATINGS
APPLICATION TECHNIQUES, PHYSICAL PROPERTIES, AND CHEMICAL RESISTANCE OF CHLORINATED RUBBER COATINGS.
W69-05808 08G

PUBLIC ACCESS TO RESERVOIRS
A FRAMEWORK FOR THE MULTIPLE USE OF MUNICIPAL WATER SUPPLY

AREAS,
W69-05935 06D

PUBLIC BENEFITS
ADAMS V GREENWICH WATER CO (DIVERSION OF RIVER FOR PUBLIC WATER SUPPLY).
W69-05793 06E

PUBLIC LAND
CRARY V STATE HIGHWAY COMM'N (EMINENT DOMAIN).
W69-05982 06E

PUBLIC RIGHTS
SOME ECONOMIC ASPECTS OF INDUSTRIAL WATER SUPPLY IN THE SOUTH,
W69-05739 06B

EVOLUTION OF MICHIGAN WATER LAWS,
W69-05778 06E

EVOLUTION OF MICHIGAN WATER LAWS- SURFACE WATER RIGHTS OF RIPARIANS AND NON-RIPARIANS.
W69-05779 06E

AVERY V BEALE (CONSTITUTIONALITY OF RIPARIAN PRIORITY TO ERECT DUCK BLINDS).
W69-05987 06E

PUMPED STORAGE
OPTIMUM MANAGEMENT OF A COMBINED PUMPED HYDRO AND IRRIGATION STORAGE FACILITY,
W69-05734 04A

EXPERIENCES ON STARTUP AND TRIAL OPERATION AT YARDS CREEK PUMPED STORAGE PROJECT,
W69-05824 08C

PUMPS
GOWING V LEHMANN (WATER USE EASEMENT).
W69-05985 06E

RADIOACTIVE TRACERS
AQUIFER STORAGE DETERMINATION BY RADIOTRACER TECHNIQUES,
W69-05814 07B

RADIOACTIVITY
INSTALLATION OF SOIL MOISTURE ACCESS TUBES IN ROCKY SOILS,
W69-05887 07B

RADIOECOLOGY
RUSSIAN RADIOECOLOGY, A BIBLIOGRAPHY OF SOVIET PUBLICATIONS WITH CITATIONS OF ENGLISH TRANSLATIONS AND ABSTRACTS,
W69-05708 05C

RAILROADS
WHITE V PENNSYLVANIA RR (DAMAGES FOR OBSTRUCTION OF STREAM).
W69-05794 06E

ATCHISON T AND S F RY V TAYLOR (FLOOD DAMAGE DUE TO RAILWAY EMBANKMENT).
W69-05968 04A

RAIN
ANALYSIS OF THE FORMATION OF RAIN FLOODS IN SMALL BASINS (IN RUSSIAN),
W69-05942 02E

CALCULATION OF MAXIMUM WATER DISCHARGES ORIGINATING FROM RAIN AND SNOW (IN RUSSIAN),
W69-05943 02E

RAINFALL
AN AGROCLIMATOLOGY SURVEY OF A SEMIARID AREA IN AFRICA SOUTH OF THE SAHARA,
W69-05684 02I

MEASURMENTS OF PRECIPITATION INTERCEPTION BY AN ARID ZONE PLANT COMMUNITY (ACACIA ANEURA F. MUELL),
W69-05689 02I

HARBISON-WALKER REFRACTORIES CO V SMITH (FLOOD DAMAGE DUE TO CLOGGED CULVERT).
W69-05792 06E

THE WESTERN WATER SUPPLY--WHERE IT IS,
W69-05807 02A

AN INVESTIGATION OF METEOROLOGICAL CONDITIONS DURING A CALIFORNIA RAINFALL PERIOD,
W69-05933 02B

RAINFALL EXPECTANCY
THE WESTERN WATER SUPPLY--WHERE IT IS,
W69-05807 02A

RAINFALL INTENSITY
A COUNTRY-WIDE STUDY OF INTENSE RAINFALL FOR THE UNITED KINGDOM,
W69-05925 02B

ANALYSIS OF THE FORMATION OF RAIN FLOODS IN SMALL BASINS (IN RUSSIAN),
W69-05942 02E

RAINFALL SIMULATORS
REGIONAL RAIN MODELS WITH SPACE- AND TIME-CORRELATED STRUCTURE,
W69-05731 02B

RAINFALL-RUNOFF RELATIONSHIPS
PRECIPITATION-RUNOFF RELATIONS FOR VERY SMALL SEMIARID RANGELAND WATERSHEDS,
W69-05605 02A

LINEAR TIME-VARYING MODEL OF A RAINFALL-RUNOFF RELATION,
W69-05608 02A

ANALOG MODELS FOR FLOOD CONTROL SYSTEMS,
W69-05856 04A

ANALYSIS OF THE FORMATION OF RAIN FLOODS IN SMALL BASINS (IN RUSSIAN),
W69-05942 02E

RANGE MANAGEMENT
SOIL MOISTURE RESPONSE TO RANGE IMPROVEMENT IN THE NORTHERN GREAT PLAINS,
W69-05693 02I

REAERATION
REAERATION PREDICTION IN NATURAL STREAMS,
W69-05638 05C

REASONABLE USE
EVOLUTION OF MICHIGAN WATER LAWS - SURFACE WATER RIGHTS AMONG RIPARIAN OWNERS.
W69-05780 06E

RECHARGE
CHLORIDE CONCENTRATION IN GROUNDWATER, RECHARGE RATE AND RATE OF DEPOSITION OF CHLORIDE IN THE ISRAEL COASTAL PLAIN,
W69-05905 02F

RECHARGE WELLS
AQUIFER STORAGE DETERMINATION BY RADIOTRACER TECHNIQUES,
W69-05814 07B

RECREATION
A FRAMEWORK FOR THE MULTIPLE USE OF MUNICIPAL WATER SUPPLY AREAS,
W69-05935 06D

RECREATION DEMAND
OUTDOOR RECREATION POLICY ISSUES AND RESEARCH PROBLEMS,
W69-05736 06D

POTENTIALS OF WATER-BASED RECREATION,
W69-05740 06B

REDUCTION(CHEMICAL)
MICROBIAL DISSIMILATORY SULFUR CYCLE IN ACID MINE WATER,
W69-05899 05B

REGIONAL ANALYSIS
REGIONAL RAIN MODELS WITH SPACE- AND TIME-CORRELATED STRUCTURE,
W69-05731 02B

THE RIVER BASIN DEVELOPMENT CONCEPT, WATER RESOURCES PLANNING IN THE PACIFIC NORTHWEST,
W69-05746 06B

REGRESSION ANALYSIS
THE FITTING OF GROWTH AND ALLIED CURVES OF THE ASYMPTOTIC REGRESSION TYPE BY STEVENS'S METHOD,
W69-05711 07C

USE OF INTERRELATED RECORDS TO SIMULATE STREAMFLOW,
W69-05850 02E

REGULATION
THE ANALYSIS OF DETERMINATION IN POPULATION SYSTEMS,
W69-05714 06A

REHABILITATION
REEVALUATION AND RECONSTRUCTION OF CALIFORNIA DAMS,
W69-05804 08A

RELATIVE RIGHTS
RES IPSA LOQUITUR AS APPLICABLE IN ACTIONS FOR DAMAGE TO PROPERTY BY THE OVERFLOW OR ESCAPE OF WATER.
W69-05784 06E

UPPER GREENWOOD LAKE PROPERTY OWNERS ASS'N V GROZING (CONTROLLED USE OF LAKE WATERS).
W69-05966 04A

VINSON V TURNER (INJUNCTION AGAINST CONCENTRATION OF SURFACE WATER RIDDANCE).
W69-05967 04A

RELIABILITY
CONDITIONAL PROBABILITIES OF FAILURES IN RESERVOIR OPERATION FOR THE MORAN-GOULD MODEL,
W69-05612 02E

DETERMINING MAXIMUM RELIABILITY AND EFFICIENCY OF HYDROMETEOROLOGICAL SYSTEMS AND INSTRUMENTS,
W69-05658 07A

CABLE AND CLAMP MODIFICATIONS FOR MODEL 104 MOISTURE PROBES,
W69-05883 07B

RELIABILITY ESTIMATES FOR A STORAGE RESERVOIR WITH SEASONAL INPUT,
W69-05906 06A

RELIABILITY OF WATER SUPPLY PERFORMED BY MEANS OF A STORAGE RESERVOIR WITHIN A LIMITED PERIOD OF TIME,
W69-05930 02E

REMEDIES

EVOLUTION OF MICHIGAN WATER LAWS - SURFACE WATER RIGHTS AMONG RIPARIAN OWNERS.
W69-05780 06E

INDIAN GRAVE DRAINAGE DIST V CONDRON (SUIT TO ESTABLISH RIGHTS OF PERSON OUTSIDE DRAINAGE DISTRICT).
W69-05993 04A

REMOTE CONTROL
REMOTE CONTROL OF IRRIGATION WATER FACILITIES,
W69-05833 03F

REPELLENTS
CREATING HYDROPHOBIC SOIL FOR WATER HARVESTING,
W69-05676 03B

RES JUDICATA
MOWRFY V COLEMAN (QUESTIONED VALIDITY OF WATER DISTRICT).
W69-05971 06E

RESEARCH FACILITIES
FOURTH ANNUAL REPORT, FISCAL YEAR 1967-1968.
W69-05765 09D

RESEARCH PROJECTS
ANNUAL REPORT FOR FISCAL YEAR 1968. WATER RESOURCES RESEARCH CENTER.
W69-05764 09D

RESERVOIR CONSTRUCTION
COST OF RESERVOIRS IN ILLINOIS,
W69-05915 06C

HUIE V CITY OF NEW YORK (CITY'S OBLIGATION TO MAINTAIN SUBSTITUTE HIGHWAYS).
W69-05991 06E

RESERVOIR EVAPORATION
THE EFFECTS OF WAVES ON EVAPORATION FROM A FREE WATER SURFACE,
W69-05840 02D

RESERVOIR OPERATION
CONDITIONAL PROBABILITIES OF FAILURES IN RESERVOIR OPERATION FOR THE MORAN-GOULD MODEL,
W69-05612 02E

ASSESSING UPLAND RESERVOIRS USING A DAILY FLOW MODEL,
W69-05632 02E

RESERVOIR SYSTEM SIMULATION,
W69-05717 05G

OPTIMAL OPERATING RULES FOR MULTI-RESERVOIR SYSTEMS,
W69-05723 04A

MATHEMATICAL MODELS A STOCHASTIC SEQUENTIAL APPROACH,
W69-05730 04A

RESERVOIR SITES
JENNINGS V LEAGUE OF CIVIC ORGANIZATIONS (BREACH OF CONTRACT TO PRODUCE WATER).
W69-05995 04A

RESERVOIRS
IMPOUNDMENT AND TEMPERATURE EFFECT ON WASTE ASSIMILATION,
W69-05637 05C

THE UDA WALAWE RESERVOIR PROJECT,
W69-05653 04A

A FRAMEWORK FOR THE MULTIPLE USE OF MUNICIPAL WATER SUPPLY AREAS,
W69-05935 06D

RESISTIVITY
THE USE OF THE GEOELECTRIC METHOD FOR INVESTIGATING GEOLOGIC AND HYDROLOGIC CONDITIONS IN SANTA CLARA COUNTY, CALIFORNIA,
W69-05904 07B

RESISTORS
DAMPING OF SWITCHING OVERVOLTAGES IN EHV-NETWORKS--NEW ECONOMIC ASPECTS AND SOLUTIONS,
W69-05809 08C

A NEW SURGE-LIMITING DEVICE FOR HIGH VOLTAGE STATIONS,
W69-05811 08C

RESIZE
A TOOL FOR REPAIRING INSTALLED SOIL MOISTURE ACCESS TUBES,
W69-05888 07B

RESOURCE DEVELOPMENT
THE LEGAL IMPLICATIONS OF ATMOSPHERIC WATER RESOURCES DEVELOPMENT AND MANAGEMENT.
W69-05756 02B

GOVERNMENT AND WATER RESOURCES DEVELOPMENT,
W69-05878 06D

RETAINING WALLS
EXPERIMENTAL INVESTIGATION OF THE ACTIVE PRESSURE OF A CLAY SOIL ON A RETAINING WALL,
W69-05820 08D

RETARDANTS
STUDIES WITH ANTITRANSPIRANTS ON GRAPEVINES (VITIS VINIFERA VAR. 'SULTANA'),
W69-05675 02D

RHEOLOGY
CALCULATIONS OF SLIP OF NISQUALLY GLACIER ON ITS BED NO SIMPLE RELATION OF SLIDING VELOCITY TO SHEAR STRESS,
W69-05924 02C

RIDDANCE(LEGAL ASPECTS)
BEALS V ROBERTSON (MINE WATER RUNOFF).
W69-05956 05G

VINSON V TURNER (INJUNCTION AGAINST CONCENTRATION OF SURFACE WATER RIDDANCE).
W69-05967 04A

RIPARIAN LAND
FEDERAL LAW AND SEASHORE ACCRETION.
W69-05785 06E

RIPARIAN RIGHTS
EVOLUTION OF MICHIGAN WATER LAWS,
W69-05778 06E

EVOLUTION OF MICHIGAN WATER LAWS- SURFACE WATER RIGHTS OF RIPARIANS AND NON-RIPARIANS.
W69-05779 06E

EVOLUTION OF MICHIGAN WATER LAWS - SURFACE WATER RIGHTS AMONG RIPARIAN OWNERS.
W69-05780 06E

KENNEBUNK, KENNEBUNKPORT AND WELLS WATER DIST V MAINE TURNPIKE AUTHORITY (DAMAGES FROM TURBIDITY OF BROOK).
W69-05790 06E

ANNIN V STATE (DAMAGE CAUSED BY FILLING OF CHANNEL).
W69-05797 06E

UNITED STATES V 11.48 ACRES OF LAND, ETC (COMPENSATION FOR CONDEMNED RIPARIAN RIGHTS).
W69-05964 06C

AVERY V BEALE (CONSTITUTIONALITY OF RIPARIAN PRIORITY TO ERECT DUCK BLINDS).
W69-05987 06E

RIPPLE MARKS
EVOLUTION OF A DUNED BED UNDER OSCILLATORY FLOW,
W69-05662 02J

RISKS
MATHEMATICAL MODEL FOR FLOOD RISK EVALUATION,
W69-05860 04A

RIVER BASIN DEVELOPMENT
MATHEMATICAL ANALYSIS DESIGN OF THE SIMPLE VALLEY PROJECT,
W69-05719 06A

THE RIVER BASIN DEVELOPMENT CONCEPT, WATER RESOURCES PLANNING IN THE PACIFIC NORTHWEST,
W69-05746 06B

RIVER BASINS
COLLECTIVE FACILITIES IN WATER QUALITY MANAGEMENT,
W69-05726 05G

DESIGN OF WATER-RESOURCE SYSTEMS,
W69-05729 04A

A NONLINEAR HYDROLOGIC SYSTEM RESPONSE MODEL,
W69-05858 02A

ANALYTICAL METHOD OF COMPUTING MONSOON FLOODS (KELANI GANGA RIVER BASINS AS AN EXAMPLE) (IN RUSSIAN),
W69-05947 02E

RIVER FLOW
RELATIONSHIP OF AIR TEMPERATURE TO THE OCCURRENCE OF FRAZIL ICE AND ICE FLOW IN RIVERS,
W69-05923 02C

GENERALIZED EXPRESSION FOR THE CONNECTION BETWEEN THE KINEMATIC AND MORPHOLOGIC ELEMENTS OF RIVER FLOW (IN RUSSIAN),
W69-05941 02E

RIVER SYSTEMS
RESERVOIR SYSTEM SIMULATION,
W69-05717 05G

WATER QUALITY MANAGEMENT AND SOME POLICY MODELS,
W69-05722 05G

MATHEMATICAL PROGRAMMING MODELS APPLIED TO A WATER RESOURCE SYSTEM,
W69-05725 04A

RIVERS
POTOMAC RIVER WATER QUALITY NETWORK, 1968 WATER YEAR.
W69-05920 05B

ROAD DESIGN
THE INFLUENCE OF ROADS ON WATER QUALITY CHARACTERISTICS,
W69-05886 04D

ROAD LOCATION
THE INFLUENCE OF ROADS ON WATER QUALITY CHARACTERISTICS,
W69-05886 04D

ROADS
CRITERIA FOR DESIGNING AND LOCATING LOGGING ROADS TO CONTROL SEDIMENT,
W69-05884 04D

OT DEVELOPMENT
ROOT SYSTEM OF FOUR DESERT TREE SPECIES,
W69-05690 02I

OT DISTRIBUTION
ROOT SYSTEM OF FOUR DESERT TREE SPECIES,
W69-05690 02I

WATER AVAILABILITY AND GRASS ROOT DISTRIBUTION IN SELECTED SOILS,
W69-05759 02G

OT SYSTEMS
USE OF VEGETATION AS AN INDICATOR FOR SOIL PROPERTIES UNDER DESERT CONDITIONS,
W69-05682 02G

ROOT SYSTEM OF FOUR DESERT TREE SPECIES,
W69-05690 02I

OT ZONE
ROOT SYSTEM OF FOUR DESERT TREE SPECIES,
W69-05690 02I

NOFF
THE STABILITY OF NORMAL ANNUAL RUNOFF AND SEASONAL RIVER DISCHARGES UNDER CONDITIONS OF DEVELOPMENT OF AGROTECHNICAL ENTERPRISES IN THEIR DRAINAGE AREAS (RUSSIAN),
W69-05938 04A

CALCULATION OF MAXIMUM WATER DISCHARGES ORIGINATING FROM RAIN AND SNOW (IN RUSSIAN),
W69-05943 02E

METHODS OF PREVENTING MUDFLOWS (IN RUSSIAN),
W69-05945 04A

IMMENSE LANDSLIDE OBSTRUCTION OF ZERAVSHAN RIVER, APRIL 24, 1964 (IN RUSSIAN),
W69-05946 02E

NOFF FORECASTING
PRECIPITATION-RUNOFF RELATIONS FOR VERY SMALL SEMIARID RANGELAND WATERSHEDS,
W69-05605 02A

LINE SOILS
DESALINIZATION OF SOILS UNDER CONTROLLED UNSATURATED FLOW CONDITIONS,
W69-05687 02G

SOIL INVESTIGATIONS IN ARID REGIONS,
W69-05692 02G

LINE WATER
A STUDY OF GROUNDWATER CONTAMINATION DUE TO SALINE WATER DISPOSAL IN THE MORROW COUNTY OIL FIELDS,
W69-05749 05B

SALT ACCUMULATION PROCESSES IN THE GROUND WATERS OF THE KIROVABAD-KAZAKH MASSIF,
W69-05954 02F

LINE WATER-FRESHWATER INTERFACES
A STEP IN OPTIMIZING THE DEVELOPMENT OF THE BASAL WATER LENS OF SOUTHERN OAHU, HAWAII,
W69-05663 02F

LT BALANCE
SALT AND WATER BALANCE, COACHELLA VALLEY, CALIFORNIA,
W69-05670 02G

SALT BALANCE, IRRIGATION EFFICIENCY, AND DRAINAGE DESIGN,
W69-05671 03F

LT TOLERANCE
SALT BALANCE, IRRIGATION EFFICIENCY, AND DRAINAGE DESIGN,
W69-05671 03F

LTS
SOIL INVESTIGATIONS IN ARID REGIONS,
W69-05692 02G

ND BARS
SOME PATTERNS OF FORMATION OF A RIVER MOUTH BAR WHERE RIVER FACTORS PLAY AN IMPORTANT ROLE (EXEMPLIFIED BY THE VISTULA DELTA),
W69-05953 02J

NDS
THE INFLUENCE OF SUBSURFACE ASPHALT BARRIERS ON THE WATER PROPERTIES AND THE PRODUCTIVITY OF SAND SOILS,
W69-05802 02G

NITARY LANDFILLS
HYDROGEOLOGIC DATA FROM FOUR LANDFILLS IN NORTHEASTERN ILLINOIS,
W69-05896 07C

NTA CLARA COUNTY(CALIF)
THE USE OF THE GEOELECTRIC METHOD FOR INVESTIGATING GEOLOGIC AND HYDROLOGIC CONDITIONS IN SANTA CLARA COUNTY, CALIFORNIA,
W69-05904 07B

HARDAKOW DYE METHOD
AN IMPROVEMENT SCHARDAKOW DYE TECHNIQUE FOR THE MEASUREMENT OF PLANT WATER POTENTIALS,
W69-05688 02I

HEDULING
EXPERIENCE WITH AND EVALUATION OF CRITICAL PATH METHODS,
W69-05817 08A

SEA ICE
SEA-ICE DYNAMICS,
W69-05921 02C

SEA WATER
A CHANGE OF GROUNDWATER REGIME AS A METHOD OF CONTROLLING THE INCURSIONS OF SEA WATER (RUSSIAN),
W69-05939 04B

SEA-ICE DYNAMICS
SEA-ICE DYNAMICS,
W69-05921 02C

SECONDARY EFFLUENTS
NUTRIENT REMOVAL FROM SECONDARY EFFLUENT BY ALUM FLOCCULATION AND LIME PRECIPITATION,
W69-05865 05D

SEDIMENT CONTROL
SEDIMENT CONTROL METHODS, INTRODUCTION AND WATERSHED AREA,
W69-05620 02J

AN OPERATIONS RESEARCH APPROACH TO BASIN SEDIMENT CONTROL,
W69-05733 02J

CRITERIA FOR DESIGNING AND LOCATING LOGGING ROADS TO CONTROL SEDIMENT,
W69-05884 04D

THE INFLUENCE OF ROADS ON WATER QUALITY CHARACTERISTICS,
W69-05886 04D

SEDIMENT TRANSPORT
CRITERIA FOR DESIGNING AND LOCATING LOGGING ROADS TO CONTROL SEDIMENT,
W69-05884 04D

SEDIMENTATION
SEDIMENT CONTROL METHODS, INTRODUCTION AND WATERSHED AREA,
W69-05620 02J

THE BEHAVIOR OF LARGE PARTICLES FALLING IN QUIESCENT LIQUIDS,
W69-05625 02J

MATHEMATICAL MODEL AND FORTRAN IV PROGRAM FOR COMPUTER SIMULATION OF DELTAIC SEDIMENTATION,
W69-05657 07C

BEHAVIOR OF MIDDLE LOUP RIVER CHANNEL AS INFLUENCED BY MILBURN DIVERSION DAM.
W69-05841 02J

PRELIMINARY OBSERVATIONS ON A YEAR'S CYCLE OF SEDIMENTATION IN WINDERMERE, ENGLAND,
W69-05876 02J

COMPUTATIONS OF LEVEL CHANGES AND RUNOFF DISTRIBUTION IN A DELTA BASED ON OBSERVATIONAL DATA (DANUBE DELTA AS AN EXAMPLE),
W69-05951 02E

FORMATION OF A RIVER MOUTH BAR WHERE MARINE FACTORS PLAY AN IMPORTANT ROLE (EXEMPLIFIED BY THE LIELUPE RIVER),
W69-05952 02J

SEDIMENTATION RATE
PRELIMINARY OBSERVATIONS ON A YEAR'S CYCLE OF SEDIMENTATION IN WINDERMERE, ENGLAND,
W69-05876 02J

SEDIMENTS
THE ROLE OF SOME STATISTICAL AND MATHEMATICAL METHODS IN THE INTERPRETATION OF REGIONAL GEOCHEMICAL DATA,
W69-05895 02J

SEED TREATMENT
STUDIES ON PRESOWING DROUGHT HARDENING OF WHEAT,
W69-05672 02I

SEEPAGE
SEEPAGE FLOW ANALYSIS OF A SMALL POLDER IN THE SOUTHWESTERN PART OF THE NETHERLANDS,
W69-05927 02F

SEMIARID CLIMATES
AN AGROCLIMATOLOGY SURVEY OF A SEMIARID AREA IN AFRICA SOUTH OF THE SAHARA,
W69-05684 02I

SENSITIVITY ANALYSIS
SENSITIVITY ANALYSIS METHOD OF SYSTEM IDENTIFICATION AND ITS POTENTIAL IN HYDROLOGIC RESEARCH,
W69-05603 07C

SETTLEMENT
SETTLEMENT JOINTS IN BAIGUL DAM SPILLWAY,
W69-05819 08D

GENERAL REPORT ON SHALLOW FOUNDATIONS, DEEP FOUNDATIONS WITHOUT PILES, PILE FOUNDATIONS,
W69-05846 08D

SETTLING BASINS
INDIAN GRAVE DRAINAGE DIST V CONDRON (SUIT TO ESTABLISH RIGHTS OF PERSON OUTSIDE DRAINAGE DISTRICT).
W69-05993 04A

SETTLING VELOCITY

THE BEHAVIOR OF LARGE PARTICLES FALLING IN QUIESCENT LIQUIDS,
W69-05625 02J

SEWAGE TREATMENT
CREATION OF WATER AND SEWAGE DISPOSAL AGENCIES.
W69-05788 06E

SHELLFISH
SHELLFISH.
W69-05976 06E

SHRINKAGE
SHRINKAGE CHARACTERISTICS OF SOIL-CEMENT MIXTURES,
W69-05825 08D

SHUNT REACTORS
INFLUENCE OF SHUNT REACTORS ON SWITCHING SURGES,
W69-05812 08C

SIEROZEMS
USE OF VEGETATION AS AN INDICATOR FOR SOIL PROPERTIES UNDER DESERT CONDITIONS,
W69-05682 02G

SIERRA NEVADA
INFILTRATION STUDIES ON NON-WETTABLE SOILS,
W69-05760 02G

SIMULATION ANALYSIS
SENSITIVITY ANALYSIS METHOD OF SYSTEM IDENTIFICATION AND ITS POTENTIAL IN HYDROLOGIC RESEARCH,
W69-05603 07C

RESERVOIR SYSTEM SIMULATION,
W69-05717 05G

OPTIMAL OPERATING RULES FOR MULTI-RESERVOIR SYSTEMS,
W69-05723 04A

REGIONAL RAIN MODELS WITH SPACE- AND TIME-CORRELATED STRUCTURE,
W69-05731 02B

MATHEMATICAL SIMULATION OF THE ESTUARINE BEHAVIOR AND ITS APPLICATIONS,
W69-05732 05G

OPERATIONAL HYDROLOGY USING RESIDUALS,
W69-05847 06A

HYDROLOGIC SIMULATION IN WATER-YIELD ANALYSIS,
W69-05849 02E

USE OF INTERRELATED RECORDS TO SIMULATE STREAMFLOW,
W69-05850 02E

A NONLINEAR HYDROLOGIC SYSTEM RESPONSE MODEL,
W69-05858 02A

SIMULATION OF THE EVOLUTION OF DRAINAGE-BASIN NETWORKS WITH A DIGITAL COMPUTER,
W69-05859 02E

COMPUTER SIMULATION OF ESTUARIAL NETWORKS,
W69-05861 02L

MECHANICS OF A MATHEMATICAL GROUND-WATER MODEL,
W69-05863 02F

GROUNDWATER MANAGEMENT FOR THE NATION'S FUTURE--COMPUTER SIMULATION OF GROUNDWATER BASINS,
W69-05864 04B

SINGLE-PUMPING WELL
NUMERICAL SIMULATION OF UNCONFINED FLOW INTO A SINGLE PUMPING WATER-WELL USING TWO-PHASE FLOW THEORY,
W69-05755 02F

SNOWMELT
CALCULATION OF MAXIMUM WATER DISCHARGES ORIGINATING FROM RAIN AND SNOW (IN RUSSIAN),
W69-05943 02E

SNOWPACKS
A COMPARISON OF MEASURED AND THEORETICAL SNOWPACK TEMPERATURES,
W69-05929 02C

SOCIAL IMPACT
AN APPROACH TO ATTACKING HUMAN-SOCIAL PROBLEMS RETARDING IRRIGATION AND AGRICULTURAL DEVELOPMENT IN LATIN AMERICA,
W69-05652 03F

COMMENTS ON WATER TRANSFERS AND RELATED URBAN PROBLEMS,
W69-05766 06D

SOCIAL NEEDS
COMMENTS ON WATER TRANSFERS AND RELATED URBAN PROBLEMS,
W69-05766 06D

SODIUM RADIOISOTOPES
MOVEMENTS OF RADIOSODIUM (NA-24) WITHIN AN ICE-COVERED LAKE,
W69-05870 02H

SOIL AGGREGATES
THIXOTROPIC AGING OF SYNTHETIC SOIL AGGREGATES,
W69-05908 02G

SOIL ANALYSIS
USE OF THE COLEMAN MODEL 29A ANALYZER FOR TOTAL NITROGEN ANALYSIS OF SOILS,
W69-05874 05A

A SIMPLE STEAM DISTILLATION METHOD OF ESTIMATING (BETA-HYDROXY-ALPHA-AMINO) ACIDS,
W69-05875 05A

SOIL CEMENT
SHRINKAGE CHARACTERISTICS OF SOIL-CEMENT MIXTURES,
W69-05825 08D

SOIL CHEMISTRY
DETERMINATION AND ISOTOPE-RATIO ANALYSIS OF DIFFERENT FORMS OF NITROGEN IN SOILS 7. UREA,
W69-05872 05A

A SIMPLE STEAM DISTILLATION METHOD OF ESTIMATING (BETA-HYDROXY-ALPHA-AMINO) ACIDS,
W69-05875 05A

SOIL CLASSIFICATIONS
SOIL INVESTIGATIONS IN ARID REGIONS,
W69-05692 02G

SOIL CONSERVATION
THE SOIL AND WATER CONSERVATIONIST OF TOMORROW,
W69-05842 09A

SOIL EROSION
THE DEVELOPMENT, USE AND EFFICIENCY OF INDICES OF SOIL ERODIBILITY,
W69-05826 02J

FOREST TREATMENT EFFECTS ON WATER QUALITY,
W69-05885 04D

THE INFLUENCE OF ROADS ON WATER QUALITY CHARACTERISTICS,
W69-05886 04D

SOIL INVESTIGATIONS
SOIL INVESTIGATIONS IN ARID REGIONS,
W69-05692 02G

SOIL MANAGEMENT
SOIL WATER CONTENT IN RELATION TO NUTRIENT UPTAKE BY THE PLANT,
W69-05615 02I

SOIL AND CROP MANAGEMENT FOR MAXIMUM WATER-USE EFFICIENCY O ARID AND SEMIARID LANDS,
W69-05669 03F

SOIL MOISTURE
ON THE RELATION BETWEEN TRANSPIRATION, SOIL PHYSICAL PROPERTIES AND CROP PRODUCTION AS A BASIS FOR WATER SUPPLY PLANS,
W69-05613 02I

RELATIONSHIP OF TEXTURE TO SOME IMPORTANT SOIL MOISTURE CONSTANTS,
W69-05679 02G

SOIL MOISTURE TRANSPORT DUE TO THERMAL GRADIENTS PRACTICAL ASPECTS,
W69-05691 02G

SOIL MOISTURE RESPONSE TO RANGE IMPROVEMENT IN THE NORTHERN GREAT PLAINS,
W69-05693 02I

SOIL MOISTURE METERS
INSTALLATION AND FIELD CALIBRATION OF NEUTRON-SCATTER EQUIPMENT FOR HYDROLOGIC RESEARCH IN HETEROGENEOUS AND STONY SOILS,
W69-05626 07B

INSTALLATION OF SOIL MOISTURE ACCESS TUBES IN ROCKY SOILS,
W69-05887 07B

A TOOL FOR REPAIRING INSTALLED SOIL MOISTURE ACCESS TUBES,
W69-05888 07B

SOIL WATER MEASUREMENT WITH AN AM-241 BE NEUTRON SOURCE AND AN APPLICATION TO EVAPORIMETRY,
W69-05926 02G

A RECORDING FIELD TENSIOMETER WITH RAPID RESPONSE CHARACTERISTICS,
W69-05931 02G

SOIL MOISTURE TRANSPORT
SOIL MOISTURE TRANSPORT DUE TO THERMAL GRADIENTS PRACTICAL ASPECTS,
W69-05691 02G

SOIL PRESSURE
LABORATORY LOAD TESTS ON BURIED FLEXIBLE PIPE - PROGRESS REPORT NO 1,
W69-05845 08D

SOIL PROFILES
USE OF VEGETATION AS AN INDICATOR FOR SOIL PROPERTIES UNDER DESERT CONDITIONS,
W69-05682 02G

SOIL PROPERTIES
EFFECTS OF SEEDING AND GRAZING ON INFILTRATION CAPACITY AND SOIL STABILITY OF A SUBALPINE RANGE IN CENTRAL UTAH,
W69-05889 04D

GEOMORPHIC GROUPING OF SOILS IN WATERSHED ENGINEERING,

69-05907 02G

L STABILITY
FFECTS OF SEEDING AND GRAZING ON INFILTRATION CAPACITY AND
OIL STABILITY OF A SUBALPINE RANGE IN CENTRAL UTAH
69-05889 04D

HIXOTROPIC AGING OF SYNTHETIC SOIL AGGREGATES,
69-05908 02G

L SURFACES
REATING HYDROPHOBIC SOIL FOR WATER HARVESTING,
69-05676 03B

NALYSIS OF FLOOD PROCESSES IN DRAINAGE AREAS OF VARYING
EEPAGE CHARACTER (RUSSIAN),
69-05940 02E

L TEMPERATURE
OIL MOISTURE TRANSPORT DUE TO THERMAL GRADIENTS PRACTICAL
SPECTS,
69-05691 02G

L TEXTURE
ELATIONSHIP OF TEXTURE TO SOME IMPORTANT SOIL MOISTURE
ONSTANTS,
69-05679 02G

L WATER
YDROLOGY, SOIL PROPERTIES, CROP GROWTH AND LAND DRAINAGE,
69-05607 02F

HIXOTROPIC AGING OF SYNTHETIC SOIL AGGREGATES,
69-05908 02G

L WATER MOVEMENT
ALCULATION OF PARAMETERS FOR THE EVALUATION OF THE LEACHING
F SALTS UNDER FIELD CONDITIONS, ILLUSTRATED BY NITRATE,
69-05616 02G

HE VERTICAL MOVEMENT OF WATER IN STRATIFIED POROUS
ATERIAL. 1. INFILTRATION.
69-05630 02G

OVEMENT OF WATER THROUGH SOIL AS INFLUENCED BY OSMOTIC
RESSURE AND TEMPERATURE GRADIENTS,
69-05683 02G

ESALINIZATION OF SOILS UNDER CONTROLLED UNSATURATED FLOW
ONDITIONS,
69-05687 02G

UMERICAL MODELING OF UNSATURATED GROUND WATER FLOW,
69-05918 02F

LS
N THE RELATION BETWEEN TRANSPIRATION, SOIL PHYSICAL
ROPERTIES AND CROP PRODUCTION AS A BASIS FOR WATER SUPPLY
LANS,
69-05613 02I

HARACTERIZATION OF MINERALIZABLE NITROGEN IN SOILS,
69-05703 05A

FFECT OF CULTIVATION ON THE NITROGEN DISTRIBUTION IN SOILS,
69-05710 02K

L-WATER-PLANT RELATIONSHIPS
ULES OF TRANSFER OF WATER MANAGEMENT EXPERIENCE, WITH
PECIAL REFERENCE TO THE ASSESSMENT OF DRAINAGE DESIGN
ONSTANTS,
69-05614 04A

OIL WATER CONTENT IN RELATION TO NUTRIENT UPTAKE BY THE
LANT,
69-05615 02I

LANT ECOLOGY OF AN ARID BASIN, TRES ALAMOS-REDINGTON AREA,
OUTHEASTERN ARIZONA,
69-05634 02I

HE CONTRIBUTION OF RESEARCH TO THE EFFICIENT USE OF WATER
N AGRICULTURE,
69-05650 03F

SE OF VEGETATION AS AN INDICATOR FOR SOIL PROPERTIES UNDER
ESERT CONDITIONS,
69-05682 02G

AR RADIATION
ONSUMPTIVE USE ESTIMATES FROM SOLAR RADIATION AND
EMPERATURE,
69-05686 02I

TH DAKOTA
UALITY OF WATER IN SELECTED LAKES OF EASTERN SOUTH DAKOTA,
69-05932 02H

THERN HUMID REGION
HE FUTURE AGRICULTURAL USE OF WATER - SOUTHERN HUMID
EGION,
69-05738 06B

EREIGNTY LANDS
OASTAL STATES GAS PRODUCING CO V STATE MINERAL BD
OWNERSHIP OF STREAM BED).
69-05777 06E

IET RUSSIA
USSIAN RADIOECOLOGY, A BIBLIOGRAPHY OF SOVIET PUBLICATIONS
ITH CITATIONS OF ENGLISH TRANSLATIONS AND ABSTRACTS,
W69-05708 05C

SPARK GAPS
A NEW SURGE-LIMITING DEVICE FOR HIGH VOLTAGE STATIONS,
W69-05811 08C

SPECIES DIVERSITY
A PRELIMINARY REPORT OF THE FOSSIL DIATOM FLORA FROM LAKE
HURON SEDIMENTS,
W69-05762 02H

SPECIFIC CAPACITY
STEP-DRAWDOWN TEST NEEDS CRITICAL REVIEW,
W69-05813 04B

SPECIFICATIONS
COMPARATIVE MODEL TURBINE TESTS,
W69-05806 08C

SPECTROPHOTOMETRY
ABSORPTION COEFFICIENTS OF CHLOROPHYLL DERIVATIVES,
W69-05695 02H

SPILLWAYS
SETTLEMENT JOINTS IN BAIGUL DAM SPILLWAY,
W69-05819 08D

SPRINKLER IRRIGATION
EVAPORATIVE COOLING OF HEATED IRRIGATION WATER BY SPRINKLER
APPLICATION,
W69-05606 03C

AUTOMATIC SPRINKLER IRRIGATION AND ITS FUTURE IN THE
MIDWEST,
W69-05831 03F

STAGE-DISCHARGE RELATIONS
FLOODS IN BEECHER EAST QUADRANGLE, NORTHEASTERN ILLINOIS,
W69-05911 02E

STANDARDS
WATER QUALITY IN HAWAII,
W69-05893 05G

QUALITY STANDARDS FOR NATURAL WATERS,
W69-05934 05G

STANDING WAVES
LONG STANDING WAVES IN A CURVED CANAL,
W69-05827 08B

STATE GOVERNMENTS
ALLEN V STATE (FLOOD DAMAGE DUE TO CONSTRUCTION OF DIKE).
W69-05798 06E

COMMONWEALTH V KELLEY (NEGLIGENT OBSTRUCTION TO FLOW).
W69-05970 04A

STATE JURISDICTION
WATER LAW, POLITICS, AND ECONOMICS WATER RESOURCES AND
PUBLIC REGULATIONS OF THEIR USES,
W69-05748 06B

STATISTICAL DISTRIBUTIONS
THRESHOLD PREDICTION AND CHARACTERISTICS OF LOG-NORMAL
PHENOMENA,
W69-05871 07C

STATISTICAL METHODS
THE FITTING OF GROWTH AND ALLIED CURVES OF THE ASYMPTOTIC
REGRESSION TYPE BY STEVENS'S METHOD,
W69-05711 07C

OUTDOOR RECREATION POLICY ISSUES AND RESEARCH PROBLEMS,
W69-05736 06D

USE OF INTERRELATED RECORDS TO SIMULATE STREAMFLOW,
W69-05850 02E

THRESHOLD PREDICTION AND CHARACTERISTICS OF LOG-NORMAL
PHENOMENA,
W69-05871 07C

RELIABILITY ESTIMATES FOR A STORAGE RESERVOIR WITH SEASONAL
INPUT,
W69-05906 06A

RELIABILITY OF WATER SUPPLY PERFORMED BY MEANS OF A STORAGE
RESERVOIR WITHIN A LIMITED PERIOD OF TIME,
W69-05930 02E

COMPUTATION OF ANNUAL NORMAL FLOW OF INTERMITTENT
WATERCOURSES AND MOUNTAIN RIVERS IN THE UKRAINIAN
CARPATHIANS,
W69-05950 02E

STATISTICAL MODELS
DOWNSTREAM VARIATIONS IN THE HYDRAULIC GEOMETRY OF STREAMS
SPECIAL EMPHASIS ON MEAN VELOCITY,
W69-05639 02E

THRESHOLD PREDICTION AND CHARACTERISTICS OF LOG-NORMAL
PHENOMENA,
W69-05871 07C

MARKOV CHAIN STORAGE MODELS FOR STATISTICAL HYDROLOGY,
W69-05917 07C

STEAM DISTILLATION METHOD
DETERMINATION AND ISOTOPE-RATIO ANALYSIS OF DIFFERENT FORMS
OF NITROGEN IN SOILS 4. EXCHANGEABLE AMMONIUM, NITRATE,

AND NITRITE BY DIRECT-DISTILLATION METHODS,
W69-05701 05A

STEAM DISTILLATION METHODS
DETERMINATION AND ISOTOPE-RATIO ANALYSIS OF DIFFERENT FORMS OF NITROGEN IN SOILS 7. UREA,
W69-05872 05A

A SIMPLE STEAM DISTILLATION METHOD OF ESTIMATING (BETA-HYDROXY-ALPHA-AMINO) ACIDS,
W69-05875 05A

STEAM-DISTILLATION METHOD
STEAM DISTILLATION METHODS FOR DETERMINATION OF AMMONIUM, NITRATE AND NITRITE,
W69-05709 05A

STEEL PIPES
LABORATORY LOAD TESTS ON BURIED FLEXIBLE PIPE - PROGRESS REPORT NO 1,
W69-05845 08D

STEELHEAD TROUT
FOOD AND FEEDING HABITS OF JUVENILE COHO SALMON AND STEELHEAD TROUT IN WORTHY CREEK, WASHINGTON,
W69-05890 02L

STEMFLOW
MEASUREMENTS OF PRECIPITATION INTERCEPTION BY AN ARID ZONE PLANT COMMUNITY (ACACIA ANEURA F. MUELL),
W69-05689 02I

STEP-DRAWDOWN TESTS
STEP-DRAWDOWN TEST NEEDS CRITICAL REVIEW,
W69-05813 04B

STEVENS' METHOD
THE FITTING OF GROWTH AND ALLIED CURVES OF THE ASYMPTOTIC REGRESSION TYPE BY STEVENS'S METHOD,
W69-05711 07C

STOCHASTIC PROCESSES
MATHEMATICAL MODELS A STOCHASTIC SEQUENTIAL APPROACH,
W69-05730 04A

FLOOD PROOFING IN A FLOOD PLAIN A STOCHASTIC MODEL,
W69-05851 04A

STOCKING
SOIL MOISTURE RESPONSE TO RANGE IMPROVEMENT IN THE NORTHERN GREAT PLAINS,
W69-05693 02I

STOMATA
STOMATAL OPENING IN ISOLATED EPIDERMAL STRIPS OF VICIA FABA. II. RESPONSES TO KCL CONCENTRATION AND THE ROLE OF POTASSIUM ABSORPTION,
W69-05681 02I

STORAGE COEFFICIENT
AQUIFER STORAGE DETERMINATION BY RADIOTRACER TECHNIQUES,
W69-05814 07B

STREAM EROSION
SMITH V UNITED STATES (DAMAGES FOR FILLING OF RESERVOIR).
W69-05796 06E

STREAM REAERATION PREDICTION
REAERATION PREDICTION IN NATURAL STREAMS,
W69-05638 05C

STREAMBEDS
COASTAL STATES GAS PRODUCING CO V STATE MINERAL BD (OWNERSHIP OF STREAM BED).
W69-05777 06E

STREAMFLOW
THE EFFECTS OF BENDS ON DISPERSION IN STREAMS,
W69-05609 02E

WATER CONSUMPTION IN THE LOWER COLORADO RIVER VALLEY,
W69-05678 02E

THE STATISTICAL MEASURE OF HYDROLOGIC TIME SERIES,
W69-05775 02E

LEAST SQUARES ESTIMATION OF MIXING COEFFICIENTS,
W69-05862 06A

COMPUTATION OF ANNUAL NORMAL FLOW OF INTERMITTENT WATERCOURSES AND MOUNTAIN RIVERS IN THE UKRAINIAN CARPATHIANS,
W69-05950 02E

COMPUTATIONS OF LEVEL CHANGES AND RUNOFF DISTRIBUTION IN A DELTA BASED ON OBSERVATIONAL DATA (DANUBE DELTA AS AN EXAMPLE),
W69-05951 02E

STREAMFLOW FORECASTING
MARKOV CHAIN STORAGE MODELS FOR STATISTICAL HYDROLOGY,
W69-05917 07C

STREAMFLOW REGULATION
DIVERSION WORKS FOR CONSTRUCTION,
W69-05916 04A

STREAMS
REAERATION PREDICTION IN NATURAL STREAMS,
W69-05638 05C

THE ROLE OF SOME STATISTICAL AND MATHEMATICAL METHODS IN T INTERPRETATION OF REGIONAL GEOCHEMICAL DATA,
W69-05895 02J

ALLEY V FICKEL (DIVERSION OF WATER BY LEVEE).
W69-05957 04A

COATES V UNITED STATES (DIKES AS THE PROXIMATE CAUSE OF FLOODING).
W69-05978 04A

STREPTOCOCCUS FAECALIS
FACTORS INFLUENCING THE EFFECTIVENESS OF SWIMMING POOL BACTERICIDES,
W69-05694 05F

SUBSIDENCE
MONTELEONE V BOH BROS CONSTRUCTION CO (LIABILITY FOR DAMAG CAUSED BY PILE DRIVER VIBRATIONS).
W69-05799 06E

SUCTION
MOVEMENT OF WATER THROUGH SOIL AS INFLUENCED BY OSMOTIC PRESSURE AND TEMPERATURE GRADIENTS,
W69-05683 02G

SULFATE REDUCING BACTERIA
MICROBIAL SULFATE REDUCTION AND ITS POTENTIAL UTILITY AS A ACID MINE WATER POLLUTION ABATEMENT PROCEDURE,
W69-05898 05G

SULFATES
MICROBIAL SULFATE REDUCTION AND ITS POTENTIAL UTILITY AS A ACID MINE WATER POLLUTION ABATEMENT PROCEDURE,
W69-05898 05G

SULFUR BACTERIA
BACTERIAL ORIGIN OF SULFURIC ACID IN SULFUROUS HOT SPRINGS
W69-05654 02K

SURFACE DRAINAGE
YONADI V HOMESTEAD COUNTRY HOMES (SURFACE WATERS AND THE NATURAL FLOW DOCTRINE).
W69-05962 04A

SURFACE IRRIGATION
AUTOMATION AND SEMI-AUTOMATION OF SURFACE IRRIGATION,
W69-05829 03F

DESIGN OF AN AUTOMATED SURFACE IRRIGATION SYSTEM WITH REUS SYSTEM,
W69-05830 03F

SURFACE RUNOFF
BEALS V ROBERTSON (MINE WATER RUNOFF).
W69-05956 05G

KAY-NOOJIN DEV CO V KINZER (SURFACE WATERS AND THE NATURAL FLOW DOCTRINE).
W69-05958 04A

PANAMA CITY V YORK (SURFACE WATERS AND THEIR NATURAL FLOW).
W69-05959 04A

ADAMS V LAWLER (SURFACE WATERS AND THE NATURAL FLOW DOCTRINE).
W69-05960 04A

NEWTON COCA COLA BOTTLING CO V MURPHREY (DIVERSION OF SURFACE WATERS).
W69-05961 04A

YONADI V HOMESTEAD COUNTRY HOMES (SURFACE WATERS AND THE NATURAL FLOW DOCTRINE).
W69-05962 04A

MISKOTTEN V DRENTEN (ARTIFICIAL DRAINAGE OF SURFACE WATERS)
W69-05963 04A

VINSON V TURNER (INJUNCTION AGAINST CONCENTRATION OF SURFAC WATER RIDDANCE).
W69-05967 04A

SURFACE TENSION
SURFACE TENSION IN FROUDE MODELS,
W69-05621 02E

SURFACE WATERS
SUMMARY OF WATER RESOURCES DEVELOPMENT IN IRAN,
W69-05651 02E

WATER-RESOURCES APPRAISAL OF BUTTE VALLEY, ELKO AND WHITE PINE COUNTIES, NEVADA,
W69-05656 02F

ANDERSON V CITY OF JEFFERSON (SUIT FOR DAMAGES RESULTING FROM DISCHARGE OF WATERS UPON PRIVATE PROPERTY).
W69-05800 06E

HANCOCK V STULL (OBSTRUCTION TO NATURAL FLOW OF SURFACE WATER).
W69-05990 04A

LEVIN V MYERS (DISCHARGE OF SURFACE WATERS).
W69-05997 04A

SURFACE-GROUNDWATER RELATIONSHIPS
DETERMINATION OF THE GROUND-WATER COMPONENT OF PEAK DISCHARGE FROM THE CHEMISTRY OF TOTAL RUNOFF,
W69-05628 02F

E INFILTRATION COMPONENT OF A PASTORAL EXPERIMENTAL
TCHMENT, PARTS 1 AND 2,
9-05901 02G

ES
NEW SURGE-LIMITING DEVICE FOR HIGH VOLTAGE STATIONS,
9-05811 08C

EYS
AGROCLIMATOLOGY SURVEY OF A SEMIARID AREA IN AFRICA SOUTH
THE SAHARA,
9-05684 02I

E USE OF THE GEOELECTRIC METHOD FOR INVESTIGATING GEOLOGIC
D HYDROLOGIC CONDITIONS IN SANTA CLARA COUNTY, CALIFORNIA,
9-05904 07B

EHANNA RIVER BASIN
INVESTIGATION OF THE EMPLOYMENT OF MULTIPLE OBJECTIVES IN
FR RESOURCES PLANNING,
9-05882 06B

ING POOLS
TORS INFLUENCING THE EFFECTIVENESS OF SWIMMING POOL
TERICIDES,
9-05694 05F

CHING
EW SURGE-LIMITING DEVICE FOR HIGH VOLTAGE STATIONS,
9-05811 08C

CHING SURGES
IPING OF SWITCHING OVERVOLTAGES IN EHV-NETWORKS--NEW
NOMIC ASPECTS AND SOLUTIONS,
9-05809 08C

EW SURGE-LIMITING DEVICE FOR HIGH VOLTAGE STATIONS,
-05811 08C

LUENCE OF SHUNT REACTORS ON SWITCHING SURGES,
-05812 08C

ETIC HYDROLOGY
SITIVITY ANALYSIS METHOD OF SYSTEM IDENTIFICATION AND ITS
ENTIAL IN HYDROLOGIC RESEARCH,
-05603 07C

ESSING UPLAND RESERVOIRS USING A DAILY FLOW MODEL,
-05632 02E

RATIONAL HYDROLOGY USING RESIDUALS,
-05847 06A

ROLOGIC SIMULATION IN WATER-YIELD ANALYSIS,
-05849 02E

OF INTERRELATED RECORDS TO SIMULATE STREAMFLOW,
-05850 02E

MS ANALYSIS
STRATEGY OF BUILDING MODELS OF COMPLEX ECOLOGICAL
TEMS,
-05713 06A

ANALYSIS OF DETERMINATION IN POPULATION SYSTEMS,
-05714 06A

IGN OF WATER-RESOURCE SYSTEMS,
-05729 04A

TEMS ANALYSIS,
-05742 06B

ER DISTRIBUTION SYSTEMS ANALYSIS,
-05848 06B

ER RESOURCE SYSTEMS ANALYSIS,
-05857 06A

ICAL WRITING
NSLATIONS OF FOREIGN LITERATURE ON HYDRAULICS.
-05655 08B

RATURE
OMPARISON OF MEASURED AND THEORETICAL SNOWPACK
PERATURES,
-05929 02C

OMETERS
ECORDING FIELD TENSIOMETER WITH RAPID RESPONSE
RACTERISTICS,
-05931 02G

PROCEDURES
PARATIVE MODEL TURBINE TESTS,
-05806 08C

AL BAR
RSHORE PHYTOPLANKTON POPULATIONS IN THE GRAND HAVEN,
HIGAN VICINITY DURING THERMAL BAR CONDITIONS,
-05763 02H

AL CONDUCTIVITY
L MOISTURE TRANSPORT DUE TO THERMAL GRADIENTS PRACTICAL
ECTS,
-05691 02G

AL MOISTURE TRANSPORT
L MOISTURE TRANSPORT DUE TO THERMAL GRADIENTS PRACTICAL
ECTS,
-05691 02G

THERMAL STRATIFICATION
THERMAL STRATIFICATION IN LAKES ANALYTICAL AND LABORATORY
STUDIES,
W69-05610 02H

THERMOCLINE
MOVEMENT OF WATER THROUGH SOIL AS INFLUENCED BY OSMOTIC
PRESSURE AND TEMPERATURE GRADIENTS,
W69-05683 02G

SOIL MOISTURE TRANSPORT DUE TO THERMAL GRADIENTS PRACTICAL
ASPECTS,
W69-05691 02G

THIXOTROPY
THIXOTROPIC AGING OF SYNTHETIC SOIL AGGREGATES,
W69-05908 02G

THRESHOLD PREDICTION
THRESHOLD PREDICTION AND CHARACTERISTICS OF LOG-NORMAL
PHENOMENA,
W69-05871 07C

THROUGHFALL
MEASUREMENTS OF PRECIPITATION INTERCEPTION BY AN ABID ZONE
PLANT COMMUNITY (ACACIA ANEURA F. MUELL),
W69-05689 02I

TIDAL WATERS
STATE V AMERICAN ALKYD INDUSTRIES (PENAL LIABILITY FOR WATER
POLLUTION STRICTLY CONSTRUED).
W69-05965 05G

CLARK V TODD (INVALIDATION OF OYSTER DREDGING LICENSES).
W69-05980 06E

TILE DRAINAGE
HALSRUD V BRODALE (PRIVATE DRAINAGE EASEMENT AGREEMENTS).
W69-05999 04A

TIME SERIES ANALYSIS
THE STATISTICAL MEASURE OF HYDROLOGIC TIME SERIES,
W69-05775 02E

TORTS
THE LEGAL IMPLICATIONS OF ATMOSPHERIC WATER RESOURCES
DEVELOPMENT AND MANAGEMENT.
W69-05756 02B

TOXICITY
INFLUENCE OF CHRONIC EXPOSURE TO ANIONIC DETERGENTS ON
TOXICITY OF PESTICIDES TO GOLDFISH,
W69-05768 05C

TRACERS
EVALUATION OF THE RATE OF FLOW THROUGH POROUS MEDIA USING
ELECTROKINETIC PHENOMENA,
W69-05611 02F

AQUIFER STORAGE DETERMINATION BY RADIOTRACER TECHNIQUES,
W69-05814 07B

TRAVEL OF SOLUTES IN THE LOWER MISSOURI RIVER,
W69-05909 05B

TRAINING
AN APPROACH TO ATTACKING HUMAN-SOCIAL PROBLEMS RETARDING
IRRIGATION AND AGRICULTURAL DEVELOPMENT IN LATIN AMERICA,
W69-05652 03F

FOURTH ANNUAL REPORT, FISCAL YEAR 1967-1968.
W69-05765 09D

TRANSLATIONS
TRANSLATIONS OF FOREIGN LITERATURE ON HYDRAULICS.
W69-05655 08B

TRANSPIRATION CONTROL
CONTROLLING TRANSPIRATION IN ASPEN WITH PHENYLMERCURIC
ACETATE,
W69-05627 03F

STUDIES WITH ANTITRANSPIRANTS ON GRAPEVINES (VITIS VINIFERA
VAR. SULTANA),
W69-05675 02D

TRANSPLANTING
ROOT SYSTEM OF FOUR DESERT TREE SPECIES,
W69-05690 02I

TRAVEL TIME(MISSOURI RIVER)
TRAVEL OF SOLUTES IN THE LOWER MISSOURI RIVER,
W69-05909 05B

TREATMENT EFFECTS
EFFECTS OF SEEDING AND GRAZING ON INFILTRATION CAPACITY AND
SOIL STABILITY OF A SUBALPINE RANGE IN CENTRAL UTAH,
W69-05889 04D

TREATMENT FACILITIES
CREATION OF WATER AND SEWAGE DISPOSAL AGENCIES.
W69-05788 06E

TRITIUM
AQUIFER STORAGE DETERMINATION BY RADIOTRACER TECHNIQUES,
W69-05814 07B

TUBES
A TOOL FOR REPAIRING INSTALLED SOIL MOISTURE ACCESS TUBES,
W69-05888 07B

TUNNEL CONSTRUCTION
DEVELOPMENT OF TUNNELING METHODS AND CONTROLS FOR WATER RESOURCE PROJECTS,
W69-05815 08A

TUNNELING
DEVELOPMENT OF TUNNELING METHODS AND CONTROLS FOR WATER RESOURCE PROJECTS,
W69-05815 08A

TUNNELING MACHINES
DEVELOPMENT OF TUNNELING METHODS AND CONTROLS FOR WATER RESOURCE PROJECTS,
W69-05815 08A

TURBIDITY
KENNEBUNK, KENNEBUNKPORT AND WELLS WATER DIST V MAINE TURNPIKE AUTHORITY (DAMAGES FROM TURBIDITY OF BROOK).
W69-05790 06E

TWO-PHASE FLOW
NUMERICAL SIMULATION OF UNCONFINED FLOW INTO A SINGLE PUMPING WATER-WELL USING TWO-PHASE FLOW THEORY,
W69-05755 02F

UKRAINE
CALCULATION OF MAXIMUM WATER DISCHARGES ORIGINATING FROM RAIN AND SNOW (IN RUSSIAN),
W69-05943 02E

UKRAINIAN CARPATHIANS
COMPUTATION OF ANNUAL NORMAL FLOW OF INTERMITTENT WATERCOURSES AND MOUNTAIN RIVERS IN THE UKRAINIAN CARPATHIANS,
W69-05950 02E

UNDERGROUND CAVITIES
FORMATION OF UNDERGROUND CAVITIES BY THE USE OF EXPLOSIVES,
W69-05818 08H

UNDERGROUND STREAMS
DI GIACINTO V NEW JERSEY ZINC COMPANY (DIVERSION OF SUBTERRANEAN WATERCOURSE).
W69-05975 04B

UNDERGROUND WATER STORAGE
AQUIFER STORAGE DETERMINATION BY RADIOTRACER TECHNIQUES,
W69-05814 07B

UNDISTURBED FOREST
FOREST TREATMENT EFFECTS ON WATER QUALITY,
W69-05885 04D

UNITED KINGDOM
A COUNTRY-WIDE STUDY OF INTENSE RAINFALL FOR THE UNITED KINGDOM,
W69-05925 02B

UNITED STATES
CLIMATIC ATLAS OF THE UNITED STATES,
W69-05922 02B

UNSATURATED FLOW
THE VERTICAL MOVEMENT OF WATER IN STRATIFIED POROUS MATERIAL. 1. INFILTRATION.
W69-05630 02G

DESALINIZATION OF SOILS UNDER CONTROLLED UNSATURATED FLOW CONDITIONS,
W69-05687 02G

NUMERICAL MODELING OF UNSATURATED GROUND WATER FLOW,
W69-05918 02F

UNSTEADY FLOW
FLOW RATES IN TWO-DIMENSIONAL, UNSTEADY, CONFINED GROUNDWATER FLOW,
W69-05617 02F

SURGE FLOW A MODEL OF THE WALL LAYER,
W69-05892 08B

UPPER LANDOWNERS
KAY-MOOJIN DEV CO V KINZER (SURFACE WATERS AND THE NATURAL FLOW DOCTRINE).
W69-05958 04A

ADAMS V LAWLER (SURFACE WATERS AND THE NATURAL FLOW DOCTRINE).
W69-05960 04A

YONADI V HOMESTEAD COUNTRY HOMES (SURFACE WATERS AND THE NATURAL FLOW DOCTRINE).
W69-05962 04A

URBANIZATION
COMMENTS ON WATER TRANSFERS AND RELATED URBAN PROBLEMS,
W69-05766 06D

USSR
INVESTIGATION OF SURFACE AND UNDERGROUND RUNOFF (RUSSIAN).
W69-05659 02A

METHODS FOR WORKING OUT A NATIONAL WATER BALANCE (RUSSIAN),
W69-05936 04A

A MEANING OF NATIONAL WATER BALANCE IN RATIONAL USE OF WATER RESOURCES (RUSSIAN),
W69-05937 04A

THE STABILITY OF NORMAL ANNUAL RUNOFF AND SEASONAL RIVER DISCHARGES UNDER CONDITIONS OF DEVELOPMENT OF AGROTECHNIC ENTERPRISES IN THEIR DRAINAGE AREAS (RUSSIAN),
W69-05938 04A

GENERALIZED EXPRESSION FOR THE CONNECTION BETWEEN THE KINEMATIC AND MORPHOLOGIC ELEMENTS OF RIVER FLOW (IN RUSSIAN),
W69-05941 02E

ANALYSIS OF THE FORMATION OF RAIN FLOODS IN SMALL BASINS (RUSSIAN),
W69-05942 02E

MUD FLOWS IN THE TRANSILIAN ALA-TAU AND THE MUD FLOW CATASTROPHE OF 7 JULY, 1963 IN THE ISSYK RIVER BASIN (IN RUSSIAN),
W69-05944 02E

METHODS OF PREVENTING MUDFLOWS (IN RUSSIAN),
W69-05945 04A

IMMENSE LANDSLIDE OBSTRUCTION OF ZERAVSHAN RIVER, APRIL 2 1964 (IN RUSSIAN),
W69-05946 02E

ACCURACY IN DETERMINING THE MEAN PRECIPITATION DEPTH OVER AREA,
W69-05948 02B

VALUES
POTENTIALS OF WATER-BASED RECREATION,
W69-05740 06B

VEGETATION EFFECTS
FOREST TREATMENT EFFECTS ON WATER QUALITY,
W69-05885 04D

EFFECTS OF SEEDING AND GRAZING ON INFILTRATION CAPACITY AN SOIL STABILITY OF A SUBALPINE RANGE IN CENTRAL UTAH,
W69-05889 04D

VETCH
STOMATAL OPENING IN ISOLATED EPIDERMAL STRIPS OF VICIA FAB II. RESPONSES TO KCL CONCENTRATION AND THE ROLE OF POTASSIUM ABSORPTION,
W69-05681 02I

VIBRATIONS
MONTELEONE V BOH BROS CONSTRUCTION CO (LIABILITY FOR DAMAG CAUSED BY PILE DRIVER VIBRATIONS).
W69-05799 06E

VIRGINIA
UNITED STATES V 2973 ACRES OF LAND (CONDEMNATION OF FLOWAG EASEMENTS).
W69-05984 06E

AVERY V BEALE (CONSTITUTIONALITY OF RIPARIAN PRIORITY TO ERECT DUCK BLINDS).
W69-05987 06E

VISTULA RIVER
SOME PATTERNS OF FORMATION OF A RIVER MOUTH BAR WHERE RIVE FACTORS PLAY AN IMPORTANT ROLE (EXEMPLIFIED BY THE VISTULA DELTA),
W69-05953 02J

WASHINGTON
FEDERAL LAW AND SEASHORE ACCRETION.
W69-05785 06E

WASHINGTON(DC)
ASSESSING UPLAND RESERVOIRS USING A DAILY FLOW MODEL,
W69-05632 02E

WASTE ASSIMILATIVE CAPACITY
IMPOUNDMENT AND TEMPERATURE EFFECT ON WASTE ASSIMILATION,
W69-05637 05C

WASTE TREATMENT
USE POLLUTION TO BENEFIT MANKIND,
W69-05891 05D

WASTE WATER TREATMENT
DISSOLVED OXYGEN IN THE DELAWARE ESTUARY,
W69-05727 05G

A FEASIBILITY STUDY OF A LIVESTOCK WASTE DISPOSAL SYSTEM INVOLVING THE REUSE OF WATER,
W69-05753 05D

ECONOMICS OF POLLUTION CONTROL,
W69-05880 05C

WATER
THE WESTERN WATER SUPPLY--WHERE IT IS,
W69-05807 02A

WATER ALLOCATION(POLICY)
PREDICTING EFFECTS OF WATER SHORTAGE ON CROP YIELD,
W69-05674 03F

WATER BALANCE
INVESTIGATION OF SURFACE AND UNDERGROUND RUNOFF (RUSSIAN).
W69-05659 02A

SALT AND WATER BALANCE, COACHELLA VALLEY, CALIFORNIA,
W69-05670 02G

METHODS FOR WORKING OUT A NATIONAL WATER BALANCE (RUSSIAN),

9-05936 04A

R CHEMISTRY
TERMINATION OF THE GROUND-WATER COMPONENT OF PEAK
SCHARGE FROM THE CHEMISTRY OF TOTAL RUNOFF,
9-05628 02F

TERMINATION AND ISOTOPE-RATIO ANALYSIS OF DIFFERENT FORMS
NITROGEN IN SOILS 6. MINERALIZABLE NITROGEN,
9-05699 05A

TERMINATION AND ISOTOPE-RATIO ANALYSIS OF DIFFERENT FORMS
NITROGEN IN SOILS 3. EXCHANGEABLE AMMONIUM, NITRATE,
NITRITE BY EXTRACTION-DISTILLATION METHODS,
9-05700 05A

TERMINATION AND ISOTOPE-RATIO ANALYSIS OF DIFFERENT FORMS
NITROGEN IN SOILS 4. EXCHANGEABLE AMMONIUM, NITRATE,
NITRITE BY DIRECT-DISTILLATION METHODS,
9-05701 05A

OMPARATIVE STUDY IN EUTROPHICATION,
9-05869 05C

NIFICANCE OF REDOX POTENTIAL IN NATURAL WATERS (IN
NCH),
9-05877 02K

T ACCUMULATION PROCESSES IN THE GROUND WATERS OF THE
OVABAD-KAZAKH MASSIF,
9-05954 02F

CIRCULATION
CULATION IN SHALLOW HOMOGENEOUS LAKES,
9-05618 02H

URAL AND ARTIFICIALLY (AIR-PLOUGHING) INDUCED MOVEMENT OF
IOACTIVE PHOSPHORUS FROM THE MUDS OF LAKES,
9-05698 02H

ESHORE PHYTOPLANKTON POPULATIONS IN THE GRAND HAVEN,
HIGAN VICINITY DURING THERMAL BAR CONDITIONS,
9-05763 02H

IFICIALLY INDUCED CIRCULATION OF LAKES BY MEANS OF
PRESSED AIR,
9-05866 05C

EMENTS OF RADIOSODIUM (NA-24) WITHIN AN ICE-COVERED LAKE,
9-05870 02H

CONSERVATION
SOIL AND WATER CONSERVATIONIST OF TOMORROW,
9-05842 09A

CONSUMPTION
ER CONSUMPTION IN THE LOWER COLORADO RIVER VALLEY,
9-05678 02E

CONTRACTS
NINGS V LEAGUE OF CIVIC ORGANIZATIONS (BREACH OF CONTRACT
PRODUCE WATER).
9-05995 04A

CONTROL
ER LAW, POLITICS, AND ECONOMICS WATER RESOURCES AND
LIC REGULATIONS OF THEIR USES,
9-05748 06B

HODS OF PREVENTING MUDFLOWS (IN RUSSIAN),
9-05945 04A

DEMAND
DEMAND FOR WATER SOME EMPIRICAL EVIDENCE ON CONSUMERS'
PONSE TO A COMMODITY UNCERTAIN IN SUPPLY,
9-05633 06D

SICO-TECHNICAL PROBLEMS IN MANAGING WATER RESOURCES
SSIAN),
9-05660 02A

SUMER RESPONSES TO PRICES OF RESIDENTIAL WATER,
9-05881 06C

ECASTING WATER DEMAND, AN INTER-AND INTRA-COMMUNITY
DY,
9-05900 06D

DISTRIBUTION
SICO-TECHNICAL PROBLEMS IN MANAGING WATER RESOURCES
SSIAN),
9-05660 02A

STABILITY OF NORMAL ANNUAL RUNOFF AND SEASONAL RIVER
CHARGES UNDER CONDITIONS OF DEVELOPMENT OF AGROTECHNICAL
ERPRISES IN THEIR DRAINAGE AREAS (RUSSIAN),
9-05938 04A

DISTRIBUTION(APPLIED)
ER DISTRIBUTION SYSTEMS ANALYSIS,
9-05848 06B

ANNING OF NATIONAL WATER BALANCE IN RATIONAL USE OF WATER
OURCES (RUSSIAN),
9-05937 04A

DISTRICTS
ER LAW, POLITICS, AND ECONOMICS IS OUR SYSTEM OF PUBLIC
IRICTS OUTMODED,
9-05747 06B

MOWREY V COLEMAN (QUESTIONED VALIDITY OF WATER DISTRICT).
W69-05971 06E

WATER HARVESTING
CREATING HYDROPHOBIC SOIL FOR WATER HARVESTING,
W69-05676 03B

WATER LAW
STATE PROGRAMS FOR ESTUARINE AREA CONSERVATION,
W69-05776 02L

SECTION OF MINERAL AND NATURAL RESOURCES LAW--REPORT OF THE
COMMITTEE ON WATER RESOURCES.
W69-05783 06E

RES IPSA LOQUITUR AS APPLICABLE IN ACTIONS FOR DAMAGE TO
PROPERTY BY THE OVERFLOW OR ESCAPE OF WATER.
W69-05784 06E

WATER LEVEL FLUCTUATIONS
COMPUTATIONS OF LEVEL CHANGES AND RUNOFF DISTRIBUTION IN A
DELTA BASED ON OBSERVATIONAL DATA (DANUBE DELTA AS AN
EXAMPLE),
W69-05951 02E

WATER LEVELS
CABLE AND CLAMP MODIFICATIONS FOR MODEL 104 MOISTURE PROBES,
W69-05883 07B

FINDLEY LAKE PROPERTY OWNERS, INC V TOWN OF MINA
(MAINTENANCE AND CONTROL OF WATER LEVEL OF LAKE).
W69-05973 04A

WATER LOSS
RELATION OF WATER LOSS TO MOISTURE CONTENT OF HYDROPHYTES IN
A NATURAL POND,
W69-05622 02D

WATER MANAGEMENT
PHYSICO-TECHNICAL PROBLEMS IN MANAGING WATER RESOURCES
(RUSSIAN),
W69-05660 02A

WATER MANAGEMENT(APPLIED)
RULES OF TRANSFER OF WATER MANAGEMENT EXPERIENCE, WITH
SPECIAL REFERENCE TO THE ASSESSMENT OF DRAINAGE DESIGN
CONSTANTS,
W69-05614 04A

ASSESSING UPLAND RESERVOIRS USING A DAILY FLOW MODEL,
W69-05632 02E

INVESTIGATION OF SURFACE AND UNDERGROUND RUNOFF (RUSSIAN).
W69-05659 02A

NEW THRUSTS IN GROUND WATER,
W69-05677 02F

THE RANGE OF CHOICE IN WATER MANAGEMENT. A STUDY OF
DISSOLVED OXYGEN IN THE POTOMAC ESTUARY,
W69-05715 05G

WATER QUALITY MANAGEMENT AND SOME POLICY MODELS,
W69-05722 05G

COLLECTIVE FACILITIES IN WATER QUALITY MANAGEMENT,
W69-05726 05G

OPTIMUM MANAGEMENT OF A COMBINED PUMPED HYDRO AND IRRIGATION
STORAGE FACILITY,
W69-05734 04A

RELIABILITY ESTIMATES FOR A STORAGE RESERVOIR WITH SEASONAL
INPUT,
W69-05906 06A

COST OF MUNICIPAL AND INDUSTRIAL WELLS IN ILLINOIS, 1964-
1966,
W69-05910 06C

COST OF RESERVOIRS IN ILLINOIS,
W69-05915 06C

RELIABILITY OF WATER SUPPLY PERFORMED BY MEANS OF A STORAGE
RESERVOIR WITHIN A LIMITED PERIOD OF TIME,
W69-05930 02E

WATER POLICY
DISSOLVED OXYGEN IN THE DELAWARE ESTUARY,
W69-05727 05G

THE DELAWARE ESTUARY STUDY,
W69-05728 05G

WATER POLLUTION
ECONOMICS OF POLLUTION CONTROL,
W69-05880 05C

CITY OF MERIDIAN V TINGLE (RECOVERY OF DAMAGES AGAINST
MUNICIPALITY FOR CREEK POLLUTION).
W69-05955 05G

STATE V AMERICAN ALKYD INDUSTRIES (PENAL LIABILITY FOR WATER
POLLUTION STRICTLY CONSTRUED).
W69-05965 05G

ELLER V BOARD OF EDUCATION OF BUNCOMBE COUNTY (WATER
POLLUTION AS CONSTITUTING A 'TAKING' OF PROPERTY).
W69-05986 05G

WATER POLLUTION CONTROL

MATHEMATICAL SIMULATION OF THE ESTUARINE BEHAVIOR AND ITS APPLICATIONS,
W69-05732 05G

WATER QUALITY CONTROL COMPREHENSIVE PLANNING,
W69-05744 05G

WATER QUALITY CONTROL LEGAL AND ADMINISTRATIVE ASPECTS,
W69-05745 05G

ANALOG COMPUTER -- A MODERN TOOL IN WATER POLLUTION CONTROL,
W69-05854 05G

MICROBIAL SULFATE REDUCTION AND ITS POTENTIAL UTILITY AS AN ACID MINE WATER POLLUTION ABATEMENT PROCEDURE,
W69-05898 05G

QUALITY STANDARDS FOR NATURAL WATERS,
W69-05934 05G

WATER POLLUTION CONTROL ACT
WATER QUALITY CONTROL COMPREHENSIVE PLANNING,
W69-05744 05G

WATER POLLUTION CONTROL IN GERMANY
ECONOMICS OF POLLUTION CONTROL,
W69-05880 05C

WATER POLLUTION SOURCES
RECOMMENDATIONS FOR WATER POLLUTION CONTROL IN RACCOON CREEK BASIN, OHIO.
W69-05661 05G

WATER POTENTIAL
AN IMPROVEMENT SCHARDAKOW DYE TECHNIQUE FOR THE MEASUREMENT OF PLANT WATER POTENTIALS,
W69-05688 02I

WATER PROPERTIES
FLUCTUATIONS IN WATER DROPLET EVAPORATION RATES,
W69-05750 02D

WATER PURIFICATION
FACTORS INFLUENCING THE EFFECTIVENESS OF SWIMMING POOL BACTERICIDES,
W69-05694 05F

WATER QUALITY
THE EFFECTS OF ALGAE ON WATER QUALITY,
W69-05697 05C

WATER QUALITY MODELS OF THE ESTUARY,
W69-05716 05G

COLLECTIVE FACILITIES IN WATER QUALITY MANAGEMENT,
W69-05726 05G

CRITERIA FOR DESIGNING AND LOCATING LOGGING ROADS TO CONTROL SEDIMENT,
W69-05884 04D

THE INFLUENCE OF ROADS ON WATER QUALITY CHARACTERISTICS,
W69-05886 04D

WATER QUALITY IN HAWAII,
W69-05893 05G

RIVER WATER QUALITY FOR ARTIFICIAL RECHARGE,
W69-05894 05B

CHLORIDE CONCENTRATION IN GROUNDWATER, RECHARGE RATE AND RATE OF DEPOSITION OF CHLORIDE IN THE ISRAEL COASTAL PLAIN,
W69-05905 02F

POTOMAC RIVER WATER QUALITY NETWORK, 1968 WATER YEAR.
W69-05920 05B

QUALITY OF WATER IN SELECTED LAKES OF EASTERN SOUTH DAKOTA,
W69-05932 02H

SALT ACCUMULATION PROCESSES IN THE GROUND WATERS OF THE KIROVABAD-KAZAKH MASSIF,
W69-05954 02F

WATER QUALITY ACT
QUALITY STANDARDS FOR NATURAL WATERS,
W69-05934 05G

WATER QUALITY CONTROL
FACTORS INFLUENCING THE EFFECTIVENESS OF SWIMMING POOL BACTERICIDES,
W69-05694 05F

USE OF POTASSIUM PERMANGANATE FOR CONTROL OF PROBLEM ALGAE,
W69-05704 05F

WATER QUALITY MANAGEMENT AND SOME POLICY MODELS,
W69-05722 05G

DISSOLVED OXYGEN IN THE DELAWARE ESTUARY,
W69-05727 05G

THE DELAWARE ESTUARY STUDY,
W69-05728 05G

ECONOMICS OF POLLUTION CONTROL,
W69-05880 05C

FOREST TREATMENT EFFECTS ON WATER QUALITY,
W69-05885 04D

THE INFLUENCE OF ROADS ON WATER QUALITY CHARACTERISTICS
W69-05886 04D

QUALITY STANDARDS FOR NATURAL WATERS,
W69-05934 05G

WATER REQUIREMENTS
FORECASTING WATER DEMAND, AN INTER-AND INTRA-COMMUNITY STUDY,
W69-05900 06D

WATER RESOURCES
SUMMARY OF WATER RESOURCES DEVELOPMENT IN IRAN,
W69-05651 02E

WATER-RESOURCES APPRAISAL OF BUTTE VALLEY, ELKO AND WHI PINE COUNTIES, NEVADA,
W69-05656 02F

PHYSICO-TECHNICAL PROBLEMS IN MANAGING WATER RESOURCES (RUSSIAN),
W69-05660 02A

THE RANGE OF CHOICE IN WATER MANAGEMENT. A STUDY OF DISSOLVED OXYGEN IN THE POTOMAC ESTUARY,
W69-05715 05G

MATHEMATICAL PROGRAMMING MODELS APPLIED TO A WATER RESO SYSTEM,
W69-05725 04A

DESIGN OF WATER-RESOURCE SYSTEMS,
W69-05729 04A

WATER RESOURCE SYSTEMS ANALYSIS,
W69-05857 06A

METHODS FOR WORKING OUT A NATIONAL WATER BALANCE (RUSSI
W69-05936 04A

A MEANING OF NATIONAL WATER BALANCE IN RATIONAL USE OF RESOURCES (RUSSIAN),
W69-05937 04A

THE STABILITY OF NORMAL ANNUAL RUNOFF AND SEASONAL RIVE DISCHARGES UNDER CONDITIONS OF DEVELOPMENT OF AGROTECHN ENTERPRISES IN THEIR DRAINAGE AREAS (RUSSIAN),
W69-05938 04A

THE GENEVA CONVENTIONS ON THE LAW OF THE SEA SOME SUGGESTIONS FOR THEIR REVISION,
W69-05974 06E

WATER RESOURCES DEVELOPMENT
AN APPROACH TO ATTACKING HUMAN-SOCIAL PROBLEMS RETARDIN IRRIGATION AND AGRICULTURAL DEVELOPMENT IN LATIN AMERIC
W69-05652 03F

THE UDA WALAWE RESERVOIR PROJECT,
W69-05653 04A

INVESTIGATION OF SURFACE AND UNDERGROUND RUNOFF (RUSSIA
W69-05659 02A

A STEP IN OPTIMIZING THE DEVELOPMENT OF THE BASAL WATER OF SOUTHERN OAHU, HAWAII,
W69-05663 02F

WATER RESOURCES AND ECONOMIC DEVELOPMENT IN THE SOUTH,
W69-05737 06B

CONTRIBUTIONS OF WATER RESOURCE DEVELOPMENT TO DEPRESSE AREAS DEVELOPMENT,
W69-05741 06B

WATER RESOURCES RESEARCH ACT
FOURTH ANNUAL REPORT, FISCAL YEAR 1967-1968.
W69-05765 09D

WATER REUSE
EVAPORATIVE COOLING OF HEATED IRRIGATION WATER BY SPRINK APPLICATION,
W69-05606 03C

AN ANALYSIS OF WATER NEEDS FOR ARID AND SEMI-ARID LANDS,
W69-05673 03E

A FEASIBILITY STUDY OF A LIVESTOCK WASTE DISPOSAL SYSTEM INVOLVING THE REUSE OF WATER,
W69-05753 05D

DESIGN OF AN AUTOMATED SURFACE IRRIGATION SYSTEM WITH RE SYSTEM,
W69-05830 03F

WATER RIGHTS
THE LEGAL IMPLICATIONS OF ATMOSPHERIC WATER RESOURCES DEVELOPMENT AND MANAGEMENT.
W69-05756 02B

WATER RIGHTS AND LEGISLATION IN THE EASTERN STATES,
W69-05879 06E

WATER SHORTAGE
PREDICTING EFFECTS OF WATER SHORTAGE ON CROP YIELD,
W69-05674 03F

WATER SOURCES
JENNINGS V LEAGUE OF CIVIC ORGANIZATIONS (BREACH OF CONT TO PRODUCE WATER).
W69-05995 04A

R STORAGE
LIABILITY ESTIMATES FOR A STORAGE RESERVOIR WITH SEASONAL
PUT,
9-05906 06A

LIABILITY OF WATER SUPPLY PERFORMED BY MEANS OF A STORAGE
SERVOIR WITHIN A LIMITED PERIOD OF TIME,
9-05930 02E

R SUPPLY
YSICO-TECHNICAL PROBLEMS IN MANAGING WATER RESOURCES
USSIAN),
9-05660 02A

W THRUSTS IN GROUND WATER,
9-05677 02F

ME ECONOMIC ASPECTS OF INDUSTRIAL WATER SUPPLY IN THE
JTH,
9-05739 06B

NNEBUNK, KENNEBUNKPORT AND WELLS WATER DIST V MAINE
RNPIKE AUTHORITY (DAMAGES FROM TURBIDITY OF BROOK).
9-05790 06E

AMS V GREENWICH WATER CO (DIVERSION OF RIVER FOR PUBLIC
TER SUPPLY).
9-05793 06E

E WESTERN WATER SUPPLY--WHERE IT IS,
9-05807 02A

LIABILITY ESTIMATES FOR A STORAGE RESERVOIR WITH SEASONAL
PUT,
9-05906 06A

LIABILITY OF WATER SUPPLY PERFORMED BY MEANS OF A STORAGE
SERVOIR WITHIN A LIMITED PERIOD OF TIME,
9-05930 02E

FRAMEWORK FOR THE MULTIPLE USE OF MUNICIPAL WATER SUPPLY
ERS,
9-05935 06D

THODS FOR WORKING OUT A NATIONAL WATER BALANCE (RUSSIAN),
9-05936 04A

EANING OF NATIONAL WATER BALANCE IN RATIONAL USE OF WATER
SOURCES (RUSSIAN),
9-05937 04A

WING V LEHMANN (WATER USE EASEMENT).
9-05985 06E

E V CITY OF NEW YORK (CITY'S OBLIGATION TO MAINTAIN
STITUTE HIGHWAYS).
9-05991 06E

E SUPPLY FORECASTING
E WESTERN WATER SUPPLY--WHERE IT IS,
9-05807 02A

E TEMPERATURE
THE TEMPERATURE OF WATER FLOWING THROUGH FRACTURES,
9-05624 02F

OPTIC TEMPERATURE MEASUREMENTS OF A GLACIER LAKE AND ITS
VIRONMENT,
9-05665 02C

E TRANSFERS
MENTS ON WATER TRANSFERS AND RELATED URBAN PROBLEMS,
9-05766 06D

E TREATMENT
NCENTRATION AND ACCUMULATION OF METALLIC IONS BY THE
TERIUM ZOOGLOEA,
9-05767 05D

E UTILIZATION
IL AND CROP MANAGEMENT FOR MAXIMUM WATER-USE EFFICIENCY ON
D AND SEMIARID LANDS,
9-05669 03F

EDICTING EFFECTS OF WATER SHORTAGE ON CROP YIELD,
9-05674 03F

NICIPAL AND INDUSTRIAL WATER USE,
9-05916 06D

E VALUES
ANALYSIS OF WATER NEEDS FOR ARID AND SEMI-ARID LANDS,
9-05673 03E

E WELLS
TEP IN OPTIMIZING THE DEVELOPMENT OF THE BASAL WATER LENS
SOUTHERN OAHU, HAWAII,
9-05663 02F

EP-DRAWDOWN TEST NEEDS CRITICAL REVIEW,
9-05813 04B

T OF MUNICIPAL AND INDUSTRIAL WELLS IN ILLINOIS, 1964-
6,
9-05910 06C

E WORKS
EANING OF NATIONAL WATER BALANCE IN RATIONAL USE OF WATER
OURCES (RUSSIAN),
9-05937 04A

WATER YIELD
HYDROLOGIC SIMULATION IN WATER-YIELD ANALYSIS,
W69-05849 02E

WATER YIELD IMPROVEMENT
PRELIMINARY WATER YIELDS AFTER TIMBER HARVEST ON CASTLE
CREEK, ARIZONA WATERSHEDS,
W69-05642 03B

WATERSHED PLANNING,
W69-05643 03B

SANTA YNEZ BAROMETER WATERSHED,
W69-05644 03B

WATERCOURSES(LEGAL)
ANDERSON V CITY OF JEFFERSON (SUIT FOR DAMAGES RESULTING
FROM DISCHARGE OF WATERS UPON PRIVATE PROPERTY).
W69-05800 06E

WATERSHED MANAGEMENT
PRELIMINARY WATER YIELDS AFTER TIMBER HARVEST ON CASTLE
CREEK, ARIZONA WATERSHEDS,
W69-05642 03B

WATERSHED PLANNING,
W69-05643 03B

SANTA YNEZ BAROMETER WATERSHED,
W69-05644 03B

GEOMORPHIC GROUPING OF SOILS IN WATERSHED ENGINEERING,
W69-05907 02G

WATERSHEDS(BASINS)
ECONOMICS OF WATERSHED PLANNING,
W69-05718 06B

WAVE HEIGHT
THE EFFECTS OF WAVES ON EVAPORATION FROM A FREE WATER
SURFACE,
W69-05840 02D

WAVES(WATER)
EVOLUTION OF A DUNED BED UNDER OSCILLATORY FLOW,
W69-05662 02J

THE EFFECTS OF WAVES ON EVAPORATION FROM A FREE WATER
SURFACE,
W69-05840 02D

SURGE FLOW A MODEL OF THE WALL LAYER,
W69-05892 08B

WEATHER MODIFICATION
THE LEGAL IMPLICATIONS OF ATMOSPHERIC WATER RESOURCES
DEVELOPMENT AND MANAGEMENT.
W69-05756 02B

WELLS
EVOLUTION OF MICHIGAN WATER LAWS-GROUND WATER.
W69-05781 06E

STEP-DRAWDOWN TEST NEEDS CRITICAL REVIEW,
W69-05813 04B

WESTERN CANADA SEDIMENTARY BASIN
FLUID FLOW IN THE WESTERN CANADA SEDIMENTARY BASIN. 2.
EFFECT OF GEOLOGY,
W69-05602 02F

WESTERN UNITED STATES
THE WESTERN WATER SUPPLY--WHERE IT IS,
W69-05807 02A

WHEAT
STUDIES ON PRESOWING DROUGHT HARDENING OF WHEAT,
W69-05672 02I

WINCH METHOD
OUTDOOR RECREATION POLICY ISSUES AND RESEARCH PROBLEMS,
W69-05736 06D

WIND PRESSURE
CIRCULATION IN SHALLOW HOMOGENEOUS LAKES,
W69-05618 02H

WISCONSIN
AVAILABILITY OF IRON AND MANGANESE IN SOUTHERN WISCONSIN
LAKES FOR THE GROWTH OF MICROCYSTIS AERUGINOSA,
W69-05867 05C

WITHDRAWAL
WATER CONSUMPTION IN THE LOWER COLORADO RIVER VALLEY,
W69-05678 02E

YARDS CREEK PROJECT(DEL)
EXPERIENCES ON STARTUP AND TRIAL OPERATION AT YARDS CREEK
PUMPED STORAGE PROJECT,
W69-05824 08C

YELLOWSTONE NATIONAL PARK
RATE OF SULFURIC ACID FORMATION IN YELLOWSTONE NATIONAL
PARK,
W69-05635 02K

YIELD
INTERACTION OF FOOD LEVEL AND EXPLOITATION IN EXPERIMENTAL
FISH POPULATIONS,
W69-05873 05C

ZOOGLOEA BACTERIA
CONCENTRATION AND ACCUMULATION OF METALLIC IONS BY THE BACTERIUM ZOOGLOEA,
W69-05767 05D

ZOOPLANKTON
SOME OBSERVATIONS ON THE DEPENDENCE OF ZOOPLANKTON GRAZING ON THE CELL SIZE AND CONCENTRATION OF PHYTOPLANKTON BLOOMS
W69-05696 02L

AUTHOR INDEX

ZA, MOHAMED M. I.
VALUATION OF THE RATE OF FLOW THROUGH POROUS MEDIA USING
LECTROKINETIC PHENOMENA,
69-05611 02F

OL, I. P.
ELATIONSHIP OF TEXTURE TO SOME IMPORTANT SOIL MOISTURE
ONSTANTS,
69-05679 02G

E, JAMES L.
ATER QUALITY CONTROL COMPREHENSIVE PLANNING,
69-05744 05G

SWORTH, KEITH H.
EMOTE CONTROL OF IRRIGATION WATER FACILITIES,
69-05833 03F

EN, HOWARD E.
LOODS IN BEECHER EAST QUADRANGLE, NORTHEASTERN ILLINOIS,
69-05911 02E

STRONG, ELLIS L.
EVELOPMENT OF TUNNELING METHODS AND CONTROLS FOR WATER
ESOURCE PROJECTS,
69-05815 08A

OLD, JOSEPH F.
ATERSHED PLANNING,
69-05643 03B

COCK, H. M.
HE PHREATOPHYTE PROBLEM IN ARIZONA,
69-05645 03B

KSTROM, J. E.
ONCRETE-POLYMER MATERIALS, FIRST TOPICAL REPORT,
69-05835 08F

ER, J. S.
EFERENCES FOR WELL DATA AND WATER LEVELS IN CALIFORNIA BY
HE GEOLOGICAL SURVEY,
69-05623 02F

IROVA, R. I.
ALT ACCUMULATION PROCESSES IN THE GROUND WATERS OF THE
IROVABAD-KAZAKH MASSIF,
69-05954 02F

LEY, O. F.
ATER AVAILABILITY AND GRASS ROOT DISTRIBUTION IN SELECTED
OILS,
69-05759 02G

DWIN, JOHN E.
LIMATIC ATLAS OF THE UNITED STATES,
69-05922 02B

TENSPERGER, P. A.
AMPING OF SWITCHING OVERVOLTAGES IN EHV-NETWORKS--NEW
ONOMIC ASPECTS AND SOLUTIONS,
69-05809 08C

ESON, CORNELIUS
ATER LAW, POLITICS, AND ECONOMICS IS OUR SYSTEM OF PUBLIC
ISTRICTS OUTMODED,
69-05747 06B

RD, LEO R.
IDROLOGIC SIMULATION IN WATER-YIELD ANALYSIS,
69-05849 02E

SE OF INTERRELATED RECORDS TO SIMULATE STREAMFLOW,
69-05850 02E

NKI, A. M.
OMPUTATION OF ANNUAL NORMAL FLOW OF INTERMITTENT
ATERCOURSES AND MOUNTAIN RIVERS IN THE UKRAINIAN
ARPATHIANS,
69-05950 02E

G, NORMAN A.
HE SOIL AND WATER CONSERVATIONIST OF TOMORROW,
69-05842 09A

WAGRI, VIRAF S.
LOOD PROOFING IN A FLOOD PLAIN A STOCHASTIC MODEL,
69-05851 04A

ATHEMATICAL REPRESENTATION OF AN URBAN FLOOD PLAIN,
69-05852 04A

MAYA, C. P.
OOT SYSTEM OF FOUR DESERT TREE SPECIES,
69-05690 02I

MBLA, D. R.
ELATIONSHIP OF TEXTURE TO SOME IMPORTANT SOIL MOISTURE
ONSTANTS,
69-05679 02G

GAR, J. W.
ESALINIZATION OF SOILS UNDER CONTROLLED UNSATURATED FLOW
ONDITIONS,
69-05687 02G

TINGER, NORTON W.
MECHANICS OF A MATHEMATICAL GROUND-WATER MODEL,
W69-05863 02F

BITTLER, RONALD P.
LINEAR TIME-VARYING MODEL OF A RAINFALL-RUNOFF RELATION,
W69-05608 02A

BLAKE, G. R.
THIXOTROPIC AGING OF SYNTHETIC SOIL AGGREGATES,
W69-05908 02G

BOAZ, V. L.
CORONA MEASURING TECHNIQUES FOR POWER TRANSFORMERS,
W69-05810 08C

BODVARSSON, GUNNAR
ON THE TEMPERATURE OF WATER FLOWING THROUGH FRACTURES,
W69-05624 02F

BONHAM-CARTER, G. F.
MATHEMATICAL MODEL AND FORTRAN IV PROGRAM FOR COMPUTER
SIMULATION OF DELTAIC SEDIMENTATION,
W69-05657 07C

BOROVIC, ILAN
USE OF VEGETATION AS AN INDICATOR FOR SOIL PROPERTIES UNDER
DESERT CONDITIONS,
W69-05682 02G

BOTTRILL, D. E.
STUDIES WITH ANTITRANSPIRANTS ON GRAPEVINES (VITIS VINIFERA
VAR. SULTANA),
W69-05675 02D

BOUWER, HERMAN
SALT BALANCE, IRRIGATION EFFICIENCY, AND DRAINAGE DESIGN,
W69-05671 03F

BOWER, BLAIR T.
DISSOLVED OXYGEN IN THE DELAWARE ESTUARY,
W69-05727 05G

THE DELAWARE ESTUARY STUDY,
W69-05728 05G

BOWER, CHARLES A.
SALT AND WATER BALANCE, COACHELLA VALLEY, CALIFORNIA,
W69-05670 02G

BOWIE, J. E.
TRAVEL OF SOLUTES IN THE LOWER MISSOURI RIVER,
W69-05909 05B

BOYD, J. HAYDEN
COLLECTIVE FACILITIES IN WATER QUALITY MANAGEMENT,
W69-05726 05G

BREMNER, J. M.
DETERMINATION AND ISOTOPE-RATIO ANALYSIS OF DIFFERENT FORMS
OF NITROGEN IN SOILS 6. MINERALIZABLE NITROGEN,
W69-05699 05A

DETERMINATION AND ISOTOPE-RATIO ANALYSIS OF DIFFERENT FORMS
OF NITROGEN IN SOILS 3. EXCHANGEABLE AMMONIUM, NITRATE,
AND NITRITE BY EXTRACTION-DISTILLATION METHODS,
W69-05700 05A

DETERMINATION AND ISOTOPE-RATIO ANALYSIS OF DIFFERENT FORMS
OF NITROGEN IN SOILS 4. EXCHANGEABLE AMMONIUM, NITRATE,
AND NITRITE BY DIRECT-DISTILLATION METHODS,
W69-05701 05A

CHARACTERIZATION OF MINERALIZABLE NITROGEN IN SOILS,
W69-05703 05A

STEAM DISTILLATION METHODS FOR DETERMINATION OF AMMONIUM,
NITRATE AND NITRITE,
W69-05709 05A

EFFECT OF CULTIVATION ON THE NITROGEN DISTRIBUTION IN SOILS,
W69-05710 02K

DETERMINATION AND ISOTOPE-RATIO ANALYSIS OF DIFFERENT FORMS
OF NITROGEN IN SOILS 7. UREA,
W69-05872 05A

USE OF THE COLEMAN MODEL 29A ANALYZER FOR TOTAL NITROGEN
ANALYSIS OF SOILS,
W69-05874 05A

A SIMPLE STEAM DISTILLATION METHOD OF ESTIMATING (BETA-
HYDROXY-ALPHA-AMINO) ACIDS,
W69-05875 05A

BROWER, STEPHEN L.
AN APPROACH TO ATTACKING HUMAN-SOCIAL PROBLEMS RETARDING
IRRIGATION AND AGRICULTURAL DEVELOPMENT IN LATIN AMERICA,
W69-05652 03F

BROWN, BARRY P.
MUNICIPAL AND INDUSTRIAL WATER USE,
W69-05916 06D

BROWN, SEWARD R.
ABSORPTION COEFFICIENTS OF CHLOROPHYLL DERIVATIVES,
W69-05695 02H

BROWN, WILLIAM G.
OUTDOOR RECREATION POLICY ISSUES AND RESEARCH PROBLEMS,
W69-05736 06D

BRYANT, HOWARD C.
FLUCTUATIONS IN WATER DROPLET EVAPORATION RATES,
W69-05750 02D

BRYAN, ROBKE B.
THE DEVELOPMENT, USE AND EFFICIENCY OF INDICES OF SOIL ERODIBILITY,
W69-05826 02J

BUGLIARELLO, GEORGE
FLOOD PROOFING IN A FLOOD PLAIN A STOCHASTIC MODEL,
W69-05851 04A

MATHEMATICAL REPRESENTATION OF AN URBAN FLOOD PLAIN,
W69-05852 04A

BURBANK, NATHAN C.
WATER QUALITY IN HAWAII,
W69-05893 05G

BURNETT, GRAYDON E.
BUREAU OF RECLAMATION EXPERIENCE WITH FROST ACTION ON CONCRETE,
W69-05801 08F

BYBORDI, M.
THE VERTICAL MOVEMENT OF WATER IN STRATIFIED POROUS MATERIAL. 1. INFILTRATION.
W69-05630 02G

CAMPBELL, WILLIAM J.
SYNOPTIC TEMPERATURE MEASUREMENTS OF A GLACIER LAKE AND ITS ENVIRONMENT,
W69-05665 02C

SEA-ICE DYNAMICS,
W69-05921 02C

CARLSTON, CHARLES W.
DOWNSTREAM VARIATIONS IN THE HYDRAULIC GEOMETRY OF STREAMS SPECIAL EMPHASIS ON MEAN VELOCITY,
W69-05639 02E

CARSTENS, MARION R.
EVOLUTION OF A DUNED BED UNDER OSCILLATORY FLOW,
W69-05662 02J

CARY, J. W.
SOIL MOISTURE TRANSPORT DUE TO THERMAL GRADIENTS PRACTICAL ASPECTS,
W69-05691 02G

CHILDS, E. C.
THE VERTICAL MOVEMENT OF WATER IN STRATIFIED POROUS MATERIAL. 1. INFILTRATION.
W69-05630 02G

CHIU, CHAO-LIU
LINEAR TIME-VARYING MODEL OF A RAINFALL-RUNOFF RELATION,
W69-05608 02A

CLERICI, A.
INFLUENCE OF SHUNT REACTORS ON SWITCHING SURGES,
W69-05812 08C

CLINE, J. F.
EVAPORATIVE COOLING OF HEATED IRRIGATION WATER BY SPRINKLER APPLICATION,
W69-05606 03C

CLYDE, CALVIN G.
EVALUATION OF THE RATE OF FLOW THROUGH POROUS MEDIA USING ELECTROKINETIC PHENOMENA,
W69-05611 02F

COCHEME, J.
AN AGROCLIMATOLOGY SURVEY OF A SEMIARID AREA IN AFRICA SOUTH OF THE SAHARA,
W69-05684 02I

COLOMBO, P.
CONCRETE-POLYMER MATERIALS, FIRST TOPICAL REPORT,
W69-05835 08F

COLTHARP, G. B.
CONTROLLING TRANSPIRATION IN ASPEN WITH PHENYLMERCURIC ACETATE,
W69-05627 03F

COOLEY, RICHARD L.
NUMERICAL SIMULATION OF UNCONFINED FLOW INTO A SINGLE PUMPING WATER-WELL USING TWO-PHASE FLOW THEORY,
W69-05755 02F

CORTRIGHT, CLIFFORD J.
REEVALUATION AND RECONSTRUCTION OF CALIFORNIA DAMS,
W69-05804 08A

COUTY, FLOYD L.
WATER RESOURCES AND ECONOMIC DEVELOPMENT IN THE SOUTH,
W69-05737 06D

COBY, J. T.
INFILTRATION STUDIES ON NON-WETTABLE SOILS,
W69-05760 02G

COWGILL, URSULA M.
A COMPARATIVE STUDY IN EUTROPHICATION,
W69-05869 05C

CRUTCHFIELD, JAMES A.
THE CONVENTION ON FISHING AND LIVING RESOURCES OF THE HIGH SEAS.
W69-05791 06E

DABIRI, HASSAN
NUMERICAL MODELING OF UNSATURATED GROUND WATER FLOW,
W69-05918 02F

DAKE, JONAS M.
THERMAL STRATIFICATION IN LAKES ANALYTICAL AND LABORATORY STUDIES,
W69-05610 02H

DAKIN, T. W.
CORONA MEASURING TECHNIQUES FOR POWER TRANSFORMERS,
W69-05810 08C

DANILEVICH, B. B.
CALCULATION OF MAXIMUM WATER DISCHARGES ORIGINATING FROM RAIN AND SNOW (IN RUSSIAN),
W69-05943 02E

DAVIS, H. CRAIG
ECONOMIC EVALUATION OF WATER, PART V MULTIREGIONAL INPUT-OUTPUT TECHNIQUES AND WESTERN WATER RESOURCES DEVELOPMENT,
W69-05754 06B

DAVIS, R. K.
THE RANGE OF CHOICE IN WATER MANAGEMENT. A STUDY OF DISSOLVED OXYGEN IN THE POTOMAC ESTUARY,
W69-05715 05G

DAWES, J. H.
COST OF RESERVOIRS IN ILLINOIS,
W69-05915 06C

DE RIDDER, N. A.
SEEPAGE FLOW ANALYSIS OF A SMALL POLDER IN THE SOUTHWESTERN PART OF THE NETHERLANDS,
W69-05927 02F

DERVARTANIAN, M. E.
FACTORS INFLUENCING THE EFFECTIVENESS OF SWIMMING POOL BACTERICIDES,
W69-05694 05F

DICK JR, G. F.
EFFECT OF SMALL SURFACE WAVES ON EVAPORATION THROUGH MONOLAYERS,
W69-05604 02D

DIKEOU, J. T.
CONCRETE-POLYMER MATERIALS, FIRST TOPICAL REPORT,
W69-05835 08F

DIMAKSYAN, A. M.
DETERMINING MAXIMUM RELIABILITY AND EFFICIENCY OF HYDROMETEOROLOGICAL SYSTEMS AND INSTRUMENTS,
W69-05658 07A

DIRECTO, LEON S.
RIVER WATER QUALITY FOR ARTIFICIAL RECHARGE,
W69-05894 05B

DJURDJEVIC, P.
DAMPING OF SWITCHING OVERVOLTAGES IN EHV-NETWORKS--NEW ECONOMIC ASPECTS AND SOLUTIONS,
W69-05809 08C

DOBINA, A. S.
FORMATION OF UNDERGROUND CAVITIES BY THE USE OF EXPLOSIVES,
W69-05818 08H

DONOHUE, DAVID A. T.
NUMERICAL SIMULATION OF UNCONFINED FLOW INTO A SINGLE PUMPING WATER-WELL USING TWO-PHASE FLOW THEORY,
W69-05755 02F

DORFMAN, ROBERT
MATHEMATICAL ANALYSIS DESIGN OF THE SIMPLE VALLEY PROJECT
W69-05719 06A

DESIGN OF WATER-RESOURCE SYSTEMS,
W69-05729 04A

DRACUP, JOHN A.
SENSITIVITY ANALYSIS METHOD OF SYSTEM IDENTIFICATION AND ITS POTENTIAL IN HYDROLOGIC RESEARCH,
W69-05603 07C

SIMULATION OF EVAPORATION FROM CONSTANT SOURCE WITH FINITE AREAS,
W69-05636 07C

DUGAN, PATRICK R.
CONCENTRATION AND ACCUMULATION OF METALLIC IONS BY THE BACTERIUM ZOOGLOEA,
W69-05767 05D

INFLUENCE OF CHRONIC EXPOSURE TO ANIONIC DETERGENTS ON TOXICITY OF PESTICIDES TO GOLDFISH,
W69-05768 05C

MICROBIAL SULFATE REDUCTION AND ITS POTENTIAL UTILITY AS AN ACID MINE WATER POLLUTION ABATEMENT PROCEDURE,
W69-05898 05G

MICROBIAL DISSIMILATORY SULFUR CYCLE IN ACID MINE WATER,
W69-05899 05B

UNIN, P. X.
THE INFILTRATION COMPONENT OF A PASTORAL EXPERIMENTAL CATCHMENT, PARTS 1 AND 2,
W69-05901 02G

THE EVAPOTRANSPIRATION COMPONENT OF A PASTORAL EXPERIMENTAL CATCHMENT,
W69-05902 02D

YSART, BENJAMIN C.
WATER QUALITY MANAGEMENT AND SOME POLICY MODELS,
W69-05722 05G

ASTERBROOK, CALVIN C.
THE EFFECTS OF WAVES ON EVAPORATION FROM A FREE WATER SURFACE,
W69-05840 02D

HRLICH, GARRY G.
BACTERIAL ORIGIN OF SULFURIC ACID IN SULFUROUS HOT SPRINGS,
W69-05654 02K

ISENLOHR, W. S., JR.
RELATION OF WATER LOSS TO MOISTURE CONTENT OF HYDROPHYTES IN A NATURAL POND,
W69-05622 02D

LLIS, HAROLD H.
WATER RESOURCES AND ECONOMIC DEVELOPMENT IN THE SOUTH,
W69-05737 06B

WATER RIGHTS AND LEGISLATION IN THE EASTERN STATES,
W69-05879 06E

LY, NORTHCUTT
AMERICAN POLICY OPTIONS IN THE DEVELOPMENT OF UNDERSEA MINERAL RESOURCES.
W69-05787 06E

MBRODI, GABRIELLA
AERODYNAMIC AND SURFACE FACTORS IN EVAPORATION,
W69-05631 02I

NGLAND, C. B.
GEOMORPHIC GROUPING OF SOILS IN WATERSHED ENGINEERING,
W69-05907 02G

RDMANN, R. C.
SENSITIVITY ANALYSIS METHOD OF SYSTEM IDENTIFICATION AND ITS POTENTIAL IN HYDROLOGIC RESEARCH,
W69-05603 07C

RICKSON, A. E.
THE INFLUENCE OF SUBSURFACE ASPHALT BARRIERS ON THE WATER PROPERTIES AND THE PRODUCTIVITY OF SAND SOILS,
W69-05802 02G

RIKSSON, ERIK
CHLORIDE CONCENTRATION IN GROUNDWATER, RECHARGE RATE AND RATE OF DEPOSITION OF CHLORIDE IN THE ISRAEL COASTAL PLAIN,
W69-05905 02F

VERTS, CURTISS M.
WATER QUALITY CONTROL LEGAL AND ADMINISTRATIVE ASPECTS,
W69-05745 05G

VSTROPOV, N. A.
FORMATION OF UNDERGROUND CAVITIES BY THE USE OF EXPLOSIVES,
W69-05818 08H

LK, LLOYD L.
ANALOG COMPUTER -- A MODERN TOOL IN WATER POLLUTION CONTROL,
W69-05854 05G

RVOLDEN, R. N.
HYDROGEOLOGIC DATA FROM FOUR LANDFILLS IN NORTHEASTERN ILLINOIS,
W69-05896 07C

VORIN, N. N.
A CHANGE OF GROUNDWATER REGIME AS A METHOD OF CONTROLLING THE INCURSIONS OF SEA WATER (RUSSIAN),
W69-05939 04B

SCHBACH, PAUL E.
DESIGN OF AN AUTOMATED SURFACE IRRIGATION SYSTEM WITH REUSE SYSTEM,
W69-05830 03F

SCHER, HUGO B.
THE EFFECTS OF BENDS ON DISPERSION IN STREAMS,
W69-05609 02E

SCHER, E. A.
STOMATAL OPENING IN ISOLATED EPIDERMAL STRIPS OF VICIA FABA. II. RESPONSES TO KCL CONCENTRATION AND THE ROLE OF POTASSIUM ABSORPTION,
W69-05681 02I

SHER, GORDON P.
DIGITAL COMPUTERS AND ENVIRONMENTAL CONTROL,
W69-05855 05G

TCH, WILLIAM N.
ASSESSING UPLAND RESERVOIRS USING A DAILY FLOW MODEL,
W69-05632 02E

ITZGERALD, GEORGE P.
USE OF POTASSIUM PERMANGANATE FOR CONTROL OF PROBLEM ALGAE,
W69-05704 05F

FITZGERALD, G. P.
FACTORS INFLUENCING THE EFFECTIVENESS OF SWIMMING POOL BACTERICIDES,
W69-05694 05F

FLAHERTY, DAVID C.
DEATH OF A LAKE,
W69-05844 05C

FRANQUIN, P.
AN AGROCLIMATOLOGY SURVEY OF A SEMIARID AREA IN AFRICA SOUTH OF THE SAHARA,
W69-05684 02I

FRASIER, GARY W.
CREATING HYDROPHOBIC SOIL FOR WATER HARVESTING,
W69-05676 03B

FRIEDMAN, BARRY A.
CONCENTRATION AND ACCUMULATION OF METALLIC IONS BY THE BACTERIUM ZOOGLOEA,
W69-05767 05D

FULTON, J. D.
SOME OBSERVATIONS ON THE DEPENDENCE OF ZOOPLANKTON GRAZING ON THE CELL SIZE AND CONCENTRATION OF PHYTOPLANKTON BLOOMS,
W69-05696 02L

GANDIN, L. S.
THE ECONOMIC APPROACH TO THE PLANNING OF A NETWORK OF METEOROLOGICAL STATIONS,
W69-05949 07A

GANNON, JOHN J.
QUALITY STANDARDS FOR NATURAL WATERS,
W69-05934 05G

GAN, G. N.
COMPUTATIONS OF LEVEL CHANGES AND RUNOFF DISTRIBUTION IN A DELTA BASED ON OBSERVATIONAL DATA (DANUBE DELTA AS AN EXAMPLE),
W69-05951 02E

GARDNER, ROBERT S.
WATER AND WATERCOURSES--NAVIGABILITY OF STREAMS IN MISSOURI.
W69-05782 06E

GARRETT, R. G.
THE ROLE OF SOME STATISTICAL AND MATHEMATICAL METHODS IN THE INTERPRETATION OF REGIONAL GEOCHEMICAL DATA,
W69-05895 02J

GARTON, JAMES E.
AUTOMATION AND SEMI-AUTOMATION OF SURFACE IRRIGATION,
W69-05829 03F

GAVISH, URI
USE OF VEGETATION AS AN INDICATOR FOR SOIL PROPERTIES UNDER DESERT CONDITIONS,
W69-05682 02G

GEORGE, KALANKAMARY P.
SHRINKAGE CHARACTERISTICS OF SOIL-CEMENT MIXTURES,
W69-05825 08D

GERLOFF, GERALD C.
AVAILABILITY OF IRON AND MANGANESE IN SOUTHERN WISCONSIN LAKES FOR THE GROWTH OF MICROCYSTIS AERUGINOSA,
W69-05867 05C

CELL CONTENTS OF NITROGEN AND PHOSPHORUS AS A MEASURE OF THEIR AVAILABILITY FOR GROWTH OF MICROCYSTIS AERUGINOSA,
W69-05868 05C

GIBB, J. P.
COST OF MUNICIPAL AND INDUSTRIAL WELLS IN ILLINOIS, 1964-1966,
W69-05910 06C

GILMAN, R. D.
THIXOTROPIC AGING OF SYNTHETIC SOIL AGGREGATES,
W69-05908 02G

GLANCY, PATRICK A.
WATER-RESOURCES APPRAISAL OF BUTTE VALLEY, ELKO AND WHITE PINE COUNTIES, NEVADA,
W69-05656 02F

GREENWALD, MARGARET
LIST OF REFERENCES ON CONTROL OF AQUATIC PLANTS, INCLUDING ALGAE,
W69-05705 05G

SUPPLEMENT TO THE LIST OF REFERENCES ON CONTROL OF AQUATIC PLANTS, INCLUDING ALGAE,
W69-05706 05G

GREEN, DON W.
NUMERICAL MODELING OF UNSATURATED GROUND WATER FLOW,
W69-05918 02F

GUSENKOV, YE P.
SOIL INVESTIGATIONS IN ARID REGIONS,
W69-05692 02G

GUSHCHINA, M. V.
ACCURACY IN DETERMINING THE MEAN PRECIPITATION DEPTH OVER AN AREA,

W69-05948 02B

GUY, H. P.
THE BEHAVIOR OF LARGE PARTICLES FALLING IN QUIESCENT LIQUIDS,
W69-05625 02J

HADJITHEODOROU, CHRISTOS
CIRCULATION IN SHALLOW HOMOGENEOUS LAKES,
W69-05618 02H

HAGAN, ROBERT M.
PREDICTING EFFECTS OF WATER SHORTAGE ON CROP YIELD,
W69-05674 03F

HALL, C.
SURFACE TENSION IN FROUDE MODELS,
W69-05621 02E

HAMZAH, A. M. O.
LONG STANDING WAVES IN A CURVED CANAL,
W69-05827 08B

HANSEN, C. M.
THE INFLUENCE OF SUBSURFACE ASPHALT BARRIERS ON THE WATER PROPERTIES AND THE PRODUCTIVITY OF SAND SOILS,
W69-05802 02G

HANSEN, WILLIAM H.
SANTA YNEZ BAROMETER WATERSHED,
W69-05644 03B

HARDER, J. A.
ANALOG MODELS FOR FLOOD CONTROL SYSTEMS,
W69-05856 04A

HARKAULI, A. M.
SETTLEMENT JOINTS IN BAIGUL DAM SPILLWAY,
W69-05819 08D

HARLEMAN, DONALD R. F.
THERMAL STRATIFICATION IN LAKES ANALYTICAL AND LABORATORY STUDIES,
W69-05610 02H

HART, G. E.
CONTROLLING TRANSPIRATION IN ASPEN WITH PHENYLMERCURIC ACETATE,
W69-05627 03F

HASLER, ARTHUR D.
ARTIFICIALLY INDUCED CIRCULATION OF LAKES BY MEANS OF COMPRESSED AIR,
W69-05866 05C

MOVEMENTS OF RADIOSODIUM (NA-24) WITHIN AN ICE-COVERED LAKE,
W69-05870 02H

HASLER, A. D.
NATURAL AND ARTIFICIALLY (AIR-PLOUGHING) INDUCED MOVEMENT OF RADIOACTIVE PHOSPHORUS FROM THE MUDS OF LAKES,
W69-05698 02H

HAUPT, HAROLD F.
THE INFLUENCE OF ROADS ON WATER QUALITY CHARACTERISTICS,
W69-05886 04D

HAYS, JAMES R.
LEAST SQUARES ESTIMATION OF MIXING COEFFICIENTS,
W69-05862 06A

HEATH, MILTON S., JR.
STATE PROGRAMS FOR ESTUARINE AREA CONSERVATION,
W69-05776 02L

HEBERT, MICHAEL P.
FEDERAL LAW AND SEASHORE ACCRETION.
W69-05785 06E

HERMANN, EDWARD R.
THRESHOLD PREDICTION AND CHARACTERISTICS OF LOG-NORMAL PHENOMENA,
W69-05871 07C

HERTSGAARD, THOR A.
ECONOMIC IMPACT OF WATER RESOURCE DEVELOPMENT,
W69-05751 06B

HETLING, LEO J.
WATER QUALITY MODELS OF THE ESTUARY,
W69-05716 05G

HIGGINS, BOBBY J.
AN INVESTIGATION OF METEOROLOGICAL CONDITIONS DURING A CALIFORNIA RAINFALL PERIOD
W69-05933 02B

HINES, WILLIAM W.
WATER QUALITY MANAGEMENT AND SOME POLICY MODELS,
W69-05722 05G

HIORNS, R. W.
THE FITTING OF GROWTH AND ALLIED CURVES OF THE ASYMPTOTIC REGRESSION TYPE BY STEVENS'S METHOD,
W69-05711 07C

HITCHON, BRIAN
FLUID FLOW IN THE WESTERN CANADA SEDIMENTARY BASIN. 2. EFFECT OF GEOLOGY,
W69-05602 02F

HOAGLAND, G. G.
NONDESTRUCTIVE CONCRETE TESTS--GRAND COULEE SPILLWAY BRI
W69-05823 08F

HODDE, CHARLES W.
THE WESTERN WATER SUPPLY--WHERE IT IS,
W69-05807 02A

HOLLEY, EDWARD R.
UNIFIED VIEW OF DIFFUSION AND DISPERSION,
W69-05619 01B

HOLLING, CRAWFORD S.
THE STRATEGY OF BUILDING MODELS OF COMPLEX ECOLOGICAL SYSTEMS,
W69-05713 06A

HOLTAN, H. N.
GEOMORPHIC GROUPING OF SOILS IN WATERSHED ENGINEERING,
W69-05907 02G

HOUSTON, WALTER R.
SOIL MOISTURE RESPONSE TO RANGE IMPROVEMENT IN THE NORTH GREAT PLAINS,
W69-05693 02I

HOWARD, A. K.
LABORATORY LOAD TESTS ON BURIED FLEXIBLE PIPE - PROGRESS REPORT NO 1,
W69-05845 08D

HOWARD, CHARLES D. D.
WATER DISTRIBUTION SYSTEMS ANALYSIS,
W69-05848 06B

HSIAO, THEODORE C.
STOMATAL OPENING IN ISOLATED EPIDERMAL STRIPS OF VICIA F II. RESPONSES TO KCL CONCENTRATION AND THE ROLE OF POTASSIUM ABSORPTION,
W69-05681 02I

HUFSCHMIDT, MAYNARD M.
DESIGN OF WATER-RESOURCE SYSTEMS,
W69-05729 04A

SYSTEMS ANALYSIS,
W69-05742 06B

WATER RESOURCE SYSTEMS ANALYSIS,
W69-05857 06A

HUGHES, G. M.
HYDROGEOLOGIC DATA FROM FOUR LANDFILLS IN NORTHEASTERN ILLINOIS,
W69-05896 07C

HUNGATE, F. P.
EVAPORATIVE COOLING OF HEATED IRRIGATION WATER BY SPRINK APPLICATION,
W69-05606 03C

HUNT, BRUCE W.
FLOW RATES IN TWO-DIMENSIONAL, UNSTEADY, CONFINED GROUNDWATER FLOW,
W69-05617 02F

HUSSAIN, S. B.
INFILTRATION STUDIES ON NON-WETTABLE SOILS,
W69-05760 02G

JACKSON, DANIEL F.
THE EFFECTS OF ALGAE ON WATER QUALITY,
W69-05697 05C

JAROCKI, WALENTY
RELATIONSHIP OF AIR TEMPERATURE TO THE OCCURRENCE OF FRAZ ICE AND ICE FLOW IN RIVERS,
W69-05923 02C

JEGLIC, JOHN M.
MATHEMATICAL SIMULATION OF THE ESTUARINE BEHAVIOR AND ITS APPLICATIONS,
W69-05732 05G

JENETT, ERIC
EXPERIENCE WITH AND EVALUATION OF CRITICAL PATH METHODS,
W69-05817 08A

JOERES, ERHARD F.
AN OPERATIONS RESEARCH APPROACH TO BASIN SEDIMENT CONTROL
W69-05733 02J

JOHNSTON, JAMES M.
FOOD AND FEEDING HABITS OF JUVENILE COHO SALMON AND STEELHEAD TROUT IN WORTHY CREEK, WASHINGTON,
W69-05890 02L

JOHNSTON, J. R.
SOIL AND CROP MANAGEMENT FOR MAXIMUM WATER-USE EFFICIENCY ARID AND SEMIARID LANDS,
W69-05669 03F

JOHNS, B.
LONG STANDING WAVES IN A CURVED CANAL,
W69-05827 08B

JONES, JOHN F.
DETERMINATION OF THE GROUND-WATER COMPONENT OF PEAK DISCHARGE FROM THE CHEMISTRY OF TOTAL RUNOFF,
W69-05628 02F

KAGAN, R. L.
ACCURACY IN DETERMINING THE MEAN PRECIPITATION DEPTH OVER AN AREA,
W69-05948 02B

THE ECONOMIC APPROACH TO THE PLANNING OF A NETWORK OF METEOROLOGICAL STATIONS,
W69-05949 07A

KALACHEV, B. A.
SOIL INVESTIGATIONS IN ARID REGIONS,
W69-05692 02G

KAUL, R. N.
ROOT SYSTEM OF FOUR DESERT TREE SPECIES,
W69-05690 02I

KECKLER, WILLIAM G.
OPTIMUM MANAGEMENT OF A COMBINED PUMPED HYDRO AND IRRIGATION STORAGE FACILITY,
W69-05734 04A

KEELEY, JACK W.
AQUIFER STORAGE DETERMINATION BY RADIOTRACER TECHNIQUES,
W69-05814 07B

KEENEY, D. R.
DETERMINATION AND ISOTOPE-RATIO ANALYSIS OF DIFFERENT FORMS OF NITROGEN IN SOILS 6. MINERALIZABLE NITROGEN,
W69-05699 05A

DETERMINATION AND ISOTOPE-RATIO ANALYSIS OF DIFFERENT FORMS OF NITROGEN IN SOILS 3. EXCHANGEABLE AMMONIUM, NITRATE, AND NITRITE BY EXTRACTION-DISTILLATION METHODS,
W69-05700 05A

CHARACTERIZATION OF MINERALIZABLE NITROGEN IN SOILS,
W69-05703 05A

EFFECT OF CULTIVATION ON THE NITROGEN DISTRIBUTION IN SOILS,
W69-05710 02K

DETERMINATION AND ISOTOPE-RATIO ANALYSIS OF DIFFERENT FORMS OF NITROGEN IN SOILS 7. UREA,
W69-05872 05A

USE OF THE COLEMAN MODEL 29A ANALYZER FOR TOTAL NITROGEN ANALYSIS OF SOILS,
W69-05874 05A

A SIMPLE STEAM DISTILLATION METHOD OF ESTIMATING (BETA-HYDROXY-ALPHA-AMINO) ACIDS,
W69-05875 05A

KENNARD, W. C.
CONNECTICUT INSTITUTE OF WATER RESOURCES, ANNUAL REPORT 1967 68,
W69-05773 09D

KENNEY, D. R.
DETERMINATION AND ISOTOPE-RATIO ANALYSIS OF DIFFERENT FORMS OF NITROGEN IN SOILS 4. EXCHANGEABLE AMMONIUM, NITRATE, AND NITRITE BY DIRECT-DISTILLATION METHODS,
W69-05701 05A

STEAM DISTILLATION METHODS FOR DETERMINATION OF AMMONIUM, NITRATE AND NITRITE,
W69-05709 05A

KERRIDGE, G. H.
STUDIES WITH ANTITRANSPIRANTS ON GRAPEVINES (VITIS VINIFERA VAR. SULTANA),
W69-05675 02D

KHANNA, M. M. L.
SETTLEMENT JOINTS IN BAIGUL DAM SPILLWAY,
W69-05819 08D

KHOSLA, B. K.
RELATIONSHIP OF TEXTURE TO SOME IMPORTANT SOIL MOISTURE CONSTANTS,
W69-05679 02G

KHUWAKASEM, VACHI
CHLORIDE CONCENTRATION IN GROUNDWATER, RECHARGE RATE AND RATE OF DEPOSITION OF CHLORIDE IN THE ISRAEL COASTAL PLAIN,
W69-05905 02F

KIRBY, WILLIAM H.
MARKOV CHAIN STORAGE MODELS FOR STATISTICAL HYDROLOGY,
W69-05917 07C

KLEMENT, ALFRED W., JR.
RUSSIAN RADIOECOLOGY, A BIBLIOGRAPHY OF SOVIET PUBLICATIONS WITH CITATIONS OF ENGLISH TRANSLATIONS AND ABSTRACTS,
W69-05708 05C

KLEMES, VIT
RELIABILITY ESTIMATES FOR A STORAGE RESERVOIR WITH SEASONAL INPUT,
W69-05906 06A

RELIABILITY OF WATER SUPPLY PERFORMED BY MEANS OF A STORAGE RESERVOIR WITHIN A LIMITED PERIOD OF TIME,
W69-05930 02E

KNEESE, ALLEN V.
DISSOLVED OXYGEN IN THE DELAWARE ESTUARY,
W69-05727 05G

THE DELAWARE ESTUARY STUDY,
W69-05728 05G

ECONOMICS OF POLLUTION CONTROL,
W69-05880 05C

KNETSCH, JACK L.
POTENTIALS OF WATER-BASED RECREATION,
W69-05740 06B

KNISEL, WALTER G., JR.
THE STATISTICAL MEASURE OF HYDROLOGIC TIME SERIES,
W69-05775 02E

KOLENBRANDER, G. J.
CALCULATION OF PARAMETERS FOR THE EVALUATION OF THE LEACHING OF SALTS UNDER FIELD CONDITIONS, ILLUSTRATED BY NITRATE,
W69-05616 02G

KONDRATOVA, A. V.
ATTACK ON CUMULUS CLOUDS BY MAN-MADE VERTICAL ASCENDING CURRENTS,
W69-05821 03B

KRENKEL, PETER A.
IMPOUNDMENT AND TEMPERATURE EFFECT ON WASTE ASSIMILATION,
W69-05637 05C

REAERATION PREDICTION IN NATURAL STREAMS,
W69-05638 05C

LEAST SQUARES ESTIMATION OF MIXING COEFFICIENTS,
W69-05862 06A

KRISHNAMURTI, T. N.
AN INVESTIGATION OF METEOROLOGICAL CONDITIONS DURING A CALIFORNIA RAINFALL PERIOD,
W69-05933 02B

KUKACKA, L. E.
CONCRETE-POLYMER MATERIALS, FIRST TOPICAL REPORT,
W69-05835 08F

KUZNETSOV, I. A.
A MEANING OF NATIONAL WATER BALANCE IN RATIONAL USE OF WATER RESOURCES (RUSSIAN),
W69-05937 04A

LANDON, R. A.
HYDROGEOLOGIC DATA FROM FOUR LANDFILLS IN NORTHEASTERN ILLINOIS,
W69-05896 07C

LANE, L.
PRECIPITATION-RUNOFF RELATIONS FOR VERY SMALL SEMIARID RANGELAND WATERSHEDS,
W69-05605 02A

LANGLEY, MAURICE N.
AUTOMATION OF IRRIGATION,
W69-05834 03F

LARSON, L. R.
QUALITY OF WATER IN SELECTED LAKES OF EASTERN SOUTH DAKOTA,
W69-05932 02H

LAU, L. STEPHEN
A STEP IN OPTIMIZING THE DEVELOPMENT OF THE BASAL WATER LENS OF SOUTHERN OAHU, HAWAII,
W69-05663 02F

LEBRASSEUR, R. J.
SOME OBSERVATIONS ON THE DEPENDENCE OF ZOOPLANKTON GRAZING ON THE CELL SIZE AND CONCENTRATION OF PHYTOPLANKTON BLOOMS,
W69-05696 02L

LEE, G. FRED
NUTRIENT REMOVAL FROM SECONDARY EFFLUENT BY ALUM FLOCCULATION AND LIME PRECIPITATION,
W69-05865 05D

LEE, JOHN C. H., JR.
CONTRIBUTIONS OF WATER RESOURCE DEVELOPMENT TO DEPRESSED AREAS DEVELOPMENT,
W69-05741 06B

LEHR, JAY H.
A STUDY OF GROUNDWATER CONTAMINATION DUE TO SALINE WATER DISPOSAL IN THE MORROW COUNTY OIL FIELDS,
W69-05749 05B

LETEY, J.
MOVEMENT OF WATER THROUGH SOIL AS INFLUENCED BY OSMOTIC PRESSURE AND TEMPERATURE GRADIENTS,
W69-05683 02G

LEVINE, GILBERT
THE SOIL AND WATER CONSERVATIONIST OF TOMORROW,
W69-05842 09A

LIGGETT, JAMES A.
CIRCULATION IN SHALLOW HOMOGENEOUS LAKES,
W69-05618 02H

LIKENS, GENE E.
MOVEMENTS OF RADIOSODIUM (NA-24) WITHIN AN ICE-COVERED LAKE,
W69-05870 02H

LINDAHL, MERLIN E.
RIVER WATER QUALITY FOR ARTIFICIAL RECHARGE,
W69-05894 05B

LINDORF, MARVIN R.
COMPUTER SIMULATION OF ESTUARIAL NETWORKS,
W69-05861 02L

LOELTZ, OMAR J.
WATER CONSUMPTION IN THE LOWER COLORADO RIVER VALLEY,
W69-05678 02E

LUTHIN, J. N.
DESALINIZATION OF SOILS UNDER CONTROLLED UNSATURATED FLOW CONDITIONS,
W69-05687 02G

LYNN, WALTER R.
DIGITAL COMPUTERS AND ENVIRONMENTAL CONTROL,
W69-05855 05G

MATHEMATICAL MODEL FOR FLOOD RISK EVALUATION,
W69-05860 04A

LYTLE, CHARLES F.
RUSSIAN RADIOECOLOGY, A BIBLIOGRAPHY OF SOVIET PUBLICATIONS WITH CITATIONS OF ENGLISH TRANSLATIONS AND ABSTRACTS,
W69-05708 05C

MAASS, ARTHUR
DESIGN OF WATER-RESOURCE SYSTEMS,
W69-05729 04A

MACEK, KENNETH J.
GROWTH AND RESISTANCE TO STRESS IN BROOK TROUT FED SUBLETHAL LEVELS OF DDT,
W69-05770 05C

REPRODUCTION IN BROOK TROUT (SALVELINUS FONTINALIS) FED SUBLETHAL CONCENTRATIONS OF DDT,
W69-05771 05C

MACMILLAN, CAROL B.
MICROBIAL DISSIMILATORY SULFUR CYCLE IN ACID MINE WATER,
W69-05899 05B

MACY, J. E.
RES IPSA LOQUITUR AS APPLICABLE IN ACTIONS FOR DAMAGE TO PROPERTY BY THE OVERFLOW OR ESCAPE OF WATER.
W69-05784 06E

MAHDAVI, H.
SUMMARY OF WATER RESOURCES DEVELOPMENT IN IRAN,
W69-05651 02E

MAKAROVA, T. A.
COMPUTATIONS OF LEVEL CHANGES AND RUNOFF DISTRIBUTION IN A DELTA BASED ON OBSERVATIONAL DATA (DANUBE DELTA AS AN EXAMPLE),
W69-05951 02E

MALES, RICHARD MICHAEL
OPTIMAL OPERATING RULES FOR MULTI-RESERVOIR SYSTEMS,
W69-05723 04A

MALHOTRA, S. K.
NUTRIENT REMOVAL FROM SECONDARY EFFLUENT BY ALUM FLOCCULATION AND LIME PRECIPITATION,
W69-05865 05D

MANAMPERI, H. DE S.
THE UDA WALAWE RESERVOIR PROJECT,
W69-05653 04A

MANOHAR, MAN SINGH
AN IMPROVEMENT SCHARDAKOW DYE TECHNIQUE FOR THE MEASUREMENT OF PLANT WATER POTENTIALS,
W69-05688 02I

MARCHELLO, J. M.
EFFECT OF SMALL SURFACE WAVES ON EVAPORATION THROUGH MONOLAYERS,
W69-05604 02D

MARGLIN, STEPHEN A.
DESIGN OF WATER-RESOURCE SYSTEMS,
W69-05729 04A

MARMION, KEITH R.
AN ANALYSIS OF WATER NEEDS FOR ARID AND SEMI-ARID LANDS,
W69-05673 03E

MARPLE, WARREN
THE RIVER BASIN DEVELOPMENT CONCEPT, WATER RESOURCES PLANNING IN THE PACIFIC NORTHWEST,
W69-05746 06B

MATHESON, DELOSS H.
INORGANIC NITROGEN IN PRECIPITATION AND ATMOSPHERIC SEDIMENTS,
W69-05712 05B

MAXWELL, W.
SURFACE TENSION IN FROUDE MODELS,
W69-05621 02E

MCCARTY, JAMES C.
COMPUTER SIMULATION OF ESTUARIAL NETWORKS,
W69-05861 02L

MCDONALD, CHARLES C.
WATER CONSUMPTION IN THE LOWER COLORADO RIVER VALLEY,
W69-05678 02E

MCGUINNESS, C. L.
NEW THRUSTS IN GROUND WATER,
W69-05677 02F

MCKINLEY, CHARLES
WATER LAW, POLITICS, AND ECONOMICS WATER RESOURCES AND PUBLIC REGULATIONS OF THEIR USES,
W69-05748 06B

MECHITOV, I. I.
METHODS OF PREVENTING MUDFLOWS (IN RUSSIAN),
W69-05945 04A

MEEUWIG, RICHARD O.
EFFECTS OF SEEDING AND GRAZING ON INFILTRATION CAPACITY AND SOIL STABILITY OF A SUBALPINE RANGE IN CENTRAL UTAH,
W69-05889 04D

MEIER, MARK F.
CALCULATIONS OF SLIP OF NISQUALLY GLACIER ON ITS BED NO SIMPLE RELATION OF SLIDING VELOCITY TO SHEAR STRESS,
W69-05924 02C

MEL'NICHUK, O. N.
COMPUTATION OF ANNUAL NORMAL FLOW OF INTERMITTENT WATERCOURSES AND MOUNTAIN RIVERS IN THE UKRAINIAN CARPATHIANS,
W69-05950 02E

MICHARD, G.
SIGNIFICANCE OF REDOX POTENTIAL IN NATURAL WATERS (IN FRENCH),
W69-05877 02K

MIKHAYLOV, V. N.
COMPUTATIONS OF LEVEL CHANGES AND RUNOFF DISTRIBUTION IN A DELTA BASED ON OBSERVATIONAL DATA (DANUBE DELTA AS AN EXAMPLE),
W69-05951 02E

SOME PATTERNS OF FORMATION OF A RIVER MOUTH BAR WHERE RIVER FACTORS PLAY AN IMPORTANT ROLE (EXEMPLIFIED BY THE VISTULA DELTA),
W69-05953 02J

MINK, J. F.
A STEP IN OPTIMIZING THE DEVELOPMENT OF THE BASAL WATER LENS OF SOUTHERN OAHU, HAWAII,
W69-05663 02F

MOGG, JOE L.
STEP-DRAWDOWN TEST NEEDS CRITICAL REVIEW,
W69-05813 04B

MOORE, DAVID J.
A FIELD AND LABORATORY STUDY OF FLUORIDE UPTAKE BY OYSTERS,
W69-05752 05C

MOORE, H. R.
CORONA MEASURING TECHNIQUES FOR POWER TRANSFORMERS,
W69-05810 08C

MORRIS, R. J.
INFILTRATION STUDIES ON NON-WETTABLE SOILS,
W69-05760 02G

MOTT, D. GORDON
THE ANALYSIS OF DETERMINATION IN POPULATION SYSTEMS,
W69-05714 06A

MOYLAN, JOSEPH J.
WATER RESOURCES AND ECONOMIC DEVELOPMENT IN THE SOUTH,
W69-05737 06B

MULLINER, H. ROBERT
AUTOMATIC SPRINKLER IRRIGATION AND ITS FUTURE IN THE MIDWEST,
W69-05831 03F

MURPHEE, CLYDE E.
WATER RESOURCES AND ECONOMIC DEVELOPMENT IN THE SOUTH,
W69-05737 06B

MYERS, LLOYD E.
CREATING HYDROPHOBIC SOIL FOR WATER HARVESTING,
W69-05676 03B

NEILSON, FRANK M.
EVOLUTION OF A DUNED BED UNDER OSCILLATORY FLOW,
W69-05662 02J

NELSON, DAVID M.
THE VALUE OF WATER FOR IRRIGATION IN THE KANSAS RIVER VALLEY,
W69-05919 06B

NEVILLE, ADAM M.
CONCRETE--A NON-ELASTIC MATERIAL IN THE LABORATORY AND IN STRUCTURES,
W69-05822 08F

NICHOL, IAN
THE ROLE OF SOME STATISTICAL AND MATHEMATICAL METHODS IN THE INTERPRETATION OF REGIONAL GEOCHEMICAL DATA,
W69-05895 02J

NIELSEN, D. R.
DESALINIZATION OF SOILS UNDER CONTROLLED UNSATURATED FLOW CONDITIONS,
W69-05687 02G

NOEHRE, ALLEN W.

FLOODS IN BEECHER EAST QUADRANGLE, NORTHEASTERN ILLINOIS,
W69-05911 02E

NORTH, RONALD M.
CONSUMER RESPONSES TO PRICES OF RESIDENTIAL WATER,
W69-05881 06C

ODA, SHIGERU
THE GENEVA CONVENTIONS ON THE LAW OF THE SEA SOME SUGGESTIONS FOR THEIR REVISION,
W69-05974 06E

OERSHAN, GIDEON
USE OF VEGETATION AS AN INDICATOR FOR SOIL PROPERTIES UNDER DESERT CONDITIONS,
W69-05682 02G

OSBORN, H. B.
PRECIPITATION-RUNOFF RELATIONS FOR VERY SMALL SEMIARID RANGELAND WATERSHEDS,
W69-05605 02A

PACKER, PAUL E.
CRITERIA FOR DESIGNING AND LOCATING LOGGING ROADS TO CONTROL SEDIMENT,
W69-05884 04D

FOREST TREATMENT EFFECTS ON WATER QUALITY,
W69-05885 04D

THE INFLUENCE OF ROADS ON WATER QUALITY CHARACTERISTICS,
W69-05886 04D

PAGE, LEO M.
THE USE OF THE GEOELECTRIC METHOD FOR INVESTIGATING GEOLOGIC AND HYDROLOGIC CONDITIONS IN SANTA CLARA COUNTY, CALIFORNIA,
W69-05904 07B

PALMER, LEONARD
SURVEY OF WATER INDUCED LAND-INSTABILITY HAZARDS IN THE PORTLAND, OREGON REGION,
W69-05640 08D

PARKER, FRANK L.
IMPOUNDMENT AND TEMPERATURE EFFECT ON WASTE ASSIMILATION,
W69-05637 05C

PARSONS, T. R.
SOME OBSERVATIONS ON THE DEPENDENCE OF ZOOPLANKTON GRAZING ON THE CELL SIZE AND CONCENTRATION OF PHYTOPLANKTON BLOOMS,
W69-05696 02L

PASSMORE, RONALD E.
COMPARATIVE MODEL TURBINE TESTS,
W69-05806 08C

PENCE, GEORGE D., JR.
MATHEMATICAL SIMULATION OF THE ESTUARINE BEHAVIOR AND ITS APPLICATIONS,
W69-05732 05G

PENNINGTON, WINIFRED
LAKE SEDIMENTS THE BOTTOM DEPOSITS OF THE NORTH BASIN OF WINDERMERE, WITH SPECIAL REFERENCE TO THE DIATOM SUCCESSION,
W69-05707 02H

PETRI, L. R.
TRAVEL OF SOLUTES IN THE LOWER MISSOURI RIVER,
W69-05909 05B

QUALITY OF WATER IN SELECTED LAKES OF EASTERN SOUTH DAKOTA,
W69-05932 02H

PETROV, V. P.
DETERMINING MAXIMUM RELIABILITY AND EFFICIENCY OF HYDROMETEOROLOGICAL SYSTEMS AND INSTRUMENTS,
W69-05658 07A

PINDER, GEORGE F.
DETERMINATION OF THE GROUND-WATER COMPONENT OF PEAK DISCHARGE FROM THE CHEMISTRY OF TOTAL RUNOFF,
W69-05628 02F

PINE, WILFRED H.
THE VALUE OF WATER FOR IRRIGATION IN THE KANSAS RIVER VALLEY,
W69-05919 06B

PISANO, WILLIAM C.
ASSESSING UPLAND RESERVOIRS USING A DAILY FLOW MODEL,
W69-05632 02E

OPERATIONAL HYDROLOGY USING RESIDUALS,
W69-05847 06A

POLISHCHUK, A. I.
ACCURACY IN DETERMINING THE MEAN PRECIPITATION DEPTH OVER AN AREA,
W69-05948 02B

PORTER, LELAND C.
BUREAU OF RECLAMATION EXPERIENCE WITH FROST ACTION ON CONCRETE,
W69-05801 08F

POSSINGHAM, J. V.
STUDIES WITH ANTITRANSPIRANTS ON GRAPEVINES (VITIS VINIFERA VAR. SULTANA),
W69-05675 02D

POTTER, J. LEON
USE POLLUTION TO BENEFIT MANKIND,
W69-05891 05D

PRASAD, RAMANAND
A NONLINEAR HYDROLOGIC SYSTEM RESPONSE MODEL,
W69-05858 02A

PRATT, GEORGE L.
A FEASIBILITY STUDY OF A LIVESTOCK WASTE DISPOSAL SYSTEM INVOLVING THE REUSE OF WATER,
W69-05753 05D

PUGH, C. A.
THE PHREATOPHYTE PROBLEM IN ARIZONA,
W69-05645 03B

QUICK, M. C.
A COMPARISON OF MEASURED AND THEORETICAL SNOWPACK TEMPERATURES,
W69-05929 02C

RANDLES, CHESTER I.
MICROBIAL SULFATE REDUCTION AND ITS POTENTIAL UTILITY AS AN ACID MINE WATER POLLUTION ABATEMENT PROCEDURE,
W69-05898 05G

MICROBIAL DISSIMILATORY SULFUR CYCLE IN ACID MINE WATER,
W69-05899 05B

RAWITZ, ERNEST
INSTALLATION AND FIELD CALIBRATION OF NEWTRON-SCATTER EQUIPMENT FOR HYDROLOGIC RESEARCH IN HETEROGENEOUS AND STONY SOILS,
W69-05626 07B

REISER, C. O.
ANALYSIS OF AN EVAPORATION CONTROL SYSTEM ON THE SEA OF GALILEE,
W69-05601 03F

RICHARDSON, BLAND Z.
CABLE AND CLAMP MODIFICATIONS FOR MODEL 104 MOISTURE PROBES,
W69-05883 07B

INSTALLATION OF SOIL MOISTURE ACCESS TUBES IN ROCKY SOILS,
W69-05887 07B

A TOOL FOR REPAIRING INSTALLED SOIL MOISTURE ACCESS TUBES,
W69-05888 07B

RICHEY, E. P.
FLUID MECHANICS OF DOWNSTREAM FISH PASSAGE STRUCTURES,
W69-05667 08I

RICH, LOWELL R.
PRELIMINARY WATER YIELDS AFTER TIMBER HARVEST ON CASTLE CREEK, ARIZONA WATERSHEDS,
W69-05642 03B

RIGGS, F. E.
ECONOMICS OF WATERSHED PLANNING,
W69-05718 06B

RIJTEMA, P. E.
ON THE RELATION BETWEEN TRANSPIRATION, SOIL PHYSICAL PROPERTIES AND CROP PRODUCTION AS A BASIS FOR WATER SUPPLY PLANS,
W69-05613 02I

ROBB, DAVID C. N.
CONSUMPTIVE USE ESTIMATES FROM SOLAR RADIATION AND TEMPERATURE,
W69-05686 02I

ROBISON, F. L.
FLOODS IN NEW YORK- 1967,
W69-05912 02E

RODDA, JOHN C.
A COUNTRY-WIDE STUDY OF INTENSE RAINFALL FOR THE UNITED KINGDOM,
W69-05925 02B

ROGERS, LEROY
THE FUTURE AGRICULTURAL USE OF WATER - SOUTHERN HUMID REGION,
W69-05738 06B

ROHLICH, G. A.
NUTRIENT REMOVAL FROM SECONDARY EFFLUENT BY ALUM FLOCCULATION AND LIME PRECIPITATION,
W69-05865 05D

ROMASHIN, V. V.
FORMATION OF A RIVER MOUTH BAR WHERE MARINE FACTORS PLAY AN IMPORTANT ROLE (EXEMPLIFIED BY THE LIELUPE RIVER),
W69-05952 02J

ROZHDESTVENSKIY, G. D.
MUD FLOWS IN THE TRANSILIAN ALA-TAU AND THE MUD FLOW CATASTROPHE OF 7 JULY, 1963 IN THE ISSYK RIVER BASIN (IN RUSSIAN),
W69-05944 02E

IMMENSE LANDSLIDE OBSTRUCTION OF ZERAVSHAN RIVER, APRIL 24, 1964 (IN RUSSIAN),
W69-05946 02E

RUCKSTUHL, G.
INFLUENCE OF SHUNT REACTORS ON SWITCHING SURGES,
W69-05812 08C

SANDERSON, E. W.
COST OF MUNICIPAL AND INDUSTRIAL WELLS IN ILLINOIS, 1964-1966,
W69-05910 06C

SAUNDERS, ROBERT J.
FORECASTING WATER DEMAND, AN INTER-AND INTRA-COMMUNITY STUDY,
W69-05900 06D

SCALF, MARION R.
AQUIFER STORAGE DETERMINATION BY RADIOTRACER TECHNIQUES,
W69-05814 07B

SCHENCK, HILBERT, JR.
SIMULATION OF THE EVOLUTION OF DRAINAGE-BASIN NETWORKS WITH A DIGITAL COMPUTER,
W69-05859 02E

SCHMID, ALLAN A.
EVOLUTION OF MICHIGAN WATER LAWS,
W69-05778 06E

EVOLUTION OF MICHIGAN WATER LAWS- SURFACE WATER RIGHTS OF RIPARIANS AND NON-RIPARIANS.
W69-05779 06E

EVOLUTION OF MICHIGAN WATER LAWS - SURFACE WATER RIGHTS AMONG RIPARIAN OWNERS.
W69-05780 06E

EVOLUTION OF MICHIGAN WATER LAWS-GROUND WATER.
W69-05781 06E

SCHMITZ, WILLIAM R.
ARTIFICIALLY INDUCED CIRCULATION OF LAKES BY MEANS OF COMPRESSED AIR,
W69-05866 05C

SCHOEN, ROBERT
RATE OF SULFURIC ACID FORMATION IN YELLOWSTONE NATIONAL PARK,
W69-05635 02K

SCHOEN, R.
BACTERIAL ORIGIN OF SULFURIC ACID IN SULFUROUS HOT SPRINGS,
W69-05654 02K

SCHULTZ, J. D.
CONTROLLING TRANSPIRATION IN ASPEN WITH PHENYLMERCURIC ACETATE,
W69-05627 03F

SCHULTZ, VINCENT
RUSSIAN RADIOECOLOGY, A BIBLIOGRAPHY OF SOVIET PUBLICATIONS WITH CITATIONS OF ENGLISH TRANSLATIONS AND ABSTRACTS,
W69-05708 05C

SHAMIR, URI
WATER DISTRIBUTION SYSTEMS ANALYSIS,
W69-05848 06B

SHANE, RICHARD M.
MATHEMATICAL MODEL FOR FLOOD RISK EVALUATION,
W69-05860 04A

SHANNON, JOHN W.
USE OF ATMOMETERS IN ESTIMATING EVAPOTRANSPIRATION,
W69-05685 02D

SHIH, CHAU
SIMULATION OF EVAPORATION FROM CONSTANT SOURCE WITH FINITE AREAS,
W69-05636 07C

SHIPLEY, H.
DEVELOPMENT OF AUTOMATION ON THE SALT RIVER PROJECT,
W69-05832 03F

SHMUELI, E.
THE CONTRIBUTION OF RESEARCH TO THE EFFICIENT USE OF WATER IN AGRICULTURE,
W69-05650 03F

SHUBINSKI, ROBERT P.
COMPUTER SIMULATION OF ESTUARIAL NETWORKS,
W69-05861 02L

SILLIMAN, RALPH P.
INTERACTION OF FOOD LEVEL AND EXPLOITATION IN EXPERIMENTAL FISH POPULATIONS,
W69-05873 05C

SIMONS, D. B.
THE BEHAVIOR OF LARGE PARTICLES FALLING IN QUIESCENT LIQUIDS,
W69-05625 02J

SINGHAL, M. S. S.
SETTLEMENT JOINTS IN BAIGUL DAM SPILLWAY,
W69-05819 08D

SKOOG, FOLKE
AVAILABILITY OF IRON AND MANGANESE IN SOUTHERN WISCONSIN LAKES FOR THE GROWTH OF MICROCYSTIS AERUGINOSA,
W69-05867 05C

CELL CONTENTS OF NITROGEN AND PHOSPHORUS AS A MEASURE OF THEIR AVAILABILITY FOR GROWTH OF MICROCYSTIS AERUGINOSA,
W69-05868 05C

SKRIBNYY, M. P.
PHYSICO-TECHNICAL PROBLEMS IN MANAGING WATER RESOURCES (RUSSIAN),
W69-05660 02A

ANALYSIS OF FLOOD PROCESSES IN DRAINAGE AREAS OF VARYING SEEPAGE CHARACTER (RUSSIAN),
W69-05940 02E

ANALYTICAL METHOD OF COMPUTING MONSOON FLOODS (KELANI GANGA RIVER BASINS AS AN EXAMPLE) (IN RUSSIAN),
W69-05947 02E

SLATYER, R. O.
MEASUREMENTS OF PRECIPITATION INTERCEPTION BY AN ARID ZONE PLANT COMMUNITY (ACACIA ANEURA F. MUELL),
W69-05689 02I

SMITH, STEPHEN C.
GOVERNMENT AND WATER RESOURCES DEVELOPMENT,
W69-05878 06D

SMUCKER, A. J. M.
THE INFLUENCE OF SUBSURFACE ASPHALT BARRIERS ON THE WATER PROPERTIES AND THE PRODUCTIVITY OF SAND SOILS,
W69-05802 02G

SOMERS, WILLIAM P.
ASSESSING UPLAND RESERVOIRS USING A DAILY FLOW MODEL,
W69-05632 02E

SORENSEN, ERIC E.
REGIONAL RAIN MODELS WITH SPACE- AND TIME-CORRELATED STRUCTURE,
W69-05731 02B

SPENCER, JAMES R.
SALT AND WATER BALANCE, COACHELLA VALLEY, CALIFORNIA,
W69-05670 02G

STAFFORD, JAMES P.
DIVERSION WORKS FOR CONSTRUCTION,
W69-05816 04A

STEINBERG, M.
CONCRETE-POLYMER MATERIALS, FIRST TOPICAL REPORT,
W69-05835 08F

STEINBERG, ROBERT M.
RESERVOIR SYSTEM SIMULATION,
W69-05717 05G

STEPP, JAMES J.
SOME ECONOMIC ASPECTS OF INDUSTRIAL WATER SUPPLY IN THE SOUTH,
W69-05739 06B

STERNBERG, YARON M.
SOME APPROXIMATE SOLUTIONS OF RADIAL FLOW PROBLEMS,
W69-05903 02F

STEWART, J. IAN
PREDICTING EFFECTS OF WATER SHORTAGE ON CROP YIELD,
W69-05674 03F

STIRK, G. B.
SOIL WATER MEASUREMENT WITH AN AM-241 BE NEUTRON SOURCE AND AN APPLICATION TO EVAPORIMETRY,
W69-05926 02G

STOERMER, E. F.
A PRELIMINARY REPORT OF THE FOSSIL DIATOM FLORA FROM LAKE HURON SEDIMENTS,
W69-05762 02H

NEARSHORE PHYTOPLANKTON POPULATIONS IN THE GRAND HAVEN, MICHIGAN VICINITY DURING THERMAL BAR CONDITIONS,
W69-05763 02H

STOEVENER, HERBERT H.
OUTDOOR RECREATION POLICY ISSUES AND RESEARCH PROBLEMS,
W69-05736 06D

STRINGHAM, G. E.
THE BEHAVIOR OF LARGE PARTICLES FALLING IN QUIESCENT LIQUIDS,
W69-05625 02J

SUTHERLAND, ALEX J.
MATHEMATICAL MODEL AND FORTRAN IV PROGRAM FOR COMPUTER SIMULATION OF DELTAIC SEDIMENTATION,
W69-05657 07C

SWAIN, FRANCIS E.
APPLICATION OF ELECTRONIC COMPUTERS TO IRRIGATION AND DRAINAGE SYSTEM PROBLEMS,
W69-05803 02A

SWED, R. J.
EXPERIENCES ON STARTUP AND TRIAL OPERATION AT YARDS CREEK PUMPED STORAGE PROJECT,
W69-05824 08C

SZEICZ, G.
AERODYNAMIC AND SURFACE FACTORS IN EVAPORATION,
W69-05631 02I

TAJCHMAN, S.
AERODYNAMIC AND SURFACE FACTORS IN EVAPORATION,
W69-05631 02I

TANGBORN, WENDELL V.
MASS BALANCES OF SOME NORTH CASCADE GLACIERS AS DETERMINED BY HYDROLOGIC PARAMETERS 1920-65,
W69-05664 02C

TANNER, WILLIAM F.
SURGE FLOW A MODEL OF THE WALL LAYER,
W69-05892 08B

TARASOV, B. L.
EXPERIMENTAL INVESTIGATION OF THE ACTIVE PRESSURE OF A CLAY SOIL ON A RETAINING WALL,
W69-05820 08D

THACKSTON, EDWARD L.
IMPOUNDMENT AND TEMPERATURE EFFECT ON WASTE ASSIMILATION,
W69-05637 05C

REAERATION PREDICTION IN NATURAL STREAMS,
W69-05638 05C

LEAST SQUARES ESTIMATION OF MIXING COEFFICIENTS,
W69-05862 06A

THOMAS, HAROLD A., JR.
DESIGN OF WATER-RESOURCE SYSTEMS,
W69-05729 04A

MATHEMATICAL MODELS A STOCHASTIC SEQUENTIAL APPROACH,
W69-05730 04A

TOLLEY, G. S.
ECONOMICS OF WATERSHED PLANNING,
W69-05718 06B

WATER RESOURCES AND ECONOMIC DEVELOPMENT IN THE SOUTH,
W69-05737 06B

TRELEASE, FRANK J.
MECHANICS OF A MATHEMATICAL GROUND-WATER MODEL,
W69-05863 02F

TURCHINOVICH, V. T.
METHODS FOR WORKING OUT A NATIONAL WATER BALANCE (RUSSIAN),
W69-05936 04A

TURNOVSKY, STEPHEN J.
THE DEMAND FOR WATER SOME EMPIRICAL EVIDENCE ON CONSUMERS' RESPONSE TO A COMMODITY UNCERTAIN IN SUPPLY,
W69-05633 06D

TUTIN, WINIFRED
PRELIMINARY OBSERVATIONS ON A YEAR'S CYCLE OF SEDIMENTATION IN WINDERMERE, ENGLAND,
W69-05876 02J

TUTTLE, JON H.
MICROBIAL SULFATE REDUCTION AND ITS POTENTIAL UTILITY AS AN ACID MINE WATER POLLUTION ABATEMENT PROCEDURE,
W69-05898 05G

MICROBIAL DISSIMILATORY SULFUR CYCLE IN ACID MINE WATER,
W69-05899 05B

TYSON, HOWELL N., JR.
GROUNDWATER MANAGEMENT FOR THE NATION'S FUTURE--COMPUTER SIMULATION OF GROUNDWATER BASINS,
W69-05864 04B

VAN BAVEL, C. H. M.
SOIL WATER MEASUREMENT WITH AN AM-241 BE NEUTRON SOURCE AND AN APPLICATION TO EVAPORIMETRY,
W69-05926 02G

VAN DOREN, C. E.
SOIL AND CROP MANAGEMENT FOR MAXIMUM WATER-USE EFFICIENCY ON ARID AND SEMIARID LANDS,
W69-05669 03F

VANONI, VITO A.
SEDIMENT CONTROL METHODS, INTRODUCTION AND WATERSHED AREA,
W69-05620 02J

VENURI, VENKATESWARARAO
SENSITIVITY ANALYSIS METHOD OF SYSTEM IDENTIFICATION AND ITS POTENTIAL IN HYDROLOGIC RESEARCH,
W69-05603 07C

VENETIS, C.
CONDITIONAL PROBABILITIES OF FAILURES IN RESERVOIR OPERATION FOR THE MORAN-GOULD MODEL,
W69-05612 02E

VESIC, ALEKSANDAR S.
GENERAL REPORT ON SHALLOW FOUNDATIONS, DEEP FOUNDATIONS WITHOUT PILES, PILE FOUNDATIONS,
W69-05846 08D

VIAN, A.
INFLUENCE OF SHUNT REACTORS ON SWITCHING SURGES,
W69-05812 08C

VISSER, W. C.
ROLES OF TRANSFER OF WATER MANAGEMENT EXPERIENCE, WITH SPECIAL REFERENCE TO THE ASSESSMENT OF DRAINAGE DESIGN CONSTANTS,
W69-05614 04A

VULFSON, M. I.
ATTACK ON CUMULUS CLOUDS BY MAN-MADE VERTICAL ASCENDING CURRENTS,
W69-05821 03B

WALLACE, THOMAS S.
PILE TESTS GUIDE FOUNDATION DESIGN,
W69-05843 08D

WATERMEYER, PETER
MATHEMATICAL MODELS A STOCHASTIC SEQUENTIAL APPROACH,
W69-05730 04A

WATHNE, MAGNE
COST OF RESERVOIRS IN ILLINOIS,
W69-05915 06C

WATSON, K. K.
A RECORDING FIELD TENSIOMETER WITH RAPID RESPONSE CHARACTERISTICS,
W69-05931 02G

WEBB, J. S.
THE ROLE OF SOME STATISTICAL AND MATHEMATICAL METHODS IN THE INTERPRETATION OF REGIONAL GEOCHEMICAL DATA,
W69-05895 02J

WEBER, ERNEST M.
GROUNDWATER MANAGEMENT FOR THE NATION'S FUTURE--COMPUTER SIMULATION OF GROUNDWATER BASINS,
W69-05864 04B

WEEKS, LOWELL O.
SALT AND WATER BALANCE, COACHELLA VALLEY, CALIFORNIA,
W69-05670 02G

REMOTE CONTROL OF IRRIGATION WATER FACILITIES,
W69-05833 03F

WEGGEL, J. RICHARD
SURFACE TENSION IN FROUDE MODELS,
W69-05621 02E

WEINAUG, CHARLES F.
NUMERICAL MODELING OF UNSATURATED GROUND WATER FLOW,
W69-05918 02F

WELLS, DAN M.
AN ANALYSIS OF WATER NEEDS FOR ARID AND SEMI-ARID LANDS,
W69-05673 03E

WERNER, ROBERT REHN
AN INVESTIGATION OF THE EMPLOYMENT OF MULTIPLE OBJECTIVES IN WATER RESOURCES PLANNING,
W69-05882 06B

WESSELING, J.
HYDROLOGY, SOIL PROPERTIES, CROP GROWTH AND LAND DRAINAGE,
W69-05607 02F

WIERSUM, L. K.
SOIL WATER CONTENT IN RELATION TO NUTRIENT UPTAKE BY THE PLANT,
W69-05615 02I

WILLIAMS, ROY E.
GROUND WATER FLOW SYSTEMS AND THE ORIGIN OF EVAPORITE DEPOSITS,
W69-05758 02F

COMMENTS ON WATER TRANSFERS AND RELATED URBAN PROBLEMS,
W69-05766 06D

WIT, K. E.
SEEPAGE FLOW ANALYSIS OF A SMALL POLDER IN THE SOUTHWESTERN PART OF THE NETHERLANDS,
W69-05927 02F

WOLF, HERMAN B.
A NEW SURGE-LIMITING DEVICE FOR HIGH VOLTAGE STATIONS,
W69-05811 08C

WOLF, M. A.
EVAPORATIVE COOLING OF HEATED IRRIGATION WATER BY SPRINKLER APPLICATION,
W69-05606 03C

WOODRUFF, D. E.
STUDIES ON PRESOWING DROUGHT HARDENING OF WHEAT,
W69-05672 02I

WOODWORTH, ROGER C.
THE FUTURE AGRICULTURAL USE OF WATER - SOUTHERN HUMID REGION,
W69-05738 06B

YANG, J. J.
A PRELIMINARY REPORT OF THE FOSSIL DIATOM FLORA FROM LAKE HURON SEDIMENTS,
W69-05762 02H

YANG, K. H.
EXPERIENCES ON STARTUP AND TRIAL OPERATION AT YARDS CREEK PUMPED STORAGE PROJECT,
W69-05824 08C

YEVJEVICH, VUJICA
THE STATISTICAL MEASURE OF HYDROLOGIC TIME SERIES,
W69-05775 02E

YOUNG, GEORGE K.
ASSESSING UPLAND RESERVOIRS USING A DAILY FLOW MODEL,
W69-05632 02E

OPERATIONAL HYDROLOGY USING RESIDUALS,
W69-05847 06A

YUNUSOV, G. B.
THE STABILITY OF NORMAL ANNUAL RUNOFF AND SEASONAL RIVER DISCHARGES UNDER CONDITIONS OF DEVELOPMENT OF AGROTECHNICAL ENTERPRISES IN THEIR DRAINAGE AREAS (RUSSIAN),
W69-05938 04A

ZHELEZNYAKOV, G. V.
GENERALIZED EXPRESSION FOR THE CONNECTION BETWEEN THE KINEMATIC AND MORPHOLOGIC ELEMENTS OF RIVER FLOW (IN RUSSIAN),
W69-05941 02E

CALCULATION OF MAXIMUM WATER DISCHARGES ORIGINATING FROM RAIN AND SNOW (IN RUSSIAN),
W69-05943 02E

ZIMMERMANN, ROBERT C.
PLANT ECOLOGY OF AN ARID BASIN, TRES ALAMOS-BEDINGTON AREA, SOUTHEASTERN ARIZONA,
W69-05634 02I

ZIMONT, I. L.
ANALYSIS OF THE FORMATION OF RAIN FLOODS IN SMALL BASINS (IN RUSSIAN),
W69-05942 02E

ZWERMAN, PAUL J.
THE SOIL AND WATER CONSERVATIONIST OF TOMORROW,
W69-05842 09A

ORGANIZATIONAL INDEX

ACADEMY OF SCIENCES OF THE AZERBAIJANIAN, BAKU (USSR).
SALT ACCUMULATION PROCESSES IN THE GROUND WATERS OF THE KIROVABAD-KAZAKH MASSIF,
W69-05954 02F

AGRICULTURAL RESEARCH COUNCIL, CAMBRIDGE (ENGLAND). UNIT OF SOIL PHYSICS AND CAMBRIDGE UNIV. (ENGLAND). SCHOOL OF AGRICULTURE.
THE VERTICAL MOVEMENT OF WATER IN STRATIFIED POROUS MATERIAL. 1. INFILTRATION.
W69-05630 02G

AGRICULTURAL RESEARCH SERVICE, BELTSVILLE, MD. HYDROGRAPH LAB.
GEOMORPHIC GROUPING OF SOILS IN WATERSHED ENGINEERING,
W69-05907 02G

AGRICULTURAL RESEARCH SERVICE, BUSHLAND, TEX.
SOIL AND CROP MANAGEMENT FOR MAXIMUM WATER-USE EFFICIENCY ON ARID AND SEMIARID LANDS,
W69-05669 03F

AGRICULTURAL RESEARCH SERVICE, KIMBERLY, IDAHO. SNAKE RIVER RESEARCH CENTER.
SOIL MOISTURE TRANSPORT DUE TO THERMAL GRADIENTS PRACTICAL ASPECTS,
W69-05691 02G

AGRICULTURAL RESEARCH SERVICE, MILES CITY, MONT.
SOIL MOISTURE RESPONSE TO RANGE IMPROVEMENT IN THE NORTHERN GREAT PLAINS,
W69-05693 02I

AGRICULTURAL RESEARCH SERVICE, PHOENIX, ARIZ. WATER CONSERVATION LAB.
SALT BALANCE, IRRIGATION EFFICIENCY, AND DRAINAGE DESIGN,
W69-05671 03F

CREATING HYDROPHOBIC SOIL FOR WATER HARVESTING,
W69-05676 03B

SOIL WATER MEASUREMENT WITH AN AM-241 BE NEUTRON SOURCE AND AN APPLICATION TO EVAPORIMETRY,
W69-05926 02G

A RECORDING FIELD TENSIOMETER WITH RAPID RESPONSE CHARACTERISTICS,
W69-05931 02G

AGRICULTURAL RESEARCH SERVICE, RIESEL, TEX.
THE STATISTICAL MEASURE OF HYDROLOGIC TIME SERIES,
W69-05775 02E

AGRICULTURAL RESEARCH SERVICE, RIVERSIDE, CALIF. SALINITY LAB. AND COACHELLA VALLEY COUNTY WATER DISTRICT, CALIF.
SALT AND WATER BALANCE, COACHELLA VALLEY, CALIFORNIA,
W69-05670 02G

AGRICULTURAL RESEARCH SERVICE, TUCSON, ARIZ.
PRECIPITATION-RUNOFF RELATIONS FOR VERY SMALL SEMIARID RANGELAND WATERSHEDS,
W69-05605 02A

AKADEMIYA NAUK SSSR, MOSCOW. COUNCIL ON THE PROBLEMS OF WATER ECONOMY.
INVESTIGATION OF SURFACE AND UNDERGROUND RUNOFF (RUSSIAN).
W69-05659 02A

PHYSICO-TECHNICAL PROBLEMS IN MANAGING WATER RESOURCES (RUSSIAN),
W69-05660 02A

METHODS FOR WORKING OUT A NATIONAL WATER BALANCE (RUSSIAN),
W69-05936 04A

A MEANING OF NATIONAL WATER BALANCE IN RATIONAL USE OF WATER RESOURCES (RUSSIAN),
W69-05937 04A

THE STABILITY OF NORMAL ANNUAL RUNOFF AND SEASONAL RIVER DISCHARGES UNDER CONDITIONS OF DEVELOPMENT OF AGROTECHNICAL ENTERPRISES IN THEIR DRAINAGE AREAS (RUSSIAN),
W69-05938 04A

A CHANGE OF GROUNDWATER REGIME AS A METHOD OF CONTROLLING THE INCURSIONS OF SEA WATER (RUSSIAN),
W69-05939 04B

ANALYSIS OF FLOOD PROCESSES IN DRAINAGE AREAS OF VARYING SEEPAGE CHARACTER (RUSSIAN),
W69-05940 02E

GENERALIZED EXPRESSION FOR THE CONNECTION BETWEEN THE KINEMATIC AND MORPHOLOGIC ELEMENTS OF RIVER FLOW (IN RUSSIAN),
W69-05941 02E

ANALYSIS OF THE FORMATION OF RAIN FLOODS IN SMALL BASINS (IN RUSSIAN),
W69-05942 02E

CALCULATION OF MAXIMUM WATER DISCHARGES ORIGINATING FROM RAIN AND SNOW (IN RUSSIAN),
W69-05943 02E

MUD FLOWS IN THE TRANSILIAN ALA-TAU AND THE MUD FLOW CATASTROPHE OF 7 JULY, 1963 IN THE ISSYK RIVER BASIN (IN RUSSIAN),
W69-05944 02E

METHODS OF PREVENTING MUDFLOWS (IN RUSSIAN),
W69-05945 04A

IMMENSE LANDSLIDE OBSTRUCTION OF ZERAVSHAN RIVER, APRIL 24, 1964 (IN RUSSIAN),
W69-05946 02E

ANALYTICAL METHOD OF COMPUTING MONSOON FLOODS (KELANI GANGA RIVER BASINS AS AN EXAMPLE) (IN RUSSIAN),
W69-05947 02E

ALBERTA UNIV., EDMONTON.
THE DEVELOPMENT, USE AND EFFICIENCY OF INDICES OF SOIL ERODIBILITY,
W69-05826 02J

AMERICAN BAR ASSOCIATION, CHICAGO, ILL. COMMITTEE ON WATER RESOURCES.
SECTION OF MINERAL AND NATURAL RESOURCES LAW--REPORT OF THE COMMITTEE ON WATER RESOURCES.
W69-05783 06E

AMERICAN BAR ASSOCIATION, CHICAGO, ILL. SECTION OF MINERAL AND NATURAL RESOURCES LAW.
THE GENEVA CONVENTIONS ON THE LAW OF THE SEA SOME SUGGESTIONS FOR THEIR REVISION,
W69-05974 06E

AMERICAN BAR ASSOCIATION, CHICAGO, ILL. SECTION OF NATURAL RESOURCES LAW.
AMERICAN POLICY OPTIONS IN THE DEVELOPMENT OF UNDERSEA MINERAL RESOURCES.
W69-05787 06E

AMERICAN CHEMICAL SOCIETY, NEW YORK. HYDRAULICS DIV.
SEDIMENT CONTROL METHODS, INTRODUCTION AND WATERSHED AREA,
W69-05620 02J

AMERICAN SOCIETY OF CIVIL ENGINEERS, NEW YORK. COMMITTEE ON HYDROMECHANICS.
TRANSLATIONS OF FOREIGN LITERATURE ON HYDRAULICS.
W69-05655 08B

APPALACHIA PLANNING GROUP.
CONTRIBUTIONS OF WATER RESOURCE DEVELOPMENT TO DEPRESSED AREAS DEVELOPMENT,
W69-05741 06B

ARIZONA STATE UNIV, TEMPE.
ANALYSIS OF AN EVAPORATION CONTROL SYSTEM ON THE SEA OF GALILEE,
W69-05601 03F

ARIZONA UNIV., TUCSON. ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION.
PRELIMINARY WATER YIELDS AFTER TIMBER HARVEST ON CASTLE CREEK, ARIZONA WATERSHEDS,
W69-05642 03B

ARIZONA UNIV., TUCSON. WEATHER MODIFICATION LAW PROJECT STAFF.
THE LEGAL IMPLICATIONS OF ATMOSPHERIC WATER RESOURCES DEVELOPMENT AND MANAGEMENT.
W69-05756 02B

BATTELLE-NORTHWEST, RICHLAND, WASH. PACIFIC NORTHWEST LAB.
EVAPORATIVE COOLING OF HEATED IRRIGATION WATER BY SPRINKLER APPLICATION,
W69-05606 03C

BONNEVILLE POWER ADMINISTRATION, PORTLAND, OREG.
THE RIVER BASIN DEVELOPMENT CONCEPT, WATER RESOURCES PLANNING IN THE PACIFIC NORTHWEST,
W69-05746 06B

BRITISH COLUMBIA UNIV., VANCOUVER. DEPT. OF CIVIL ENGINEERING.
A COMPARISON OF MEASURED AND THEORETICAL SNOWPACK TEMPERATURES,
W69-05929 02C

BROOKHAVEN NATIONAL LABORATORY, UPTON, N. Y. BUREAU OF RECLAMATION, DENVER, COLO.
CONCRETE-POLYMER MATERIALS, FIRST TOPICAL REPORT,
W69-05835 08F

BROWN AND ROOT, INC, HOUSTON, TEX.
EXPERIENCE WITH AND EVALUATION OF CRITICAL PATH METHODS,
W69-05817 08A

BROWN, BOVERI AND CO. LTD., BADEN (SWITZERLAND).
DAMPING OF SWITCHING OVERVOLTAGES IN EHV-NETWORKS--NEW ECONOMIC ASPECTS AND SOLUTIONS,
W69-05809 08C

BUREAU OF COMMERCIAL FISHERIES, SEATTLE, WASH. BIOLOGICAL LAB.
INTERACTION OF FOOD LEVEL AND EXPLOITATION IN EXPERIMENTAL FISH POPULATIONS,
W69-05873 05C

BUREAU OF RECLAMATION, DENVER, COLO.
CONSUMPTIVE USE ESTIMATES FROM SOLAR RADIATION AND TEMPERATURE,

W69-05686 02I

BUREAU OF RECLAMATION EXPERIENCE WITH FROST ACTION ON CONCRETE,
W69-05801 08F

APPLICATION OF ELECTRONIC COMPUTERS TO IRRIGATION AND DRAINAGE SYSTEM PROBLEMS,
W69-05803 02A

NONDESTRUCTIVE CONCRETE TESTS--GRAND COULEE SPILLWAY BRIDGE,
W69-05823 08F

BEHAVIOR OF MIDDLE LOUP RIVER CHANNEL AS INFLUENCED BY MILBURN DIVERSION DAM.
W69-05841 02J

LABORATORY LOAD TESTS ON BURIED FLEXIBLE PIPE - PROGRESS REPORT NO 1,
W69-05845 08D

BUREAU OF RECLAMATION, SALT LAKE CITY, UTAH.
DEVELOPMENT OF TUNNELING METHODS AND CONTROLS FOR WATER RESOURCE PROJECTS,
W69-05815 08A

BUREAU OF RECLAMATION, WASHINGTON, D. C.
AUTOMATION OF IRRIGATION,
W69-05834 03F

CALIFORNIA AGRICULTURAL EXPERIMENT STATION, RIVERSIDE.
MOVEMENT OF WATER THROUGH SOIL AS INFLUENCED BY OSMOTIC PRESSURE AND TEMPERATURE GRADIENTS,
W69-05683 02G

CALIFORNIA STATE DEPT. OF WATER RESOURCES, BAKERSFIELD.
USE OF ATMOMETERS IN ESTIMATING EVAPOTRANSPIRATION,
W69-05685 02D

CALIFORNIA STATE DEPT. OF WATER RESOURCES, SACRAMENTO.
REEVALUATION AND RECONSTRUCTION OF CALIFORNIA DAMS,
W69-05804 08A

MUNICIPAL AND INDUSTRIAL WATER USE,
W69-05916 06D

CALIFORNIA UNIV., BERKELEY PUBLIC HEALTH SERVICE, SAN FRANCISCO, CALIF. AND WATER RESOURCES ENGINEERS, INC., LAFAYETTE, CALIF.
COMPUTER SIMULATION OF ESTUARIAL NETWORKS,
W69-05861 02L

CALIFORNIA UNIV., BERKELEY.
THE EFFECTS OF BENDS ON DISPERSION IN STREAMS,
W69-05609 02E

ECONOMIC EVALUATION OF WATER, PART V MULTIREGIONAL INPUT-OUTPUT TECHNIQUES AND WESTERN WATER RESOURCES DEVELOPMENT,
W69-05754 06B

ANALOG MODELS FOR FLOOD CONTROL SYSTEMS,
W69-05856 04A

CALIFORNIA UNIV., DAVIS. DEPT. OF IRRIGATION.
DESALINIZATION OF SOILS UNDER CONTROLLED UNSATURATED FLOW CONDITIONS,
W69-05687 02G

CALIFORNIA UNIV., DAVIS. DEPT. OF WATER SCIENCE AND ENGINEERING.
PREDICTING EFFECTS OF WATER SHORTAGE ON CROP YIELD,
W69-05674 03F

CALIFORNIA UNIV., DAVIS. LAB. OF PLANT-WATER RELATIONS.
STOMATAL OPENING IN ISOLATED EPIDERMAL STRIPS OF VICIA FABA. II. RESPONSES TO KCL CONCENTRATION AND THE ROLE OF POTASSIUM ABSORPTION,
W69-05681 02I

CALIFORNIA UNIV., LOS ANGELES.
SIMULATION OF EVAPORATION FROM CONSTANT SOURCE WITH FINITE AREAS,
W69-05636 07C

CALIFORNIA UNIV., LOS ANGELES. DEPT. OF METEOROLOGY.
AN INVESTIGATION OF METEOROLOGICAL CONDITIONS DURING A CALIFORNIA RAINFALL PERIOD,
W69-05933 02B

CANADIAN DEPT. OF FORESTRY, VICTORIA (BRITISH COLUMBIA).
THE STRATEGY OF BUILDING MODELS OF COMPLEX ECOLOGICAL SYSTEMS,
W69-05713 06A

CARNEGIE INST. OF TECHNOLOGY, PITTSBURGH, PA.
MATHEMATICAL REPRESENTATION OF AN URBAN FLOOD PLAIN,
W69-05852 04A

CENTRAL ARID ZONE RESEARCH INST., JODHPUR (INDIA).
AN IMPROVEMENT SCHARDAKOW DYE TECHNIQUE FOR THE MEASUREMENT OF PLANT WATER POTENTIALS,
W69-05688 02I

ROOT SYSTEM OF FOUR DESERT TREE SPECIES,
W69-05690 02I

CENTRO ELETTROTECNICO SPERIMENTALE ITALIANO, MILAN.
INFLUENCE OF SHUNT REACTORS ON SWITCHING SURGES,
W69-05412 08C

CHIPMAN CHEMICAL CO., INC., BOUND BROOK, N. J. RESEARCH DIV.
LIST OF REFERENCES ON CONTROL OF AQUATIC PLANTS, INCLUDING ALGAE,
W69-05705 05G

SUPPLEMENT TO THE LIST OF REFERENCES ON CONTROL OF AQUATIC PLANTS, INCLUDING ALGAE,
W69-05706 05G

CITY UNIV., LONDON (ENGLAND). DEPT. OF CIVIL ENGINEERING.
CONDITIONAL PROBABILITIES OF FAILURES IN RESERVOIR OPERATION FOR THE MORAN-GOULD MODEL,
W69-05612 02E

CLARKSON COLL. OF TECHNOLOGY, POTSDAM, N. Y.
SIMULATION OF THE EVOLUTION OF DRAINAGE-BASIN NETWORKS WITH A DIGITAL COMPUTER,
W69-05859 02E

CLEMSON UNIV., S. C.
SOME ECONOMIC ASPECTS OF INDUSTRIAL WATER SUPPLY IN THE SOUTH,
W69-05739 06B

COACHELLA VALLEY COUNTY WATER DISTRICT, CALIF.
REMOTE CONTROL OF IRRIGATION WATER FACILITIES,
W69-05833 03F

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF ECONOMICS.
GOVERNMENT AND WATER RESOURCES DEVELOPMENT,
W69-05878 06D

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, GLEN OSMOND (AUSTRALIA). DIV. OF HORTICULTURAL RESEARCH AND COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, MERBEIN (VICTORIA). DIV. OF HORTICULTURAL RESEARCH.
STUDIES WITH ANTITRANSPIRANTS ON GRAPEVINES (VITIS VINIFERA VAR. SULTANA),
W69-05675 02D

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, CANBERRA (AUSTRALIA). DIV. OF LAND RESEARCH AND REGIONAL SURVEY.
MEASUREMENTS OF PRECIPITATION INTERCEPTION BY AN ARID ZONE PLANT COMMUNITY (ACACIA ANEURA F. MUELL),
W69-05689 02I

CONNECTICUT UNIV., STORRS.
CONNECTICUT INSTITUTE OF WATER RESOURCES, ANNUAL REPORT 1967 68,
W69-05773 09D

CORNELL AERONAUTICAL LAB. INC., BUFFALO, N. Y.
THE EFFECTS OF WAVES ON EVAPORATION FROM A FREE WATER SURFACE,
W69-05840 02D

CORNELL UNIV., ITHACA, N. Y.
DIGITAL COMPUTERS AND ENVIRONMENTAL CONTROL,
W69-05855 05G

MATHEMATICAL MODEL FOR FLOOD RISK EVALUATION,
W69-05860 04A

MARKOV CHAIN STORAGE MODELS FOR STATISTICAL HYDROLOGY,
W69-05917 07C

A FRAMEWORK FOR THE MULTIPLE USE OF MUNICIPAL WATER SUPPLY AREAS,
W69-05935 06D

CORNELL UNIV., ITHACA, N. Y. COLL. OF ENGINEERING AND PUERTO RICO UNIV., MAYAGUEZ. ENGINEERING AND WATER RESOURCES RESEARCH INST.
CIRCULATION IN SHALLOW HOMOGENEOUS LAKES,
W69-05618 02H

CORPS OF ENGINEERS, CHARLESTON, S. C.
FLOOD PLAIN INFORMATION, IRWIN, LONG AND PAW CREEKS, CHARLOTTE, NORTH CAROLINA (VOLUME 1).
W69-05647 04A

CORPS OF ENGINEERS, MEMPHIS, TENN.
FLOOD PLAIN INFORMATION, FORKED DEER RIVERS, AND LEWIS CREEK, DYERSBURG, TENNESSEE.
W69-05648 04A

CORPS OF ENGINEERS, ROCK ISLAND, ILL.
FLOOD PLAIN INFORMATION, ROCK RIVER AT BELOIT, WISCONSIN.
W69-05646 04A

CORPS OF ENGINEERS, SACRAMENTO, CALIF.
HYDROLOGIC SIMULATION IN WATER-YIELD ANALYSIS,
W69-05849 02E

USE OF INTERRELATED RECORDS TO SIMULATE STREAMFLOW,
W69-05850 02E

CORPS OF ENGINEERS, SAVANNAH, GA.
FLOOD PLAIN INFORMATION, CONLEY CREEK-SOUTH RIVER, METROPOLITAN ATLANTA, GEORGIA.
W69-05913 04A

FLOOD PLAIN INFORMATION, CASEY CANAL SOUTH, SAVANNAH AND CHATHAM COUNTY, GEORGIA.
W69-05914 04A

CORPS OF ENGINEERS, SEATTLE, WASH.
FLOOD PLAIN INFORMATION, CHEHALIS AND SKOOKUMCHUCK RIVERS, CENTRALIA-CHEHALIS, WASHINGTON.

W69-05649 04A

COUNCIL OF STATE GOVERNMENTS AND SOUTHERN LAND ECONOMICS RESEARCH COMMITTEE.
WATER RESOURCES AND ECONOMIC DEVELOPMENT IN THE SOUTH,
W69-05737 06B

DENERS (GEORGE), CONSULTING ENGINEERS (QUEBEC).
COMPARATIVE MODEL TURBINE TESTS,
W69-05806 08C

DEPARTMENT OF AGRICULTURE, UNIVERSITY PARK PA. NORTHEAST WATERSHED RESEARCH CENTER.
INSTALLATION AND FIELD CALIBRATION OF NEWTRON-SCATTER EQUIPMENT FOR HYDROLOGIC RESEARCH IN HETEROGENEOUS AND STONY SOILS,
W69-05626 07B

DEPARTMENT OF IRRIGATION, COLOMBO (CEYLON). DIV. OF PLANNING, RESEARCH AND DESIGNS.
THE UDA WALAWE RESERVOIR PROJECT,
W69-05653 04A

DU PONT DE NEMOURS (E. I.) AND CO., WILMINGTON, DEL.
ANALOG COMPUTER -- A MODERN TOOL IN WATER POLLUTION CONTROL,
W69-05854 05G

DUKE POWER CO., CHARLOTTE, N.C.
A NEW SURGE-LIMITING DEVICE FOR HIGH VOLTAGE STATIONS,
W69-05811 08C

DUKE UNIV., DURHAM, N. C.
GENERAL REPORT ON SHALLOW FOUNDATIONS, DEEP FOUNDATIONS WITHOUT PILES, PILE FOUNDATIONS,
W69-05846 08D

ECONOMIC RESEARCH SERVICE, WASHINGTON, D. C. RESOURCE DEVELOPMENT ECONOMICS DIV.
WATER RIGHTS AND LEGISLATION IN THE EASTERN STATES,
W69-05879 06E

EGYPTIAN DESERT INST., CAIRO AND UTAH WATER RESEARCH LAB., LOGAN.
EVALUATION OF THE RATE OF FLOW THROUGH POROUS MEDIA USING ELECTROKINETIC PHENOMENA,
W69-05611 02F

ENGINEERING CONSTRUCTION CORP., LTD, BOMBAY (INDIA) AND CARNEGIE INST. OF TECH., PITTSBURGH, PA.
FLOOD PROOFING IN A FLOOD PLAIN A STOCHASTIC MODEL,
W69-05851 04A

ENVIRONMENTAL DYNAMICS, INC., LOS ANGELES, CALIF. AND BANARAS HINDU UNIV., VARANASI (INDIA).
SENSITIVITY ANALYSIS METHOD OF SYSTEM IDENTIFICATION AND ITS POTENTIAL IN HYDROLOGIC RESEARCH,
W69-05603 07C

ENVIRONMENTAL SCIENCE SERVICES ADMINISTRATION, WASHINGTON, D. C.
CLIMATIC ATLAS OF THE UNITED STATES,
W69-05922 02B

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, ADA, OKLA.
AQUIFER STORAGE DETERMINATION BY RADIOTRACER TECHNIQUES,
W69-05814 07B

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, WASHINGTON, D. C.
ASSESSING UPLAND RESERVOIRS USING A DAILY FLOW MODEL,
W69-05632 02E

RECOMMENDATIONS FOR WATER POLLUTION CONTROL IN RACCOON CREEK BASIN, OHIO.
W69-05661 05G

WATER QUALITY MODELS OF THE ESTUARY,
W69-05716 05G

OPERATIONAL HYDROLOGY USING RESIDUALS,
W69-05847 06A

FISHERIES RESEARCH BOARD OF CANADA, NANAIMO (BRITISH COLUMBIA). PACIFIC OCEANOGRAPHIC GROUP.
SOME OBSERVATIONS ON THE DEPENDENCE OF ZOOPLANKTON GRAZING ON THE CELL SIZE AND CONCENTRATION OF PHYTOPLANKTON BLOOMS,
W69-05696 02L

FLORIDA STATE UNIV., TALLAHASSEE. DEPT. OF GEOLOGY.
SURGE FLOW A MODEL OF THE WALL LAYER,
W69-05892 08B

FOREST SERVICE (USDA), LOGAN, UTAH. INTERMOUNTAIN FOREST AND RANGE EXPERIMENT STATION.
CRITERIA FOR DESIGNING AND LOCATING LOGGING ROADS TO CONTROL SEDIMENT,
W69-05884 04D

FOREST TREATMENT EFFECTS ON WATER QUALITY,
W69-05885 04D

THE INFLUENCE OF ROADS ON WATER QUALITY CHARACTERISTICS,
W69-05886 04D

INSTALLATION OF SOIL MOISTURE ACCESS TUBES IN ROCKY SOILS,
W69-05887 07B

A TOOL FOR REPAIRING INSTALLED SOIL MOISTURE ACCESS TUBES,
W69-05888 07B

EFFECTS OF SEEDING AND GRAZING ON INFILTRATION CAPACITY AND SOIL STABILITY OF A SUBALPINE RANGE IN CENTRAL UTAH,
W69-05889 04D

FOREST SERVICE (USDA), LOGAN. INTERMOUNTAIN FOREST AND RANGE EXPERIMENT STATION.
CABLE AND CLAMP MODIFICATIONS FOR MODEL 104 MOISTURE PROBES,
W69-05883 07B

FOREST SERVICE (USDA), NEW HAVEN, CONN. NORTHEASTERN FOREST EXPERIMENT STATION.
THE ANALYSIS OF DETERMINATION IN POPULATION SYSTEMS,
W69-05714 06A

FOREST SERVICE (USDA), TEMPE, ARIZ. FOREST HYDROLOGICAL LAB.
WATERSHED PLANNING,
W69-05643 03B

FRESHWATER BIOLOGICAL ASSOCIATION, AMBLESIDE (ENGLAND).
LAKE SEDIMENTS THE BOTTOM DEPOSITS OF THE NORTH BASIN OF WINDERMERE, WITH SPECIAL REFERENCE TO THE DIATOM SUCCESSION,
W69-05707 02H

GENERAL ELECTRIC CO., PHILADELPHIA, PA AND FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, PHILADELPHIA, PA.
MATHEMATICAL SIMULATION OF THE ESTUARINE BEHAVIOR AND ITS APPLICATIONS,
W69-05732 05G

GEOLOGICAL SURVEY, ALBANY, N. Y.
FLOODS IN NEW YORK- 1967,
W69-05912 02E

GEOLOGICAL SURVEY, ARLINGTON, VA.
DOWNSTREAM VARIATIONS IN THE HYDRAULIC GEOMETRY OF STREAMS SPECIAL EMPHASIS ON MEAN VELOCITY,
W69-05639 02E

GEOLOGICAL SURVEY, CARSON CITY, NEV.
WATER-RESOURCES APPRAISAL OF BUTTE VALLEY, ELKO AND WHITE PINE COUNTIES, NEVADA,
W69-05656 02F

GEOLOGICAL SURVEY, DENVER, COLO.
RELATION OF WATER LOSS TO MOISTURE CONTENT OF HYDROPHYTES IN A NATURAL POND,
W69-05622 02D

GEOLOGICAL SURVEY, MENLO PARK, CALIF.
REFERENCES FOR WELL DATA AND WATER LEVELS IN CALIFORNIA BY THE GEOLOGICAL SURVEY,
W69-05623 02F

RATE OF SULFURIC ACID FORMATION IN YELLOWSTONE NATIONAL PARK,
W69-05635 02K

BACTERIAL ORIGIN OF SULFURIC ACID IN SULFUROUS HOT SPRINGS,
W69-05654 02K

GEOLOGICAL SURVEY, TACOMA, WASH.
MASS BALANCES OF SOME NORTH CASCADE GLACIERS AS DETERMINED BY HYDROLOGIC PARAMETERS 1920-65,
W69-05664 02C

SYNOPTIC TEMPERATURE MEASUREMENTS OF A GLACIER LAKE AND ITS ENVIRONMENT,
W69-05665 02C

SEA-ICE DYNAMICS,
W69-05921 02C

CALCULATIONS OF SLIP OF NISQUALLY GLACIER ON ITS BED NO SIMPLE RELATION OF SLIDING VELOCITY TO SHEAR STRESS,
W69-05924 02C

GEOLOGICAL SURVEY, TUCSON, ARIZ. AND BUREAU OF RECLAMATION, PHOENIX, ARIZ.
THE PHREATOPHYTE PROBLEM IN ARIZONA,
W69-05645 03B

GEOLOGICAL SURVEY, WASHINGTON, D. C.
THE BEHAVIOR OF LARGE PARTICLES FALLING IN QUIESCENT LIQUIDS,
W69-05625 02J

PLANT ECOLOGY OF AN ARID BASIN, TRES ALAMOS-REDINGTON AREA, SOUTHEASTERN ARIZONA,
W69-05634 02I

TRAVEL OF SOLUTES IN THE LOWER MISSOURI RIVER,
W69-05909 05B

FLOODS IN BEECHER EAST QUADRANGLE, NORTHEASTERN ILLINOIS,
W69-05911 02E

QUALITY OF WATER IN SELECTED LAKES OF EASTERN SOUTH DAKOTA,
W69-05932 02H

GEOLOGICAL SURVEY, WASHINGTON, D. C. WATER RESOURCES DIV.
NEW THRUSTS IN GROUND WATER,
W69-05677 02F

GEOLOGICAL SURVEY, YUMA, ARIZ. WATER RESOURCES DIV.
WATER CONSUMPTION IN THE LOWER COLORADO RIVER VALLEY,
W69-05678 02E

GEORGIA INST. OF TECH., ATLANTA CLEMSON UNIV., S. C.
WATER QUALITY MANAGEMENT AND SOME POLICY MODELS,
W69-05722 05G

GEORGIA INST. OF TECH., ATLANTA. SCHOOL OF ENGINEERING AND GEORGIA INST. OF TECH., ATLANTA. WATER RESOURCES CENTER.
EVOLUTION OF A DUNED BED UNDER OSCILLATORY FLOW,
W69-05662 02J

GEORGIA UNIV., ATHENS. DEPT. OF AGRICULTURAL ECONOMICS.
CONSUMER RESPONSES TO PRICES OF RESIDENTIAL WATER,
W69-05881 06C

HAMILTON FILTRATION PLANT (ONTARIO).
INORGANIC NITROGEN IN PRECIPITATION AND ATMOSPHERIC SEDIMENTS,
W69-05712 05B

HARVARD UNIV., CAMBRIDGE, MASS.
MATHEMATICAL ANALYSIS DESIGN OF THE SIMPLE VALLEY PROJECT,
W69-05719 06A

MATHEMATICAL MODELS A STOCHASTIC SEQUENTIAL APPROACH,
W69-05730 04A

HARVARD UNIV., CAMBRIDGE, MASS. HARVARD WATER PROGRAM.
SYSTEMS ANALYSIS,
W69-05742 06B

HARVARD UNIV., CAMBRIDGE.
DESIGN OF WATER-RESOURCE SYSTEMS,
W69-05729 04A

HARZA ENGINEERING CO., CHICAGO, ILL. AND BAUER ENGINEERING, INC., CHICAGO, ILL.
CHICAGOLAND DEEP TUNNEL SYSTEM FOR POLLUTION AND FLOOD CONTROL FIRST CONSTRUCTION ZONE, DEFINITE PROJECT REPORT.
W69-05743 05G

HAWAII UNIV., HONOLULU. SCHOOL OF PUBLIC HEALTH.
WATER QUALITY IN HAWAII,
W69-05893 05G

HAWAII UNIV., HONOLULU. WATER RESOURCES RESEARCH CENTER.
A STEP IN OPTIMIZING THE DEVELOPMENT OF THE BASAL WATER LENS OF SOUTHERN OAHU, HAWAII,
W69-05663 02F

HYDROLOGICAL RESEARCH UNIT, WALLINGFORD (ENGLAND).
A COUNTRY-WIDE STUDY OF INTENSE RAINFALL FOR THE UNITED KINGDOM,
W69-05925 02B

IDAHO BUREAU OF MINES AND GEOLOGY, MOSCOW.
GROUND WATER FLOW SYSTEMS AND THE ORIGIN OF EVAPORITE DEPOSITS,
W69-05758 02F

IDAHO UNIV., MOSCOW. DEPT. OF HYDROLOGY.
COMMENTS ON WATER TRANSFERS AND RELATED URBAN PROBLEMS,
W69-05766 06D

ILLINOIS STATE GEOLOGICAL SURVEY, URBANA.
HYDROGEOLOGIC DATA FROM FOUR LANDFILLS IN NORTHEASTERN ILLINOIS,
W69-05896 07C

ILLINOIS STATE WATER SURVEY, URBANA.
COST OF MUNICIPAL AND INDUSTRIAL WELLS IN ILLINOIS, 1964-1966,
W69-05910 06C

COST OF RESERVOIRS IN ILLINOIS,
W69-05915 06C

ILLINOIS UNIV., URBANA.
A NONLINEAR HYDROLOGIC SYSTEM RESPONSE MODEL,
W69-05858 02A

ILLINOIS UNIV., URBANA. DEPT. OF CIVIL ENGINEERING.
UNIFIED VIEW OF DIFFUSION AND DISPERSION,
W69-05619 01B

SURFACE TENSION IN FROUDE MODELS,
W69-05621 02E

INDIANA UNIV., BLOOMINGTON. DEPT. OF GEOLOGY.
SOME APPROXIMATE SOLUTIONS OF RADIAL FLOW PROBLEMS,
W69-05903 02F

INSTITUTE FOR LAND AND WATER MANAGEMENT RESEARCH, WAGENINGEN (NETHERLANDS).
HYDROLOGY, SOIL PROPERTIES, CROP GROWTH AND LAND DRAINAGE,
W69-05607 02F

ON THE RELATION BETWEEN TRANSPIRATION, SOIL PHYSICAL PROPERTIES AND CROP PRODUCTION AS A BASIS FOR WATER SUPPLY PLANS,
W69-05613 02I

RULES OF TRANSFER OF WATER MANAGEMENT EXPERIENCE, WITH SPECIAL REFERENCE TO THE ASSESSMENT OF DRAINAGE DESIGN CONSTANTS,
W69-05614 04A

SEEPAGE FLOW ANALYSIS OF A SMALL POLDER IN THE SOUTHWESTERN PART OF THE NETHERLANDS,
W69-05627 02F

INSTITUTE FOR SOIL FERTILITY, GRONINGEN (NETHERLANDS).
SOIL WATER CONTENT IN RELATION TO NUTRIENT UPTAKE BY THE PLANT,
W69-05617 02I

CALCULATION OF PARAMETERS FOR THE EVALUATION OF THE LEACHING OF SALTS UNDER FIELD CONDITIONS, ILLUSTRATED BY NITRATE,
W69-05616 02G

INTERNATIONAL BUSINESS MACHINES CORP., LOS ANGELES, CALIF. AND CALIFORNIA STATE DEPT. OF WATER RESOURCES, LOS ANGELES.
GROUNDWATER MANAGEMENT FOR THE NATION'S FUTURE--COMPUTER SIMULATION OF GROUNDWATER BASINS,
W69-05864 04B

INTERSTATE COMMISSION ON THE POTOMAC RIVER BASIN, WASHINGTON, D. C.
POTOMAC RIVER WATER QUALITY NETWORK, 1968 WATER YEAR.
W69-05920 05B

INTER-AMERICAN CENTER FOR THE INTEGRAL DEVELOPMENT OF LAND AND WATER RESOURCES.
AN APPROACH TO ATTACKING HUMAN-SOCIAL PROBLEMS RETARDING IRRIGATION AND AGRICULTURAL DEVELOPMENT IN LATIN AMERICA,
W69-05652 03F

IOWA STATE UNIV., AMES.
USE OF THE COLEMAN MODEL 29A ANALYZER FOR TOTAL NITROGEN ANALYSIS OF SOILS,
W69-05874 05A

IOWA STATE UNIV., AMES. DEPT. OF AGRONOMY.
DETERMINATION AND ISOTOPE-RATIO ANALYSIS OF DIFFERENT FORMS OF NITROGEN IN SOILS 6. MINERALIZABLE NITROGEN,
W69-05699 05A

DETERMINATION AND ISOTOPE-RATIO ANALYSIS OF DIFFERENT FORMS OF NITROGEN IN SOILS 3. EXCHANGEABLE AMMONIUM, NITRATE, AND NITRITE BY EXTRACTION-DISTILLATION METHODS,
W69-05700 05A

DETERMINATION AND ISOTOPE-RATIO ANALYSIS OF DIFFERENT FORMS OF NITROGEN IN SOILS 4. EXCHANGEABLE AMMONIUM, NITRATE, AND NITRITE BY DIRECT-DISTILLATION METHODS,
W69-05701 05A

CHARACTERIZATION OF MINERALIZABLE NITROGEN IN SOILS,
W69-05703 05A

STEAM DISTILLATION METHODS FOR DETERMINATION OF AMMONIUM, NITRATE AND NITRITE,
W69-05709 05A

DETERMINATION AND ISOTOPE-RATIO ANALYSIS OF DIFFERENT FORMS OF NITROGEN IN SOILS 7. UREA,
W69-05872 05A

A SIMPLE STEAM DISTILLATION METHOD OF ESTIMATING (BETA-HYDROXY-ALPHA-AMINO) ACIDS,
W69-05875 05A

IOWA STATE UNIV., AMES. DEPT. OF SOILS.
EFFECT OF CULTIVATION ON THE NITROGEN DISTRIBUTION IN SOILS,
W69-05710 02K

JERSEY CENTRAL POWER AND LIGHT CO., MORRISTOWN, N. J. AND TIPPETTS-ABBETT-MCCARTHY-STRATTON, NEW YORK.
EXPERIENCES ON STARTUP AND TRIAL OPERATION AT YARDS CREEK PUMPED STORAGE PROJECT,
W69-05824 08C

JOHNS HOPKINS UNIV., BALTIMORE, MD.
AN OPERATIONS RESEARCH APPROACH TO BASIN SEDIMENT CONTROL,
W69-05733 02J

JOINT FAO/UNESCO/WMO INTERAGENCY PROJECT ON AGROCLIMATOLOGY.
AN AGROCLIMATOLOGY SURVEY OF A SEMIARID AREA IN AFRICA SOUTH OF THE SAHARA,
W69-05684 02I

KANSAS STATE UNIV., MANHATTAN. DEPT. OF AGRICULTURAL ECONOMICS.
THE VALUE OF WATER FOR IRRIGATION IN THE KANSAS RIVER VALLEY,
W69-05919 06B

KANSAS UNIV., LAWRENCE.
NUMERICAL MODELING OF UNSATURATED GROUND WATER FLOW,
W69-05918 02F

LEEDS UNIV. (ENGLAND).
CONCRETE--A NON-ELASTIC MATERIAL IN THE LABORATORY AND IN STRUCTURES,
W69-05822 08F

LONDON UNIV. (ENGLAND). DEPT. OF STATISTICS.
THE FITTING OF GROWTH AND ALLIED CURVES OF THE ASYMPTOTIC REGRESSION TYPE BY STEVENS'S METHOD,
W69-05711 07C

LOS PADRES NATIONAL FOREST, SANTA BARBARA, CALIF.
SANTA YNEZ BAROMETER WATERSHED,
W69-05644 03B

LOWRY AND ASSOCIATES, SACRAMENTO, CALIF.
PILE TESTS GUIDE FOUNDATION DESIGN,
W69-05843 08D

MAIN GEOPHYSICAL OBSERVATORY, LENINGRAD (USSR).
ACCURACY IN DETERMINING THE MEAN PRECIPITATION DEPTH OVER AN AREA,
W69-05948 02B

THE ECONOMIC APPROACH TO THE PLANNING OF A NETWORK OF METEOROLOGICAL STATIONS,
W69-05949 07A

MARYLAND UNIV., COLLEGE PARK.
EFFECT OF SMALL SURFACE WAVES ON EVAPORATION THROUGH MONOLAYERS,
W69-05604 02D

MASSACHUSETTS INST. OF TECH., CAMBRIDGE.
OPTIMAL OPERATING RULES FOR MULTI-RESERVOIR SYSTEMS,
W69-05723 04A

MATHEMATICAL PROGRAMMING MODELS APPLIED TO A WATER RESOURCE SYSTEM,
W69-05725 04A

MASSACHUSETTS UNIV., AMHERST.
ANNUAL REPORT FOR FISCAL YEAR 1968. WATER RESOURCES RESEARCH CENTER.
W69-05764 09D

MATSON RESEARCH CORP., SAN FRANCISCO, CALIF.
REGIONAL RAIN MODELS WITH SPACE- AND TIME-CORRELATED STRUCTURE,
W69-05731 02B

MICHIGAN STATE UNIV., EAST LANSING.
EVOLUTION OF MICHIGAN WATER LAWS,
W69-05778 06E

EVOLUTION OF MICHIGAN WATER LAWS- SURFACE WATER RIGHTS OF RIPARIANS AND NON-RIPARIANS.
W69-05779 06E

EVOLUTION OF MICHIGAN WATER LAWS - SURFACE WATER RIGHTS AMONG RIPARIAN OWNERS.
W69-05780 06E

EVOLUTION OF MICHIGAN WATER LAWS-GROUND WATER.
W69-05781 06E

THE INFLUENCE OF SUBSURFACE ASPHALT BARRIERS ON THE WATER PROPERTIES AND THE PRODUCTIVITY OF SAND SOILS,
W69-05802 02G

MICHIGAN UNIV., ANN ARBOR. GREAT LAKES RESEARCH DIV.
A PRELIMINARY REPORT OF THE FOSSIL DIATOM FLORA FROM LAKE HURON SEDIMENTS,
W69-05762 02H

NEARSHORE PHYTOPLANKTON POPULATIONS IN THE GRAND HAVEN, MICHIGAN VICINITY DURING THERMAL BAR CONDITIONS,
W69-05763 02H

MINISTRY OF WATER AND POWER, TEHRAN (IRAN).
SUMMARY OF WATER RESOURCES DEVELOPMENT IN IRAN,
W69-05651 02E

MINNESOTA UNIV., ST. PAUL.
THIXOTROPIC AGING OF SYNTHETIC SOIL AGGREGATES,
W69-05908 02G

MISSISSIPPI UNIV., UNIVERSITY.
SHRINKAGE CHARACTERISTICS OF SOIL-CEMENT MIXTURES,
W69-05825 08D

MISSOURI UNIV., COLUMBIA. SCHOOL OF LAW.
WATER AND WATERCOURSES--NAVIGABILITY OF STREAMS IN MISSOURI.
W69-05782 06E

NATIONAL ASSOCIATION OF CORROSION ENGINEERS, HOUSTON, TEX.
APPLICATION TECHNIQUES, PHYSICAL PROPERTIES, AND CHEMICAL RESISTANCE OF CHLORINATED RUBBER COATINGS.
W69-05808 08G

NEBRASKA UNIV., LINCOLN.
DESIGN OF AN AUTOMATED SURFACE IRRIGATION SYSTEM WITH REUSE SYSTEM,
W69-05830 03F

AUTOMATIC SPRINKLER IRRIGATION AND ITS FUTURE IN THE MIDWEST,
W69-05831 03F

NEBRASKA UNIV., LINCOLN. DEPT. OF CIVIL ENGINEERING.
RIVER WATER QUALITY FOR ARTIFICIAL RECHARGE,
W69-05894 05B

NEGEV INST. FOR ARID ZONE RESEARCH, BEERSHEBA (ISRAEL).
USE OF VEGETATION AS AN INDICATOR FOR SOIL PROPERTIES UNDER DESERT CONDITIONS,
W69-05682 02G

NEVADA OPERATIONS OFFICE (AEC), LAS VEGAS.
RUSSIAN RADIOECOLOGY, A BIBLIOGRAPHY OF SOVIET PUBLICATIONS WITH CITATIONS OF ENGLISH TRANSLATIONS AND ABSTRACTS,
W69-05708 05C

NEVADA UNIV., RENO. DESERT RESEARCH INST.
INFILTRATION STUDIES ON NON-WETTABLE SOILS,
W69-05760 02G

FOURTH ANNUAL REPORT, FISCAL YEAR 1967-1968.
W69-05765 09D

NEW MEXICO STATE UNIV., UNIVERSITY PARK. WATER RESOURCES RESEARCH INST.
WATER AVAILABILITY AND GRASS ROOT DISTRIBUTION IN SELECTED SOILS,
W69-05759 02G

NEW MEXICO UNIV., ALBUQUERQUE.
FLUCTUATIONS IN WATER DROPLET EVAPORATION RATES,
W69-05750 02D

NORTH CAROLINA STATE UNIV., RALEIGH. DEPT. OF ZOOLOGY.
A FIELD AND LABORATORY STUDY OF FLUORIDE UPTAKE BY OYSTERS,
W69-05752 05C

NORTH CAROLINA UNIV., CAHPEL HILL. INST. OF GOVERNMENT.
STATE PROGRAMS FOR ESTUARINE AREA CONSERVATION,
W69-05776 02L

NORTH CAROLINA UNIV., CHAPEL HILL.
WATER RESOURCE SYSTEMS ANALYSIS,
W69-05857 06A

NORTH DAKOTA STATE UNIV., FARGO.
ECONOMIC IMPACT OF WATER RESOURCE DEVELOPMENT,
W69-05751 06B

A FEASIBILITY STUDY OF A LIVESTOCK WASTE DISPOSAL SYSTEM INVOLVING THE REUSE OF WATER,
W69-05753 05D

NORTHWESTERN UNIV., EVANSTON, ILL. DEPT. OF CIVIL ENGINEERING.
THRESHOLD PREDICTION AND CHARACTERISTICS OF LOG-NORMAL PHENOMENA,
W69-05871 07C

NOVA SCOTIA DEPT. OF MINES, HALIFAX.
DETERMINATION OF THE GROUND-WATER COMPONENT OF PEAK DISCHARGE FROM THE CHEMISTRY OF TOTAL RUNOFF,
W69-05628 02F

OHIO STATE UNIV., COLUMBUS AND RESOURCES FOR THE FUTURE, INC., WASHINGTON, D. C.
COLLECTIVE FACILITIES IN WATER QUALITY MANAGEMENT,
W69-05726 05G

OHIO STATE UNIV., COLUMBUS.
CONCENTRATION AND ACCUMULATION OF METALLIC IONS BY THE BACTERIUM ZOOGLOEA,
W69-05767 05D

INFLUENCE OF CHRONIC EXPOSURE TO ANIONIC DETERGENTS ON TOXICITY OF PESTICIDES TO GOLDFISH,
W69-05768 05C

OHIO STATE UNIV., COLUMBUS. DEPT. OF GEOLOGY.
A STUDY OF GROUNDWATER CONTAMINATION DUE TO SALINE WATER DISPOSAL IN THE MORROW COUNTY OIL FIELDS,
W69-05749 05B

OHIO STATE UNIV., COLUMBUS. DEPT. OF MICROBIAL AND CELLULAR BIOLOGY.
MICROBIAL SULFATE REDUCTION AND ITS POTENTIAL UTILITY AS AN ACID MINE WATER POLLUTION ABATEMENT PROCEDURE,
W69-05898 05G

MICROBIAL DISSIMILATORY SULFUR CYCLE IN ACID MINE WATER,
W69-05899 05B

OKLAHOMA STATE UNIV., STILLWATER.
AUTOMATION AND SEMI-AUTOMATION OF SURFACE IRRIGATION,
W69-05829 03F

OREGON STATE LEGISLATURE, SALEM.
WATER LAW, POLITICS, AND ECONOMICS IS OUR SYSTEM OF PUBLIC DISTRICTS OUTMODED,
W69-05747 06B

OREGON STATE UNIV., CORVALLIS. DEPT. OF AGRICULTURAL ECONOMICS.
OUTDOOR RECREATION POLICY ISSUES AND RESEARCH PROBLEMS,
W69-05736 06D

OREGON STATE UNIV., CORVALLIS. DEPT. OF OCEANOGRAPHY AND OREGON STATE UNIV., CORVALLIS. DEPT. OF MATHEMATICS.
ON THE TEMPERATURE OF WATER FLOWING THROUGH FRACTURES,
W69-05624 02F

PACIFIC NORTHWEST RIVER BASINS COMMISSION, VANCOUVER, WASH.
THE WESTERN WATER SUPPLY--WHERE IT IS,
W69-05807 02A

PARIS UNIV., ST. MAUR (FRANCE). FACULTE DES SCIENCES.
SIGNIFICANCE OF REDOX POTENTIAL IN NATURAL WATERS (IN FRENCH),
W69-05877 02K

PENNSYLVANIA STATE UNIV., UNIVERSITY PARK. INST. FOR RESEARCH ON LAND AND WATER RESOURCES.
NUMERICAL SIMULATION OF UNCONFINED FLOW INTO A SINGLE PUMPING WATER-WELL USING TWO-PHASE FLOW THEORY,
W69-05755 02F

PENNSYLVANIA UNIV., PHILADELPHIA.
THE DEMAND FOR WATER SOME EMPIRICAL EVIDENCE ON CONSUMERS' RESPONSE TO A COMMODITY UNCERTAIN IN SUPPLY,
W69-05633 06D

PITTSBURGH UNIV., PA. DEPT. OF CIVIL ENGINEERING.
LINEAR TIME-VARYING MODEL OF A RAINFALL-RUNOFF RELATION,
W69-05608 02A

PORTLAND STATE COLL., OREG. DEPT. OF EARTH SCIENCE AND OREGON STATE UNIV., CORVALLIS.
SURVEY OF WATER INDUCED LAND-INSTABILITY HAZARDS IN THE PORTLAND, OREGON REGION,
W69-05640 08D

PUNJAB AGRICULTURAL UNIV., HISSAR (INDIA). DEPT. OF SOILS.
RELATIONSHIP OF TEXTURE TO SOME IMPORTANT SOIL MOISTURE

CONSTANTS,
W69-05679 02G

QUEENSLAND WHEAT RESEARCH INST., TOOWOOMBA (AUSTRALIA). PRIMARY INDUSTRIES DEPT.
STUDIES ON PRESOWING DROUGHT HARDENING OF WHEAT,
W69-05672 02I

QUEEN'S UNIV., KINGSTON (ONTARIO). DEPT. OF BIOLOGY.
ABSORPTION COEFFICIENTS OF CHLOROPHYLL DERIVATIVES,
W69-05695 02H

READING UNIV. (ENGLAND).
LONG STANDING WAVES IN A CURVED CANAL,
W69-05827 08B

REED COLL., PORTLAND, OREG.
WATER LAW, POLITICS, AND ECONOMICS WATER RESOURCES AND PUBLIC REGULATIONS OF THEIR USES,
W69-05748 06B

RESEARCH COUNCIL OF ALBERTA, EDMONTON.
FLUID FLOW IN THE WESTERN CANADA SEDIMENTARY BASIN. 2. EFFECT OF GEOLOGY,
W69-05602 02F

RESOURCES FOR THE FUTURE, INC., WASHINGTON, D. C.
RESERVOIR SYSTEM SIMULATION,
W69-05717 05G

DISSOLVED OXYGEN IN THE DELAWARE ESTUARY,
W69-05727 05G

THE DELAWARE ESTUARY STUDY,
W69-05728 05G

POTENTIALS OF WATER-BASED RECREATION,
W69-05740 06B

ECONOMICS OF POLLUTION CONTROL,
W69-05880 05C

RESOURCES FOR THE FUTURE, WASHINGTON, D.C.
THE RANGE OF CHOICE IN WATER MANAGEMENT. A STUDY OF DISSOLVED OXIGEN IN THE POTOMAC ESTUARY,
W69-05715 05G

ROTHAMSTED EXPERIMENTAL STATION, HARPENDEN (ENGLAND) AND MUNICH UNIV. (WEST GERMANY). METEOROLOGISCHES INSTITUT.
AERODYNAMIC AND SURFACE FACTORS IN EVAPORATION,
W69-05631 02I

ROYAL SCHOOL OF MINES, LONDON (ENGLAND) AND IMPERIAL COLL. OF SCIENCE AND TECHNOLOGY, LONDON (ENGLAND). DEPT. OF GEOLOGY.
THE ROLE OF SOME STATISTICAL AND MATHEMATICAL METHODS IN THE INTERPRETATION OF REGIONAL GEOCHEMICAL DATA,
W69-05895 02J

SALT RIVER PROJECT, PHOENIX, ARIZ.
DEVELOPMENT OF AUTOMATION ON THE SALT RIVER PROJECT,
W69-05832 03F

SANTA CLARA VALLEY WATER CONSERVATION DISTRICT, CALIF.
THE USE OF THE GEOELECTRIC METHOD FOR INVESTIGATING GEOLOGIC AND HYDROLOGIC CONDITIONS IN SANTA CLARA COUNTY, CALIFORNIA,
W69-05904 07B

SLOVAK ACADEMY OF SCIENCES, BRATISLAVA (CZECHOSLOVAKIA). INST. OF HYDROLOGY AND HYDRAULICS.
RELIABILITY ESTIMATES FOR A STORAGE RESERVOIR WITH SEASONAL INPUT,
W69-05906 06A

RELIABILITY OF WATER SUPPLY PERFORMED BY MEANS OF A STORAGE RESERVOIR WITHIN A LIMITED PERIOD OF TIME,
W69-05930 02E

SOIL CONSERVATION AUTHORITY, KEW (AUSTRALIA).
THE INFILTRATION COMPONENT OF A PASTORAL EXPERIMENTAL CATCHMENT, PARTS 1 AND 2,
W69-05901 02G

THE EVAPOTRANSPIRATION COMPONENT OF A PASTORAL EXPERIMENTAL CATCHMENT,
W69-05902 02D

SOIL CONSERVATION SERVICE, WASHINGTON, D. C. AND CORNELL UNIV., ITHACA, N. Y.
THE SOIL AND WATER CONSERVATIONIST OF TOMORROW,
W69-05842 09A

SOUTH DAKOTA STATE UNIV., BROOKINGS. DEPT. OF AGRICULTURAL ECONOMICS.
AN INVESTIGATION OF THE EMPLOYMENT OF MULTIPLE OBJECTIVES IN WATER RESOURCES PLANNING,
W69-05882 06B

STANFORD RESEARCH INST., MENLO PARK, CALIF.
OPTIMUM MANAGEMENT OF A COMBINED PUMPED HYDRO AND IRRIGATION STORAGE FACILITY,
W69-05734 04A

STANFORD UNIV., CALIF. AND CANTERBURY UNIV., CHRISTCHURCH (NEW ZEALAND).
MATHEMATICAL MODEL AND FORTRAN IV PROGRAM FOR COMPUTER SIMULATION OF DELTAIC SEDIMENTATION,
W69-05657 07C

STATE HYDROLOGICAL INST., LENINGRAD (USSR).
DETERMINING MAXIMUM RELIABILITY AND EFFICIENCY OF HYDROMETEOROLOGICAL SYSTEMS AND INSTRUMENTS,
W69-05658 07A

STATE OCEANOGRAPHIC INSTITUTE, MOSCOW (USSR).
COMPUTATIONS OF LEVEL CHANGES AND RUNOFF DISTRIBUTION IN A DELTA BASED ON OBSERVATIONAL DATA (DANUBE DELTA AS AN EXAMPLE),
W69-05951 02E

SOME PATTERNS OF FORMATION OF A RIVER MOUTH BAR WHERE RIVER FACTORS PLAY AN IMPORTANT ROLE (EXEMPLIFIED BY THE VISTULA DELTA),
W69-05953 02J

STATE OCEANOGRAPHIC INST., MOSCOW (USSR).
FORMATION OF A RIVER MOUTH BAR WHERE MARINE FACTORS PLAY AN IMPORTANT ROLE (EXEMPLIFIED BY THE LIELUPE RIVER),
W69-05952 02J

STOCKHOLM UNIV. (SWEDEN). INTERNATIONAL METEOROLOGICAL INST. AND DEPARTMENT OF NATURAL RESOURCES, BANGKOK (THAILAND).
CHLORIDE CONCENTRATION IN GROUNDWATER, RECHARGE RATE AND RATE OF DEPOSITION OF CHLORIDE IN THE ISRAEL COASTAL PLAIN,
W69-05905 02F

SYRACUSE UNIV., N. Y. DEPT. OF CIVIL ENGINEERING.
THE EFFECTS OF ALGAE ON WATER QUALITY,
W69-05697 05C

TECHNION - ISRAEL INST. OF TECH., HAIFA MASSACHUSETTS INST. OF TECH., CAMBRIDGE AND MAGUIRE (CHARLES A.) AND ASSOCIATES, BOSTON, MASS.
WATER DISTRIBUTION SYSTEMS ANALYSIS,
W69-05848 06B

TENNESSEE VALLEY AUTHORITY, WILSON DAM, ALA., AGRICULTURAL DEVELOPMENT DIV.
THE FUTURE AGRICULTURAL USE OF WATER - SOUTHERN HUMID REGION,
W69-05738 06B

TEXAS TECHNOLOGICAL COLL., LUBBOCK. DEPT. OF CIVIL ENGINEERING AND TEXAS TECHNOLOGICAL COLL., LUBBOCK. WATER RESOURCES CENTER.
AN ANALYSIS OF WATER NEEDS FOR ARID AND SEMI-ARID LANDS,
W69-05673 03E

U S ARMY CORPS OF ENGINEERS, VICKSBURG, MISS.
DIVERSION WORKS FOR CONSTRUCTION,
W69-05816 04A

UKRAINSKII NAUCHNO-ISSLEDOVATELSKII GIDRO-METEOROLOGICHESKII INSTITUT, KIEV (USSR).
COMPUTATION OF ANNUAL NORMAL FLOW OF INTERMITTENT WATERCOURSES AND MOUNTAIN RIVERS IN THE UKRAINIAN CARPATHIANS,
W69-05950 02E

UNIVERSAL OIL PRODUCTS, ST. PAUL, MINN.
STEP-DRAWDOWN TEST NEEDS CRITICAL REVIEW,
W69-05813 04B

UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI (GHANA) AND MASSACHUSETTS INST. OF TECH., CAMBRIDGE. HYDRODYNAMICS LAB.
THERMAL STRATIFICATION IN LAKES ANALYTICAL AND LABORATORY STUDIES,
W69-05610 02H

UTAH STATE UNIV., LOGAN.
CONTROLLING TRANSPIRATION IN ASPEN WITH PHENYLMERCURIC ACETATE,
W69-05627 03F

VANDERBILT UNIV., NASHVILLE, TENN. DEPT. OF SANITARY AND WATER RESOURCES ENGINEERING.
IMPOUNDMENT AND TEMPERATURE EFFECT ON WASTE ASSIMILATION,
W69-05637 05C

REAERATION PREDICTION IN NATURAL STREAMS,
W69-05638 05C

VANDERBILT UNIV., NASHVILLE, TENN. AND BOEING CO., HUNTSVILLE, ALA.
LEAST SQUARES ESTIMATION OF MIXING COEFFICIENTS,
W69-05862 06A

VITRO/HANFORD ENGINEERING SERVICES, RICHLAND, WASH.
USE POLLUTION TO BENEFIT MANKIND,
W69-05891 05D

VOLCANI INST. OF AGRICULTURE RESEARCH, BET-DAGAN (ISRAEL). DIV. OF IRRIGATION.
THE CONTRIBUTION OF RESEARCH TO THE EFFICIENT USE OF WATER IN AGRICULTURE,
W69-05650 03F

WASHINGTON UNIV., SEATTLE. DEPT. OF CIVIL ENGINEERING.
FLOW RATES IN TWO-DIMENSIONAL, UNSTEADY, CONFINED GROUNDWATER FLOW,
W69-05617 02F

FLUID MECHANICS OF DOWNSTREAM FISH PASSAGE STRUCTURES,
W69-05667 08I

WASHINGTON UNIV., SEATTLE. FISHERIES RESEARCH INST.
FOOD AND FEEDING HABITS OF JUVENILE COHO SALMON AND STEELHEAD TROUT IN WORTHY CREEK, WASHINGTON,
W69-05890 02L

WEST VIRGINIA UNIV., MORGANTOWN. BUREAU OF BUSINESS

RESEARCH.
FORECASTING WATER DEMAND, AN INTER-AND INTRA-COMMUNITY STUDY,
W69-05900 06D

WESTINGHOUSE ELECTRIC CORP., MUNCIE, IND. AND WESTINGHOUSE ELECTRIC CORP., PITTSBURGH, PA.
CORONA MEASURING TECHNIQUES FOR POWER TRANSFORMERS,
W69-05810 08C

WISCONSIN UNIV., MADISON. DEPT OF BOTANY.
CELL CONTENTS OF NITROGEN AND PHOSPHORUS AS A MEASURE OF THEIR AVAILABILITY FOR GROWTH OF MICROCYSTIS AERUGINOSA,
W69-05868 05C

WISCONSIN UNIV., MADISON. DEPT. OF BOTANY.
AVAILABILITY OF IRON AND MANGANESE IN SOUTHERN WISCONSIN LAKES FOR THE GROWTH OF MICROCYSTIS AERUGINOSA,
W69-05867 05C

WISCONSIN UNIV., MADISON. DEPT. OF CIVIL ENGINEERING.
NUTRIENT REMOVAL FROM SECONDARY EFFLUENT BY ALUM FLOCCULATION AND LIME PRECIPITATION,
W69-05865 05D

WISCONSIN UNIV., MADISON. DEPT. OF ZOOLOGY.
NATURAL AND ARTIFICIALLY (AIR-PLOUGHING) INDUCED MOVEMENT OF RADIOACTIVE PHOSPHORUS FROM THE MUDS OF LAKES,
W69-05698 02H

ARTIFICIALLY INDUCED CIRCULATION OF LAKES BY MEANS OF COMPRESSED AIR,
W69-05866 05C

MOVEMENTS OF RADIOSODIUM (NA-24) WITHIN AN ICE-COVERED LAKE,
W69-05870 02H

WISCONSIN UNIV., MADISON. HYDRAULIC AND SANITARY LAB.
USE OF POTASSIUM PERMANGANATE FOR CONTROL OF PROBLEM ALGAE,
W69-05704 05F

WISCONSIN UNIV., MADISON. WATER CHEMISTRY LAB.
FACTORS INFLUENCING THE EFFECTIVENESS OF SWIMMING POOL BACTERICIDES,
W69-05694 05F

WYOMING UNIV., LARAMIE AND COLORADO STATE UNIV., FORT COLLINS.
MECHANICS OF A MATHEMATICAL GROUND-WATER MODEL,
W69-05863 02F

YALE UNIV., NEW HAVEN, CONN. OSBORN MEMORIAL LAB.
A COMPARATIVE STUDY IN EUTROPHICATION,
W69-05869 05C

ACCESSION NUMBER INDEX

03F	W69-05601	02I	W69-05681	02H	W69-05763	06A	W69-05847	02C	W69-05924
02F	W69-05602	02G	W69-05682	09D	W69-05764	06B	W69-05848	02B	W69-05925
07C	W69-05603	02G	W69-05683	09D	W69-05765	02E	W69-05849	02G	W69-05926
02D	W69-05604	02I	W69-05684	06D	W69-05766	02E	W69-05850	02F	W69-05927
02A	W69-05605	02D	W69-05685	05D	W69-05767	04A	W69-05851	02C	W69-05929
03C	W69-05606	02I	W69-05686	05C	W69-05768	04A	W69-05852	02E	W69-05930
02F	W69-05607	02G	W69-05687	05C	W69-05770	05G	W69-05854	02G	W69-05931
02A	W69-05608	02I	W69-05688	05C	W69-05771	05G	W69-05855	02H	W69-05932
02E	W69-05609	02I	W69-05689	09D	W69-05773	04A	W69-05856	02B	W69-05933
02H	W69-05610	02I	W69-05690	02E	W69-05775	06A	W69-05857	05G	W69-05934
02F	W69-05611	02G	W69-05691	02L	W69-05776	02A	W69-05858	06D	W69-05935
02E	W69-05612	02G	W69-05692	06E	W69-05777	02E	W69-05859	04A	W69-05936
02I	W69-05613	02I	W69-05693	06E	W69-05778	04A	W69-05860	04A	W69-05937
04A	W69-05614	05F	W69-05694	06E	W69-05779	02L	W69-05861	04A	W69-05938
02I	W69-05615	02H	W69-05695	06E	W69-05780	06A	W69-05862	04B	W69-05939
02G	W69-05616	02L	W69-05696	06E	W69-05781	02F	W69-05863	02E	W69-05940
02F	W69-05617	05C	W69-05697	06E	W69-05782	04B	W69-05864	02E	W69-05941
02H	W69-05618	02H	W69-05698	06E	W69-05783	05D	W69-05865	02E	W69-05942
01B	W69-05619	05A	W69-05699	06E	W69-05784	05C	W69-05866	02E	W69-05943
02J	W69-05620	05A	W69-05700	06E	W69-05785	05C	W69-05867	02E	W69-05944
02E	W69-05621	05A	W69-05701	06E	W69-05786	05C	W69-05868	04A	W69-05945
02D	W69-05622	05A	W69-05703	06E	W69-05787	05C	W69-05869	02E	W69-05946
02F	W69-05623	05F	W69-05704	06E	W69-05788	02H	W69-05870	02E	W69-05947
02F	W69-05624	05G	W69-05705	06E	W69-05789	07C	W69-05871	02B	W69-05948
02J	W69-05625	05G	W69-05706	06E	W69-05790	05A	W69-05872	07A	W69-05949
07B	W69-05626	02H	W69-05707	06E	W69-05791	05C	W69-05873	02E	W69-05950
03F	W69-05627	05C	W69-05708	06E	W69-05792	05A	W69-05874	02E	W69-05951
02F	W69-05628	05A	W69-05709	06E	W69-05793	05A	W69-05875	02J	W69-05952
02G	W69-05630	02K	W69-05710	06E	W69-05794	02J	W69-05876	02J	W69-05953
02I	W69-05631	07C	W69-05711	06E	W69-05795	02K	W69-05877	02F	W69-05954
02E	W69-05632	05B	W69-05712	06E	W69-05796	06D	W69-05878	05G	W69-05955
06D	W69-05633	06A	W69-05713	06E	W69-05797	06E	W69-05879	05G	W69-05956
02I	W69-05634	06A	W69-05714	06E	W69-05798	05C	W69-05880	04A	W69-05957
02K	W69-05635	05G	W69-05715	06E	W69-05799	06C	W69-05881	04A	W69-05958
07C	W69-05636	05G	W69-05716	06E	W69-05800	06B	W69-05882	04A	W69-05959
05C	W69-05637	05G	W69-05717	08F	W69-05801	07B	W69-05883	04A	W69-05960
05C	W69-05638	06B	W69-05718	02G	W69-05802	04D	W69-05884	04A	W69-05961
02E	W69-05639	06A	W69-05719	02A	W69-05803	04D	W69-05885	04A	W69-05962
08D	W69-05640	05G	W69-05722	08A	W69-05804	04D	W69-05886	04A	W69-05963
03B	W69-05642	04A	W69-05723	08C	W69-05806	07B	W69-05887	06C	W69-05964
03B	W69-05643	04A	W69-05725	02A	W69-05807	07B	W69-05888	05G	W69-05965
03B	W69-05644	05G	W69-05726	08G	W69-05808	04D	W69-05889	04A	W69-05966
03B	W69-05645	05G	W69-05727	08C	W69-05809	02L	W69-05890	04A	W69-05967
04A	W69-05646	05G	W69-05728	08C	W69-05810	05D	W69-05891	04A	W69-05968
04A	W69-05647	04A	W69-05729	08C	W69-05811	08B	W69-05892	04A	W69-05969
04A	W69-05648	04A	W69-05730	08C	W69-05812	05G	W69-05893	04A	W69-05970
04A	W69-05649	02B	W69-05731	04B	W69-05813	05B	W69-05894	06E	W69-05971
03F	W69-05650	05G	W69-05732	07B	W69-05814	02J	W69-05895	06E	W69-05972
02E	W69-05651	02J	W69-05733	08A	W69-05815	07C	W69-05896	04A	W69-05973
03F	W69-05652	04A	W69-05734	04A	W69-05816	05G	W69-05898	06E	W69-05974
04A	W69-05653	06D	W69-05736	08A	W69-05817	05B	W69-05899	04B	W69-05975
02K	W69-05654	06B	W69-05737	08H	W69-05818	06D	W69-05900	06E	W69-05976
08B	W69-05655	06B	W69-05738	08D	W69-05819	02G	W69-05901	04A	W69-05978
02F	W69-05656	06B	W69-05739	08D	W69-05820	02D	W69-05902	04A	W69-05979
07C	W69-05657	06B	W69-05740	03B	W69-05821	02F	W69-05903	06E	W69-05980
07A	W69-05658	06B	W69-05741	08F	W69-05822	07B	W69-05904	06E	W69-05981
02A	W69-05659	06B	W69-05742	08F	W69-05823	02F	W69-05905	06E	W69-05982
02A	W69-05660	05G	W69-05743	08C	W69-05824	06A	W69-05906	06E	W69-05983
05G	W69-05661	05G	W69-05744	08D	W69-05825	02G	W69-05907	06E	W69-05984
02J	W69-05662	05G	W69-05745	02J	W69-05826	02G	W69-05908	06E	W69-05985
02F	W69-05663	06B	W69-05746	08B	W69-05827	05B	W69-05909	05G	W69-05986
02C	W69-05664	06B	W69-05747	03F	W69-05829	06C	W69-05910	06E	W69-05987
02C	W69-05665	06B	W69-05748	03F	W69-05830	02E	W69-05911	04A	W69-05988
01I	W69-05667	05B	W69-05749	03F	W69-05831	02E	W69-05912	04A	W69-05989
03F	W69-05669	02D	W69-05750	03F	W69-05832	04A	W69-05913	04A	W69-05990
02G	W69-05670	06B	W69-05751	03F	W69-05833	04A	W69-05914	06E	W69-05991
03F	W69-05671	05C	W69-05752	03F	W69-05834	06C	W69-05915	04A	W69-05993
02I	W69-05672	05D	W69-05753	08F	W69-05835	06D	W69-05916	04A	W69-05994
03E	W69-05673	06B	W69-05754	02D	W69-05840	07C	W69-05917	04A	W69-05995
03F	W69-05674	02F	W69-05755	02J	W69-05841	02F	W69-05918	04A	W69-05996
02D	W69-05675	02B	W69-05756	09A	W69-05842	06B	W69-05919	04A	W69-05997
03B	W69-05676	02F	W69-05758	08D	W69-05843	05B	W69-05920	04A	W69-05998
02F	W69-05677	02G	W69-05759	05C	W69-05844	02C	W69-05921	04A	W69-05999
02E	W69-05678	02G	W69-05760	08D	W69-05845	02B	W69-05922	04A	W69-06000
02G	W69-05679	02H	W69-05762	08D	W69-05846	02C	W69-05923		

ABSTRACT SOURCES

Source	Accession Numbers	
A. Center of Competence		
(1) U.S. Geological Survey - Hydrology	W69-05601 -- W69-05667 W69-05891 -- W69-05954	126
(2) University of Arizona - Arid Land Water Resources	W69-05669 -- W69-05693	24
(3) University of Wisconsin - Eutrophication	W69-05694 -- W69-05714 W69-05865 -- W69-05877	33
(4) Cornell University - Water Resources Systems Policy Models	W69-05715 -- W69-05734 W69-05847 -- W69-05864	34
(5) Rutgers University - Water Resources Economics	W69-05736 -- W69-05742 W69-05878 -- W69-05882	12
(6) University of Chicago - Metropolitan Water Resources Management	W69-05743 -- W69-05748	6
(7) Bureau of Reclamation - Hydraulics and Engineering Structures	W69-05801 -- W69-05846 W69-05756	41
(8) University of Florida - Eastern U.S. Water Law	W69-05776 -- W69-05800 W69-05955 -- W69-06000	69
B. Other		
(1) Ohio State University - Water Resources Center	W69-05749 -- W69-05767 W69-05768	3
(2) Pennsylvania State University - Institute for Research on Land and Water Resources	W69-05755	1
(3) University of New Mexico - Water Resources Research Institute	W69-05750 -- W69-05759	2
(4) North Dakota State University - Water Resources Research Institute	W69-05751 -- W69-05753	2
(5) University of North Carolina - Water Resources Research Institute	W69-05752	1
(6) University of California - Water Resources Center	W69-05754	1
(7) University of Alaska - Institute of Water Resources		0
(8) University of Idaho - Water Resources Research Institute	W69-05758 -- W69-05766	2
(9) University of Nevada - Center for Water Resources Research	W69-05760 -- W69-05765	2

0)	University of New Hampshire - Water Resources Research Center	W69-05770 -- W69-05771	2
1)	University of Michigan	W69-05762 -- W69-05763	2
2)	University of Massachusetts - Water Resources Research Center	W69-05764	1
3)	Virginia Polytechnic Institute - Water Resources Research Center		0
4)	University of Connecticut - Institute of Water Resources	W69-05773	1
5)	Agricultural Research Service	W69-05775	1
6)	Forest Service, USDA	W69-05883 -- W69-05889	7
7)	University of Washington - Fisheries Research Institute	W69-05890	1
		Grand Total	374

Subject Fields

1 NATURE OF WATER

2 WATER CYCLE

3 WATER SUPPLY AUGMENTATION AND CONSERVATION

4 WATER QUANTITY MANAGEMENT AND CONTROL

5 WATER QUALITY MANAGEMENT AND PROTECTION

6 WATER RESOURCES PLANNING

7 RESOURCES DATA

8 ENGINEERING WORKS

9 MANPOWER, GRANTS, AND FACILITIES

10 SCIENTIFIC AND TECHNICAL INFORMATION

INDEXES

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

ABSTRACT SOURCES

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF COMMERCE

LIBRARY RATE
PRINTED MATTER

U.S. DEPARTMENT OF COMMERCE
CLEARINGHOUSE FOR FEDERAL
SCIENTIFIC AND TECHNICAL INFORMATION
SPRINGFIELD, VA. 22151

OFFICIAL BUSINESS

16.3391
Se 48

UNIVERSITY OF ILLINOIS
AUG 2 9 1969
LIBRARY

SELECTED WATER RESOURCES ABSTRACTS

VOLUME 2, NUMBER 15
AUGUST 1, 1969

W69-06001 -- W69-06420

Selected Water Resources Abstracts is published semimonthly for the Water Resources Scientific Information Center (WRSIC) by the Clearinghouse for Federal Scientific and Technical Information (CFSTI) of the Bureau of Standards, U. S. Department of Commerce. It is available to Federal agencies, contractors, or grantees in water resources upon request to: Manager, Water Resources Scientific Information Center, Office of Water Resources Research, U. S. Department of the Interior, Washington, D. C. 20240. Annual subscription is $22.00 (domestic), $27.50 (foreign), single copy price is $3.00. Certain documents abstracted in this journal can be purchased from the Clearinghouse at the prices indicated in the entry. Prepayment is required.

CLEARINGHOUSE
FOR FEDERAL SCIENTIFIC AND TECHNICAL INFORMATION
U.S. Department of Commerce, Springfield, Va., 22151

SELECTED
WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

VOLUME 2, NUMBER 15
AUGUST 1, 1969

W69-06001 -- W69-06420

---

se of funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources. WRSIC is not presently prepared to furnish loan or retention copies of the publications announced.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas. Centers, and their subject coverage, now in operation are:

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

CONTENTS

FOREWORD_____iii

SUBJECT FIELDS AND GROUPS

(Use Edge Index on back cover to Locate Subject Fields and Indexes in the journal.)

01 NATURE OF WATER
Includes the following Groups: Properties; Aqueous Solutions and Suspensions

02 WATER CYCLE
Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION
Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL
Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Non-Water Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION
Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING
Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA
Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS
Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS, AND FACILITIES
Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.

10 SCIENTIFIC AND TECHNICAL INFORMATION
Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

01. NATURE OF WATER

1A. Properties

PLASTIC FLOW AND PRESSURE MELTING IN THE DEFORMATION OF ICE I,
Cambridge Univ. (England). Cavendish Lab.
P. Barnes, and D. Tabor.
Comm of Snow and Ice, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 79, pp 303-315, 1967. 13 p, 8 fig, 1 tab, 15 ref.

Descriptors: *Ice, *Melting, *Plastic deformation, Flow, Mechanical properties, Physical properties, Thermodynamics, Rheology, Temperature, Pressure, Crystal growth.
Identifiers: Plastic flow, Regelation, Pressure melting.

Previous studies on the indentation of ice indicated some anomalies in its deformation properties near the melting point. Above the pressure melting temperature, there was a considerable increase in the flow rate of ice. In addition, the deformed ice was characterized by its large grain size and loss of bubbles. Recent experiments furnish data from which it is possible to give a quantitative treatment of the deformation mechanisms involved in the pressure melting regime. It is concluded that, above the pressure melting temperature, a liquid-like layer is formed at the ice grain boundaries. This process accounts for the bubble loss and formation of large grains. Together with a surface regelation process, it also accounts for the major part of the increase in flow rate observed. (Knapp-USGS)
W69-06270

02. WATER CYCLE

2A. General

SOME MAPS OF ISANOMALIES IN ENERGY BALANCE CLIMATOLOGY,
California Univ., Los Angeles. Dept. of Geography.
For primary bibliographic entry see Field 02B.
W69-06050

LOSS RATES ON SELECTED CATCHMENTS IN VICTORIA,
Water Research Foundation of Australia, Kingford.
For primary bibliographic entry see Field 02D.
W69-06085

THE HYDROLOGIC CYCLE AND THE WATER BALANCE IN NATURE,
Research Inst. for Water Resources Development, Budapest (Hungary).
J. Kienitz, K. Szesztay, and K. Ubell.
2nd Int Postgrad Course on Hydrol Method for Develop Water Resources Manage, Budapest, Hung, Jan-July 1968, Manual No 8, 1968. 197 p, 72 fig, 18 tab, 44 ref.

Descriptors: *Hydrologic budget, *Water balance, Hydrologic cycle, Desalination, Surface waters, Groundwater, Climatology, Precipitation (Atmospheric), Evapotranspiration, Meteorology, Statistical methods, Data collections, Network design.
Identifiers: *Technical manuals, *Textbooks.

The concept of the hydrologic cycle is outlined and methods for computing the water balance in natural and man-modified hydrologic systems are given in a technical manual presented as a chapter of a text written for an international postgraduate course in water resources management. Data processing methods are reviewed. The water balance is subdivided for discussion into atmospheric balance, surface water balance, groundwater, and meteorological considerations. Evapotranspiration and precipitation computations are given special consideration. Desalting is suggested as a way of increasing fresh water supplies in water-short areas. (Knapp-USGS)
W69-06227

HYDROLOGICAL FORECASTING,
Research Inst. for Water Resources Development, Budapest (Hungary).
O. Starosolszky, K. Szesztay, and K. Ubell.
2nd Int Postgrad Course on Hydrol Methods for Develop Water Resources Manage, Budapest, Hung, Jan-July, Manual No 9, 1968. 140 p, 91 fig, 6 tab, 44 ref.

Descriptors: *Forecasting, *Water management (Applied), River forecasting, Runoff forecasting, Flood forecasting, Streamflow forecasting, Estimating, Statistical methods, Synthetic hydrology, Network design, Data collections, Freezing, Thawing, Water levels, Water level fluctuations.
Identifiers: *Textbooks, *Technical manuals.

Hydrological forecasting methods are given in a technical manual presented as a chapter of a text written for an international postgraduate course in water resources management. The design of data collection networks for forecasting systems and the organization of forecasting networks on the local through the national government levels are discussed. Methods are given for using data to obtain forecasts for river flow, river stage, lake stage, ice formation, ice melting, groundwater levels, and groundwater discharge. (Knapp-USGS)
W69-06228

THE HEAT BUDGET OF A MELTING COVER OF SEA ICE,
McGill Univ., Montreal (Quebec). Ice Research Project.
For primary bibliographic entry see Field 02C.
W69-06263

GLACIER MASS BUDGET AND MESOSCALE WEATHER IN THE AUSTRIAN ALPS 1964 TO 1966,
Innsbruck Univ. (Austria). Inst. of Meteorology and Geophysics.
For primary bibliographic entry see Field 02C.
W69-06267

THE GREENLAND MASS BALANCE FLUX DIVERGENCE CONSIDERATIONS,
Cold Regions Research and Engineering Lab., Hanover, N. H.
For primary bibliographic entry see Field 02C.
W69-06268

2B. Precipitation

THE AREAL EXTENSION OF RAINFALL RECORDS: AN ALTERNATIVE MODEL,
University Coll. of Wales, Aberystwyth. Dept. of Geography.
D. J. Unwin.
J Hydrol, Vol 7, No 4, pp 404-414, Apr 1969. 11 p, 2 fig, 4 tab, 20 ref.

Descriptors: *Rainfall, *Statistical models, Regression analysis, Statistical methods, Synoptic analysis, Climatology, Meteorology.
Identifiers: Trend surface analysis, Snowdonia (Wales).

Trend surface analysis is proposed as an alternative to conventional regression analysis for analyzing areal rainfall totals. The method was tested using data from Snowdonia, North Wales and was found to be slightly more efficient. The area shows a strong effect of altitude on rainfall but has a superimposed decrease in rainfall in the SW-NE direction because of prevailing rain-bearing SW winds. Trend surface analysis treats the areal variation of rainfall as a regional component independent of altitude with residuals ascribed to the altitude effect. (Knapp-USGS)
W69-06018

SOME MAPS OF ISANOMALIES IN ENERGY BALANCE CLIMATOLOGY,
California Univ., Los Angeles. Dept. of Geography.
Werner H. Terjung.
Arch Meteorol, Geophys, and Bioklimatol, Ser B, No 16, pp 279-315, 1968. 36 p, 28 fig, 1 tab, 15 ref.

Descriptors: *Climatology, *Energy budget, Solar radiation, Heat flow, Heat balance, Temperature, Regression analysis, Synoptic analysis.
Identifiers: Energy balance maps, Bowen ratio, Radiation efficiency.

A series of world maps of isanomalies of annual and seasonal global radiation, net radiation, latent heat flux, sensible heat flux, maps of residuals from regression, radiation efficiency, and the Bowen Ratio have been constructed on the data base of BUDYKO'S Atlas of the Heat Balance of the Earth, 1963. Among the major features observed was the dissimilarity in patterns of isanomalies for the eastern and western sectors of the world's semi-permanent subtropical highs and the great difference between oceanic and continental surfaces. (Knapp-USGS)
W69-06050

PROBABILITY FORECASTS OF 30-DAY PRECIPITATION,
Virginia Polytechnic Inst., Blacksburg. Dept. of Statistics.
John W. Philpot, and Richard G. Krutchkoff.
Virginia Water Resources Res Center Rep, Feb 1969. 113 p, 13 fig, 30 tab, 19 ref, 9 append. OWRR Proj No A-027-VA.

Descriptors: *Forecasting, *Precipitation (Atmospheric), *Weather forecasting, *Statistical models, Probability, Reliability, Computer models, Computer programs, Digital computers.
Identifiers: Weather Bureau, Forecast improvement, Precipitation probability.

A process for improving the usefulness of the Weather Bureau's 30-day precipitation forecasts is proposed. A computer program for generating an estimated conditional probability distribution of monthly local rainfall is described and a program listing is included. Input data are past weather bureau forecasts, local precipitation data, and current weather bureau forecast. (Knapp-USGS)
W69-06205

RAINSTORMS AND HAIL,
Gidrometeorologicheskii Institut, Leningrad (USSR). High-Altitude Geophysics Inst.
G. K. Sulakvelidze.
Available from Clearinghouse as TT 68-50466; $3.00 paper copy and $0.65 in microfiche. Trans Livnevye Osadki i Grad, Leningrad, Gidrometeoizdat 1969. 310 p, 94 fig, 43 tab, 276 ref.

Descriptors: *Precipitation (Atmospheric), *Hail, *Rain, *Cloud physics, Artificial precipitation, Cloud seeding, Climatology, Condensation, Meteorology, Air circulation, Weather modification, Convection.
Identifiers: *USSR, Convective storms.

A monograph presents theoretical and experimental results concerning the formation of rain from convective clouds. The study was conducted by members of the High-Altitude Geophysics Institute USSR, during 1956-1966. A new hypothesis of hail formation is proposed, and on its basis a method is developed for modifications of convective clouds with the aim of preventing heavy hailstorms. An account is given of hail forecasting reliability based on an analysis of the vertical atmospheric stability and the hypothesis of hail formation presented in this work. Radar methods of investigating rain and hail clouds are discussed and the results are given. The monograph is intended for specialists in the field of cloud physics and weather control, meteorologists, and postgraduate students on hydrometeorology. (Knapp-USGS)

W69-06214

PRECISION MEASUREMENTS OF WATER DROPLET EVAPORATION RATES,
New Mexico Univ., Albuquerque. Dept. of Physics and Astronomy.
For primary bibliographic entry see Field 02D.
W69-06236

2C. Snow, Ice, and Frost

FREEZING IN FOREST SOIL AS INFLUENCED BY SOIL PROPERTIES, LITTER, AND SNOW,
Minnesota Univ., St. Paul. School of Forestry.
David B. Thorud, and David A. Anderson.
Univ Minn Water Resources Res Center Bull 10, Jan 1969. 41 p, 19 fig, 12 tab, 19 ref, 1 append. OWRR Proj No A-004-MINN.

Descriptors: *Freezing, *Soils, *Forest soils, Frost protection, Frozen soils, Frost, Snow cover, Runoff, Infiltration, Soil physical properties.
Identifiers: Freezing rate (Soils).

Freezing of forest soil was studied in small soil columns using 28 cu ft freezers. The blocks of soil were 10 1/2 in. deep, 13 in. long, and 8 1/2 in. wide, and were undisturbed sequences carefully cut in the field. The effect on freezing of soil type differences was less than the effect of variations in litter and snow cover. Loamy sand froze in 28% less time than a silt loam. Bare soil froze 55% faster than litter covered soil. A 2- in. snow layer increased freezing time, but snow and pine litter together increased freezing time 54% over the time for the same thickness of litter alone, and 123% compared to snow alone. Water in the litter decreased freezing time as much as 61%. (Knapp-USGS)
W69-06028

CLIMATOLOGY OF SEVERE WINTER STORMS IN ILLINOIS,
Illinois State Water Survey, Urbana.
Stanley A. Changnon, Jr.
Ill State Water Surv Bull 53, 1969. 45 p, 38 fig, 32 tab, 29 ref.

Descriptors: *Illinois, *Climatic data, *Storm structure, *Snowfall, Frequency, Meteorological data, Damages, Blizzards, Hydrologic budget, Ice, Winds, Synotic analysis, Probability.
Identifiers: *Winter storms, Snowstorms.

Damaging winter storms with glazing conditions and more than 6 in. of snow occur several times a year in Illinois. Winter storm data for the period 1900-1960 are analyzed. The information shows that storms usually center in northwestern Illinois and are characterized by 6 in. snow depth or more over an average area of 7,500 sq mi. Point snowfall of 12 in. and glaze of 2 in. thickness has occurred in all areas of the state, and a maximum of 37 in. at a point occurred in a 1900 storm. The greatest direct loss to property was in 1924 when a 12 4 million dollar loss was recorded. The study shows that 5 weather types lead to the production of severe winter storms in Illinois. The Colorado low produces approximately 45% of the storms and is largely responsible for the most widespread heavy snow and greater overall damage than the other weather types. (Gabriel-USGS)
W69-06210

THE LONGITUDINAL VELOCITY PROFILE OF LARGE ICE MASSES,
Melbourne Univ., Parkville (Australia). Antarctic Div.
W. Budd.
Comm of Snow and Ice, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 79, pp 58-77, 1967. 20 p, 5 fig, 2 tab, 15 ref.

Descriptors: *Glaciers, *Movement, *Rheology, *Antarctic, Mathematical models, Ice, Non-newtonian flow, Mechnical properties, Plasticity, Viscosity, Shear stress, Shear strength, Shear drag, Slopes.
Identifiers: *Wilkes dome, Convergent flow, Divergent flow, Ice sheets, Continental glaciers.

Detailed measurements of ice movement, strain rates, ice thickness and elevation of the Wilkes local ice cap have provided means of testing various theories of ice movement, and thereby have provided information on the flow law of the ice. An analysis has been made of 2-dimensional ice flow to determine the longitudinal strain rate and velocity as a function of the ice mass dimensions and the flow law parameters of ice. It has been necessary to use a flow law consisting of a linear term plus a high power term to cover both the high shear at the base and the low but fluctuating longitudinal strain rates. By the application of this theory to the analysis of the Wilkes dome data it is found that the basal friction varies as the smoothed surface and is related to the ice thickness and velocity, depending on a high power in the flow law. Fluctuations in surface slope over smaller distance give rise to small changes in longitudinal stress and similar changes in the strain rate, but the magnitude of these changes at low stresses involves only a small power in the flow law. An extension of the analysis by Weertman (1957) for 3-dimensional ice shelf spread has been carried out to drive the effect of an arbitrary transverse strain on the longitudinal velocity gradient. This allows the above results to be applied to 3-dimensional diverging or converging flow. This analysis has been found successful in explaining the lower longitudinal strain rates over the 'less active' side of the Wilkes dome where transverse extension is the dominant strain rate. (Knapp-USGS)
W69-06257

GLACIAL EROSION,
Bristol Univ. (England), H. H. Wills Physics Lab.
J. F. Nye and P. C. S. Martin.
Comm of Snow and Ice, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 79, pp 78-86, 1967. 9 p, 2 fig, 10 ref.

Descriptors: *Glaciers, *Erosion, *Scour, Topography, Movement, Rheology, Abrasion, Cavitation, Friction, Shear stress, Slopes, Ice, Mechanical properties, Plasticity, Shear drag.
Identifiers: *Glacial erosion.

Slip-line fields are discussed for a perfectly plastic glacier moving over an irregular bed. It is argued that erosion will proceed in such a way that the bed becomes either a slip-line or an envelope of slip-lines. This implies that there is an upper limit to the longitudinal concave curvatures of the bed, but no corresponding limit to convex curvatures. The mechanism provides a natural explanation for the typical long profiles of glacier valleys. Examples are given to show that so-called rock bars can form at places where there is no obviously harder rock, and that, conversely, an obviously harder rock does not necessarily form a rock bar. (Knapp-USGS)
W69-06258

EROSIVE PROCESSES WHICH ARE LIKELY TO ACCENTUATE OR REDUCE THE BOTTOM RELIEF OF VALLEY GLACIERS,
For primary bibliographic entry see Field 02J.
W69-06259

RIFTS AT THE FOOT OF BEARDMORE GLACIER, ANTARCTICA,
Cambridge Univ. (England). Dept. of Applied Mathematics and Theoretical Physics; and Scott Polar Research Inst., Cambridge (England).
Ian Collins, and Charles Swithinbank.
Comm of Snow and Ice, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 79, pp 109-114, 1967. 6 p, 4 fig, 5 ref.

Descriptors: *Glaciers, *Antarctic, Floating, Rheology, Ice, Movement, Mechanical properties, Plasticity, Yield strength, Strength, Deflection.
Identifiers: *Antarctic shelf ice, Ice rifts.

Series of rifts have frequently been observed
Antarctic glaciers. In the past these have been
terpreted as annual phenomena, and measu
values of the separation of consecutive rifts use
estimate the mass budget of the Antarctic c
tinent. However, measurements of the velocity
ice movement in the vicinity of a similar type of
ries of rifts on the Beardmore Glacier show t
these do not form annually. Moreover surface f
tures indicate that the first rift appears close to
line of floatation. It is suggested that these r
occur when, in going afloat, the ice 'falls' ove
submerged cliff. Some simple calculations
presented which support this view. The distan
between consecutive rifts is predicted using expe
mental values of the strength of ice and is in go
agreement with measurement. In this theory
distance is essentially independent of the speed
ice movement. (Knapp-USGS)
W69-06260

**INVESTIGATIONS ON FISSION PRODUCTS
THE ACCUMULATION AREA OF AN ALPI
GLACIER (KESSELWANDFERNER, OETZT
ALPS),**
Innsbruck Univ. (Austria). Dept. of Physics; a
Alpine Forschungsstelle der Universitaet In
sbruck, Obergurgl (Austria).
W. Ambach, H. Eisner, and F. A. Prantl.
Comm of Snow and Ice, Proc Gen Assembly
Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub
pp 117-125, 1967. 9 p, 4 fig, 11 ref.

Descriptors: *Glaciers, *Radioactive dating, *Ce
um, Flow rates, Gamma rays, Firn, Snow, Compa
tion, Snowpack, Ice, Movement, Alpine.
Identifiers: *Alps, Cesium radioisotopes, Gamm
ray spectrometry, Beta radiation measureme
Firn accumulation rate.

In the summer of 1964 six firn pits were dug at va
ous altitudes in the accumulation area of the Ke
selwandferner (Oetztal Alps, Austria) covering t
annual layers of net accumulation from 1960/61
1963/64. The total beta-activity and the gamm
ray spectra of continuous sets of samples were me
sured. From the 0.66 MeV peak in the spectra t
Cs-137 contribution to the fission product mixtu
was determined quantitatively. The results sho
that Cs-137 was essentially preserved within the a
nual layers of net accumulation from 1961/62
1963/64. Thus the late summer horizons of 196
and 1964 present on the average characteristi
changes in the Cs-137 activity profile, and can b
used for dating purposes. The results of the tot
beta-activity measurements show, in addition, fir
layers of relatively high total beta-activity betwee
the late summer horizons of 1961 and 1964. In th
case, a displacement of individual fission produc
stronger than that of Cs-137 is possible by mel
water percolation into deeper firn layers. Recen
measurements of the vertical distribution of th
total beta-activity show a significant decrease i
firn layers above the late summer horizon of 1964
This may be also regarded as a criterion for datin
purposes. (Knapp-USGS)
W69-06261

**TRITIUM CONTENT IN THE FIRN LAYERS O
AN ALPINE GLACIER,**
Innsbruck Univ. (Austria). Dept. of Physics; an
International Atomic Energy Agency (Vienna).
W. Ambach, H. Eisner, and L. L. Thatcher.
Comm of Snow and Ice, Proc Gen Assembly o
Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No
79, pp 126-134, 1967. 9 p, 6 fig, 1 tab, 9 ref.

Descriptors: *Radioactive dating, *Tritium
*Glaciers, *Alpine, Firn, Fallout, Melting, Runoff
Streamflow, Movement, Ice, Tracers.
Identifiers: *Glacial meltwater tracers, Alpine gla
cier.

During the summer months of 1963 and 1964 firn
samples for the determination of the tritium con-
tent were taken from the accumulation area of the
Kesselwandferner (Oetztal Alps). In a 20 m deep
vertical firn pit the annual net accumulation from

the years of between 1963 and 1951 were investigated. Samples from the annual layers between 1964 and 1960 were taken in 6 other pits at various locations on the Kesselwandferner in order to study the local variations in tritium content. The vertical distribution of tritium in the firn layers shows characteristic variations which can be attributed to thermonuclear bomb tests. Melt-water infiltration can cause considerable changes in tritium content. On an average, however, an identifiable boundary between tritium-containing tritium-lacking layers is maintained within the annual layer of net accumulation of 1961/62. In addition, ice samples taken from the ablation area were investigated which show no contamination by recent melt-water. The high tritium content of firn layers accumulated in recent years can be used for run-off studies. In this procedure the tritium deposited in younger firn layers can be used as a tracer for making the melt-water flow. (Knapp-USGS)
W69-06262

THE HEAT BUDGET OF A MELTING COVER OF SEA ICE,
McGill Univ., Montreal (Quebec). Ice Research Project.
M. P. Langleben.
Comm of Snow and Ice, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 79, pp 151-160, 1967. 10 p, 3 fig, 1 tab, 7 ref. Contract No CP-69-600000.

Descriptors: *Melting, *Sea ice, Energy budget, Solar radiation, Wind, Water temperature, Ablation, Evaporation, Arctic Ocean.
Identifiers: Sea ice melting, Ellesmere Island.

An investigation of the energy budget of a cover of sea ice was made in the late spring and early summer of 1965 at Tanquary Fiord, Ellesmere Island. Measurements in the first 2 metres above the surface, of wind speed and humidity were automatically recorded at 3 levels, as were more detailed temperature profiles through the thickness of the ice sheet. Solar radiation, incident on and reflected by the surface, was obtained on a continuous basis as was also the radiation balance. Daily observations were made on surface ablation, on the depth of melt water on the puddled surface, and of the total ice thickness. The salinity profile through the ice sheet was taken at weekly intervals. Energy balances were obtained for a pre-ablation period of 1 week during which the snow cover disintegrated but there was no apparent ablation of the ice, a pre-runoff period of 1 week during which the albedo decreased from about 0.6 to 0.2 and all the melt water remained on the surface, and the ablation period of 3 weeks during which draining of melt water through fissures in the ice was occurring and the surface assumed the characteristics puddled and hummocked appearance. The fluxes of sensible and latent heat were generally directed towards the ice sheet and provided less than 10% of the energy necessary to effect the observed ablation and change of heat content of the ice cover. The dominant factor during the melt season is the net radiation, which accounted for over 90% of the energy requirement.
W69-06263

EXPERIENCES IN COMPARING GEOMETRIC ELEMENTS OF GLACIER VARIATIONS,
J. Kick.
Comm of Snow and Ice, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 79, pp 173-181, 1967. 9 p, 2 fig, 3 tab, 9 ref.

Descriptors: *Glaciers, *Regimen, *Regression analysis, Melting, Ablation, Statistical methods, Length, Height.
Identifiers: Glacial dimension variation, Standard deviations.

The significance of the variation of some single glaciers is calculated to test its validity for regional extrapolation. The confidence levels of the sample means were calculated for length variation (L) and of level variation (h) measurements. The dispersion of the 18 L-data decreases and the confidence level of the mean increases if in a period of similar trend, longer periods of measurement are used. From the scatter of the h-values of 8 glaciers in the E. Alps it is deduced that 4-times more L-measurements than h-measurements would be necessary to ascertain the same confidence level of the mean. The h-data, taken solely from the equilibrium height zones, proved to be acceptable substitutes for the h-values of the whole glaciers, though they are generally a little smaller. For most of the time between 1920 and 1960 the h-values of the Aletschgletscher in Switzerland and of Tunsbergdalsbreen in Norway range within the confidence interval of the h-mean of the 8 glaciers in the E. Alps. The altitude functions of h are compared. The dispersion of the h-values of corresponding height zones of 6 Nanga Parbat glaciers for the period of 1934-1958 has proved to be no larger than for the alpine glaciers. A diagram and 3 tables with variation data and their standard deviations are given. (Knapp-USGS)
W69-06264

CHANGE OF ITALIAN GLACIERS DURING THE DECADE 1957-1966 (FRENCH),
Manfredo Vanni.
Comm of Snow and Ice, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 79, pp 182-192, 1967. 11 p, 3 fig, 4 tab, 2 ref. Article written in Italian.

Descriptors: *Glaciers, *Alpine, Ablation, Melting, Surveys, Snow surveys, Climatology, Temperature, Snowpacks, Cirques, Glaciation.
Identifiers: *Italian Alps, Glacial retreat, Mean summer temperature.

The Italian Glaciological Committee (CNR) undertook the first regular annual measurements of variations in Italian glaciers in 1925, the year which saw the beginning of an intense phase of retreat that was to continue for more than 40 years. The percentage of retreating glaciers reached maximums of 90 and 95% with a steady fall in the numbers of advancing, stationary and uncertain glaciers. The surface area of glacial cover in the Italian Alps fell during this 40-yr period by an average of more than 15% and thickness reduced by more than 40 m (1 m a year). For about 10 decades no factor suggested that this trend would reverse, but in the last decade statistics seem to suggest that it may now be doing so. An increase in the percentage of uncertain, snow-covered and stationary glaciers was seen in 1956 and, with some fluctuations, it has continued to the present. In 1960 to 1966, 42% of the glaciers were stationary with 50% in retreat. These results of direct measurement are supported by other observations including a fall in mean summer temperature, considerable snow-cover in the highest regions of the collection basins, persistence of extensive, thick patches of residual snow, particularly in those cirques and gullies where tiny glaciers used to be present before their gradual disappearance. (Knapp-USGS)
W69-06265

SALTS AND ASSOCIATED PHENOMENA OF THE TERMINI OF THE HOBBS AND TAYLOR GLACIERS, VICTORIA LAND, ANTARCTICA,
Wisconsin Univ., Madison.
Robert F. Black, and Carl J. Bowser.
Comm of Snow and Ice, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 79, pp 226-238, 1967. 13 p, 11 fig, 22 ref.

Descriptors: *Salts, *Aqueous solutions, *Crystallization, Freezing, Sodium sulfate, Water quality, Antarctic, Ponds, Evaporation, Glacial drift, Halides, Thermal springs, Weathering.
Identifiers: *Victoria Land (Antarctica), Freeze concentration (Salts), Mirabilite, Aragonite, Ice-cored moraines, Moraines.

Mirabilite in disseminated crystals and relatively pure deposits is abundant in and on ice-cored moraine and under active ice at the terminus of Hobbs Glacier on the west side of McMurdo Sound. In 1966, 132 isolated deposits were located and described between sea level and nearly 200 m elevation. Stratification, texture, and sorting of the deposits and associated clastics and algae indicate they are pond deposits presumably concentrated by freezing and evaporation. Highly controlled deposits are conformable with fabrics in enclosing glacial ice, but others on top of the ice-cored moraine are undisturbed. The oldest deposits are in the basal shear moraine of the Hobbs Glacier; associated organic matter is radiocarbon dated at 12,000 years B. P. Other contorted deposits within the ice-cored moraine which has been derived from Koettlitz Glacier are dated by associated algae as 2,640 and 2,800 radiocarbon years B. P. The ultimate source of the salts is not known. (Knapp-USGS)
W69-06266

GLACIER MASS BUDGET AND MESOSCALE WEATHER IN THE AUSTRIAN ALPS 1964 TO 1966,
Innsbruck Univ. (Austria). Inst. of Meteorology and Geophysics.
Herfried C. Hoinkes, F. Howorka, and W. Schneider.
Comm of Snow and Ice, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 79, pp 241-254, 1967. 14 p, 4 fig, 8 tab, 9 ref. UNESCO contract NS/2803/65.

Descriptors: *Glaciers, *Alpine, *Regimen, *Climatology, Synoptic analysis, Ablation, Melting, Hydrologic budget, Weather, Precipitation (Atmospheric), Temperature, Snow, Firn.
Identifiers: *Glacial mass budget, *Austrian Alps, Mesoscale weather.

Mass budgets 1964-1966 of Hintereisferner and Kesselwandferner (Otztal Alps, Tyrol), and of Stubacher Sonnblick-Kees (Granatspitzgruppe, Salzburg) are compared with climatological data. Net ablation as function of time, the net budget gradient in the ablation area, and the retreat of the transient snowline were calculated with the aid of nomographs. These were constructed from daily observations at Vent (1900 m), using reduced cumulative temperatures and taking into account the retardation of ice melt by falls of fresh snow. The duration of the ablation period of 150 days in 1963/64 correspond to a strongly negative mass budget, whereas 64 days in 1964/65 were indicative of a highly positive mass budget. The mesoscale weather affecting glaciers is furthermore described by the frequency of selected weather types during the potential ablation season May to September. As a consequence of the more cyclonic character of the weather in the ablation season of 1965 temperatures at the 500 mbar level over the Alps were much lower. Characteristic deviations from the average height of the 500 mbar surface are used to correlate atmospheric circulation and glacier mass budget. (Knapp-USGS)
W69-06267

THE GREENLAND MASS BALANCE FLUX DIVERGENCE CONSIDERATIONS,
Cold Regions Research and Engineering Lab., Hanover, N. H.
Malcolm Mellor.
Comm of Snow and Ice, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 79, pp 275-281, 1967. 7 p, 2 tab, 10 ref.

Descriptors: *Glaciers, *Arctic, *Regimen, Hydrologic budget, Precipitation (Atmospheric), Ablation, Flow, Rheology, Strain, Strain measurement, Statistical methods, Mathematical models.
Identifiers: *Greenland, Flux divergence calculations, Glacial flow mechanics.

Fluctuations of glacier thickness with time are related to surface accumulation rate, principal flow

velocity, and principal flow and cross-slope strain rates by a partial differentiated flux divergence equation. Measured strain rates and other relevant data indicate a strong positive mass balance at 2 sites on the southern part of the Greenland ice cap and a possible weak negative balance in the northern part. A new analysis of published data indicates a negative balance in the central part of the ice cap. The flux divergence approach, although present results are inconclusive, holds considerable promise in mass balance investigations. With modern logistics, many sites can be investigated and flux divergence results can be validated on a statistical basis if errors are randomized. (Knapp-USGS)
W69-06268

MASS BALANCE OBSERVATIONS ON THE BARNES ICE CAP, BAFFIN ISLAND, CANADA,
O. H. Loken, and R. B. Sagar.
Comm of Snow and Ice, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol., Pub No 79, pp 282-291, 1967. 10 p, 4 fig, 4 tab, 8 ref.

Descriptors: *Glaciers, *Arctic, *Regimen, Data collections, Hydrologic budget, Snowpacks, Firn, Precipitation (Atmospheric), Ablation, Melting, Solar radiation, Climatology, Weather, Flow.
Identifiers: *Barnes ice cap, Baffin Island, Canada, Ice cap climatology.

Mass balance studies on the Barnes Ice Cap, Baffin Island, are described. The ice cap has an area of about 6,000 sq km. Its length is about 150 km and its width varies from 22-62 km. The maximum altitude is about 1,128 m, and the rim is about 500 m high. Ice altitude measurements are made on 199 stakes 1 km apart on 3 lines across the ice cap and along lines at the ends. Average snow depth is measured by sounding stick using 5-10 soundings at each stake. Density is determined at every 5th to 10th stake by Monte Rosa sampler. The southern part receives more winter accumulation than the northern part of the ice cap, but the difference varies from year to year. The winter balance on the top of the ice cap exceeds the winter season precipitation at nearby weather stations by an average factor of 3-4. The 1965-66 mean mass balance for the ice cap was -93 cm, a loss equal to 2-3 times the mean annual winter accumulation. The 1964-65 mass balance near the northern end was close to 0, and the equilibrium line there was at an altitude of about 800 m a. s. l. An east-west asymmetry of the mass balance exists across the crest of the ice cap; the northeast side has a more positive mass balance than the southwest side. Studies of moraine patterns around the ice cap indicates that this pattern has persisted for as much as five thousand years. (Knapp-USGS)
W69-06269

PLASTIC FLOW AND PRESSURE MELTING IN THE DEFORMATION OF ICE I,
Cambridge Univ. (England). Cavendish Lab.
For primary bibliographic entry see Field 01A.
W69-06270

2D. Evaporation and Transpiration

LOSS RATES ON SELECTED CATCHMENTS IN VICTORIA,
Water Research Foundation of Australia, Kingsford.
A. Karoly
Water Res Found of Australia Bull No 13, 1965. 48 p, 22 fig, 10 tab, 8 ref.

Descriptors: *Rainfall-runoff relationships, *Surface-groundwater relationships, *Rainfall disposition, Base flow, Infiltration, Runoff, Runoff coefficient, Storage coefficient, Small watersheds.
Identifiers: *Australia, Loss rates (Rainfall-runoff relationships).

Storm rainfalls on 9 catchments in Victoria, Australia were analyzed for rainfall-runoff relationships and 137 loss rates were derived. Loss rate is defined as the average rate of potential infiltration loss to surface runoff during the supply period of a storm. Relationships between loss rates and some hydrualic factors of the drainage basins were calculated. Frequency distributions and seasonal variations of loss rate were calculated and compared with U. S. and other Australian rates. (Knapp-USGS)
W69-06085

PRECISION MEASUREMENTS OF WATER DROPLET EVAPORATION RATES,
New Mexico Univ., Albuquerque. Dept. of Physics and Astronomy.
Pyung Syk Ro, T. S. Fahlen, and H. C. Bryant.
Appl Opt, Vol 7, No 5, pp 883-890, May 1968. 8 p, 12 fig, 2 tab, 9 ref.

Descriptors: *Evaporation, *Raindrops, Measurement, Instrumentation, Research and development, Temperature, Optical properties, Light intensity.
Identifiers: Glory effect (Meteorology), Lasers, Reflection, Interference (Optical), Interferometry.

The rate at which a motionless droplet evaporates can be measured continuously and precisely by determining the period of intensity fluctuation of laser light reflected off the center of the droplet. The back scattered light is the coherent sum of light reflected from the external and the internal surfaces of the droplet; under typical conditions the back scattered light intensity oscillates at about 2 Hz. This method is applied to pure water droplets in the diameter range from 0.6 mm to 1.8 mm, supported by bead thermistors and beaded glass fibers, and the results are compared with the quasi-stationary theory of Maxwell. Our measurements show that, after steady state is reached, the rate of change of diameter is inversely proportional to the diameter, as predicted in the quasi-stationary theory. Our experiments give a somewhat slower evaporation rate than the theory predicts; this discrepancy can be eliminated if one assumes that the surface temperature of the droplet is somewhat lower than measured with the bead thermistor. Using the optical method, mechanical resonances of the droplet can be sensitively detected; acoustically induced shape resonances are briefly investigated. (Knapp-USGS)
W69-06236

2E. Streamflow and Runoff

A PORTABLE RAINFALL SIMULATOR AND RUNOFF SAMPLER,
New Mexico State Univ., Las Cruces.
For primary bibliographic entry see Field 07B.
W69-06011

THE MOON'S RESOURCES,
National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center.
P. D. Lowman, Jr.
Sci J, Vol 5, No 5, pp 90-95, May 1969. 6 p, 3 photo, 2 tab, 4 ref.

Descriptors: *Resource development, *Resources, *Water resources, *Moon, Ice, Hydrates, Mining, Soils, Rocks.
Identifiers: Natural resources (Lunar).

Materials available on the Moon are practical sources for many of the products needed to supply exploration parties. Soil and rock are, of course, very abundant and useful for construction. Water has not been detected but it is very likely to exist as ice just below the surface, or it may be produced from various hydrated minerals. From water, oxygen and hydrogen may be produced by using solar energy. Several gas emissions or volcanic eruptions have been observed on the Moon. Volcanic gases should be good sources of water, hydrogen, chlorides, sulfides, and carbon dioxide. Nothing is known about the presence or concentrations of ores on the Moon, but if the lunar crust is similar in general composition to the Earth's crust, the should be possible to extract most metals. (Kna USGS)
W69-06015

THE IUH (INSTANTANEOUS UNIT HYDR GRAPH) OF THE MUSKINGUM CHANN REACH,
City Univ., London (England). Dept. of Civil gineering.
C. Venetis.
J Hydrol, Vol 7, No 4, pp 444-447, Apr 1969. 4 fig, 3 ref.

Descriptors: *Routing, *Unit hydrographs, Strea flow forecasting, Runoff forecasting, Mathemati studies, Equations, Channel flow, Hydrogra analysis.
Identifiers: Muskingum routing, Instantaneous u hydrograph.

The Muskingum method of flood routing invol the assumption of a linear transformation of flood wave. The instantaneous unit hydrograph the channel reach corresponding to the Musk gum equation is derived and shown to contai negative impulse at the origin which explains Muskingum prediction of negative outflow un certain conditions. The application of the convo tion integral in the Muskingum flood rout method is briefly outlined. (Knapp-USGS)
W69-06020

NUMERICAL EXPERIMENTS WITH TH STANFORD WATERSHED MODEL ON SMA AGRICULTURAL WATERSHEDS IN VI GINIA,
Virginia Polytechnic Inst., Blacksburg. Dept. Agricultural Engineering; and Agricultu Research Service, Blacksburg, Va. Soil and Wa Conservation Research Div.
V. O. Shanholtz, and J. B. Burford.
Virginia Water Resources Res Center Rep, 196 37 p, 15 fig, 13 tab, 6 ref. OWRR Proj No A-01 VA.

Descriptors: *Mathematical models, *Comput models, *Rainfall-runoff relationships, *Virgin Digital computers, Demonstration watershed Computer programs, Runoff forecasting, Strea flow forecasting, Routing, Water yield.
Identifiers: Stanford Watershed Model.

A FORTRAN program of the Stanford Watersh Model was used to synthesize streamflow on small agricultural watersheds, Brush and Cr Creeks, in Virginia. There were no statistically si nificant differences at the 15% level betwee synthesized and recorded mean monthyly wat yield for the watersheds. The estimates of ma imum daily peak discharges on Brush Creek we significantly different from recorded values at th 1% level. Because snowmelt was not included the model, some discrepancies occurred in calcu lated magnitudes and timing of peak discharge Base flow tends to be consistently underestimate Estimates of peak daily discharges were erratic bu reasonably good, with major difficulties in summe when antecedent moisture was low. (Knapp USGS)
W69-06032

THE VALLEYS OF IOWA-1: VALLEY WIDTH AND STREAM DISCHARGE RELATIONSHIP IN THE MAJOR STREAMS,
Iowa Univ., Iowa City. Dept. of Geography.
Neil E. Salisbury, James C. Knox, and Richard A. Stephenson.
Iowa State Water Resources Res Inst Proj Comple tion Rep, Dec 31, 1968. 107 p, 42 fig, 4 tab, 49 ref OWRR Project No A-006-IA.

Descriptors: *Geomorphology, *Drainage pattern (Geologic), *Iowa, *Streams, Terrain analysis Topography, Discharge (Water), Streamflow Floods, Glacial drift, Till, Pleistocene epoch Drainage density.

dentifiers: Valley width-stream discharge relationships.

The relationships between valley bottom widths and stream sizes in Iowa, particularly as shown by changes of width with downstream distance or with decline, are discussed in a general study of valley form and stream discharge. The variables studied were spatial variations in lithology, the influence of buried valleys, geologic structure, the influence of tributaries, the effects of meltwater, and the effects of various Pleistocene constructional landforms, particularly end moraines. The width-distance relationships is most useful in predicting runoff in stream basins with well integrated drainage patterns, and least useful where headwaters are on drift and the lower courses on well-integrated terrain. Constrictions in valley width are often associated with bedrock outcrops. Discharge records are tabulated for the 26 basins studied. The relationships between basins were studied by regression analysis. (Knapp-USGS)
W69-06034

WATER RESOURCES RESEARCH IN VIRGINIA,
Virginia Polytechnic Inst., Blacksburg. Water Resources Research Center.
William R. Walker.
Virginia Water Resources Res Center Bull 18, Sept 1968. 50 p, 4 parts, 1 append. OWRR Project No A-999-VA.

Descriptors: *Water resources, *Water resources research act, *Research facilities, *Projects, *Virginia, Research and development, Institutions, Water resources development, Grants, Colleges, Contracts.
Identifiers: *Water resources research, Project listing.

A detailed survey of active and current water resources research projects conducted by Universities, Government Agencies, and industries in Virginia is presented. The research projects are described by listing the agency performing the work, title of the project, principal investigators, project description, starting date, and cost. The mailing addresses of all project organizations are listed. (Knapp-USGS)
W69-06039

WATER RESOURCE RECORDS OF THE CONFINA CREEK BASIN AREA, FLORIDA,
Geological Survey, Washington, D. C.
H. H. Musgrove, J. B. Foster, and L. G. Toler.
Florida Board of Conserv, Div Geol Inform Circ No 57, 1968. 127 p, 9 fig, 14 tab.

Descriptors: *Data collections, *Hydrologic data, *Water resources, *Florida, Surface waters, Groundwater, Water wells, Streamflow, Lake stages, Water levels, Water temperature, Water quality, Rainfall, Water yield, Aquifers, Logging (Recording).
Identifiers: Econfina Creek (Fla).

Water resources data are compiled for the Econfina Creek basin, Florida. Tabulated data include streamflow, lake stages, chemical analyses of surface waters, water temperatures, chloride contents, rainfall, well locations, groundwater levels, pumping test data, well lithologic logs, well pumpage records, and groundwater chemical analyses. (Knapp-USGS)
W69-06051

FLOODS AT JACKSON, OHIO,
Geological Survey, Washington, D. C.
Carl E. Webber, and Ronald I. Mayo.
Geol Surv Hydrol Invest Atlas HA-325, 1968. 1 sheet, 3 fig, 1 map, 2 tab, 2 ref.

Descriptors: *Floods, *Stage-discharge relations, Ohio, Hydrologic data, Data collections, Duration curves, Probability.
Identifiers: Atlas (Water data), Flood frequencies, Recurrence intervals, Flood profiles, Jackson (Ohio).

Hydrologic data are presented to be used to evaluate the extent, depth and frequency of flooding that may be expected along Little Salt Creek and its tributaries in the vicinity of Jackson, Ohio. The flooded area is shown on a topographic map scaled 1:12,000. Flood profiles, cross sections, and frequency curves show heights and probabilities of past and predicted floods. (Knapp-USGS)
W69-06056

FLOOD PLAIN INFORMATION, UPPER FLINT RIVER, MUD AND JESTER CREEKS, METROPOLITAN ATLANTA, GEORGIA.
Corps of Engineers, Mobile, Ala.
For primary bibliographic entry see Field 04A.
W69-06057

FLOOD PLAIN INFORMATION, CASEY CANAL NORTH, SAVANNAH AND CHATHAM COUNTY, GEORGIA.
Corps of Engineers, Savannah, Ga.
For primary bibliographic entry see Field 04A.
W69-06058

FLOOD PLAIN INFORMATION, TAR RIVER AND STONY CREEK, ROCKY MOUNT, NORTH CAROLINA.
Corps of Engineers, Wilmington, N. C.
For primary bibliographic entry see Field 04A.
W69-06059

FLOOD PLAIN INFORMATION, COBBS CREEK-FOWLER BRANCH, DEKALB COUNTY, GEORGIA.
Corps of Engineers, Savannah, Ga.
For primary bibliographic entry see Field 04A.
W69-06060

FLOOD PLAIN INFORMATION, ROCK RIVER AT JANESVILLE, WISCONSIN.
Corps of Engineers, Rock Island, Ill.
For primary bibliographic entry see Field 04A.
W69-06061

FLOOD PLAIN INFORMATION, BIG WALNUT CREEK, VICINITY OF COLUMBUS, OHIO.
Corps of Engineers, Huntington, W. Va.
For primary bibliographic entry see Field 04A.
W69-06062

FLOOD PLAIN INFORMATION, HUNNICUTT CREEK, ATHENS, CLARKE COUNTY, GEORGIA.
Corps of Engineers, Savannah, Ga.
For primary bibliographic entry see Field 04A.
W69-06063

FLOOD PLAIN INFORMATION, TAR RIVER AT LOUISBURG, NORTH CAROLINA.
Corps of Engineers, Wilmington, N. C.
For primary bibliographic entry see Field 04A.
W69-06064

FLOOD PLAIN INFORMATION, DICKINSON BAYOU, DICKINSON, TEXAS.
Corps of Engineers, Galveston, Tex.
For primary bibliographic entry see Field 04A.
W69-06065

FLOOD PLAIN INFORMATION, ELLERBE, GOOSE, WARREN, SANDY AND THIRD FORK CREEKS, DURHAM, NORTH CAROLINA.
Corps of Engineers, Wilmington, N. C.
For primary bibliographic entry see Field 04A.
W69-06066

FLOOD PLAIN INFORMATION, TURTLE CREEK, ROCK COUNTY, WISCONSIN.
Corps of Engineers, Rock Island, Ill.
For primary bibliographic entry see Field 04A.
W69-06067

FLOOD PLAIN INFORMATION, BEAVERDAM CREEK, PRINCE GEORGES COUNTY, MARYLAND.
Corps of Engineers, Baltimore, Md.
For primary bibliographic entry see Field 04A.
W69-06068

FLOOD PLAIN INFORMATION, OTTAWA RIVER, ALLEN COUNTY, OHIO.
Corps of Engineers, Detroit, Mich.
For primary bibliographic entry see Field 04A.
W69-06069

FLOOD PLAIN INFORMATION, OHIO RIVER, JEFFERSON COUNTY, KENTUCKY.
Corps of Engineers, Louisville, Ky.
For primary bibliographic entry see Field 04A.
W69-06070

THE HYDROLOGY OF THE LEXINGTON AND FAYETTE-COUNTY AREA, KENTUCKY,
Geological Survey, Louisville, Ky.
For primary bibliographic entry see Field 02F.
W69-06084

STAGE-DISCHARGE RELATIONS ON BIG LOST RIVER WITHIN NATIONAL REACTOR TESTING STAION, IDAHO,
Geological Survey, Idaho Falls, Idaho.
R. D. Lamke.
Prepared on behalf of the US Atomic Energy Comm. Geol Surv Open-file Rep IDO-22050, Mar 1969. 29 p, 30 fig, 7 ref.

Descriptors: *Stage-discharge relations, *Streamflow, *Idaho, Floods, Hydrologic data, Flow characteristics, Flow rates, Playas, Dikes, Flood control.
Identifiers: National Reactor Testing Station (Idaho), Big Lost River, Rating curves.

Theoretical stage-discharge relations were computed for 11 selected sites on the Big Lost River system within the National Reactor Testing Station and are shown graphically. These rating curves were computed by various techniques, which are dependent upon the hydraulic characteristics of each site. Relative accuracies of the rating curves are shown by presenting the curves of higher accuracy as solid lines and the curves of lower accuracy by dashed lines. The rating curves apply only for the conditions and for the physical and hydraulic characteristics existing in April 1968. After a large flood the curves could be considerably different because of erosion of the channels, dikes, and road embankments. Also, the curves for the culverts are for conditions of no debris at the entrances and in the barrels. Datum used in this report is mean sea level. (Knapp-USGS)
W69-06204

WATER RESOURCES IN THE GOOSE CREEK-ROCK CREEK BASINS, IDAHO, NEVADA AND UTAH,
Geological Survey, Boise, Idaho.
For primary bibliographic entry see Field 02F.
W69-06206

RESERVOIRS: PROBLEMS AND CONFLICTS,
For primary bibliographic entry see Field 06B.
W69-06207

SUMMARY OF MAXIMUM DISCHARGES IN UTAH STREAMS,
Geological Survey, Salt Lake City, Utah.
G. L. Whitaker.

Utah State Dep Natur Resources Tech Publication No 21, 1969. 42 p, 13 fig, 4 tab, 7 ref.

Descriptors: *Data collections, *Hydrologic data, *Peak discharge, *Utah, Floods, Rainfall-runoff relationships, Runoff, Hydrographs, Stage-discharge relations, Streamflow.
Identifiers: Maximum stream discharges (Utah).

Maximum discharges determined at regular continuous-record stations, at crest-stage stations, and at miscellaneous sites in or near the borders of Utah through September 1967 are compiled in tables of this report. The data are presented separately for the Colorado River Basin and for the Great Basin and are summarized in graphs. Based on available data, figures representing the maximum floods of record are presented both in the graphs and in tabular form. (Knapp-USGS)
W69-06209

SURFACE DRAINAGE CHARACTERISTICS IN VOLUSIA COUNTY, FLORIDA,
Geological Survey, Ocala, Fla.
Darwin D. Knochenmus.
Florida Board of Conserv, Div of Geol Map Ser No 30, Dec 1968. 1 sheet, 5 fig, 1 tab, 2 ref.

Descriptors: *Drainage, *Hydrogeology, *Water table, *Florida, Water levels, Runoff, Surface-groundwater relationships, Drainage systems, Surface drainage, Subsurface drainage, Drainage wells, Aquifers, Groundwater.
Identifiers: Volusia County (Florida).

The surface drainage characteristics of Volusia County, Florida are shown by 4 maps describing drainage basins, rainfall, and runoff, piezometric surface, and feasibility of drainage projects. Hydrogeology has the greatest influence on the runoff distribution of the county. Because surface materials are permeable, rain infiltrates readily to the water table, 5-30 ft below the land surface. Many acres of low elevation are waterlogged and difficult to drain with surface canals because there the piezometric surface is higher than the land surface. (Knapp-USGS)
W69-06216

WATER IN BROWARD COUNTY, FLORIDA,
Geological Survey, Miami, Fla.
H. J. McCoy, and C. B. Sherwood.
Florida Board of Conserv, Div of Geol, Map Ser No 29, Nov 1968. 1 sheet, 9 fig, 7 ref.

Descriptors: *Water resources, *Groundwater, *Surface waters, *Florida, Water management (Applied), Canal seepage, Drains, Saline water intrusion, Water levels, Water table, Water wells, Water yield, Water sources, Water quality.
Identifiers: Broward County (Florida).

A general description of the water resources of Broward County, Florida is presented in a 1-sheet report consisting of text, graphs, and maps. Most water supplies in the county are obtained from the Biscayne aquifer which extends from the surface to over 200 ft deep and consists of sand and limestone. Wells in the thick limestone near the coast yield over 1,000 gpm. The water is hard and suitable for most uses. The effects of rainfall and pumpage on water levels are shown by well hydrographs. Stage-discharge relations of the drainage canals are shown graphically. The canals and the aquifers are hydraulically connected into an integrated flow system which is a physical basis for areal water management to assure long-term supplies of high-quality water. Saline water intrusion is shown by a contour map. (Knapp-USGS)
W69-06217

EFFECTS OF SMALL STRUCTURES ON WATER YIELD IN TEXAS,
Geological Survey, Austin, Tex., and Texas Univ., Austin. Dept. of Civil Engineering.
For primary bibliographic entry see Field 03B.
W69-06218

FLOODS OF THE 1965 WATER YEAR IN MISSISSIPPI,
Geological Survey, Jackson, Miss.
Kenneth V. Wilson, and B. E. Ellison, Jr.
Miss State Board of Water Commissioners Bull 68-2, Sept 1968. 20 p, 4 fig, 1 tab, 1 ref.

Descriptors: *Floods, *Stage-discharge relations, *Mississippi, Surface waters, Streamflow, Hydrologic data, Data collections, Discharge measurement.
Identifiers: Mississippi floods (1965), Flood data.

The floods caused by 'Hurricane Hilda' in October 1964 were the greatest known in southern Mississippi. Unusual floods also occurred in various parts of the State during November and December 1964, and during February 1965. On October 3-4, 1964, as much as 12 1/2 in. of rain fell in the McComb-Brookhaven area in a 24-hr period. The rainfall was widespread, with at least 10 in. falling over an area of 1,300 sq mi, and at least 8 in. falling over an area of 4,000 sq mi. Record floods occurred on many streams draining areas between 10 and 750 sq mi. Bridge and road washouts occurred and agricultural losses were fairly high. As much as 10 in. of rain in a 24-hr period fell at Port Gibson on Nov. 27-28, 1964. The resulting floods were unusually high from small drainage areas between Port Gibson and Jackson, especially in the vicinity of Utica. Less significant floods on small streams occurred in southcentral Mississippi on Dec. 10-11, 1964, as a result of a 4-in. rainfall. Rainfall of 4 to 9 in. fell in northeastern and central Mississippi during the period Feb. 7-12, 1965, and caused unusual floods on the larger streams. Stages and discharges of the significant floods on major streams are tabulated. Frequency curves, hydrographs, and flood profiles are presented. (Knapp-USGS)
W69-06219

HYDROLOGICAL ASPECTS OF WATER MANAGEMENT,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 06B.
W69-06221

SURFACE WATER HYDROLOGY (GENERAL OUTLINE),
Research Inst. for Water Resources Development, Budapest (Hungary).
L. Rakoczi, and K. Szesztay.
2nd Int Postgrad Course on Hydrol Method for Develop Water Resources Manage, Budapest, Hung, Jan-July 1968, Manual No 3, 1968. 108 p, 41 fig, 9 tab, 29 ref.

Descriptors: *Water management (Applied), *Water resources development, *Surface waters, Planning, Floods, Climatology, Hydrology, Runoff, Routing, Data collections, Networks, Hydrologic data, Water quality, Ice, Freezing, Erosion, Water temperature, Water balance, Hydrologic budget.
Identifiers: *Textbooks, Technical manuals, Lecture notes.

The requirements of water management agencies for surface water data and the methods of gathering information are outlined in a technical manual presented as a chapter of a text written for an international postgraduate course in water resources management. The principles of organizing hydrological services involve establishing climatic and hydrologic data collection networks and experimental facilities. Examples are given of national networks already in operation and in the planning stages. The principles of surface water hydrology, including drainage basin morphology, runoff formation, floods, river morphology, erosion, stream water quality, ice, water balance, and thermal regime of standing waters, are discussed. (Knapp-USGS)
W69-06222

ESTIMATION OF SURFACE-WATE RESOURCES,
Research Inst. for Water Resources Developmen Budapest (Hungary).
G. Kienitz, Gy Kovacs, M. Dobo, L. Rakoczi, and O. Starosolszky.
2nd Int Postgrad Course on Hydrol Methods fo Develop Water Resources Manage, Budapes Hung, Jan-July, 1968, Manual No 10, 1968. 221 p 73 fig, 7 tab, 60 ref.

Descriptors: *Water resources, *Water require ments, *Water management (Applied), *Surfac waters, Network design, Data collections, Stream flow forecasting, Hydrograph analysis, Wate supply, Water demand, International waters, Wate storage, Water allocation (Policy), Streamflow Stream gages.
Identifiers: *Textbooks, *Technical manuals.

The determination of surface water resources an the social, legal, and economic aspects of interna tional development of water resources ar discussed in a technical manual presented as chapter of a text written for an international post graduate course in water resources management Inevitably, regional water resources managemen will involve intergovernmental planning and agree ments. Already downstream uses of water are af fected by upstream uses across national boundarie in many parts of the world. Methods are given to calculate regional water availability using stream and lake gaging networks. Estimation of regional demand for water is outlined. Management of streamflow for reliable water supplies, flood prevention, waste dilution, sediment control, and groundwater level maintenance is discussed. (K-napp-USGS)
W69-06229

HYDROLOGY OF WATER STORAGE,
Research Inst. for Water Resource Development, Budapest (Hungary).
B. Csermak, T. Krempels, K. Szesztay, I. V. Nagy, and K. Ubell.
2nd Int Postgrad Course on Hydrol Methods for Develop Water Resources Manage, Budapest, Hung, Jan-July 1968, Manual No 12, 1968. 193 p, 83 fig, 8 tab, 131 ref.

Descriptors: *Water management (Applied), *Reservoir operation, *Water yield, *Hydrology, Water resources, Runoff forecasting, Multiple-purpose reservoirs, Water utilization, Water demand, Water storage, Streamflow, Streamflow forecasting, Reservoir storage, River flow, Dams, River forecasting, Reservoir yield.
Identifiers: *Lecture notes, Reservoir management, Technical manuals, Textbooks.

The hydrological aspects of reservoir planning are discussed in a technical manual presented as a chapater of a text written for an international post-graduate course in water resources management. The topics discussed include types of reservoir, basic hydrological data requirements, methods of yield estimation, dimensions of reservoirs for constant output, criteria for yield estimation, water demand estimation, multiple purpose reservoirs, problems of operation, and operating practices in Hungary and Japan. Site selection, investigation, and runoff zone protection are outlined. Underground storage is briefly discussed. (Knapp-USGS)
W69-06231

LONG-TERM TREND ANALYSES OF WATER QUALITY-A MODEL STUDY OF THE PASSAIC RIVER BASIN,
Rutgers - The State Univ., Newark, N. J. Dept. of Environmental Science; and Geological Survey, Trenton, N. J.
For primary bibliographic entry see Field 05B.
W69-06235

FLOOD PLAIN INFORMATION, RICHLAND COUNTY, SOUTH CAROLINA.
Corps of Engineers, Charleston, S. C.
For primary bibliographic entry see Field 04A.
W69-06238

FLOOD PLAIN INFORMATION, GUADALUPE RIVER, SPRING CREEK AND LONE TREE CREEK, VICTORIA, TEXAS.
Turner, Collie and Braden, Inc., Houston, Tex.
For primary bibliographic entry see Field 04A.
W69-06239

FLOOD PLAIN INFORMATION, SABINE RIVER AND ADAMS BAYOU, ORANGE, TEXAS AREA.
Turner, Collie and Braden, Inc., Houston, Tex.
For primary bibliographic entry see Field 04A.
W69-06240

FLOOD PLAIN INFORMATION, DICKINSON, NORTH DAKOTA DRAINAGE DITCH.
Corps of Engineers, Omaha, Neb.
For primary bibliographic entry see Field 04A.
W69-06241

FLOOD PLAIN INFORMATION, PIGEON CREEK, BENTLEYVILLE, FALLOWFIELD TOWNSHIP AND SOMERSET TOWNSHIP, PENNSYLVANIA.
Corps of Engineers, Pittsburg, Pa.
For primary bibliographic entry see Field 04A.
W69-06242

FLOOD PLAIN INFORMATION, CUMBERLAND RIVER, ROARING RIVER, AND DOE CREEK, GAINESBORO, TENNESSEE.
Corps of Engineers, Nashville, Tenn.
For primary bibliographic entry see Field 04A.
W69-06243

FLOOD PLAIN INFORMATION, KOOKUMCHUCK RIVER, BUCODA, WASHINGTON.
Corps of Engineers, Seattle, Wash.
For primary bibliographic entry see Field 04A.
W69-06244

FLOOD PLAIN INFORMATION, LAWSONS FORK CREEK AND FAIRFOREST CREEK, SPARTANBURG, SOUTH CAROLINA.
Corps of Engineers, Charleston, S. C.
For primary bibliographic entry see Field 04A.
W69-06245

FLOOD PLAIN INFORMATION, SOUTH FORK OF FORKED DEER RIVER AND SUGAR CREEK, HENDERSON, TENNESSEE.
Corps of Engineers, Memphis, Tenn.
For primary bibliographic entry see Field 04A.
W69-06246

FLOOD PLAIN INFORMATION, ARROYO DE LOS CHAMISOS AND ARROYO HONDO, SANTA FE, NEW MEXICO.
Corps of Engineers, Albuquerque, N. Mex.
For primary bibliographic entry see Field 04A.
W69-06247

FLOOD PLAIN INFORMATION, CLARK FORK, MISSOULA, MONTANA.
Corps of Engineers, Seattle, Wash.
For primary bibliographic entry see Field 04A.
W69-06248

WATER RESOURCES INVENTORY OF CONNECTICUT-PART 3, LOWER THAMES AND SOUTHEASTERN COASTAL RIVER BASINS,
Geological Survey, Hartford, Conn.
For primary bibliographic entry see Field 02F.
W69-06250

MEASUREMENT OF PEAK DISCHARGE BY INDIRECT METHODS,
Geological Survey, Washington, D. C.
M. A. Benson.
World Meteorol Organ Tech Note No 90, 1968. 161 p, 105 fig, 16 tab, 36 ref.

Descriptors: *Discharge (Water), *Discharge measurement, *Peak discharge, Stream gages, Channel flow, Spillway crests, Hydraulics, Stage-discharge relations, Weirs, Culverts.
Identifiers: *Indirect discharge measurements, Slope-area method.

The discharge of streams is usually measured by the current-meter method. During flood periods, however, it is frequently impossible or impractical to measure the discharges by this method when they occur. Consequently, many peak discharges must be determined after the passage of the flood by indirect methods such as slope area, contracted opening, flow-over-dam, flow-through-culvert, rather than by direct current-meter measurement. Indirect methods of determining peak discharge are based on hydraulic equations which relate the discharge to the water-surface profile and the geometry of the channel. A field survey is made after the flood to determine the location and elevation of high-water marks and the characteristics of the channel. Detailed descriptions of the procedures used in collecting the field data and in computing the discharge are given for each of the methods. (Knapp- (USGS)
W69-06251

HYDROLOGICAL BENCH MARKS,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 07A.
W69-06252

QUALITY OF SURFACE WATERS FOR IRRIGATION, WESTERN STATES-1961,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 03F.
W69-06253

QUALITY OF SURFACE WATERS FOR IRRIGATION, WESTERN STATES-1960,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 03F.
W69-06254

TRITIUM CONTENT IN THE FIRN LAYERS OF AN ALPINE GLACIER,
Innsbruck Univ. (Austria). Dept. of Physics; and International Atomic Energy Agency (Vienna).
For primary bibliographic entry see Field 02C.
W69-06262

2F. Groundwater

COASTAL EVIDENCES OF GROUND WATER CONDITIONS IN THE VICINITY OF ANAEHOOMALU AND LALAMILO, SOUTH KOHALA, HAWAII,
Hawaii Univ., Honolulu. Water Resources Research Center.
For primary bibliographic entry see Field 03B.
W69-06006

THE MOON'S RESOURCES,
National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center.
For primary bibliographic entry see Field 02E.
W69-06015

CONSTRUCTION OF PIEZOMETERS, AND METHOD OF INSTALLATION FOR GROUND WATER OBSERVATIONS IN AQUIFERS,
Commonwealth Scientific and Industrial Research Organization, Merbein (Victoria). Div. of Horticultural Research.
For primary bibliographic entry see Field 07B.
W69-06019

GROUND-WATER RESOURCES OF MATAGORDA COUNTY, TEXAS,
Texas Water Development Board, Austin.
Weldon W. Hammond, Jr.
Tex Water Develop Board, Rep No 91, Mar 1969. 163 p, 35 fig, 12 tab, 55 ref.

Descriptors: *Groundwater, *Hydrologic data, *Water resources, *Texas, Aquifers, Water yield, Water wells, Water quality, Water levels, Hydrogeology, Water table, Water sources, Rainfall, Water-level fluctuations.
Identifiers: *Matagorda County (Tex).

Groundwater in Matagorda County, Texas, occurs in several formations of Cenozoic age with similar lithology. The formations are composed of interfingering beds and lenses of silt, clay, sand, and gravel, and function as a single water-bearing unit termed the Gulf Coast aquifer. Groundwater moves at 10 to 20 ft per yr from areas of recharge in and north of the county to areas of discharge in the Gulf of Mexico. Use of groundwater in the county has increased from 14 mgd in 1946 to 17 mgd in 1966. Of the 18,600 acre-feet or 17 mgd in 1966, 60% was for irrigation, 20% for industry, 12.5% for public supply, and 7.5% for rural domestic and livestock uses. Water levels in wells are gradually declining, especially in the western part of the county. However, the present pumpage of 18,600 acre-ft per yr (17 mgd) could be continued safely and economically indefinitely. Fresh groundwater containing less than 1,000 ppm dissolved solids is available in most of the county, while slightly saline water containing 1,000 to 3,000 ppm dissolved solids is available in all of the county. Groundwater suitable for irrigation is available in most of the county. On the basis of the transmission capability of the aquifer and upon development of a portion of the water in storage, about 118,000 acre-ft or over 6 times present pumpage could be pumped annually in Matagorda County for the next 100 yr. (Knapp-USGS)
W69-06025

ANNUAL REPORT ON GROUND WATER IN ARIZONA, SPRING 1967 TO SPRING 1968.
Geological Survey, Tucson, Ariz.

Ariz State Land Dep Water Resources Rep No 38, Feb 1969. 54 p, 32 fig, 1 tab.

Descriptors: *Groundwater, *Hydrologic data, *Data collections, *Water levels, *Arizona, Water-level fluctuations, Hydrogeology, Observation wells, Water yield.
Identifiers: Arizona water levels (1967-68).

The groundwater conditions in Arizona, spring 1967 to spring 1968, are described by graphs showing water levels in selected wells, graphs showing estimated pumpage, and maps showing depth to water, change in water levels, and potential well production. In 1967 nearly 5.2 million acre-ft of water was withdrawn, and water levels declined in most of the State. Detailed descriptions of the groundwater situations are given for each physiographic province in the State. (Knapp-USGS)
W69-06026

THE LOCATION OF DEEP AQUIFERS BY RESISTIVITY SOUNDINGS,
MacQuarie Univ., Sydney (Australia). School of Earth Sciences; and Sydney Univ., (Australia). Dept. of Geology and Geophysics.
R. J. Henderson, and D. W. Emerson.
Australian J Sci, Vol 31, No 8, pp 299-300, Feb 1969. 2 p, 1 fig, 7 ref.

Descriptors: *Electrical studies, *Resistivity, *Geologic investigations, *Aquifers, Hydrogeology, Groundwater, Logging (Recording), Electrical well logging.
Identifiers: *Australia, Geophysical groundwater prospecting.

Field tests were made in Australia to study the feasibility of using earth resistivity methods to locate deep aquifers. Electric well logs were used to provide detailed information to check the results of the resistivity soundings made with the Schlumberger array with separations of up to 2 km. Theoretical sounding curves were constructed from geological data, and were very similar to the observed curves. It should be possible to locate an aquifer as deep as 500 m under conditions similar to those in the test area where a confined sandstone aquifer was overlain by alluvium and clay and underlain by volcanic and sedimentary rocks. (Knapp-USGS)
W69-06027

HYDROGEOLOGIC DATA RELATED TO ESTABLISHMENT OF A PUMPING STATION IN THE EVERGLADES NATIONAL PARK, FLORIDA,
Geological Survey, Tallahassee, Fla.
Charles A. Appel, and Howard Klein.
Geol Surv open-file rep, 1969. 36 p, 5 fig, 1 tab, 3 ref.

Descriptors: *Water sources, *Groundwater, *Florida, National Parks, Aquifers, Transmissivity, Water yield, Water levels, Water control, Water distribution (Applied), Water supply.
Identifiers: *Everglades National Park, Water-collection galleries, Streamflow augmentation.

In order to alleviate the effects of prolonged drought on the plant and animal life in the northeastern part of the Everglades National Park, Florida, the National Park Service considered the possibility of pumping groundwater from a collection gallery to replenish deficient water in the Shark River Slough area. Design criteria called for a sustained yield of 100 cfs from a 4,000-ft gallery for as long as 100 days, with a resultant drawdown not to exceed 8 ft in the gallery. Results of tests along the northeastern boundary of the Park showed that the proposed gallery would yield only about 10% of the required rate. Results from an alternate site, from 10 to 14 mi to the south, indicated that a gallery there would have to be at least 20,000 ft long to yield 100 cfs. (Knapp-USGS)
W69-06033

WATER RESOURCES RESEARCH IN VIRGINIA,
Virginia Polytechnic Inst., Blacksburg. Water Resources Research Center.
For primary bibliographic entry see Field 02E.
W69-06039

RECORDS OF OBSERVATION WELLS AND WATER-LEVEL FLUCTUATIONS IN THE ABERDEEN-SPRINGFIELD AREA, BINGHAM AND POWER COUNTIES, IDAHO, IN 1967,
Geological Survey, Boise, Idaho
H. G. Sisco, and M. L. Griffiths.
Geol Surv Basic-Data mimeogr rep, Aug 1968. 27 p, 18 fig, 1 tab, 15 ref

Descriptors: *Observation wells, *Water levels, *Water-level fluctuations, *Data collections, *Idaho, Water wells, Hydrographs, Reservoirs, Irrigation.
Identifiers: Periodic observations, Bingham County, Power County, Aberdeen-Springfield (Idaho)

Records of water level fluctuations in observation wells in the Aberdeen-Springfield area, Bingham and Power Counties, Idaho, are tabulated. The observation well network consists of 21 wells west of the Snake River and east of the Aberdeen and High Line canals in an area irrigated with canal water, 4 wells south of the American Falls Reservoir in an area irrigated with surface water and groundwater, and 8 wells west of the canals in an area irrigated with groundwater. Monthly measurements of depth to water were made in 29 wells. In addition, 2 wells in Bingham County and 3 wells in Power County had recording gages. Information about location, type, depth, use, and altitude of the observation wells is tabulated. In addition to the tables of monthly observations of water levels for each well, hydrographs are used to show water level fluctuations. (Knapp-USGS)
W69-06040

THE PIEZOMETRIC SURFACE OF THE COASTAL PLAIN AQUIFER IN GEORGIA, ESTIMATES OF ORIGINAL ELEVATION AND LONG-TERM DECLINE,
Georgia Univ., Athens.
Robert E. Carver.
Southeastern Geol, Vol 9, No 2, pp 87-99, June 1968. 13p, 3 fig, 1 tab, 26 ref.

Descriptors: *Potentiometric level, *Aquifers, *Drawndown, Georgia, Water level fluctuations, Groundwater, Water levels, Discharge (Water), Observation wells.
Identifiers: Coastal Plain Aquifer (Ga).

The principal source of underground water in the Coastal Plain of Georgia is an artesian aquifer consisting of Eocene to Miocene limestones capped by impervious Miocene sediments. The aquifer is heavily pumped and deep cones of depression in the piezometric surface developed around centers of population and industrial activity. Reports on artesian wells in Georgia published in 1898, 1908, and 1915 provided data which, after selection for reliability, were used to determine the original piezometric surface of the aquifer in an area extending from a line joining Augusta and Fort Gaines to the Atlantic Coast and Florida border. Comparison of the map of the original piezometric surface with a map of the piezometric surface in 1942 indicates significant changes in aquifer pressures between 1880 and 1942, notably a 40 ft decline in head in the area north of Tifton, Georgia. Comparison of the original piezometric surface map with recent data indicates that pressure declined approximately 35 ft in the area near the coast and 75 ft in the area north of Tifton between 1880 and 1966. The longterm effect of heavy pumping around major municipal and industrial centers on the Atlantic Coast is surprisingly far-reaching and suggests that a more extensive network of observation wells is needed to adequately monitor aquifer pressures. (Knapp-USGS)
W69-06043

WATER RESOURCE RECORDS OF THE ECONFINA CREEK BASIN AREA, FLORIDA,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02E.
W69-06051

GROUND-WATER RESOURCES OF GREENVILLE COUNTY, SOUTH CAROLINA,
Geological Survey, Columbia, S. C., and South Carolina State Development Board.
Neil C. Koch.
SC State Develop Board Bull No 38, 1968. 47 p, 11 fig, 25 tab, 21 ref.

Descriptors: *Water resources, *Groundwater, Hydrologic data, *South Carolina, Water levels, Water yield, Water quality, Water wells, Hydrogeology, Aquifers, Water table, Water sources.
Identifiers: Greenville County (SC).

Groundwater in Greenville County, South Carolina, occurs in crystalline rock, saprolite, and overlying sediments. Yields up to 200 gpm are obtained from drilled wells in crystalline rock, and yields up to 5 gpm can be obtained from dug or bored wells in the saprolite or overlying sediments. The best yields can be obtained from wel crystalline rock located in valleys or draws; on slopes have slightly lower yields. Wells loc on hills have yields 1/2 to 1/3 of those in val The average yield of all drilled wells in Green County for which data are available is 17 Wells drilled in mica schist or granite gneiss the highest average yields, about 38 gpm, whe wells drilled in granite, gneiss-schist com biotite-hornblende gneiss, biotite gneiss, and n granite gneiss have average yields from 15 t gpm. Geologic conditions to look for in selecti well site are coarse textured rock, joints and tures, quartz veins, and thick saprolite and ov ing sediments. Most groundwaters are soft; 98 157 samples analyzed had a hardness of less 60 ppm. The iron content of 61% of the sam ranged from 0 to 0.3 ppm. Water from the gn schist complex had the highest iron content; 70 the samples contained more than 0.3 ppm i Surface water is the largest source of suppl Greenville County. It is slightly acidic and lo dissolved solids. The dissolved soilds content creases as the water moves downstream. (USGS
W69-06052

TEST WELL EXPLORATION IN THE MYAK RIVER BASIN AREA, FLORIDA,
Geological Survey, Tallahassee, Fla.
H. Sutcliffe, Jr., and B. F. Joyner.
Florida Div of Geol Inform Circ No 56, 1968. 6 15 fig, 3 tab, 4 append.

Descriptors: *Data collections, *Hydrologic d *Water wells, *Florida, Observation wells, Wa levels, Logging (Recording), Water qua Aquifers, Water sources, Water yield, Drill ho Subsurface investigations.
Identifiers: Myakka River (Florida).

In recent years, difficulties encountered in obta ing groundwater supplies with acceptable chemi characteristics in the Myakka River basin a Florida led to the implementation of a test drill program. Under this program, well drilling and d collection were executed in such a manner that water-producing zones of the local aquife together with the quality and quantity of the wa available, were effectively identified. A st drilling method was utilized which allowed the c lection of formation cuttings, water samples, a water-level data, from isolated zones in the well drilling proceeded. The step drilling procedure described. Hydrologic driller's logs, geophysi logs, and chemical quality of water tables a presented. (USGS)
W69-06053

THE ROLE OF GROUNDWATER IN TH DEVELOPMENT OF WATER RESOURCES,
Water Planning for Israel Ltd., Tel Aviv. Resear Dept.
For primary bibliographic entry see Field 04B.
W69-06054

UNDERGROUND STORAGE OF FLUIDS,
Michigan Univ., Ann Arbor. Dept of Chemical an Metallurgical Engineering; and Texas Univ Austin. Dept. of Petroleum Engineering.
Donald L. Katz, and Keith H. Coats.
Ann Arbor, Mich, Ulrich's Books, Inc, 1968. 575 228 fig, 43 tab, 167 ref, 15 append.

Descriptors: *Underground storage, *Liquid *Gases, *Aquifers, *Reservoirs, Usable storag Natural gas, Oil reservoirs, Borehole geophysic Hydrogeology, Drill holes, Boreholes, Geolog formations, Hydraulics.
Identifiers: Underground fluid storage.

The underground storage of fluids is discussed in comprehensive technical monograph writte primarily for engineers, geologists, and manage working on the design, development, and operatio of storage projects. The topics described in deta are geology of storage, sources of undergroun

geological data, rock properties, fluid properties, well drilling, geophysical well logging, well equipment, fluid flow, aquifer hydraulics, use of gas fields for storage, use of aquifers for storage, storage operation, control of underground gas movement, storage in salt cavities, storage in frozen ground, and liquified natural gas storage. The methods presented for engineering computations include computer programs for well tests and linear programming techniques for aquifer characteristics. Legal and governmental aspects of underground storage and the use of explosions, including nuclear explosions, to create cavities and zones of high permeability are discussed. (Knapp-USGS)
W69-06055

PRELIMINARY REPORT ON THE IRRIGATION POTENTIAL OF DUNN COUNTY, WISCONSIN,
Wisconsin Univ., Madison. Geological and Natural History Survey.
For primary bibliographic entry see Field 02G.
W69-06074

HYDROGEOLOGY AT SHELBYVILLE, ILLINOIS - A BASIS FOR WATER RESOURCES PLANNING,
Illinois State Geological Survey, Urbana.
Keros Cartwright, and Paul Kraatz.
Ill State Geol Surv Environ Geol Note No 15, June 1967. 15 p, 4 fig, 5 ref.

Descriptors: *Hydrogeology, *Aquifers, *Water wells, *Municipal water, *Illinois, Glacial drift, Sands, Gravels, Water yield, Discharge (Water).
Identifiers: Shelbyville (Ill).

The city of Shelbyville, Illinois, obtains its public water supply from 2 sand and gravel aquifers that are contiguous at the site of the present municipal well field southwest of the city. To help the city make long-range plans for future water supplies, a hydrogeologic study of the aquifer system was made. The study outlines the present well field and areas for future water resource development. The potential yield of the well field was found to be more than 3 times the present pumpage. Several methods of water management would be physically feasible, and the physical conditions will allow the city considerable flexibility in planning future water facilities.
W69-06075

GEOLOGIC STUDIES AS AN AID TO GROUNDWATER MANAGEMENT,
Illinois State Geological Survey, Urbana.
For primary bibliographic entry see Field 04B.
W69-06082

THE HYDROLOGY OF THE LEXINGTON AND FAYETTE-COUNTY AREA, KENTUCKY,
Geological Survey, Louisville, Ky.
D. S. Mull.
Lexington and Fayette County Planning Comm Coop Rep, 1967. 24 p, 23 fig, 3 tab, 27 ref.

Descriptors: *Water resources, *Water management (Applied), *Hydrologic data, *Kentucky, Streamflow, Runoff, Aquifers, Groundwater movement, Water supply, Water utilization, Water levels, Recharge, Discharge (Water), Hydrographs, Duration curves, Floods, Waste disposal, Water pollution.
Identifiers: Lexington (Ky), Fayette River, Kentucky River, Recurrence intervals, Flood frequencies.

A study was made of the hydrology of Fayette County, Kentucky to provide information for use by the County Planning Commission and other planning agencies. The annual precipitation averages 43.71 in. or 582 mgd. About 60% is consumed by crops, natural vegetation, evaporation, and man. About 224 mgd leaves the county in streamflow and 16 mgd in groundwater flow through cavernous limestones. During high streamflow, aquifers are recharged at a fairly high rate because of the abundance of joints and solution openings in the underlying limestones. Streamflow is summarized by duration curves for the Kentucky River and its major tributaries. Flood recurrence intervals are also shown graphically. Groundwater levels and flow directions are mapped. Chemical analysis data are tabulated for 9 streams, 29 wells, and 6 springs. Management problems include water pollution, future supply and demand, storm water disposal, and sewage treatment and disposal. (Knapp-USGS)
W69-06084

USE OF GRAVITY SHAFTS FOR GROUND WATER RECHARGE,
North Dakota State Univ., Fargo. Coll. of Civil Engineering.
For primary bibliographic entry see Field 04B.
W69-06202

WATER RESOURCES IN THE GOOSE CREEK-ROCK CREEK BASINS, IDAHO, NEVADA AND UTAH,
Geological Survey, Boise, Idaho.
E. G. Crosthwaite.
Idaho Dep of Reclam Water Inform Bull No 8, Feb 1969. 73 p, 25 fig, 6 tab, 28 ref.

Descriptors: *Water resources, *Groundwater, *Surfaces waters, *Idaho, Recharge, Water yield, Irrigation water, Water wells, Aquifers, Water sources, Water quality, Streamflow, Precipitation (Atmospheric).
Identifiers: Goose Creek-Rock Creek Area (Idaho).

In the Goose Creek-Rock Creek area of Idaho, Utah, and Nevada, 4 aquifers yield enough water for irrigation. The aquifers are Paleozoic limestone, Pliocene Idavada welded tuffs, ash flows, sands, and gravels, Pleistocene and Holocene Snake River basalts, and Pleistocene and Holocene alluvium. Estimated stream yield is 140,000 acre-ft per yr, all of which is used for irrigation. Total aquifer recharge is about 94,000 acre-ft per yr from rainfall and 345,000 acre-ft per yr from irrigation. Total recharge from all sources is about 400,000-500,000 acre-ft per yr. Of the total annual recharge, the Idavada Volcanics take 64,000 acre-ft, basalts take 330,000 acre-ft, and alluvium takes 45,000 acre-ft. About 430 wells pump 185,000 acre-ft per yr. Water levels are declining in areas where aquifers are thin and have low transmissibility, or pumpage is heavy. Most irrigation water has low salinity hazard. Some water from basalt and alluvium has medium to high salinity hazard. Stream water has medium salinity hazard. (Knapp-USGS)
W69-06206

GROUNDWATER LEVELS AND PUMPAGE IN THE PEORIA-PEKIN AREA; ILLINOIS, 1890-1966,
Illinois State Water Survey, Urbana.
Miguel A. Marino, and Richard J. Schicht.
Ill State Water Surv Rep of Invest 61, 1969. 29 p, 43 fig, 5 ref, append.

Descriptors: *Groundwater, *Water levels, *Illinois, Discharge (Water), Water yield, Water supply, Water-level fluctuations, Water wells, Hydrographs, Observation wells, Recharge, Potentiometric level.
Identifiers: Peoria (Ill), Pekin (Ill).

Groundwater resources in the Peoria-Pekin area are developed from sand and gravel aquifers. Water-level fluctuations in the aquifers, influenced by large grounswater withdrawals, are currently monitored in 14 observation wells. The Peoria-Pekin area is covered mostly with glacial drift, except in places where bedrock is exposed. In a large part of the area the glacial drift contains a thick deposit of Sankoty sand immediately above bedrock. Conditions are favorable for development of large water supplies in the Sankoty sand and glacial outwash. Estimated pumpage from wells in the Peoria-Pekin area increased from about 1.5 mgd in 1870 to 80.6 mgd in 1944. The maximum rate of pumpage increase occurred from 1932 to 1933 when pumpage increased from 39.5 mgd to 60.3 mgd. Since 1944 pumpage has decreased erratically to approximately 65 mgd in 1966. Pumpage is concentrated in 5 major pumping centers: the Central Well Field, Sankoty Well Field, North Well Field, East Peoria, and Pekin South areas. Water-level declines, attributed to groundwater wtihdrawals in the Sankoty, the North, and the Central Well Field areas, have established hydraulic gradients from the Illinois River toward pumping centers. East of the Illinois River the groundwater surface contours show a steep gradient toward the river. In the immediate proximity of the river the average slope of the groundwater surface is about 30 ft per mile. (Knapp-USGS)
W69-06208

SELECTED HYDROLOGIC DATA, SOUTHERN UTAH AND GOSHEN VALLEYS, UTAH,
Geological Survey, Salt Lake City, Utah.
R. M. Cordova.
Utah Div of Water Rights Basic-Data Release No 16, 1969. 35 p, 2 fig, 1 plate, 10 tab.

Descriptors: *Data collections, *Hydrologic data, *Utah, Surface waters, Groundwater, Water quality, Water yield, Water wells, Springs, Streamflow, Water levels, Potentiometric level.
Identifiers: Southern Utah Valley, Goshen Valley (Utah).

Basic hydrological data are tabulated for Southern Utah and Goshen Valleys, Utah. The data include well and spring records, water levels, artesian pressures, drillers' logs, stream discharge records, and water chemical analyses. (Knapp-USGS)
W69-06211

GROUND-WATER LEVELS IN NEW MEXICO, 1967,
Geological Survey, Albuquerque, N. Mex.
F. E. Busch, and J. D. Hudson.
N Mex State Eng Basic Data Rep, 1969. 74 p, 30 fig, 36 tab, 41 ref.

Descriptors: *Data collection, *Hydrologic data, *Water levels, *Groundwater, *New Mexico, Observation wells, Water wells, Water-level fluctuations, Groundwater basins, Arid lands.
Identifiers: Periodic observations.

Annual measurements of water level in a network of about 1,500 observation wells in New Mexico are tabulated. The areas of groundwater observation were in 7 major surface-water drainage basins or groups of basins, most of which are in areas where groundwater is used in large quantities for irrigation, municipal, or industrial purposes. Maps and hydrographs are used to show water-level changes. Precipitation data are tabulated. (Knapp-USGS)
W69-06212

GROUND-WATER RESOURCES AND RELATED GEOLOGY OF NORTH-CENTRAL SPOKANE AND SOUTHEASTERN STEVENS COUNTIES, WASHINGTON,
Geological Survey, Washington, D. C.
Denzel R. Cline.
Wash State Dep Water Resources, Water Supply Bull No 17, 1969. 195 p, 10 fig, 2 plate, 11 tab, 27 ref, 1 append.

Descriptors: *Water resources, *Groundwater, *Washington, *Water yield, Discharge (Water), Water quality, Specific capacity, Aquifers, Hydrologic data, Water levels, Hydrogeology, Water table, Water sources, Quaternary period.
Identifiers: *Spokane (Wash).

Groundwater in the Spokane area, Washington, is found in aquifers in Quaternary loess, sand, alluvium and glacial drift deposits, Tertiary basalts and sands, and pre-Tertiary basement granites and metamorphic rocks. The basement rocks yield as much as 35 gpm to wells but some wells yield no water. The Tertiary rocks generally yield less than 35 gpm. The Quaternary rocks are several hundred ft thick in valleys and yield several thousand gpm with only a few ft of drawdown. Water levels are generally less than 100 ft below the land surface, but under mesas the deepest levels are below 500 ft. Recharge is probably about 1/5 of precipitation, or about 160,000 ac-ft/yr. In 1964, approximately 9 billion gal was pumped in the area, about 90% from unconsolidated deposits in the Spokane Metropolitan area. There has been no regional water-level decline. Most well water is hard and generally of good quality except where iron is excessive. (Knapp-USGS)
W69-06213

WATER IN BROWARD COUNTY, FLORIDA,
Geological Survey, Miami, Fla.
For primary bibliographic entry see Field 02E.
W69-06217

HYDROLOGICAL ASPECTS OF WATER MANAGEMENT,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 06B.
W69-06221

HYDROLOGY OF GROUNDWATER (GENERAL OUTLINE),
Research Inst. for Water Resources Development, Budapest (Hungary).
K. Ubell.
2nd Int Postgrad Course on Hydrol Method for Develop Water Resources Manage, Budapest, Hung, Jan-July 1968, Manual No 4, 1968. 105 p, 46 fig, 2 tab, 44 ref.

Descriptors: *Hydrogeology, *Groundwater movement, Water yield, Permeability, Porosity, Transmissivity, Aquifers, Aquicludes, Water levels, Water level fluctuations, Water table, Springs, Water wells.
Identifiers: Groundwater hydrology, Textbooks, Technical manuals.

The principles of groundwater hydrology are outlined in a technical manual presented as a chapter of a text written for an international postgraduate course in water resources management. Rocks are classified according to the nature, interconnection, and volume of interstices. The occurrence of groundwater, its management, and its natural discharge are discussed. Groundwater level fluctuations due to evaporation, pumping, wind, tides, earthquakes, streamflow, recharge, and runoff are described. Steady and unsteady saturated and unsaturated groundwater flow are characterized and equations are given for flow calculations. (Knapp-USGS)
W69-06223

ESTIMATION OF GROUNDWATER RESOURCES,
Research Inst. for Water Resources Development, Budapest (Hungary)
M. Erdelyi, J. Galfi, G. Ollos, K. Ubell, and E. Varrok.
2nd Int Postgrad Course on Hydrol Methods for Develop Water Resources Manage, Budapest, Hung, Jan-July 1968, Manual No 11, 1968. 273 p, 117 fig, 3 tab, 61 ref.

Descriptors: *Water resources, *Groundwater, Water yield, Groundwater movement, Hydrogeology, Electrical well logging, Seismic studies, Electrical studies, Geophysics, Model studies, Hydraulic models, Analog models, Computer models, Water management (Applied).
Identifiers: *Technical manuals, Hydrological exploration, Groundwater resource estimation, Technical manuals, Textbooks, Pumping tests, Well testing.

Techniques for conducting groundwater or hydrogeological investigations and evaluating groundwater resources are given in a technical manual presented as a chapter of a text written for an international postgraduate course in water resources management. The methods of exploration discussed include surficial mapping, the use of air photos, earth resistivity surveys, thermal surveys, and electrical well logging. Hydrological investigation strategy is discussed for forested areas, uncovered areas, and sedimentary lowlands. Methods for the collection and evaluation of subsurface data are outlined. Equations and methods for the study of well hydraulics, steady flow, unsteady flow, aquifer leakage, pumping tests, drawdown analysis, image methods of well test analysis, the analysis of multiple well systems, and well development, are given. Groundwater theory is discussed and illustrated with solved problems. Model studies and modeling methods including analog models and computer models are described. The principles of estimating groundwater resources and safe yield used in the U.S., USSR, Germany, and Hungary are outlined. (Knapp-USGS)
W69-06230

ISOTOPE HYDROLOGY OF THE ARTESIAN AQUIFERS OF THE STYRIAN BASIN, AUSTRIA,
International Atomic Energy Agency, Vienna (Austria). Section of Hydrology.
For primary bibliographic entry see Field 02K.
W69-06249

WATER RESOURCES INVENTORY OF CONNECTICUT-PART 3, LOWER THAMES AND SOUTHEASTERN COASTAL RIVER BASINS,
Geological Survey, Hartford, Conn.
Chester E. Thomas, Michael A. Cervione, Jr., and I. G. Grossman.
Conn Water Resources Bull No 15, 1968. 105 p, 45 fig, 4 plate, 41 tab, 123 ref.

Descriptors: *Water Resources, *Surface waters, *Groundwater, *Connecticut, Streamflow, Runoff, Precipitation (Atmospheric), Water wells, Aquifers, Hydrologic data, Data collections, Water quality, Water levels, Water sources.
Identifiers: Lower Thames River basin (Connecticut).

The lower Thames and southeastern coastal river basins of Connecticut have a relatively abundant supply of water of generally good quality. Annual precipitation ranges from about 32 to 65 inches and averages about 48 inches. For the 30-yr period 1931 through 1960, the annual runoff from the report area averaged nearly 26 inches. A total annual average of 860 billion gal is available. Stratified drift is the only aquifer generally capable of yielding more than 100 gpm to individual wells. It covers about 20% of the area and occurs chiefly in lowlands where it overlies till and bedrock. The permeability of the coarse-grained stratified drift averages about 1,500 gpd per sq ft. Wells tapping this unit yield from 4 to 880 gpm and average 146 gpm. Fine-grained stratified drift has an average permeability of about 300 gpd per sq ft and can usually yield supplies sufficient for household use to dug wells. Bedrock and till are widespread but generally provide only small water supplies. Bedrock is tapped chiefly by drilled wells, about 90% of which will supply at least 3 gpm. The permeability of till ranges from about 0.2 gpd per sq ft to 120 gpd per sq ft. Long-term yields estimated for 18 areas of stratified drift especially favorable for development of large groundwater supplies ranged from 1.3 to 66 mgd. The chemical quality of water in the report area is generally good to excellent. Only 12% of the wells sampled yielded water with more than 200 ppm of dissolved solids and only 8% yielded water with more than 120 ppm of hardness. (Knapp-USGS)
W69-06250

HYDROLOGICAL BENCH MARKS,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 07A.
W69-06252

2G. Water in Soils

NON-EQUILIBRIUM THERMODYNAMICS OF THE SOIL-WATER SYSTEM,
Agricultural Univ., Wageningen (Netherlands). Lab. of Soils and Fertilizers.
P. H. Groenevelt, and G. H. Bolt.
J Hydrol, Vol 7, No 4, pp 358-388, Apr 1969. 31 p, 1 tab, 14 ref.

Descriptors: *Thermodynamics, *Soil water movement, Aqueous solutions, Energy transfer, Entropy, Enthalpy, Free energy, Mass transfer, Heat transfer, Temperature, Physicochemical properties, Soils, Porous media, Saline water systems, Osmosis.
Identifiers: *Non-equilibrium thermodynamics, Gradients.

The use of thermodynamics in studying the soil water system is reviewed. A combination of the Gibbs equation of thermostatics, with appropriate conservation equations, is shown to yield an expression for the local production of entropy accompanying the flow of heat and mass. For viscous flow this local entropy production is not related unambiguously to the local rate of loss of pressure and potential energy, as part of the energy may be transferred to the environment in the form of viscous stress energy or stored as kinetic energy. The application of this equation to flow in porous media requires its integration over a finite volume as only surface averaged fluxes and potential differences over finite distances are accessible for experimental determination. In the process of integration the above energy transfer terms tend to disappear, yielding a straightforward expression for the entropy production, in terms of the 'macroscopic' gradients of the temperature and thermodynamic potentials. A regrouping of terms is shown to yield an alternative expression in terms of the fluxes of heat and soil solution, the diffusion fluxes of salts, and the electric current. For the single salt system the conjugated forces are then the gradients of the temperature, hydraulic head, osmotic pressure, and electric potential. The magnitude of transport coefficients in isothermal systems is calculated for an assumed model based on the presence of an electric double layer as the main cause of the selective action of the porous system on transport processes. (Knapp-USGS)
W69-06016

FACTORS RESTRICTING INFILTRATION RATES ON DECOMPOSED GRANITIC SOILS,
Nevada Univ., Reno. Coll. of Agriculture.
John T. Cory, and Robert J. Morris.
Water Resources Res Center Proj Rep No 11, Desert Res Inst, pp 1-18, July 1968. 18 p, 2 fig, 5 tab, 13 ref. OWRR Project A-020-NEV.

Descriptors: *Organic soils, *Wettability, *Forest soils, *Forest fires, Permeability, Soil physical properties, Soil chemical properties, Wetting, Organic matter.
Identifiers: Non-wettable soils, Fired soils.

A preliminary report is given on the effects of physical and chemical relationships that influence the movement of water into granitic soils. The soil samples selected were obtained in brushland and pine covered areas representing both natural unburned and burned habitats. Organic material accumulated from forest litter decomposition or fungi activity restrict water flow in a 1/2 to 1 in. soil layer beneath the exposed soil surface. When fired, the organic layer appears to diffuse and/or distill downward to a depth of from 1 to 2 1/2 in. and increase in band width depending on the time and temperature of the exposure. As the organic matter

from fired soils causes a significant greater water repellency effect and a change in molecular composition it is postulated that the repellent layer formed under these conditions may represent a partially polymeric or silica-organic system. (Knapp-USGS)
W69-06041

INFILTROMETER STUDIES ON NON-WETTABLE SOILS ON EAST SIERRA NEVADA,
Nevada Univ., Reno. Coll. of Agriculture.
Syed B. Hussain, C. M. Skau, and R. O. Meeuwig.
Water Resources Res Center Proj Rep No 11, Desert Res Inst, pp 19-28, July 1968. 10 p, 1 tab, 9 ref. OWRR Project A-020-NEV.

Descriptors: *Organic soils, *Wettability, *Forest soils, Forest fires, Permeability, Soil physical properties, Soil chemical properties, Wetting, Organic matter.
Identifiers: Non-wettable soils, Fired soils.

Some forest soils on the eastern slopes of the Sierra Nevada near Mt. Rose are non-wettable, probably because of the presence of organic matter from pine litter. Infiltrometer plots, 30 1/2-by-20 in., were located in pure stands of pine, manzanita and tobaccobrush with 100% litter cover to test the differences in overland flow and sediment yield among the 3 cover types. Tests were also made on plots where mat-like pine litter was pealed off leaving bare soil. Results of these 'bared pine plots' were compared with those of bare soil plots in the open patches to differentiate the effect, if any, of pine litter on wettability of the underlying soil from its physical effects of restraining overland flow and sediment yield. Runoff-erosion measurements were made in another pine stand after an intense fire that consumed all litter. If litter is removed by fire, retention capacity of soil is not decreased as much as it would be if removal were effected by some other means. This may be due to the water-holding-capacity of ash on burned plots. Fire appears to intensify non-wettability in soil as revealed by comparison of burned and burned-disturbed plots. Retention and sediment yield data are tabulated. (Knapp-USGS)
W69-06042

THE MEASUREMENT OF THE HYDRAULIC CONDUCTIVITY OF UNSATURATED POROUS MATERIALS UTILIZING A ZONE OF ENTRAPPED AIR,
Agricultural Research Service, Phoenix, Ariz. Water Conserv Lab.
K. K. Watson.
Soil Sci Soc Amer Proc, Vol 31, No 6, pp 716-720, Nov-Dec 1967. 5 p, 10 fig, 13 ref.

Descriptors: *Hydraulic conductivity, *Permeameters, *Soils, Unsaturated flow, Soil water movement, Permeability, Unsteady flow, Pore pressure, Wetting, Saturation, Soaking.
Identifiers: Air entrapment permeametry, Pore air pressure.

A steady-state method for determining the major portion of the hydraulic conductivity-water content relationship of reasonably coarse-grained unsaturated porous materials is presented. In the method, an initially saturated column of the material, in the process of draining to a water table at its base, is rewet at an appropriate time at its upper surface from a ponded supply. This occasions an increase in the pore air pressure in the zone of air entrapped in the profile between the wetting and draining fronts. Two physical consequences of this flow system, the formation of a bell-shaped water content profile and the rapid attainment of steady-state conditions, allow the determination of the conductivity-water content relationship. Precautions to be taken in using the method are outlined, and experimental details are discussed. Two sets of experimental results are documented. (Knapp-USGS)
W69-06071

SOIL-WATER PROPERTIES COMPUTED FROM TRANSIENT FLOW DATA,
California Univ., Riverside. Dept. of Soils and Plant Nutrition.
L. V. Weeks, and S. J. Richards.
Soil Sci Soc Amer Proc, Vol 31, No 6, pp 721-725, Nov-Dec 1967. 5 p, 2 fig, 6 tab, 6 ref.

Descriptors: *Hydraulic conductivity, *Soil water movement, *Permeameters, *Unsaturated flow, Soils, Permeability, Unsteady flow, Pore pressure, Wetting, Saturation, Soaking, Hydraulic gradient, Diffusion, Computer programs.
Identifiers: Transient flow permeameter.

A method is given for calculating water conductivity of unsaturated soil by measuring suction heads during transient changes of moisture content in a horizontal soil column. Absolute values of slopes of the soil moisture characteristic curve are used to calculate soil water diffusivity. The method requires neither difficult boundary condition computation nor equilibrium flow conditions. A FORTRAN IV program is available to reduce the data. Water conductivity values are independent of hydraulic gradients over a wide range of gradient values. Relative errors between measured and calculated diffusivity values were less than 50% in 74% of 288 measurements. Errors in water conductivity were less than 50% in 83% of 288 measurements. (Knapp-USGS)
W69-06072

PRELIMINARY REPORT ON THE IRRIGATION POTENTIAL OF DUNN COUNTY, WISCONSIN,
Wisconsin Univ., Madison. Geological and Natural History Survey.
Perry G. Olcott, Francis D. Hole, and G. F. Hanson.
Wis Univ Geol and Nat Hist Surv Spec Rep No 1, July 1967. 17 p, 6 fig, 4 tab.

Descriptors: *Irrigation, *Water supply, *Soils, *Wisconsin, Groundwater, Aquifers, Sandstones, Glacial drift, Water yield, Water quality, Drainage, Infiltration, Soil physical properties, Soil chemical properties, Irrigation water, Irrigation wells, Hydrogeology, Hydrologic data.
Identifiers: Dunn County (Wis), Irrigation potential.

The suitability of soils for irrigation and the availability of groundwater are used to assess the irrigation potential of Dunn County, Wisconsin. Wells of 500-1000 gpm probably can be developed in most parts of the county, which is underlain by the Galesville, Eau Claire, and Mt. Simon sandstones, with an aggregate thickness of 380-450 ft. About 1/3 of the county is covered with nearly level sands and loams which are largely irrigable. Feasibility of irrigation depends on the acreage that can be irrigated as a unit. Irrigation is not expected to have a significant effect on the groundwater reservoir until a large number of wells are operated, by which time it will be possible to calculate the best spacing of wells to minimize the effect of pumping on water levels. (Knapp-USGS)
W69-06074

SOIL PHYSICS,
Research Inst. for Water Resources Development, Budapest (Hungary).
A. Kezdi.
2nd Int Postgrad Course on Hydrol Methods for Develop Water Resources Manage, Budapest, Hung, Jan-July 1968, Manual No 5, 1968. 97 p, 56 fig, 2 tab.

Descriptors: *Soil physical properties, *Soil water movement, *Soil physics, *Soil mechanics, Mechanical properties, Mohr failure theory, Seepage, Soil dynamics, Soil pressure, Soil strength, Soil moisture, Soil stability, Soil compaction.
Identifiers: *Technical manuals, Textbooks.

The soil properties important in water resources studies are described in a technical manual presented as a chapter of a text written for an international postgraduate course in water resources management. The soil properties that are important from a practical standpoint are permeability, compressibility, and shear strength. Soil stresses caused by seepage, unsaturated flow, and saturated flow are analyzed and methods given for their calculation. The application of the theory of elasticity to soil stress analysis is given. The principles of soil water movement are discussed and methods for its calculation are presented. Criteria for soil strength failure and methods of strength calculation are discussed. (Knapp-USGS)
W69-06224

2H. Lakes

ECOLOGICAL RELATIONSHIPS OF ORGANIC MATTER AND BACTERIA IN TUTTLE CREEK RESERVOIR,
Kansas State Univ., Manhattan.
John O. Harris.
Final Project Report-Kansas Water Resources Research Institute, July 1968. 11 p. OWRR Project A-012-KAN.

Descriptors: *Reservoir microbiology, *Flood microbiology, Water populations, *Reservoir pollution, Food chain, Productivity, Zooplankton, Self-purification, Energy sources.

A detailed study of the bacteria in water of Tuttle Creek Reservoir was conducted from March 1966 to March 1968. The bacterial population is generally low as compared with mid-Western rivers. The primary factor in determining the types and numbers of bacteria appears to be the impoundment of runoff and flood waters of the Big Blue river and its tributaries. Microorganisms present are predominantly soil types. Incomplete data indicate zooplankton feed extensively on the bacteria. Sewage type bacteria are normally absent from the reservoir during times between flood inflow. Self-purification is rapid. A technique consisting of incremental additions of various possible limiting nutrients, incubation, and characterization of the resulting populations was developed. Results indicate organic matter (available energy), nitrogenous materials, and phosphates all limit microbial growth in the reservoir. This short term study emphasizes the need for continued research on reservoir microbiology especially as it relates to the food chain and over-all water quality.
W69-06014

MOUNTAIN AND DESERT LAKES IN SOUTHERN KAZAKHSTAN, THEIR RESOURCES AND METHODS OF ECONOMIC DEVELOPMENT,
G. G. Muravlev.
Transl JPRS Rep No 45, 063, from Vestnik Akademii Nauk Kazakhskoy SSR, Alma-Ata, pp 38-45, Oct 1967. 8 p, 2 tab.

Descriptors: *Lake basins, *Water resources, *Developed waters, *Economics, Geography, Geology, Alluvium, Karst, Precipitation, Water supply, Water storage, Runoff, Groundwater, Vegetation, Aquatic life, Recreation facilities, Water level fluctuations, Exploitation, Irrigation, Saline lakes.
Identifiers: *Southern Kazakhstan, USSR.

By assuming that the small lakes of Kazakhstan can be conveniently regarded as peculiar geographic complexes and landscapes the Kazakhstan lakes were investigated on the basis of geological, geochemical, geographical, and hydrological data recorded by earlier investigators. The study shows that Kazakhstan has more than 6,500 lakes of about 1 sq km or more area, 21,000 lakes 0.3 km or more in length, and about 35,000 lakes covering an areas of 1 ha or more. More than 3,000 artificial reservoirs and ponds exist. In general the study shows that the lakes in the mountain regions differ

considerably from those in the desert zone in the structure of the basins, in the processes that take place in them, and in the volume and development of their resources. The former lakes are fed by running fresh-water, whereas the lakes of the second type have little or no drainage and are mineralized in varying degrees. Rational and efficient utilization of these lake resources requires some transformation of the lakes by modifying the basin, water-salt balance, and composition of the organisms present in the lakes and shore areas. (Gabriel-USGS)
W69-06073

DENSITY FLOW REGIME OF FRANKLIN D. ROOSEVELT LAKE,
Battelle-Northwest, Richland, Wash. Dept. of Environmental Health and Engineering; and Bureau of Commercial Fisheries, Seattle, Wash. Fish Passage Research Program.
Robert T. Jaske, and George R. Synder.
ASCE Proc, J Sanit Eng Div, Vol 93, No SA3, Psp 5272, pp 15-28, June 1967. 14 p, 11 fig, 9 ref, 1 append.

Descriptors: *Washington, *Reservoirs, *Thermal stratification, *Density currents, *Water circulation, Density stratification, Columbia River, Water temperature.
Identifiers: Lake Roosevelt (Wash).

The thermal regime of Lake Roosevelt for the summers of 1964 and 1965, when compared with Yih and the Laboratory studies of Debler, shows good agreement regarding the position of the interfacial layer between the upper relatively stagnant zone and the region of primary flow transport. Further study of the temperature data and confirmation by a limited amount of current measurement shows the location of a second, lower interface roughly conforming to the upper boundary. During the season when stratification occurs, the resulting jet flow travels in a flat, undulating fashion, at times rising above the level of the discharge. Existing theory appears inadequate to fully predict this behavior, although an empirical relationship can be derived to perform engineering analysis. The study confirms the necessity to consider density currents in the management of special releases and in thermal and chemical material balances. Furthermore, the dynamic conditions within the reservoir distort the resulting flow jets to the extent that cooler masses can be by-passed. Another result is the blocking of the formation of 'normal' current jets, and, as a consequence, Lake Roosevelt fills with cool water by displacement from the north without any significant horizontal redistribution.
W69-06076

EUFAULA RESERVOIR AERATION RESEARCH-1968,
Robert S. Kerr Water Research Center, Ada, Okla.
For primary bibliographic entry see Field 05G.
W69-06255

AGE AND GROWTH OF WHITE BASS IN ONEIDA LAKE, NEW YORK,
Cornell Univ., Ithaca, N. Y. Dept. of Conservation.
For primary bibliographic entry see Field 05C.
W69-06275

BEHAVIOR OF HUMIC ACID IN RECENT LAKE SEDIMENTS TOWARD SODIUM HYDROXYDE AQUEOUS SOLUTION AT THE EXTRACTION (IN JAPANESE),
Akira Otsuki, and Takashisa Hanya
Misc Rept Res Inst Nat Resources, Tokyo, No 69, pp 23-33, 1967. 15 fig, 5 tab, 12 ref. English summary

Descriptors: *Humic acids, *Lakes, *Sediments, Carbon cycle, Chemical analysis, Chemical degradation, Diagenesis, Limnology, Organic compounds, Organic matter, Soil analysis, Soil chemistry, Temperature, Water chemistry.
Identifiers: *Extraction methods, *Hymatomelanic, *Lake Haruna (Japan), Infrared spectoroscopy.

Consideration of the nature of organic matter in recent sediments is important from the point of view of the carbon cycle in lakes. The concept of soil humic substances was adapted to a study of organic matter in such sediments. They studied conditions of NaOH concentration and temperature for extraction of raw humic acid from recent sediments of Lake Haruna, Japan, and examined changes in their infrared spectra to determine alterations in humic acid and hymatomelanic acid (methanol soluble fraction). Spectra of humic acid obtained, under their conditions, showed no change, but those of hymatomelanic acid changed considerably, thus providing some evidence for the relationships between humic acid and hymatomelanic acid. (Eichhorn-Wis)
W69-06278

A BIOLOGICAL TEST FOR DETERMINING THE POTENTIAL PRODUCTIVITY OF WATER,
Vermont Univ., Burlington. Dept. of Zoology.
For primary bibliographic entry see Field 05A.
W69-06279

RECOVERY OF ORGANICS FROM A EUTROPHIC LAKE BY THE CARBON ADSORPTION TECHNIQUE,
Wisconsin Univ., Madison. Hydraulic Lab.; and Wisconsin Univ., Madison. Water Chemistry Lab.
For primary bibliographic entry see Field 05A.
W69-06282

MOVEMENT OF RADIOSODIUM IN A CHEMICALLY STRATIFIED LAKE,
Wisconsin Univ., Madison. Dept. of Zoology.
Gene E. Likens, and Arthur D. Hasler.
Science, Vol 131, pp 1676-1677, June 1960. 1 fig, 4 ref.

Descriptors: *Radioecology, *Meromixis, *Lakes, Carbonates, Currents (Water), Density stratification, Diffusion, Limnology, Radioactive waste disposal, Seiches, Stratification, Sulfides, Water chemistry, Water circulation, Wisconsin.
Identifiers: *Radiosodium, *Experimental limnology, Anoxia, Bog lakes, Chemocline, Eddy diffusion, Mixolimnion, Monimolimnion, Scintillation detection, Sodium-24, Stewart's Dark Lake (Wis), Temperate lakes.

Authors introduced radiosodium (Na-24) as an approximate point source at 8 meters depth in meromictic Stewart's Dark Lake, Wisconsin (area: approximately 2 acres; maximum depth: 8.8 meters; average depth: 4.3 meters; thermally and chemically stratified). They observed dispersal at various depths by submerging a scintillation detector along three transects of the lake. Radiosodium dispersed horizontally at an average rate of 18 meters/day. No appreciable vertical movement of radioactivity not attributable to density differences between the radioactive solution and the lake water at release was detectable. Authors suggest two possible hypotheses for the rapid movements observed: (1) physical transport as influenced by eddy diffusion, currents, and internal seiches; and (2) biological transport of the radionuclide within the lake. (Eichhorn-Wis)
W69-06283

SOURCES OF ELEMENTAL NITROGEN IN FERMENTATION GASES,
Wisconsin Univ., Madison. Water Chemistry Lab.
For primary bibliographic entry see Field 05C.
W69-06285

2J. Erosion and Sedimentation

THORIUM AND URANIUM CONCENTRATIONS AND ISOTOPE RATIOS IN RIVER SEDIMENTS,
Yale Univ., New Haven, Conn. Dept. of Geology.
Martha R. Scott.
Earth and Planetary Sci Lett, Vol 4, No 3, pp 245-252, May 1968. 8 p, 3 fig, 2 tab, 33 ref. Grant NAT (30-1) 2912-AEC.

Descriptors: *Sediments, *Organic matter, *Uranium radioisotopes, Clays, Alluvium, Sands, Particle size, Provenance, Streams, Water chemistry, Adsorption.
Identifiers: *Thorium, *Uranium, Complex ions.

Sediments from 5 rivers in the eastern and southern United States were divided into several size fractions and analyzed for thorium and uranium isotope concentrations. The U-238 decay series exhibits disequilibrium as a result of weathering. The U-234/U-238 activity ratio is less than unity in sediment derived from well-leached soils and greater than unity in sediment containing relatively large amounts of organic material from organic-rich surface layers of soil profiles. Th-230 exists in excess of equilibrium amounts relative to its parent U-234 in the fine fraction of most of the sediments analyzed. The thorium concentration and Th-230 excess are significantly higher in the 2-0.2 microns and less than 0.2 micron size fractions than in the 2-20 micron fractions, indicating adsorption by clays, complexing with sesquioxides, or possible concentration in resistates. Unsupported Th-230 is being added to deep-sea sediments at a maximum rate of 0.5 dpm/sq cm/1000 yr; therefore, detrital material is not a significant source of excess Th-230 in deep-sea sediments. (Knapp-USGS)
W69-06045

THE EFFECT OF LOOSE BLOCKS ON THE RATE OF SEDIMENT TRANSPORT,
California Univ., Berkeley. Hydraulic Engineering Lab.
D. L. Aramayo.
Calif Univ Water Resources Center Contrib No 118, Feb 1967. 39 p, 5 fig, 4 plate, 2 tab, 4 ref. WRC Proj No W118-IU-67.

Descriptors: *Sediment control, *Sediment transport, *Channel erosion, *Model studies, *Hydraulic models, Roughness (Hydraulic), Open channel flow, Sedimentation rates, Sediment discharge, Sediment load, Flow resistance, Turbulence, Fluid friction, Hydraulic design.
Identifiers: Sediment transport reduction.

In flume experiments on the effect of loose concrete blocks of various shapes and spacing on stream beds in reducing degradation, no definite conclusions were reached as to feasibility. When the blocks were very closely spaced they increased turbulence enough to prevent dune and ripple formation, and increased the rate of sediment transport by reducing bed form roughness. Optimum spacing of blocks is close enough to add bed roughness but distant enough to allow dune and ripple formation. This spacing is 15-20 diameters. Triangular pyramids were not stable on alluvial beds because of scour and undermining at their leading edges. Angle iron jacks followed the same spacing criteria as blocks; there was significant transport reduction at a spacing of over 15 diameters. (Knapp-USGS)
W69-06083

USE OF GRAVITY SHAFTS FOR GROUND WATER RECHARGE,
North Dakota State Univ., Fargo. Coll. of Civil Engineering.
For primary bibliographic entry see Field 04B.
W69-06202

SEDIMENT TRANSPORTATION IN ALLUVIAL STREAMS,
Research Inst. for Water Resources Development, Budapest (Hungary).
J. L. Bogardi.
2nd Int Postgrad Course on Hydrol Methods for Develop Water Resources Manage, Budapest, Hung, Jan-July 1968, Manual No 13 1968. 133 p, 35 fig, 40 ref.

Descriptors: *Sediment transport, Bed load, Suspended load, Water management (Applied), Sedimentation rates, Sediment load, Sedimentology, Sediment yield, Hydraulics, Particle shape, Particle size, Setting velocity, Sampling, Laboratory tests, Flumes, Hydraulic models, Mathematical models.
Identifiers: *Textbooks, *Technical manuals.

Sediment transport and sediment sampling are discussed in a technical manual presented as a chapter of a text written for an international postgraduate course in water resources management. Both empirical and theoretical descriptions of sediment movement are examined in detail. Hydraulic and mathematical model studies of bed load and suspended load movement are described and evaluated. The basic theories of the relationship of stream hydraulic regime to sediment movement are reviewed and discussed with examples taken from field and laboratory studies. Recent work in the US, USSR, and Hungary is reviewed. (Knapp-USGS)
W69-06232

KANSAS RIVER, BONNER SPRINGS TO MOUTH, DEGRADATION OF CHANNEL,
Geological Survey, Lawrence, Kans.
L. W. Furness, C. D. Albert and R. B. Leonard.
Geol Surv open-file rep, Feb 1967. 18 p, 5 fig, 2 plate, 1 tab.

Descriptors: *Degradation (Stream), *Stream erosion, *Kansas, Rivers, Sediment yield, Sands, Sand pits, Sediment transport, Construction materials.
Identifiers: *Kansas River (Kans).

The stage of low discharges in the Kansas River between Bonner Springs and Turner Bridge degraded an average of 2.6 ft from 1952-1965 ft. Degradation could be caused by increased regulation upstream, change in channel capacity, change in slope, change in sediment load, or removal of sand. Investigation of these factors showed that only sand removal is significant. The quantity of sand mined would have degraded the river 13.2 ft between 1939 and 1965 without upstream sediment supply, and actually resulted in 2.6 ft of net degradation. (Knapp-USGS)
W69-06256

EROSIVE PROCESSES WHICH ARE LIKELY TO ACCENTUATE OR REDUCE THE BOTTOM RELIEF OF VALLEY GLACIERS,
Hans Rothlisberger.
Comm of Snow and Ice, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 79, pp 87-97, 1967. 11 p, 3 fig, 1 tab, 12 ref.

Descriptors: *Glaciers, *Erosion, Movement, Rheology, Friction, Ice, Mechanical properties, Shear stress, Shear drag.
Identifiers: Glacial chipping, Subglacial stream erosion.

Glacial erosion, particularly by particles in the base of the ice, is discussed. Inclusions collected at the bergschrund come into contact with the bed downstream, but additional fragments move downward through the ice from surface sources. Some processes involved in the downward movement of particles are bottom melting by geothermal heat, bottom melting by friction, melting by friction of flowing water, melting by heat transported in water, rotation of inclusions, and changing of ice thickness by extension or compression. Glacial valleys are commonly too large to have been produced exclusively by abrasion by surface-supplied particles. Other processes of erosion operating in glaciers are subglacial stream erosion and glacial chipping of bed material. Any chipped particles also become abrasive tools, greatly increasing the erosive effect of the chipping. (Knapp-USGS)
W69-06259

SALTS AND ASSOCIATED PHENOMENA OF THE TERMINI OF THE HOBBS AND TAYLOR GLACIERS, VICTORIA LAND, ANTARCTICA,
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 02C.
W69-06266

2K. Chemical Processes

CARBONATE SCALE IN ROMAN AND MODERN CANALS IN THE JORDAN VALLEY,
Food and Agriculture Organization of the United Nations, Iraklion (Crete).
For primary bibliographic entry see Field 08A.
W69-06017

AN EVALUATION OF SOME METHODS FOR THE DETERMINATION OF FLUORIDE IN POTABLE WATERS AND OTHER AQUEOUS SOLUTIONS,
Ministry of Technology, London (England). Lab. of Government Chemist.
For primary bibliographic entry see Field 05F.
W69-06037

DEAD SEA BRINES: DEGREE OF HALITE SATURATION BY ELECTRODE MEASUREMENTS,
Weizmann Inst. of Science, Rehovoth (Israel).
Abraham Lerman, and Adam Shatkay.
Earth and Planetary Sci Lett, Vol 5, No 2, pp 63-66, Oct 1968. 4 p, 1 fig, 1 tab, 12 ref.

Descriptors: *Brines, *Saturation, *Salinity, Water chemistry, Evaporation, Lakes, Arid lands, Salts, Halides, Chlorides, Sodium chloride, Chemical potential.
Identifiers: *Dead Sea (Israel), Ion activity product measurements.

Ion activity product measurements in the Dead Sea show undersaturation with respect to halite in the upper 40 m and very uniform near-saturation conditions below 100 m. The layer from 40-100 m has very strong saturation gradients. Calculated ionic activity products show a similar pattern, but the calculated values are everywhere higher than measured values by 15-20%. (Knapp-USGS)
W69-06038

OXYGEN ISOTOPIC COMPOSITION OF SULFATE IONS IN WATER FROM THERMAL SPRINGS,
Comitato Nazionale per le Ricerche Nucleari, Pisa (Italy). Laboratorio di Geologia Nucleare.
A. Longinelli.
Earth and Planetary Sci Lett, Vol 4, No 3, pp 206-210, May 1968. 5 p, 2 fig, 2 tab, 17 ref. C.N.R.-C.N.E.N. No. 115/1159/1472.

Descriptors: *Thermal springs, *Water sources, *Sulfates, Oxygen, Groundwater, Water chemistry, Spring waters.
Identifiers: *Oxygen isotopes, *Isotope fractionation.

No variation of the distribution of oxygen-18 between sulfate and water with temperature was found in water from 34 thermal springs in Tuscany (Italy). Oxygen isotope determinations made on Triassic and Miocene evaporites in the area show that the Upper Triassic evaporites are the source of the sulfate discharged in the spring waters. (Knapp-USGS)
W69-06044

THORIUM AND URANIUM CONCENTRATIONS AND ISOTOPE RATIOS IN RIVER SEDIMENTS,
Yale Univ., New Haven, Conn. Dept. of Geology.
For primary bibliographic entry see Field 02J.
W69-06045

ISOTOPE HYDROLOGY OF THE ARTESIAN AQUIFERS OF THE STYRIAN BASIN, AUSTRIA,
International Atomic Energy Agency, Vienna (Austria). Section of Hydrology.
G. H. Davis, G. L. Meyer and C. K. Yen.
Steirische Beitrage zur Hydrogeologie, pp 51-62, 1968. 12 p, 2 fig, 1 tab, 7 ref.

Descriptors: *Groundwater movement, *Tracers, *Radioisotopes, *Stable isotopes, Carbon radioisotopes, Tritium, Radioactive dating, Radiochemical analysis, Tracking techniques, Groundwater basins, Aquifers, Artesian wells, Hydrogeology.
Identifiers: *Austria, Styrian Basin.

Waters of the artesian aquifers of the Styrian Basin, Austria, were analyzed for radioactive and stable isotopes of hydrogen, oxygen, and carbon to characterize the waters of the separate aquifer systems, to determine the circulation of the systems, and to attempt to calculate velocity of groundwater flow. Reconnaissance sampling showed strong variation in deuterium and oxygen-18, suggesting that these isotopes might be useful in characterizing the waters. Carbon-14 and stable isotope data suggest that differences in stable isotope content are related to time since recharge, and reflect Pleistocene to Recent climatic changes. The low tritium content and the apparent carbon-14 ages suggest little groundwater circulation and there is little vertical variation in the waters. (Knapp-USGS)
W69-06249

QUALITY OF SURFACE WATERS FOR IRRIGATION, WESTERN STATES-1961,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 03F.
W69-06253

QUALITY OF SURFACE WATERS FOR IRRIGATION, WESTERN STATES-1960,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 03F.
W69-06254

HYDROLYSIS OF CONDENSED PHOSPHATES--I: NON-STERILE ENVIRONMENT,
Wisconsin Univ., Madison. Water Chemistry Lab.
Nicholas L. Clesceri, and G. Fred Lee.
Int J Air Water Pollution, Vol 9, pp 723-742, 1965. 6 fig, 3 tab, 44 ref.

Descriptors: *Environmental effects, *Hydrolysis, *Phosphates, Chemical degradation, Chemical reactions, Chlorella, Detergents, Enzymes, Eutrophication, Hydrogen ion concentration, Kinetics, Lakes, Phosphorus compounds, Temperature, Water chemistry, Water pollution control, Water pollution effects, Water pollution sources, Wisconsin.
Identifiers: *Non-sterile environment, *Condensed phosphates, Algal growth, Allen's medium, Gorham's medium, Chemical kinetics, Colloidal gels, Complexing cations, Chlorella pyrenoidosa, Culture media, Ionic environment, Lake Mendota (Wis), Pyrophosphate, Tripolyphosphate.

The kinetics of hydrolysis of pyrophosphate and tripolyphosphate in sterile and non-sterile lake water and algal culture media have been investigated. The chemical hydrolysis of these compounds is a relatively slow process, while biochemical hydrolysis is rapid. The relative stability of these compounds is dependent upon environmental factors, especially the presence of microorganisms. (Lee-Wis)
W69-06271

TOWARDS STANDARDIZATION OF SOIL EXTRACTS FOR MICROBIAL MEDIA,
Wisconsin Univ., Madison. Dept. of Soils.
R. F. Harris, and D. R. Keeney.
Can J Microbiol, Vol 14, pp 653-659, 1968. 2 fig, 2 tab, 15 ref.

Descriptors: *Soil microbiology, *Standards, *Freeze drying, Microbiology, Nutrient requirements, Nutrients, Organic compounds, Organic matter, Soil analysis, Soil chemistry, Soil microorganisms, Soils, Sediment.
Identifiers: *Microbiological media, *Soil extracts, Microbial nutrition, Organic carbon.

The effect was evaluated of soil:water ratio and autoclaving time on efficiency of organic carbon extraction from soil and developed a method for routine preparation of freeze-dried soil extracts of standardized carbon content. Optimum soil:water (weight/volume) ratio chosen for soil extract preparation depends on water-holding properties of soils and on subsequent use of extract. A ratio of 1:3 to 1:5 appears optimum for preparation of freeze-dried extracts. Efficiency of carbon recovery decreases drastically at ratios less than 1:2 to 1:3. Longer autoclaving times will yield substantial increases in organic carbon, with most marked increases occurring during first hour. No major differences were noted in numbers of soil microorganisms developing on agar media prepared from diverse extracts so long as pH (6.0-7.5) and carbon content (0.1-2.6 grams/liter) of extracts were within normal range for soil extracts used for microbial media. (Keeney-Wis)
W69-06272

HYDROLYSIS OF CONDENSED PHOSPHATES--II: STERILE ENVIRONMENT,
Wisconsin Univ., Madison. Water Chemistry Lab.
Nicholas L. Clesceri, and G. Fred Lee.
Int J Air Water Pollution, Vol 9, pp 743-751, 1965. 2 fig, 9 tab, 11 ref.

Descriptors: *Environmental effects, *Hydrolysis, *Phosphates, Calcium, Chemical degradation, Chemical reactions, Detergents, Digital computers, Eutrophication, Hydrogen ion concentration, Kinetics, Lakes, Phosphorus compounds, Temperature, Water chemistry, Water pollution control, Wisconsin, Water pollution effects, Water pollution sources.
Identifiers: *Sterile environment, *Condensed phosphates, Rate constants, Allen's medium, Culture media, Lake Mendota (Wis), Pyrophosphate, Tripolyphosphate, IBM 1620, Gorham's medium.

The kinetics of hydrolysis of pyrophosphate and tripolyphosphate in sterile lake water and algal culture media have been investigated. The rate of hydrolysis in sterile Lake Mendota, Wisconsin, water is approximately 1000 times faster than in distilled water. First order rate constants for the hydrolysis of pyrophosphate and tripolyphosphate in sterile Lake Mendota water at 25 deg Celsius and pH 8.3 are 0.0000061/minute and 0.000014 minute, respectively. The rates of hydrolysis in sterile lake water and algal culture media appear to be accelerated by calcium. (Lee-Wis)
W69-06284

SOURCES OF ELEMENTAL NITROGEN IN FERMENTATION GASES,
Wisconsin Univ., Madison. Water Chemistry Lab.
For primary bibliographic entry see Field 05C.
W69-06285

2L. Estuaries

LONGITUDINAL ESTUARINE DIFFUSION IN SAN FRANCISCO BAY, CALIFORNIA,
Oregon State Univ., Corvallis, and California Univ., Berkeley.
For primary bibliographic entry see Field 05A.
W69-06006

SOLUTION OF ESTUARY PROBLEMS AND NETWORK PROGRAMS,
Rice Univ., Houston. Dept. of Environmental Science and Engineering; and Texas Univ., Austin. Dept. of Civil Engineering.
J. V. Leeds, and H. H. Bybee.
ASCE Proc, J Sanit Eng Div, Vo. 93, No SA3, Pap 5277, pp 29-36, June 1967. 8 p, 5 fig, 7 ref, 1 append. Grant FR-254-01 (NIH), Grant 2T-WP-44-04 (PH5).

Descriptors: *Estuaries, *Path of pollutants, *Water circulation, *Computer programs, Digital computers, Data processing, Hydrologic data, Diffusion, Dispersion, Networks, Electrical networks.
Identifiers: Electrical network computer programs.

Computer programs originally written to solve electrical network problems can be used to solve estuary pollution problems. These are simple to use and efficient in calculating the frequency response of the estuary. Furthermore, sensitivities of the solution to parameter changes can be readily calculated using a method developed for electrical networks. The sensitivities are then used to indicate required measurement accuracy of the fundemental coefficients of the mathematical model. (Knapp-USGS)
W69-06077

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

THE FEASIBILITY OF DEEP-WELL INJECTION OF WASTE BRINE FROM INLAND DESALTING PLANTS,
Oak Ridge National Laboratory, Tenn.
For primary bibliographic entry see Field 05E.
W69-06286

ENVIRONMENTAL IMPACT OF BRINE EFFLUENTS ON GULF OF CALIFORNIA,
Arizona Univ., Tuscon.
For primary bibliographic entry see Field 05C.
W69-06287

SECONDARY REFRIGERANT FREEZING DESALTING PROCESS: OPERATION OF A 15,000 GPD PILOT PLANT,
Struthers Scientific and International Corp., New York.
N. Ganiaris, J. Lambiris, and R. Glasser.
Office of Saline Water, Research and Development Progress Report No. 416, March 1969. 95 p. OSW-14-01-0001-734.

Descriptors: *Desalination Processes, *Freezing, Pilot plant, Crystallization.
Identifiers: *Secondary refrigerant freezing, Butane process, Freezer, Washer, Melter.

The development of the secondary refrigerant freezing process in a 15,000 gpd pilot plant is described. The results of the experimental program demonstrated that the process was technically feasible at the 15,000 gpd pilot plant level. Product water with less than 500 ppm T.D.S. and less than 0.20 ppm of dissolved hydrocarbon was produced on a continuous basis. Sparging hydrocarbon refrigerant (butane) into precooled sea water resulted in the production of ice crystals greater than 1.0 mm diameter; higher volumetric ice production rates, and lower entrainment of butane in the ice slurry. Washing the ice countercurrently according to the hydraulic piston-bed displacement method resulted in the production of potable water. Wash column rates of about 2100 GPD/ft2 were achieved in the pilot plant wash column. On the basis of pilot plant performance, the cost of water, for plants with capacities of 1.0 to 10 million GPD is in the range of $1.00 to 0.45 per 1000 gallons. (Rinne-Office of Saline Water)
W69-06288

3B. Water Yield Improvement

COASTAL EVIDENCES OF GROUND WAT CONDITIONS IN THE VICINITY ANAEHOOMALU AND LALAMILO, SOU KOHALA, HAWAII,
Hawaii Univ., Honolulu. Water Resourc Research Center.
Doak C. Cox, Frank L. Peterson, William M. Adams, Chester Lao, and John F. Campbell.
Technical Report No 24, March 1969, 53 p. 6 ta 14 fig, 10 ref.

Descriptors: *Basalt, *Salinity, *Coastal spring *Ground-water flux, *Electrical resistivity, *Gra ty, *Electrical profiling, *Electrical soundin *Microgravity, *Hawaii, *Lava flow, *Coast spring.

Ground-water flux through the Anaehoomalu ar Lalamilo districts is thought to be quite low, owi to the small recharge which results from th generally low rainfall and the high evapotranspir tion. Computations of recharge from annual rai fall and losses from evapotranspiration suggest th the discharge along the shoreline averages only few million gallons per day per mile. Onshor reconnaissance, which included sampling of wel and water holes, and electrical resistivity and grav ty surveys, and an offshore conductivity surve confirm that fresh and brackish water appears to b discharging along the coastline from Hapuna Ba to Keawaiki Bay in quantities too small to be easil detected. No anomalously high ground-water level which might indicate the presence of large ground water flows were detected.
W69-06006

WATER AND CHOICE IN THE COLORADO BASIN: AN EXAMPLE OF ALTERNATIVES IN WATER MANAGEMENT, CH. 3, PROBLEMS OF WATER SUPPLY IN THE BASIN.
National Academy of Sciences--National Research Council, Washington, D. C. Committee on Water.
For primary bibliographic entry see Field 06B.
W69-06088

THE STATUS OF PILOT WATERSHED STUDIES IN ARIZONA,
Forest Service (USDA), Flagstaff, Ariz. Rocky Mountain Forest and Range Experiment Station.
Harry E. Brown.
Pap, Amer Soc Civ Eng Annu Meet Nat Meet Water Resour Eng, New Orleans, La., Feb 1969. 17 p, 13 fig, 30 ref.

Descriptors: Arizona, Watershed managment, *Watersheds (Basins), Snow management, Water yield, *Water yield improvement, Water conservation, Water resources, Runoff, Clearing, Evapotranspiration, Coniferous trees, Evapotranspiration control, Chaparral, Defoliants, Clearing, Vegetation, Streamflow.
Identifiers: Experimental watersheds, Deforestation.

The Forest Service is studying ways to increase water yields in Arizona by manipulating vegetation. Most treatments are designed to reduce evapotranspiration losses and to redistribute snow in a manner conducive to increased runoff efficiency. Principal methods include: (1) mechanical treatments, such as felling or bulldozer cabling coniferous trees; (2) burning chaparral; and (3) chemically treated chaparral and juniper. Examples of changes in streamflow following treatments include: (1) a 1-1/2 times increase following partial clearcutting on a mixed-conifer watershed, (2) at least a 3 times increase following burning and chemical sprout control on a chaparral watershed, and (3) no change following cabling and slash burning on a Utah juniper watershed. Many tests include evaluating changes in sediment, timber, range, and wildlife. On the basis of these and related results, limited treatment programs have been initiated on National Forest lands. Approximately 1,300 acres have been patch cut in mixed-conifer

forests, and approximately 20,000 areas of chaparral-covered lands have been burned or chemically treated. The pilot test indicates that juniper cabling is not promising for increasing water yield. (USBR)
W69-06091

EFFECTS OF SMALL STRUCTURES ON WATER YIELD IN TEXAS,
Geological Survey, Austin, Tex.; and Texas Univ., Austin. Dept. of Civil Engineering.
Stanley P. Sauer, and Frank D. Masch.
Geol Surv-Water Resources Div Rep, presented at conf on 'The Effects of Watershed Changes on Streamflow', at Tex Univ, Austin, Oct 1968. 38 p, 7 fig, 7 tab, 14 ref.

Descriptors: *Reservoir evaporation, *Water loss, *Hydrologic budget, *Texas, Consumptive use, Evaporation, Evapotranspiration, Mathematical models, Regression analysis, Forecasting, Water management (Applied), Flood control, Reservoir silting, Seepage.
Identifiers: Reservoir water loss.

Methods of computing consumptive use attributable to water storage in upstream flood control structures are proposed. Using annual data, a direct inflow-outflow relationship and a depletion-runoff relationship are developed. These relationships are not applicable after appreciable amounts of sediments fill the pools. In another approach, monthly consumptive losses are related to climatic parameters and physical characteristics of the structures and soils. These relationships were derived by multiple linear regression analysis, and will still apply as reservoir characteristics change with sedimentation. (Knapp-USGS)
W69-06218

HYDROLOGY OF LAND DRAINAGE,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 04A.
W69-06234

3C. Use of Water of Impaired Quality

PREDICTION OF CROP YIELDS FROM QUANTITY AND SALINITY OF IRRIGATION WATER,
New Mexico State Univ., Las Cruces.
H. E. Dregne.
N Mex Ag Expt Station Bulletin 543, March, 1969. 16 p, 6 tab, 16 fig. OWRR Project A-005-NMEX.

Descriptors: New Mexico, *Crop yields, Water quality, *Salinity, *Irrigation water, Soil salinity, Water requirements, Salt tolerance.

Consumptive use, salt tolerance, and water application data were used to estimate the yields of alfalfa, barley, corn, cotton, and sorghum that would be obtained after irrigation with saline water when different quantities are applied. Corn was the most sensitive to the combination of decreased moisture and increased salinity of the irrigation water, followed by alfalfa, sorghum, cotton, and barley, in that order. Estimates were made of the added water required to maintain satisfactory crop yields as the irrigation water salinity increased. The amounts of water needed became excessive for corn and alfalfa when the irrigation water salinity exceeded about 5 millimhos electrical conductivity. The calculated salinity of the soil after growing the five crops indicated that a cropping sequence of alfalfa-cotton-corn-sorghum-barley would be least likely to affect yields of succeeding crops adversely. After barley, leaching would be required prior to seeding alfalfa.
W69-06007

IRRIGATION WATER QUALITY AND THE LEACHING REQUIREMENT,
New Mexico State Univ., Las Cruces.
For primary bibliographic entry see Field 03F.
W69-06008

AN ENGINEERING-ECONOMIC ANALYSIS OF SYSTEMS UTILIZING AQUIFER STORAGE FOR THE IRRIGATION OF PARKS AND GOLF-COURSES WITH RECLAIMED WASTEWATER,
Nevada Univ., Reno.
Richard G. Orcutt.
Nevada Center for Water Resources Research Technical Report Series H-W Publ 2, October 1967. 123 p. OWRR Project A-008-NEV.

Descriptors: *Systems analysis, *Model studies, *Water reuse, *Ground-water basin, *Economic feasibility, Analytical studies, Computer models, Irrigation practices, Reclaimed water, Water injection, Aquifer, Water storage, Productivity.
Identifiers: *Las Vegas (Nevada), Hele-Shaw Model, Indigenous water.

A principal objective of this study was to develop a model which would enable the analyst to study the engineering-economic relationships of the elements of wastewater reclamation systems. Available information was used to develop a cohesive model for computing the production costs of wastewater reclamation for irrigation use. After development of the model, the sensitivity of production costs to variations in selected imput parameters was examined. Finally the model was applied to a study area, Las Vegas, Nevada, to demonstrate its application and to relate production costs to the benefits from sewerage relief so that the net cost of supplying reclaimed water to irrigation sites could be compared to the cost of alternative sources of supply. The model criterion, that all injected water should be essentially recovered, led to exploratory studies with a Hele-Shaw model from which estimates were made of the amount of indigenous water which would have to be withdrawn from the aquifer. The model enables the analyst to rapidly determine the effect of varying about 40 input parameters on the cost of water production. This article contains 17 illustrations, 12 tables, and 47 references. (Pincolini-Nev)
W69-06289

3D. Conservation in Domestic and Municipal Use

STATE WATER SUPPLY DEVELOPMENT.

N J Stat Ann secs 58:19-1 to 58:19-3, 58:19-9 to 58:19-14 (1966).

Descriptors: *New Jersey, *Water resources development, *Administrative agencies, *Water supply, Water sources, Operation and maintenance, State governments, Streams, Condemnation, Eminent domain, Water conservation, Urbanization, Public benefits, Public health, Legislation, Watersheds (Basins), Operating costs, Financing.

The New Jersey Water Supply Law is designed to provide an increase in dependable public water supply sources for domestic and industrial uses. The Act was prompted by governmental recognition of the importance of maintaining adequate water supplies in face of increasing public demand. The Act divides the state into four water supply regions. The criterion for such grouping is available water supply and needs. These divisions are empowered, subject to approval of the Division of Water Development Board, to construct and acquire water supply systems by any means available to natural persons and corporations. The divisions are empowered to institute condemnation proceedings. Surplus water in any public or private water system or watershed can be acquired by the Division where necessary to prevent a regional water shortage. As an incident to acquisition of water systems, the divisions are empowered to operate and maintain the systems and may enter into contracts necessary to carry out this function. The Divisions may integrate public and private water systems where necessary to prevent shortages. The Divisions may set rates based on cost and capital accounting after a public hearing. (Katz-Fla)
W69-06317

CREATION OF DEPARTMENT OF WATER RESOURCES AND WATER RESOURCES COMM'N.
For primary bibliographic entry see Field 06E.
W69-06333

3E. Conservation in Industry

HAUGHTON V LANKFORD (CONSTITUTIONALITY OF CONSERVATION REGULATION).
For primary bibliographic entry see Field 06E.
W69-06329

CREATION OF DEPARTMENT OF WATER RESOURCES AND WATER RESOURCES COMM'N.
For primary bibliographic entry see Field 06E.
W69-06333

LE CLAIR V SWIFT (ENFORCEMENT OF CONSERVATION STATUTES).
For primary bibliographic entry see Field 06E.
W69-06377

3F. Conservation in Agriculture

PREDICTION OF CROP YIELDS FROM QUANTITY AND SALINITY OF IRRIGATION WATER,
New Mexico State Univ., Las Cruces.
For primary bibliographic entry see Field 03C.
W69-06007

IRRIGATION WATER QUALITY AND THE LEACHING REQUIREMENT,
New Mexico State Univ., Las Cruces.
H. E. Dregne.
N Mex Ag Expt Station Bulletin 542, January 1969. 17 p, 11 tab, 2 fig, 19 ref. OWRR Project A-005-NMEX.

Descriptors: New Mexico, *Irrigation, Water quality, *Leaching requirements, Alfalfa, Barley, Salt balance, Drainage water.

A greenhouse experiment with barley and alfalfa, two soils, both calcareous and one also gypsiferous, and two irrigation waters, one a carbonate water and the other a non-carbonate water, was conducted to evaluate the validity of the leaching requirement concept. Barley and alfalfa yields were significantly higher when the non-carbonate water was used. Plant ash content did not differ with the two waters. The leaching appeared to be more effective when it was calculated from electrical conductivity of the irrigation and drainage waters than when volume leaching percentages were obtained. Chloride and volume leaching percentages were in good agreement. Carbonate retention and sulfate solution in the soil occurred when the carbonate water was used. Carbonate solution and sulfate retention occurred when the non-carbonate water was used. Carbonate retention and solution were related to the pHc of the irrigation water.
W69-06008

CONSUMPTIVE IRRIGATION REQUIREMENTS OF SELECTED IRRIGATED AREAS IN NEW MEXICO,
New Mexico Univ., Las Cruces.
Donald C. Henderson, and Earl F. Sorensen.
N Mex Ag Expt Station Bulletin 531, August 1968. 55 p, 15 tab, 2 fig, 9 ref. OWRR Project A-007-NMEX.

Descriptors: New Mexico, *Consumptive use, *Irrigation requirements, Water use, Irrigation efficiency.

The data in this bulletin (appendix tables 1 to 9) are intended to provide consumptive irrigation requirements for general planning purposes and to enable the user to approximate consumptive irrigation requirements of individual crops or the total consumptive irrigation requirement of a given cropping pattern. Except for New Mexico State Engineer hydrographic survey values, the individual consumptive irrigation requirement values of the appendix tables may tend to maximize the amounts required, because maximum growing seasons were generally used. In areas where more detailed and specific field information on local practices, cropping patterns, and other pertinent facts are available, such data should be given consideration in detailed estimates of water-use requirement for specific areas of projects.
W69-06013

HYDRAULIC OPERATING CHARACTERISTICS OF LOW GRADIENT BORDER IRRIGATION SYSTEMS,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Irrigation Engineering.
Orlando W. Howe, James R. Gilley, Dale F. Heermann, and Norman A. Evans.
Colorado State Univ Natur Resources Center Proj Completion Rep, Dec 15, 1968. 32 p, 10 fig, 6 tab, 6 ref. OWRR Proj No B-001-COLO.

Descriptors: *Irrigation efficiency, *Irrigation design, *Border irrigation, *Timing, Edge effect, Soil-water-plant relationships, Water delivery, Irrigation water, Water management (Applied), Recession curves.
Identifiers: Border irrigation efficiency, Ditch gradient efficiency.

Intensive study was made of 41 border irrigation plots to determine combinations of gradient, length, intake rate characteristics, surface hydraulic resistance and stream size that result in high irrigation distribution efficiency. Gradients ranged up to 0.005 ft per ft. Water distribution efficiency is independent of stream size within the range of 0.03 to 0.12 cfs per ft border width. Border gradient was not a significant variable within the range studied. The critical variables are cutoff time, which determines whether or not there will be surface runoff, and to some extent the advance and recession rate curves. The operating criteria for cutoff time is distance of advancing front at cutoff, X, compared to length of border, L. For heavy textured soils, the ratio should be X/L between 0.33 and 0.75, while for light textured soils it should be X/L between 0.9 and 1.1. Water distribution efficiencies of 80 to 95% can be obtained consistently. In typical operation, the water is applied for efficiency rather than for a given depth of irrigation. Frequent applications will be necessary to supply crop needs during periods of peak consumption use. (Knapp-USGS)
W69-06035

USE OF WATER FOR SUPPLEMENTAL IRRIGATION IN DELAWARE,
Delaware Univ., Newark. Agricultural Experiment Station.
William M. Crosswhite.
Del Univ Agr Exp Sta Bull No 375, Dec 1968. 24 p, 4 fig, 14 tab. OWRR Proj No B-001-DEL.

Descriptors: *Irrigation efficiency, *Delaware, *Supplemental irrigation, Economic efficiency, Crop production, Crop response, Droughts, Humid climates, Cost-benefit analysis, Profits, Specialty crops, Vegetable crops.
Identifiers: Irrigation costs.

Supplemental irrigation is used in Delaware to increase farm yield by adjusting to dry years and poor rate distribution during the growing season. High value crops are usually the first to be irrigated. The major irrigated crops are potatoes, peas, lima beans, and green beans. A total of 17,542 acres were irrigated in 1964, but the largest amount of irrigation water used to date has been about 1.5 billion gal per yr, an amount equal to about 1 day of Delaware's total streamflow. Investment and costs of irrigation systems decline rapidly with increases in the size of the system and number of acres irrigated. Total investment per acre decreased from $336 for systems with under 25 acres irrigated to $88 for systems for 150 or more acres. Increased labor efficiency is important in reducing variable costs as the number of acres irrigated by a system expands. The number of acres irrigated per farm increased from 69 acres in 1954 to 100 acres in 1959 and 111 acres in 1964. A detailed study of the yield response of asparagus to irrigation was made using experimental data for the year 1967. An average increase in asparagus yield of 461 lbs resulted when irrigation water was applied. Yields ranged from 191 lbs of asparagus (for 5 ft x 12 in. spacing using no fertilizer) to 1,391 lbs (using 5 ft x 6 in. spacing and applying 2,400 lbs of 5-10-5 fertilizer). Assuming a price of $20 per cwt for asparagus, the additional yield with irrigation had a gross value of $38.34 in the first case and $278.14 in the second. (Knapp-USGS)
W69-06036

PRELIMINARY REPORT ON THE IRRIGATION POTENTIAL OF DUNN COUNTY, WISCONSIN,
Wisconsin Univ., Madison. Geological and Natural History Survey.
For primary bibliographic entry see Field 02G.
W69-06074

MAN'S INFLUENCE ON HYDROLOGICAL PHENOMENA,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 04C.
W69-06233

QUALITY OF SURFACE WATERS FOR IRRIGATION, WESTERN STATES-1961,
Geological Survey, Washington, D. C.
S. K. Love.
Geol Surv Water-Supply Pap 1886, 1968. 154 p, 2 fig, 1 plate, 18 ref, index.

Descriptors: *Water quality, *Irrigation water, *Data collections, Streamflow, Hydrologic data, Water chemistry.
Identifiers: *Western U S, Water quality data.

Water chemical quality and streamflow data of 1961 are compiled for 73 irrigation network stations west of the Mississippi River. Stations are listed with dates of operation. Each quality record includes station location, drainage area, a list of available records, extreme values of specific conductance and sodium content, and periodic records of runoff, silica, Ca, Mg, Na, K, bicarbonate, carbonate, sulfate, Cl, F, nitrate, B, total dissolved solids, % Na, SAR, specific conductance, and pH. (Knapp-USGS)
W69-06253

QUALITY OF SURFACE WATERS FOR IRRIGATION, WESTERN STATES-1960,
Geological Survey, Washington, D. C.
S. K. Love.
Geol Surv Water-Supply Pap 1746, 1968. 152 p, 2 fig, 1 plate, 17 ref, index.

Descriptors: *Water quality, *Irrigation water, *Data collections, Streamflow, Hydrologic data, Water chemistry.
Identifiers: *Western U S, Water quality data.

Water chemical quality and streamflow data of 1960 are compiled for 73 irrigation network stations west of the Mississippi River. Stations are listed with dates of operation. Each quality record includes station location, drainage area, a list of available records, extreme values of specific co
ductance and sodium content, and periodic recor
of runoff, silica, Ca, Mg, Na, K, bicarbonate, ca
bonate, sulfate, Cl, F, nitrate, B, total dissolve
solids, % Na, specific conductance and pH. (
napp-USGS)
W69-06254

**CRITES V UNITED STATES (CLAIMS FO
LOSS IN VALUE OF LAND DUE TO IRRIGA
TION PROJECT).**

132 F Supp 469-472 (Ct Cl 1955).

Descriptors: *United States, *Condemnation, *I
rigation programs, *Flow augmentation, River
Damages, Reservoirs, Washington, Flood contro
Open channel flow, River flow, Flow rates
Drainage, Surface runoff, Aggradation, Judicia
decisions, Legal aspects, Crop production, Federa
government.
Identifiers: Yakima River.

Congress referred several claims against the United States for alleged damage to farms due to irrigation control of the Yakima River to the Court of Claims. During certain seasons, a control project of the Department of the Interior increased the flow in the river and channels adjacent to and cutting through plaintiff's properties. Plaintiffs alleged that the operation had impaired the usefulness of their lands during the normal farming season and that such constituted a taking of their property for which compensation must be paid. The courtfound no legal or equitable liability and stated that, although the usefulness of plaintiffs' lands had been impaired because of the action of the river, the court was unable, on the basis of the record, to find the government responsible or to find that there had been a material decrease in value of the lands. (Wheeler-Fla)
W69-06325

STATE FORESTS; TREE PLANNING.

Minn Stat Ann secs 89.001 and 89.26 (1946), as amended, (Supp 1968).

Descriptors: *Minnesota, *Forest management, *Hydrology, *Water conservation, Hydraulics, Water control, Water resources, Hydroelectric plants, Watercourses (Legal), Water policy, Project planning, Water utilization, Waterworks, Trees, Forests, Pulp and paper industry, Climates, Legislation, Legal aspects, State governments, Hydroelectric power.
Identifiers: *Water power.

The phrase 'state forest lands' means all land and water owned by the state within state forests. All water power having a possible average development of 100-horse power or more owned by the state and all state owned or controlled lands lying within one mile of such water power are withdrawn from sale and held for the purpose of the improvement and utilization of the same for the purpose of having paper manufacturered by plants built on and using the power of such water powers. (Shevin-Fla)
W69-06338

IRRIGATION.

Minn Stat Ann secs 113.01 to 113.06 (1947), as amended (Supp 1968).

Descriptors: *Minnesota, *Irrigation, *Dams, *Irrigation permits, Dikes, Dam construction, Construction, Ditches, Drainage systems, Watercourses, Floods, High water mark, Engineers, Damages, Irrigation engineering, Irrigable land, Irrigation programs, Irrigation water, Water sources, Legislation, Diversion, Alteration of flow, Design, Floodgates, Legal aspects.
Identifiers: Penalties (Criminal).

Any person owning land suitable for raising crops requiring irrigation, upon being licensed, may construct upon his land and across any public ditch, drain, or watercourse, a dam or dike necessary to secure the use of water for irrigation. All dams must contain gates sufficient to carry off flood water above the high water mark within 24 hours. Licenses to build such a dam must be obtained from the state drainage engineer. The person constructing the dam must post a bond which would be used to pay any one injured by the construction of the dams or any property damage resulting from its use. The construction of the dams is to be under the supervision of the state drainage engineer. If it appears that the dam cannot be operated without impairing the utility of a public drain or watercourse or without depriving other landowners of enjoyment of their land, the license shall be revoked. Any person violating any section of the act shall be guilty of a misdemeanor. (Shevin-Fla)
W69-06340

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

FLOOD PLAIN INFORMATION, UPPER FLINT RIVER, MUD AND JESTER CREEKS, METROPOLITAN ATLANTA, GEORGIA.
Corps of Engineers, Mobile, Ala.

Prepared for Atlanta Metropolitan Planning Comm. Corps Eng Flood Plain Rep, Jan 1969. 50 p, 8 fig, 26 plate, 17 tab.

Descriptors: *Floods, *Flood damage, *Georgia, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: Atlanta (Ga), Flint River, Standard project flood, Intermediate regional flood.

Flooding of the Upper Flint River, Mud and Jester Creeks, Atlanta, Georgia is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-06057

FLOOD PLAIN INFORMATION, CASEY CANAL NORTH, SAVANNAH AND CHATHAM COUNTY, GEORGIA.
Corps of Engineers, Savannah, Ga.

Corps Eng Flood Plain Rep, Aug 1968. 35 p, 16 fig, 4 plate, 6 tab. Prepared for city of Savannah and Chatham County.

Descriptors: *Floods, *Flood damage, *Georgia, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Savannah (Ga), Chatham County, Casey Canal, Standard project flood, Intermediate regional flood.

Flooding of Casey Canal, North Savannah and Chatham Counties, Georgia is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-06058

FLOOD PLAIN INFORMATION, TAR RIVER AND STONY CREEK, ROCKY MOUNT, NORTH CAROLINA.
Corps of Engineers, Wilmington, N. C.

Corps Eng Flood Plain Rep, Aug 1968. 63 p, 18 fig, 19 plate, 13 tab. Prepared for the city of Rocky Mount.

Descriptors: *Floods, *Flood damage, *North Carolina, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Rocky Mount (NC), Tar River, Stony Creek, Standard project flood, Intermediate regional flood.

Flooding of Tar River and Stony Creek, Rocky Mount, North Carolina is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-06059

FLOOD PLAIN INFORMATION, COBBS CREEK-FOWLER BRANCH, DEKALB COUNTY, GEORGIA.
Corps of Engineers, Savannah, Ga.

Corps Eng Flood Plain Rep, June 1968. 35 p, 12 fig, 19 plate, 13 tab. Prepared for DeKalb County, Ga.

Descriptors: *Floods, *Flood damage, *Georgia, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: DeKalb County (Ga), Cobbs Creek, Fowler Branch, Standard project flood, Intermediate regional flood.

Flooding of Cobbs Creek and Fowler Branch, DeKalb County, Georgia is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combination of these approaches. (Knapp-USGS)
W69-06060

FLOOD PLAIN INFORMATION, ROCK RIVER AT JANESVILLE, WISCONSIN.
Corps of Engineers, Rock Island, Ill.

Prepared for State of Wisconsin, Dept of Natur Resources. Corps Eng Flood Plain Rep, June 1968. 53 p, 36 fig, 14 plate, 11 tab.

Descriptors: *Floods, *Flood damage, *Wisconsin, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Janesville (Wis), Rock River, Standard project flood, Intermediate regional flood.

Flooding of the Rock River, Janesville, Wisconsin is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-06061

FLOOD PLAIN INFORMATION, BIG WALNUT CREEK, VICINITY OF COLUMBUS, OHIO.
Corps of Engineers, Huntington, W. Va.

Corps Eng Flood Plain Rep, May 1968. 39 p, 9 fig, 12 plate, 7 tab. Prepared for State of Ohio, Dept Nat Res.

Descriptors: *Floods, *Flood damage, *Ohio, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Columbus (Ohio), Big Walnut Creek, Standard project flood, Intermediate regional flood.

Flooding of Big Walnut Creek, Columbus, Ohio is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-06062

FLOOD PLAIN INFORMATION, HUNNICUTT CREEK, ATHENS, CLARKE COUNTY, GEORGIA.
Corps of Engineers, Savannah, Ga.

Corps Eng Flood Plain Rep, Apr 1968. 28 p, 8 fig, 10 plate, 8 tab.

Descriptors: *Floods, *Flood damage, *Georgia, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Athens (Ga), Clarke County, Hunnicutt Creek, Standard project flood, Intermediate regional flood.

Flooding of Hunnicutt Creek, Athens, Clarke County, Georgia is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-06063

FLOOD PLAIN INFORMATION, TAR RIVER AT LOUISBURG, NORTH CAROLINA.
Corps of Engineers, Wilmington, N. C.

Corps Eng Flood Plain Rep, Mar 1968. 34 p, 8 fig, 6 plate, 7 tab.

Descriptors: *Floods, *Flood damage, *North Carolina, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Louisburg (NC), Tar River, Standard project flood, Intermediate regional flood.

Flooding of the Tar River, Louisburg, North Carolina is described in a report of flood plain

problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-06064

FLOOD PLAIN INFORMATION, DICKINSON BAYOU, DICKINSON, TEXAS.
Corps of Engineers, Galveston, Tex.

Corps Eng Flood Plain Rep, Feb 1968. 36 p, 9 fig, 22 plate, 9 tab.

Descriptors: *Floods, *Flood damage, *Texas, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Hurricanes, Historic flood.
Identifiers: Dickinson (Texas), Dickinson Bayou, Standard project flood, Intermediate regional flood, Tropical storms.

Flooding of Dickinson Bayou, Dickinson, Texas is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-06065

FLOOD PLAIN INFORMATION, ELLERBE, GOOSE, WARREN, SANDY AND THIRD FORK CREEKS, DURHAM, NORTH CAROLINA.
Corps of Engineers, Wilmington, N. C.

Corps Eng Flood Plain Rep, Jan 1968. 60 p, 15 fig, 12 plate, 19 tab.

Descriptors: *Floods, *Flood damage, *North Carolina, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: Durham (NC), Standard project flood, Intermediate regional flood.

Flooding of Ellerbe, Goose, Warren, Sandy, and Third Fork Creeks, Durham, North Carolina, is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-06066

FLOOD PLAIN INFORMATION, TURTLE CREEK, ROCK COUNTY, WISCONSIN.
Corps of Engineers, Rock Island, Ill.

Corps Eng Flood Plain Rep, Dec 1967. 60 p, 48 fig, 14 plate, 11 tab.

Descriptors: *Floods, *Flood damage, *Wisconsin, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Rock County (Wisc), Turtle Creek, Standard project flood, Intermediate regional flood.

Flooding of Turtle Creek, Rock County, Wisconsin is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-06067

FLOOD PLAIN INFORMATION, BEAVERDAM CREEK, PRINCE GEORGES COUNTY, MARYLAND.
Corps of Engineers, Baltimore, Md.

Corps Eng Flood Plain Rep, Sept 1967. 23 p, 2 fig, 8 plate, 6 tab.

Descriptors: *Floods, *Flood damage, *Maryland, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: Prince Georges County (Md), Beaverdam Creek, Standard project flood, Intermediate regional flood.

Flooding of Beaverdam Creek, Prince Georges County, Maryland is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-06068

FLOOD PLAIN INFORMATION, OTTAWA RIVER, ALLEN COUNTY, OHIO.
Corps of Engineers, Detroit, Mich.

Corps Eng Flood Plain Rep, June 1967. 21 p, 3 photo, 8 tab, 1 append.

Descriptors: *Floods, *Flood damage, *Ohio, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: Allen County (Ohio), Ottawa River, Standard project flood, Intermediate regional flood.

Flooding of the Ottawa River, Allen County, Ohio is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-06069

FLOOD PLAIN INFORMATION, OHIO RIVER, JEFFERSON COUNTY, KENTUCKY.
Corps of Engineers, Louisville, Ky.

Prepared for Louisville and Jefferson County Planning Commission. Corps Eng Flood Plain Rep, June 1967. 33 p, 6 fig, 17 plate, 6 tab.

Descriptors: *Floods, *Flood damage, *Ohio River, *Kentucky, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Jefferson County (Ky), Standard project flood, Intermediate regional flood.

Flooding of the Ohio River, Jefferson County, Kentucky is described in a report of flood pl problems based on records of rainfall, runoff, a historical and present flood heights. Maps, pho graphs, profiles, and cross sections indicate the tent of flooding that has occurred and which m be expected to occur in the future. The informati is for use in study and planning ways to minimi vulnerability to flood damages by control of flo plain use by zoning and subdivision regulations, t construction of flood protection works, or by co binations of these approaches. (Knapp-USGS)
W69-06070

HEREDA V LOWER BURRELL TP (UNNATURAL WATER AND SEWAGE DISCHARGE).
For primary bibliographic entry see Field 06E.
W69-06123

PALMER V MASSENGILL (OBSTRUCTION TO FLOW OF ARTIFICIAL WATERCOURSE).
For primary bibliographic entry see Field 06E.
W69-06147

SAELENS V POLLENTIER (SUIT TO ENJOIN DEFENDANT'S INTERFERENCE WITH THE FLOW OF SURFACE WATERS).
For primary bibliographic entry see Field 06E.
W69-06149

STANDARD WAREHOUSE CO V ATLANTIC COAST LINE RR (NEGLIGENT CONSTRUCTION AND MAINTENANCE OF A DRAINAGE SYSTEM).
For primary bibliographic entry see Field 06E.
W69-06152

BELVEAL V H B C DEVELOPMENT CO (OBSTRUCTION OF NATURAL WATERCOURSE AND CONCENTRATION OF FLOW).
For primary bibliographic entry see Field 06E.
W69-06154

WHEATLEY V CASS COUNTY (DIVERSION OF NATURAL FLOW OF FLOOD WATERS BY THE STATE FOLLOWED BY SUBSEQUENT RESUMPTION OF SAME FLOW).
For primary bibliographic entry see Field 06E.
W69-06156

KEYTON V MISSOURI-KANSAS-TEXAS RR (ACTION FOR DAMAGES CAUSED BY OBSTRUCTING NATURAL FLOW OF SURFACE WATER).
For primary bibliographic entry see Field 06E.
W69-06162

CASANOVER V VILLANOVA REALTY CO (DIKE REMOVAL AND RUNOFF).
For primary bibliographic entry see Field 06E.
W69-06163

CITY OF MACON V CANNON (SURFACE WATER RUNOFF).
For primary bibliographic entry see Field 06E.
W69-06166

TAYLOR V HARRISON CONSTR CO (ARTIFICIAL INCREASE OF SURFACE WATERS).
For primary bibliographic entry see Field 06E.
W69-06167

GREENBURG V CITY OF STEUBENVILLE (DAMAGE CAUSED BY AN ACT OF GOD AND CONCURRENT NEGLIGENCE).
For primary bibliographic entry see Field 06E.
W69-06170

ACCURATE DIE CASTING CO V CITY OF CLEVELAND (FLOOD DAMAGE FROM SUBSURFACE DRAINAGE).
For primary bibliographic entry see Field 06E.
W69-06171

CITY OF JACKSON V COOK (COMPENSATION FOR DAMAGES FROM NEGLIGENT DISPOSAL OF DRAINAGE WATER).
For primary bibliographic entry see Field 06E.
W69-06174

PETER WENDEL AND SONS V CITY OF NEWARK (DAMAGE FROM ARTIFICIAL DRAINAGE SYSTEM).
For primary bibliographic entry see Field 06E.
W69-06176

MAYOR OF AMERICUS V BRIGHTWELL (SURFACE DRAINAGE AND ALTERATION OF FLOW).
For primary bibliographic entry see Field 06E.
W69-06177

CITY OF JACKSON V ROBERTSON (INJUNCTION AGAINST DISCHARGING DRAINAGE UPON LOWER PROPERTY).
For primary bibliographic entry see Field 06E.
W69-06179

SLOUGH V STATE (ARTIFICIAL DIVERSION OF NATURAL WATERCOURSES).
For primary bibliographic entry see Field 06E.
W69-06184

KENNEDY V UNION ELECTRIC CO OF MISSOURI (SILT ACCRETION AND FLOODING).
For primary bibliographic entry see Field 06E.
W69-06188

HARGADINE V SHARKEY (DIVERSION OF WATER FROM ITS NATURAL COURSES).
For primary bibliographic entry see Field 06E.
W69-06193

ARCHER V J S COMPTON, INC (INTERFERENCE WITH NATURAL FLOW).
For primary bibliographic entry see Field 06E.
W69-06196

DEPBURN V MADDOX (LIABILITY OF DRAINAGE DISTRICT).
For primary bibliographic entry see Field 06E.
W69-06197

UNITED STATES V SHAPIRO (RIGHT TO DIPEL SURFACE WATER).
For primary bibliographic entry see Field 06E.
W69-06198

WATCLIFFE V INDIAN HILL ACRES (RIGHTS TO DISPOSE OF SURFACE RUNOFF WATERS).
For primary bibliographic entry see Field 06E.
W69-06199

SURFACE DRAINAGE CHARACTERISTICS IN VOLUSIA COUNTY, FLORIDA,
Geological Survey, Ocala, Fla.
For primary bibliographic entry see Field 02E.
W69-06216

HYDROLOGY OF LAND DRAINAGE,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 02E.
W69-06234

2nd Int Postgrad Course on Hydrol Methods for Develop Water Resources Manage, Budapest, Hung, Jan-July 1968, Manual No 15, 1968. 94 p, 14 fig, 1 tab, 20 ref.

Descriptors: *Drainage, *Drainage engineering, Subsurface drainage, Surface drainage, Systems analysis, Linear programming, Synthetic hydrology, Model studies, Mathematical models, Hydrograph analysis, Unit hydrographs, Hydrology, Land management, Water management (Applied), Land reclamation, Soil water movement, Groundwater movement, Water quality.
Identifiers: *Textbooks, *Technical manuals.

The hydrological bases of surface and subsurface land drainage engineering are explained in a technical manual presented as a chapter of a text written for an international post-graduate course in water resources management. Methods are given to calculate and predict water yield to drainage systems, drawdown curves, runoff, streamflow, and economic costs and benefits of drainage systems. Drainage spacing and geometry are discussed and planning schemes are presented. Drainage research is described and the results of projects in several countries are examined. Both synthetic and analytical hydrologic models are used to calculate drainage needs and results. (Knapp-USGS)
W69-06234

FLOOD PLAIN INFORMATION, RICHLAND COUNTY, SOUTH CAROLINA.
Corps of Engineers, Charleston, S. C.

Corps Eng Flood Plain Rep, Aug 1968. 56 p, 13 fig, 27 plate, 8 tab.

Descriptors: *Floods, *Flood damage, *South Carolina, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Richland (SC), Crane Creek, Smith Brand, Standard project flood, Intermediate regional flood.

Flooding of Crane Creek and Smith Branch, Richland County, South Carolina is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-06238

FLOOD PLAIN INFORMATION, GUADALUPE RIVER, SPRING CREEK AND LONE TREE CREEK, VICTORIA, TEXAS.
Turner, Collie and Braden, Inc., Houston, Tex.

Corps Eng Flood Plain Rep, July 1968. 46 p, 8 fig, 27 plate, 11 tab.

Descriptors: *Floods, *Flood damage, *Texas, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Victoria (Tex), Guadalupe River, Spring Creek, Lone Tree Creek, Standard project flood, Intermediate regional flood.

Flooding of the Guadalupe River, Spring Creek, and Lone Tree Creek, Victoria, Texas is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-06239

FLOOD PLAIN INFORMATION, SABINE RIVER AND ADAMS BAYOU, ORANGE, TEXAS AREA.
Turner, Collie and Braden, Inc., Houston, Tex.

Corps Eng Flood Plain Rep, July 1968. 45 p, 8 fig, 25 plate, 11 tab.

Descriptors: *Floods, *Flood damage, *Texas, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Orange (Tex), Sabine River, Standard project flood, Intermediate regional flood.

Flooding of the Sabine River and Adams Bayou, Orange, Texas is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works or by combinations of these approaches. (Knapp-USGS)
W69-06240

FLOOD PLAIN INFORMATION, DICKINSON, NORTH DAKOTA DRAINAGE DITCH.
Corps of Engineers, Omaha, Neb.

Corps Eng Flood Plain Rep, June 1968. 21 p, 6 plate, 1 map, 3 tab.

Descriptors: *Floods, *Flood damage, *North Dakota, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: Dickinson (ND), Standard project flood, Intermediate regional flood.

Flooding of the Dickinson, North Dakota drainage ditch is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-06241

FLOOD PLAIN INFORMATION, PIGEON CREEK, BENTLEYVILLE, FALLOWFIELD TOWNSHIP AND SOMERSET TOWNSHIP, PENNSYLVANIA.
Corps of Engineers, Pittsburg, Pa.

Corps Eng Flood Plain Rep, Mar 1968. 27 p, 2 fig, 9 plate, 8 tab.

Descriptors: *Floods, *Flood damage, *Pennsylvania, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: Bentleyville (Pa), Fallowfield Township, Somerset Township, Pigeon Creek, Standard project flood, Intermediate regional flood.

Flooding of Pigeon Creek, Bentleyville, Fallowfield Township, and Somerset Township, Pennsylvania is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability

to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-06242

FLOOD PLAIN INFORMATION, CUMBERLAND RIVER, ROARING RIVER, AND DOE CREEK, GAINESBORO, TENNESSEE.
Corps of Engineers, Nashville, Tenn.

Corps Eng Flood Plain Rep, Feb 1968. 65 p, 8 fig, 16 plate, 17 tab.

Descriptors: *Floods, *Flood damage, *Tennessee, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Gainesboro (Tenn), Cumberland River, Roaring River, Doe Creek, Standard project flood, Intermediate regional flood.

Flooding of the Cumberland River, Roaring River, and Doe Creek, Gainesboro, Tennessee is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-06243

FLOOD PLAIN INFORMATION, SKOOKUMCHUCK RIVER, BUCODA, WASHINGTON.
Corps of Engineers, Seattle, Wash.

Corps Eng Flood Plain Rep, Feb 1968. 31 p, 4 fig, 9 plate, 8 tab.

Descriptors: *Floods, *Flood damage, *Washington, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: Bucoda (Wash), Skookumchuck River, Standard project flood, Intermediate regional flood.

Flooding of the Skookumchuck River, Bucoda, Washington is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-06244

FLOOD PLAIN INFORMATION, LAWSONS FORK CREEK AND FAIRFOREST CREEK, SPARTANBURG, SOUTH CAROLINA.
Corps of Engineers, Charleston, S. C

Corps Eng Flood Plain Rep, Feb 1968. 70 p, 19 fig, 25 plate, 16 tab

Descriptors: *Floods, *Flood damage, *South Carolina, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Spartanburg (SC), Lawsons Fork Creek, Fairforest Creek, Standard project flood, Intermediate regional flood.

Flooding of Lawsons Fork Creek and Fairforest Creek, Spartanburg, South Carolina is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-06245

FLOOD PLAIN INFORMATION, SOUTH FORK OF FORKED DEER RIVER AND SUGAR CREEK, HENDERSON, TENNESSEE.
Corps of Engineers, Memphis, Tenn.

Corps Eng Flood Plain Rep, Jan 1968. 48 p, 7 fig, 11 plate, 12 tab.

Descriptors: *Floods, *Flood damage, *Tennessee, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Henderson (Tenn), Forked Deer River, Sugar Creek, Standard project flood, Intermediate regional flood.

Flooding of the Forked Deer River and Sugar Creek, Henderson, Tennessee is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-06246

FLOOD PLAIN INFORMATION, ARROYO DE LOS CHAMISOS AND ARROYO HONDO, SANTA FE, NEW MEXICO.
Corps of Engineers, Albuquerque, N. Mex.

Corps Eng Flood Plain Rep, Dec 1967. 34 p, 5 fig, 20 plate, 11 tab.

Descriptors: *Floods, *Flood damage, *New Mexico, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Santa Fe (N Mex), Arroyo de los Chamisos, Arroyo Hondo, Standard project flood, Intermediate regional flood.

Flooding of the Arroyo de los Chamisos and Arroyo Hondo, Santa Fe, New Mexico is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-06247

FLOOD PLAIN INFORMATION, CLARK FORK, MISSOULA, MONTANA.
Corps of Engineers, Seattle, Wash.

Corps Eng Flood Plain Rep, Nov 1967. 32 p, 4 fig, 9 plate, 8 tab.

Descriptors: *Floods, *Flood damage, *Montana, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Missoula (Montana), Clark Fork, Standard project flood, Intermediate regional flood.

Flooding of Clark Fork, Missoula, Montana is described in a report of flood plain problems based on records of rainfall, runoff, and historical an present flood heights. Maps, photographs, profile and cross sections indicate the extent of floodin that has occurred and which may be expected t occur in the future. The information is for use i study and planning ways to minimize vulnerabilit to flood damages by control of flood plain use b zoning and subdivision regulations, the construc tion of flood protection works, or by combination of these approaches. (Knapp-USGS)
W69-06248

HARVESTING UNDERWATER WEEDS,
Wisconsin Univ., Madison. Dept. of Mechanica Engineering.
For primary bibliographic entry see Field 05G.
W69-06276

THE LAW OF WATER IN NEW JERSEY,
Rutgers - The State Univ., New Brunswick, N. J School of Law.
For primary bibliographic entry see Field 06E.
W69-06301

PHILLIPS V CHESSON (DIVERSION CAUSED BY EXCAVATED SLOPE).

231 NC 566, 58 SE 2d 343-348 (1950).

Descriptors: *North Carolina, *Damages, *Market value, *Natural flow doctrine, Diversion, Slopes, Surface waters, Discharge (Water), Overland flow, Overflow, Surface runoff, Excavation, Rain water, Legal aspects, Judicial decisions, Real property.
Identifiers: *Permanent damages, *Temporary damages, Injunctions (Mandatory), Dominant estates, Servient estates.

Plaintiff brought suit to recover damages for the dumping of clay excavation from defendant's lot and for diversion of water from said lot onto plaintiff's lower lot; included in the complaint was a prayer for a mandatory injunction requiring correction of such injurious conditions. The governing rule of law is that defendants, as owners of land on a higher level than adjoining land, cannot divert surface water or interfere with its natural flow, by artificial obstruction or device, without incurring liability to the owner of the lower lot. However, as a general rule, the decrease in market value of plaintiff's property will not be the measure of damages for a temporary injury to real estate; only when the injury is permanent is the decrease in fair market value an appropriate measure of damages. Thus, the trial judge's instruction to jury that plaintiff could recover, if at all, the decrease in reasonable market value of his property directly resulting from defendant's wrongful diversion of water, was erroneous. (Reed-Fla)
W69-06309

MESSANA V MAULE INDUSTRIES (NEGLIGENT FLOODING OF FARM LAND).

50 So 2d 874-877 (Fla 1951).

Descriptors: *Florida, *Flood damage, *Crops, *Pumping, Legislation, Judicial decisions, Legal aspects, Floods.
Identifiers: Fact pleading, Causes of action, Motions to dismiss, Punitive damages, Intentional torts.

Plaintiff brought action for damages to his farm land allegedly due to his neighbor's willful and wanton negligence in pumping water onto the plaintiff's land. The trial judge dismissed the complaint for failure to state a cause of action. The Florida Supreme Court reversed the lower court's decision, holding that the complaint was sufficient to state a cause of action under the new common law rules of pleading. (Watson-Fla)
W69-06310

DAVENPORT V TOWN OF DANVERS (FLOODING OF LAND BY CITY DAM).

126 NE 2d 530-531 (Mass 1955).

Descriptors: *Massachusetts, *Flooding, *Dams, *Municipal water, Backwater, Dam construction, Judicial decisions, Legal aspects, Reservoirs, Water supply, Damages, Streams, Legislation, Cities, Eminent domain, Overflow, Flood damage, Mills, Mill dams, Engineering structures, Riparian rights, Riparian land, Obstruction to flow.
Identifiers: Demurrers, Injunctions (Mandatory), Injunctions (Prohibitory).

Plaintiff brought action for damages and to enjoin flooding of his land due to the construction of a dam by the defendant town on a creek running through the plaintiff's property. The trial court sustained the city's demurrer and dismissed the plaintiff's bill. The supreme judicial court held that the demurrer should not have been sustained because it was based upon the allegation that the dam was built pursuant to legislation which allowed the taking of water for municipal purposes, and this fact was not established by the pleadings. The court stated that the landowner could recover damages and that the requested injunction should be granted. The appellate court further stated that the town derived no authority to flood property from mill acts; these acts related only to the construction and maintenance of dams for water mills. (Watson-Fla)
W69-06311

ATCHLEY V TENNESSEE VALLEY AUTHORITY (FLOODING OF CROPS CAUSED BY RAISED RESERVOIR WATERS).

69 F Supp 952-956 (N D Ala 1947).

Descriptors: *United States, *Tennessee Valley Authority Project, *Flood control, *Reservoirs, Crops, Navigable rivers, Administrative decisions, Flooding, Dams, Navigation, Floodwater, Impoundments, Water allocation (Policy), Flood damage, Legislation, Judicial decisions, Overflow, Administrative agencies, Legal aspects, Federal government.

Plaintiffs brought action against the Tennessee Valley Authority to recover for destruction of crops as a result of a flood allegedly caused by defendant's negligence. Defendant moved for summary judgment. Plaintiffs asserted that defendant's employees, acting within the scope of their employment in the operation of the Congressionally-authorized unified system of dams and other structures, negligently raised reservoir waters until they overflowed and flooded plaintiffs' crops. The court declared that Congress did not intend that defendant be liable in connection with its handling of the waters placed under its control. The sue-and-be-sued clause in the Tennessee Valley Authority Act merely removes the procedural bar to suit against a federal agency; it does not impose liability where liability would not otherwise exist. It is well established that federal agencies are not liable for consequential damages arising out of the operation of a navigation improvement. The court ruled that since the performance by executive officers of discretionary governmental duties is not subject to judicial review, defendant's motion for summary judgment must be sustained. (Reed-Fla)
W69-06321

CITY OF MERIDAN V SULLIVAN (SUBSURFACE DRAINAGE).
55 So 2d 851-853 (Miss 1950).

Descriptors: *Mississippi, *Subsurface drainage, Culverts, *Drains, Obstruction to flow, Soil erosion, Damages, Judicial decisions, Conveyance structures, Running waters, Cities, Local governments, Drainage water, Drainage systems, Flood damage, Alteration of flow, Maintenance, Repairing.

The plaintiff brought this suit to recover for damages to her land caused by two negligent acts of the defendant. The plaintiff alleged that the defendant had negligently broken a large hole in plaintiff's culvert which was not repaired. Furthermore, the plaintiff alleged that the defendant was negligent in failing to keep its culverts free from obstruction. As a result of the obstructions in the defendant's culvert, which was located across the street from the plaintiff's property, large quantities of water were forced up through the hole in the plaintiff's culvert and onto plaintiff's land. The result of this flooding was a gradual erosion of the foundations of plaintiff's house. The court found that the evidence was adequate to show that defendant had committed both acts of negligence complained of and that such acts combined to cause the damage sustained by the plaintiff. (Stewart-Fla)
W69-06322

BELUE V CITY OF GREENVILLE (DUTY OF CITY TO PROVIDE DRAINAGE OF THOROUGHFARES).
84 SE 2d 631-636 (SC 1954).

Descriptors: *South Carolina, *Cities, *Road construction, *Surface drainage, Land tenure, Legal aspects, Legislation, Damages, Drains, Backwater, Obstruction to flow, Judicial decisions, Excessive precipitation, Flooding, Landfill, Valve.
Identifiers: *Acts of God, Proximate cause, Debris.

Plaintiff owned a lot adjacent to a street in defendant city. Previously, the contour of plaintiff's lot had been such as to insure adequate drainage of surface water. Plaintiff alleged that the city installed curbing and gutters which destroyed plaintiff's drainage and caused excess water to concentrate on his lot. Defendant city answered, stating that plaintiff's land was a natural drain, and that the rains which caused the alleged damage were acts of God. The trial court rendered judgment for plaintiff. On appeal, the supreme court held that since the damage could be partially attributed to human agency, it was not caused by an act of God. The court found that, by filling in plaintiff's drain, the city had caused water to back up and cast debris upon plaintiff's land. This action by the city violated a state statute requiring municipalities to provide for adequate drainage of its thoroughfares. The court held plaintiff could recover for actual damages and for depreciation in property value due to the likelihood of future flooding. (Harris-Fla)
W69-06323

HILL V CITY OF GREENVILLE (DAMAGES RESULTING FROM CITY'S FAILURE TO PROVIDE DRAINAGE).

76 SE 2d 294-299 (SC 1953).

Descriptors: *South Carolina, *Cities, *Drainage, *Road construction, Highways, Paving, Drains, Ditches, Legislation, Local governments, State governments, Flooding, Surface water, Drainage programs, Administration, Legal aspects, Judicial decisions, Damages, Public rights.

Plaintiff property owners brought this suit to collect for damage caused by defendant municipality's failure to provide drainage facilities to protect plaintiff's property from surface water entering the land from a ditch in the street. This accumulation of surface water first occurred when the state highway department paved and later installed curbs and gutters on a road near plaintiff's property. Later, plaintiffs' property was annexed to defendant municipality and plaintiffs demanded that city provide drainage to protect their property. Defendant refused to provide the drainage. The appellate court held that no person can claim drainage as a right where such is not provided for by statute. No statute in this state bestows such right upon plaintiff. Furthermore, the court felt it unfair to hold the city liable for delict of the state highway department committed years before plaintiffs' property became a part of the city. Judgment was rendered in favor of the municipality. (Logan-Fla)
W69-06324

POWERS AND FUNCTIONS OF DEPARTMENT OF WATER RESOURCES - FLOOD CONTROL.
Md Ann Code Art 96A:50-58 (1957), as amended, (Supp 1968).

Descriptors: *Maryland, *Flood control, *Watershed management, *Administrative agencies, Legislation, Water control, Legal aspects, Water management (Applied), Programs, Federal government, State governments, Project planning, Water works, Long-term planning, Regulation, Flood protection, Land management, Reservoirs, Water supply, Supply contracts, Water storage, Water costs, Real property, Eminent domain, Local governments, Adjudication procedure.

The Maryland Department of Water Resources is responsible for and must cooperate with federal and local governments in developing and implementing a long range flood control program, and shall serve as a liason to such governments in all flood control matters. The Department provides technical and financial assistance to local governments and other agencies in interpreting flood information and in drafting regulations pertaining to areas subject to flooding. Plans for local public works are reviewed by the Department, which also controls all such works. The state may acquire real property interests whenever the general assembly determines such action is necessary for proper land and watershed management. The department may estimate water-storage needs in federally constructed reservoirs and may contract with federal authorities for repayment of water supply costs. Any party aggrieved by a final decision of the Department may petition for a hearing by the Water Resources Commission. (Wheeler-Fla)
W69-06332

GOULD AND EBERHARDT, INC V CITY OF NEWARK (DISCHARGE OF SURFACE WATERS FROM STORM SEWER).
6 NJ 240, 78 A 2d 77-79 (1951).

Descriptors: *New Jersey, *Discharge (Water), *Drainage water, *Drainage systems, Cities, Natural flow, Overflow, Alteration of flow, Storm drains, Surface waters, Storm runoff, Outlet works, Remedies, Relative rights, Contracts, Construction, Projects.
Identifiers: *Equitable estoppel, Injunctions (Prohibitory), Laches.

Plaintiff brought this action against defendant city to enjoin the further discharge of storm and surface waters onto plaintiff's property from a storm sewer system constructed and maintained by defendant. Before undertaking the construction of the sewer system, the city consulted plaintiff and outlined its plans. After considering the project, plaintiff gave its consent. Over nineteen years passed before plaintiff expressed its dissatisfaction with the project. The city asserted that plaintiff should be estopped from claiming equitable relief because it had given its consent before the construction was undertaken. The court pointed out that a municipality's collection and discharge of surface waters upon private property in greater quantity than would occur from the natural flow is an active wrongdoing for which a court of equity can grant injunctive relief. However, while the court will not protect an active wrongdoer under the doctrine of equitable estoppel, in the present case, the city was not guilty of active wrongdoing since it was acting in reliance upon plaintiff's express consent. Therefore, the court held that plaintiff, having had knowledge of and having assented to the construction and having enjoyed the benefit of it for many years, was not entitled to the relief sought. (Reed-Fla)
W69-06357

STATE V BOSTIAN (EMINENT DOMAIN AND MUNICIPAL WATER SUPPLY).
For primary bibliographic entry see Field 06E.
W69-06358

WOODWARD IRON CO V MUMPOWER (DAMAGE TO SURFACE OWNERS RIGHTS FROM MINING OPERATIONS).

28 So 2d 625-629 (Ala 1947).

Descriptors: *Alabama, *Mining, *Land subsidence, *Damages, Surfaces, Legal aspects, Land tenure, Springs, Wells, Soil surfaces, Relative rights, Coal mines, Compensation, Judicial decisions, Water supply, Stock water.
Identifiers: *Absolute liability, *Robbing.

Plaintiff owned the surface rights in a certain tract of land; defendant owned the mineral rights in the same tract. Defendant conducted mining operations under the land. These mining activities included 'robbing' operations. Plaintiff relied upon a spring, stream, and well to supply water and irrigate pasture land for dairy cattle. Plaintiff had substantially improved the property by erecting certain dwellings thereon. The evidence showed that the spring and wells went dry and that large breaks appeared in the land which caused plaintiff's dwellings to sag and shift. Plaintiff was forced to haul water at great expense and inconvenience in order to carry on his business and was finally forced to suspend dairy operations. Plaintiff received a $10,000 judgment in the trial court. On appeal, the supreme court held that liability for damages of the character described was absolute and that defendant's allegations as to his exercise of due care were immaterial. The court said that defendant's expert testimony was to be considered with other evidence and was not conclusive on the issue of liability. The jury was correct in considering plaintiff's annoyance and inconvenience in arriving at its determination of damages. (Harris-Fla)
W69-06359

STIGALL V SHARKEY COUNTY (DESTRUCTION OF DRAINAGE FACILITIES CAUSING FLOOD DAMAGE).

57 So 2d 146-148 (Miss 1952).

Descriptors: *Mississippi, *Obstruction to flow, *Surface drainage, *Flooding, Laterals, Culverts, Landfills, Barriers, Canals, Legal aspects, Judicial decisions, Road construction, Backwater, Natural flow doctrine, Remedies, Adjudication procedure, Ditches, Crops, Governments, Compensation, Flood damage.
Identifiers: Injunctions (Mandatory).

The complainants alleged that their land was adequately drained by 3 drainage canals and a lateral ditch which fed one canal. They further alleged that the defendant county filled the lateral ditch in order to construct a road thereon and built a road across one of the canals; this latter road was equipped with inadequate drainage culverts. Complainants claim damages to crops by flooding and seek a mandatory injunction requiring removal of the alleged obstructions to natural drainage. The chancery court entered judgment for the defendant county. The supreme court held that damages should be determined by reference to the itemized statement of crop damages, not by application of the before-and-after test. The court further held that the chancellor had power to issue an injunction requiring the county to correct the drainage inadequacies if the facts and equities require such an order. (Harris-Fla)
W69-06360

HALL V CITY OF GREENVILLE (STATUTORY DUTY OF CITY TO PROVIDE ADEQUATE STREET DRAINAGE).

88 SE 2d 246-254 (SC 1955).

Descriptors: *Flood damage, *South Carolina, *Road construction, *Drainage, Legal aspects, Land tenure, Legislation, Cities, Alteration of flow, Backwater, Floods, Drains, Relative rights, Judicial decisions, Local governments, Concrete structures, Surface waters, Surface drainage, Damages, Roads.
Identifiers: Questions of fact.

Plaintiffs sought to recover for flood damage to property. Plaintiffs alleged that defendant city violated a statute requiring it to adequately drain its streets and thoroughfares in order to prevent passage of surface water over private lands. Plaintiffs alleged that curbs and gutters installed in street improvements in the area caused channelling of surface water onto their land, making it unfit for habitation. The lower court entered a nonsuit. On appeal, the supreme court held that in order to state a cause of action under the statute there must be sufficient facts pleaded to show a demand and a failure to provide the requested drainage. No negligence in the usual sense need be shown; the statute, however, does not make the city an insurer against surface water damage. Furthermore, the court held that certain questions of fact should have gone to the jury. The questions included whether the overflow was due to construction of drainage facilities and whether the actions taken by plaintiffs were sufficient to constitute demand under the statute. The court reversed the lower court and remanded for a new trial. (Harris-Fla)
W69-06361

BOARD OF LEVEE COMM'RS OF ORLEANS LEVEE DIST V KELLY (PUBLIC RIGHTS IN RE FLOOD CONTROL).

225 La 411, 73 So 2d 299-302 (1954).

Descriptors: *Louisiana, *Administrative agencies, *Levees, *Right-of-way, Legislation, Hydraulic structures, Dikes, Mississippi River, Streams, Running waters, Flood control, Public benefits, Public health, Prescriptive rights, Easements, Beds, Ownership of beds, Condemnation, Eminent domain, Legal aspects, Judicial decisions, Remedies, Competing uses.

Plaintiff levee board was empowered by state law to protect the general public from flood danger. Pursuant to arrangement with the Army Corps of Engineers, plaintiffs commenced acquisition of a right of way to construct an addition to an existing levee along the Mississippi River. Defendants, bare possessors, occupied a portion of that right of way and had refused to remove their residences. Plaintiff brought action for a mandatory injunction requiring such removal from the levee site. The court held that the Board was entitled to the injunction, having demonstrated that public necessity required removal of defendants. (Katz-Fla)
W69-06362

MCKEE V HASLER (LEVEE CONSTRUCTION FOR FLOOD CONTROL).
98 NE 2d 657-671 (Ind 1951).

Descriptors: *Indiana, *Levees, *Flood protection, *Construction, Engineering structures, Embankments, Flood damage, Dikes, Barriers, State governments, Legislation, Judicial decisions, Flood control, Retaining walls, Rivers, Shore protection, Public health, Legal aspects, Public benefits.
Identifiers: *Remonstrances.

Defendants, whose lands were subject to damaging overflow from a river, filed a petition under the Levee Act for construction of a levee. Plaintiffs filed intervening petitions and remonstrances to such construction. They alleged that the proposed levee was neither practicable nor sufficient to offer any protection to defendants' lands. In addition, plaintiffs charged that they should be included within the class of persons who had standing to contest the proposed construction. The court, looked to the legislative intent and purpose in construing the pertinent provisions of the Levee Act. It was found that the purpose of the Act was to protect certain lands which were subject to overflow and which were of general public utility. With this in mind, the court concluded that, in order to remonstrate, a person's lands must be directly, permanently, continuously, and materially destroyed. The Act was passed in the interest of public improvement. The construction of a public wo must, of necessity, cause inconvenience to son The plaintiffs' lands were subject only to doubt or occasional damage; therefore, the trial cour judgment for the defendants was affirme (Stewart-Fla)
W69-06363

UNITED STATES V INGRAM (BRIDGE CO STRUCTION AND RIPARIAN OBLIGATIONS)

99 F Supp 465-474 (E D Ark 1951).

Descriptors: *Arkansas, *Legislation, *Bridge *Operation and maintenance, Railroads, Unit States, Engineering structures, Navigable rive Navigable waters, Federal government, Right-o way, Access routes, Highway relocation, Eas ments, Jurisdiction, Judicial decisions, Leg aspects, Streams, Remedies, Damages, Mississip River.

The United States brought this action against t defendant county judge and others to enjo dismantling of roadways and traffic approaches a tached to a railroad bridge across the Mississip River. The bridge was constructed under a speci act of Congress, which conditioned authorizatio upon agreement by the defendant bridge compar that it would construct and maintain the roadwa and traffic approaches. A subsequent amendmer to this act provided that the bridge company coul transfer the bridge and that upon such transfer would cease to be liable for maintenance of th roadways. The court dismissed the complaint as t the bridge company noting that the transfer to de fendant county relieved the bridge company of an liability. The court found that the county did no assume the duty to maintain the roadway and wa not required by statute to so assume that duty. Th plaintiff's contention that the defendants had faile to comply with the Bridge Act of 1906 was found t be without merit since that act only applies to ac tions which affect the navigability of the river an not to actions concerned merely with highwa maintenance. (Katz-Fla)
W69-06364

CITY OF IRVINE V SMITH (FLOODING CAUSED BY BREAK IN SEWER).
304 Ky 868, 202 SW 2d 733-735 (1947).

Descriptors: *Kentucky, *Sewers, *Cities, *Tile drainage, Sewage disposal, Flooding, Flood damage, Roads, Subsurface drainage, Pipes, Drainage systems, Ravines, Culverts, Floods, Legal aspects, Judicial decisions, Public benefits, Public rights, Road construction.
Identifiers: *Public sewers, *Private sewers.

Plaintiffs brought action against a city for damages caused by a beak in a sewer line which flooded plaintiffs' basement. Before streets in plaintiffs' section of the city were constructed, plaintiffs' predecessors in title laid tiling in a ravine which crossed their lots; they then filled in the ravine and built a house on the lot. When streets were constructed, the city put culverts under the roadway. These culverts were connected with the private sewer lines under plaintiffs' property. The trial court awarded plaintiffs $500 damages, and the city appealed. The court noted the mere fact that the culverts and sewers constructed by the city were connected with the private sewers under plaintiffs' property did not indicate a dedication of the private sewer for public use. Furthermore, the fact that the city sought to work out an agreement relative to the reconstruction of the private sewer line, and the fact that the city had made repairs on the private sewer did not constitute a dedication to public use. Therefore, the court concluded hat since the evidence showed the sewer in question was a private sewer, and not a public sewer for which the city was responsible, the judgment should be reversed. (Reed-Fla)
W69-06365

MARINE AIR WAYS, INC V STATE (DEPRIVATION OF ACCESS ROUTES DUE TO BRIDGE CONSTRUCTION).

116 NYS 2d 778-779 (Appladiv 1952).

Descriptors: *New York, *Riparian rights, *Access routes, *Navigation, Bridges, Compensation, Boating, Judicial decisions, Navigable waters, Relative rights, Public benefits, State governments, Damages, Legal aspects, Community development, Public rights, High water mark.
Identifiers: Navigational servitudes.

Plaintiff sought compensation for his loss of business occassioned by the state's construction of a bridge. The bridge prevented ships with masts over 50 feet from reaching his shipyard. The bridge was constructed for highway use over a navigable stream. Clearance was 50 feet over mean high water, and the average height of the masts on the ships serviced by the plaintiff was 53-55 feet. After the construction of the bridge, these ships were either unable to reach the plaintiff's yard or had to lower or remove their masts to do so. This court affirmed a judgment dismissing the palintiff's claim. The fact that some ships could no longer reach the plaintiff's yard because of the bridge did not constitute such an interference with the plaintiff's right of access to navigable waters as would entitle him, as a riparian owner, to compensation from the state. (Blunt-Fla)
W69-06366

MCCAUSLAND V JARRELL (OBSTRUCTION OF THE FLOW OF A NATURAL STREAM).

58 SE 2d 729-746 (W Va 1951).

Descriptors: *West Virginia, *Natural streams, Surface water, *Obstruction to flow, Drainage, Alteration of flow, Barriers, Culverts, Diversion, Natural flow doctrine, Riparian rights, Riddance (Legal aspects), Streamflow, Streams, Ditches, Drains, Running waters, Watercourses (Legal), Artificial watercourses, Damages, Channels, Seepage, Banks, Water rights, Repulsion (Legal aspects).
Identifiers: Injunctions (Mandatory).

The parties owned adjoining tracts of land through which flowed several branches of a stream. Prior to 1948, one branch flowed from plaintiff's land to a farm lane between the tracts where it ran into a culvert and was deposited upon defendant's land; here it accumulated in a small pond. In 1948 defendant raised the elevation of the farm lane and closed the culvert. Defendant dug a ditch along the line to carry off the water from the stream. Plaintiff alleged that the ditch, being inadquate to carry off the natural flow of the stream, caused the water to accumulate on his land. Plaintiff sought to compel the opening of the culvert. The court held that a landowner is entitled to the unaltered flow of a natural stream through his land and to the land of a neighbor below. Therefore, a person who obstructs such a watercourse is liable to the upper owner for damages. Verdict was for the plaintiff. (Helwig-Fla)
W69-06367

NAGEE V TEXAS CONSTRUCTION CO (FLOODING ABOVE COFFER DAM).

227 La 32, 78 So 2d 500-502 (1955).

Descriptors: *Louisiana, *Flood damage, *Lumbering, *Overflow, Riparian rights, Judicial decisions, Legal aspects, Hardwood, Riparian lands, Coffer dams, Rivers, Swamps, Flooding, Damages, Obstruction to flow, Backwater, Forests, Legislation.

The construction of a coffer dam by defendant across a river, downstream from plaintiff's land, caused flooding and interfered with logging operations being conducted by plaintiff's contractor. The court found that the overflow caused no injury to plaintiff's hardwood and cypress trees, but damages were assessed, measured by the decrease in the market price of the timber during the five month period in which the overflow continued. The court held that, under the Louisiana Civil Code, where one wrongfully inundates another's land, he is obliged to compensate the injured landowner for any damages directly and proximately caused by such inundation. (E Kelley-Fla)
W69-06368

JARVIS V CORNETT (DAMAGES CAUSED BY DIVERSION OF SURFACE WATER).
257 SW 2d 524-525 (Ky 1953).

Descriptors: *Kentucky, *Riparian rights, *Diversion, *Riddance (Legal aspects), Drainage systems, Surface waters, Surface drainage, Natural flow, Surface runoff, Drainage effects, Damages, Judicial decisions, Culverts, Drainage practices, Drains, Gutters, Ditches, Pipes, Relative rights, Alteration of flow, Artificial watercourses, Legal aspects, Repulsion (Legal aspects).

Defendants owned property adjacent to and higher than plaintiffs' land. A ditch ran along a highway and passed in front of each party's property. In order to construct a driveway for their store, defendants laid pipe in the ditch and placed fill around the pipe up to the level of their lot. Plaintiffs alleged defendants allowed this pipe to become clogged, causing water to flow onto neighboring lands. This condition persisted even though defendant dug a ditch between his lot and the adjacent property to divert water back into the roadside ditch. The court found that any water flow was a natural consequence of the low level of plaintiffs' lot. The owner of an upper estate may ditch his land to carry off surface water into natural channels, using sewers, culverts, or gutters, without liability to lower owners. He may do so even though such methods increase the flow onto the lower lands, but only as long as he does not tap water from additional watersheds or divert water from natural drains which otherwise would not have flowed onto the lower estate. Evidence failed to show that defendant caused an unnatural flow of surface water onto plaintiffs' land. (Kelly-Fla)
W69-06369

GRANGER V ELM TREE VILLAGE (DISCHARGE OF EXCESS SURFACE WATER).
23 NJ Super 592, 93 A 2d 641-644 (1952).

Descriptors: *New Jersey, *Repulsion (Legal aspects), *Drainage water, *Surface runoff, Judicial decisions, Boundaries (Property), Riddance (Legal aspects), Reasonable use, Drainage, Natural streams, Artificial watercourses, Surface drainage, Construction, Damages, Embankments, Retaining walls, Bulkheads, Diversion, Obstruction to flow, Land use, Natural flow.

Plaintiff owns land adjacent to defendant contractor. Prior to construction upon defendant's land, plaintiff's land was higher in elevation, and surface water drained toward and onto defendant's land. Defendant erected houses, a concrete retaining wall, an embankment and road, and raised the level of his land above that of the plaintiff. This construction caused the natural flow of water to be changed resulting in flooding of plaintiff's land. Plaintiff sought damages and a restraining order to prevent defendant from causing water to flow onto his property. The court held that a retaining wall erected 2 feet inside the property line rather than on the line did not result in unlawful collection of water on the land. To the argument that defendant had unlawfully obstructed a natural watercourse, the court replied that the evidence failed to show the water involved was anything but surface water. Defendant made reasonable use of his land, and the court refused to modify the common enemy rule so as to require that one who discharges water from his land not cause unnecessary injury to others. (Helwig-Fla)
W69-06370

DE PIETRO V TRIANO (ESTABLISHMENT OF EASEMENT FOR SURFACE WATER DRAINAGE).
167 Pa Super 29, 74 A 2d 710-712 (1950).

Descriptors: *Pennsylvania, *Easements, *Repulsion (Legal aspects), *Surface runoff, Judicial decisions, Legal aspects, Drainage, Ditches, Boundaries (Property), Natural flow, Riddance (Legal aspects), Diversion, Reasonable use, Artificial watercourses, Water law, Water rights, Land use, Surface drainage, Real property, Obstruction to flow, Walls barriers, Discharge (Water).

The parties were adjacent landowners. Appellants owned the upper tract. Prior to the time of purchase, both parties were tenants on the same land. During this period, appellant's father dug a ditch which diverted the surface water from its natural course. After the parties purchased their respective lots, appellees built a wall across the ditch which obstructed the flow of water. Appellants alleged that they had an implied easement to discharge water into the ditch because the ditch was built with the consent and by direction of the parties' common grantor. The court held that the appellant had failed to establish the existence of an implied easement. An upper landowner has a right to discharge water on lower lands by natural means. However, the upper owner may not alter the course or volume by artificial means. If artificial means are used to divert or increase the flow, an easement must first be established. The burden is on the party claiming existence of the easement to show separation of title, intent to make easement permanent, the necessity of the easement to enjoyment of land and a continuous and self-acting servitude. Appellant failed to prove these elements. (Helwig-Fla)
W69-06371

EFNER V KETTERINGHAM (VALIDITY OF EASEMENT TO DRAIN RAIN WATER ONTO ADJOINING LAND).
41 So 2d 130-136 (La Ct App 1949).

Descriptors: *Louisiana, *Easements, *Drains, *Surface runoff, Judicial decisions, Legal aspects, Damages, Seepage, Drainage effects, Flooding, Drainage systems, Paving, Pipes, Storm drains, Tiles, Conduits, Rain, Rain water, Land tenure, Drainage engineering, Relative rights.
Identifiers: Injunction (Prohibitory), Equitable servitudes.

Plaintiff brought suit for recognition of a servitude of drip and drain and to enjoin the defendants from damaging and dislocating his downspouts which discharged rain water on the defendants' driveway. The trial court held in favor of the defendants, but the court of appeals reversed on condition that the plaintiff repair and restore the defendants' driveway. The rain water from the plaintiff's roof was flooding defendants' basement. Plaintiff had originally owned both lots and had installed the downspouts from his roof to the driveway which he had constructed on the other lot. The appellate court held that the drip and drain servitude still existed even though it was not mentioned in the deed conveying the lot upon which the drive way was located. (Watson-Fla)
W69-06372

DIXON V CITY OF NASHVILLE (DAMAGES CAUSED BY DEFLECTION OF SURFACE WATER FLOW).

203 SW 2d 178-182 (Tenn 1946).

Descriptors: *Tennessee, *Surface drainage, *Road construction, *Absorption, Judicial decisions, Legal aspects, Drainage, Furrow drainage, Drainage water, Deflection, Surface runoff, Surface waters, Gullies, Runoff, Repulsion (Legal aspects), Cities, Grading, Natural flow, Erosion, Flood damage.

Plaintiffs sued to recover for property damage caused by interference with the natural drainage of surface waters by reason of its mode of construction and drainage of streets. The court, finding that the damage had been caused by deflection and concentration of water into a drain emptying adjacent to plaintiffs' property, rendered decision for the plaintiffs. The court noted that a city may improve its property in any natural and ordinary way so long as there is no substantial change in the flow of surface waters. The court also quoted an earlier case holding that Tennessee was not a 'common enemy' state. Therefore, when disposing of surface water, the rights of adjoining owners must be respected. (Logan-Fla)
W69-06373

JOHNSON V CITY OF WINSTON-SALEM (SURFACE WATER DRAINAGE - PIPES).
239 NC 697, 81 SE 2d 153-161 (1954).

Descriptors: *North Carolina, *Flooding, *Repulsion (Legal aspects), *Riddance (Legal aspects), Drainage water, Surface waters, Surface runoff, Storm runoff, Excessive precipitation, Drainage systems, Tiles, Pipes, Cities, Easements, Judicial decisions, Legal aspects, Remedies, Local governments, Flood damage, Conduits.

Plaintiff brought suit to recover damages caused by defendants' negligent failure to maintain a drainage pipe. The plaintiff alleged that defendant landowner was under a legal duty to maintain the drain pipe and that flood damage to plaintiff's residence was caused by clogging of the pipe and overflow of drainage waters onto defendant's upper land and then onto plaintiff's land. The plaintiff alternatively attempted to prove that the defendant city had assumed control over the pipe and had been negligent in failing to maintain the pipe. The defendant landowner contended that the pipe merely channeled the normal surface flow of water onto plaintiff's servient estate, causing no damage other than that which would normally have occurred. The court held that defendant landowner was under a legal duty to exercise ordinary care in maintenance of the ditch and that the evidence was sufficient to raise issues of fact. The court found, however, that plaintiff had failed to state a cause of action against the city since he had not established sufficient incorporation of the drain into the city's drainage system. (Katz-Fla)
W69-06374

HORN V BRATTON (SUIT TO ENJOIN MAINTENANCE OF DAM AND DITCH FACILITIES).
216 SW 2d 794-795 (Ark 1949).

Descriptors: *Arkansas, *Dams, *Ditches, *Alteration of flow, Judicial decisions, Adjudication procedure, Legal aspects, Natural flow, Ponds, Drainage, Roads, Rain, Relative rights, Diversion structures, Diversion.
Identifiers: Injunctions (Mandatory), Injunctions (Prohibitory), Testimonial proof, Expert witnesses.

Plaintiff sought to enjoin the defendant from constructing a dam and to compel him to fill a ditch on the ground that these structures would divert the natural flow of water onto the plaintiff's land. The trial court held for the defendant, and the supreme court affirmed, stating that the evidence presented supported the lower court's determination that the dam and ditch would not cast water onto the plaintiff's land. The evidence referred to was primarily the testimony of the representative of the Federal Soil Conservation Service who designed the dam and ditch facilities. (Watson-Fla)
W69-06375

NATIONAL MFG CO V UNITED STATES (SOVEREIGN IMMUNITY FROM SUIT FOR FLOOD DAMAGE).

219 F 2d 263-280 (8th Cir 1954).

Descriptors: *Missouri, *Federal government, *Flood forecasting, *Flood damage, Legislation, Flood control, Flood protection, Historic flood, Maximum probable flood, Rivers, River forecasting, Flash floods, Warning systems, Navigable rivers, United States, Judicial decisions, Weather forecasting, Damages, Riparian land, Riparian waters, Legal aspects, Mississippi River.
Identifiers: Kansas River, Federal Tort Claims Act, Sovereign immunity.

Plaintiffs owned businesses on land along the Kansas River. The land was inundated by flood waters from the river causing extensive damage. Plaintiffs brought suit against the United States under the Federal Tort Claims Act for damages caused by the government's negligent failure to assemble, analyze, and distribute weather and flood information. Agent's of the United States had assured plaintiffs that the river would not overflow its banks. Plaintiffs alleged that, because of the negligent acts and omissions of defendant, they were lulled into a false sense of security and did not take precautions against the flood. A motion for summary judgment for defendant was sustained in the trial court. Plaintiff appealed. Defendant asserted that the Mississippi River Flood Control Act of 1928 declares that the United States shall not be liable for damage from floods; the Federal Tort Claims does not exempt any person or situation from this exclusionary provision. The court held that the Act meant to protect the government from liability from floods whether or not sovereign immunity could be asserted. Since the Flood Control Act was not expressly repealed by the Federal Tort Claims Act and since repeals by implication are not favored, it cannot be said that the Act was impliedly repealed. (Helwig-Fla)
W69-06376

CROSS V PACE (DAMAGE TO UNITED STATES CITIZENS BY FOREIGN DAM).

106 F Supp 484-489 (DDC 1952).

Descriptors: *St Lawrence River, *International law, *Dams, *Federal government, Damages, Backwater, Floods, Lake Ontario, Legislation, Federal jurisdiction, Judicial decisions, Political aspects, Remedies, Rivers, Water levels, Foreign waters, Administration, Governments, Flood damage.
Identifiers: *Canada, *Injunctions (Mandatory), *Constitutionality, Political questions, Commerce power, Standing.

United States citizens claimed damages due to the rising level of Lake Ontario caused by a dam on the St Lawrence River. The dam was situated partly in the United States and partly in Canada. The United States gave consent to the construction of the dam, provided the structure did not injure United States interests or the interests of its citizens. Plaintiffs alleged that defendant Secretary of the Army was derelict in his duty, that the dam was illegal, and that the enabling act by which conditional consent was given was unconstitutional. Plaintiff's sought a mandatory injunction ordering alteration of the dam in such a manner as to lower the level of Lake Ontario and, in addition, sought a declaratory judgment as to their respective rights. The district court held that defendant Secretary had discretion to determine whether to invoke conditions under the act since the decision whether to right the present wrong was a political one. The court held that it was without jurisdiction to issue an injunction and that plaintiffs lacked standing to institute the action. The court held that the enabling act was an exercise of Congress' power to regulate commerce with foreign nations and that that power includes control of navigable waters. Further, the enabling act was a manifestation of legislative consent to the construction of the dam. (Harris-Fla)
W69-06380

KRAFT V MILLER (ARTIFICIAL CONTROL OF SURFACE WATERS).

314 Mich 390, 22 NW 2d 857-862 (1946).

Descriptors: *Michigan, *Dams, *Powerplants, *Dam construction, Judicial decisions, Surface waters, Natural flow, River flow, Running waters, Watercourses, Prescriptive rights, Dam design, Flood damage, Flood control, Excess precipitation, Legal aspects, Relative rights.
Identifiers: Injunctions (Prohibitory).

Plaintiffs brought suit to enjoin defendants from increasing the height of a dam. The defendants own property and a power plant about six miles downstream from the plaintiffs' property. Increasing the dam height by 3 feet will enable the defendants to produce more electric power. The plaintiffs contend that increasing the height will cause a backup of water which will damage their property. The defendants contended that any damage to the plaintiffs' land was caused by unusual rainfall and floods. After careful consideration of facts and conditions, the court held that no substantial damage had been or will be done by raising the height of the dam an additional three feet. The injunction was denied. (Stewart-Fla)
W69-06400

STATE V SENSENBRENNER (RIPARIAN RIGHTS REGARDING NATURAL DAMS).

262 Wis 118, 53 NW 2d 773-776 (1952).

Descriptors: *Wisconsin, *Navigable waters, *Dams, *Riparian rights, Beavers, Obstruction to flow, Judicial decisions, Land tenure, Natural streams, Riparian land, Natural flow, Administrative agencies, State governments, Abatement, Water level fluctuations, Dam construction, Damages, Lakes, Backwater, Legal aspects, Relative rights.
Identifiers: Penalties (Civil).

Plaintiff brought suit to recover penalties for alleged obstruction of a navigable stream. Defendant was the riparian owner of land on both sides of the navigable stream. The stream had been obstructed by a beaver dam which caused lake waters to back up onto adjacent property. Defendant refused to allow conservation commission employees to enter his lands to destroy the dam. Plaintiff contended that defendant's refusal to grant permission constituted an affirmative act to maintain the dam. The court held that the defendant had a legal right to refuse permission. No permission would be required if plaintiff's employees had come by boat and destroyed the dam. In the absence of an affirmative act of maintenance by the defendant, plaintiff had no right to force him to remove the dam. Plaintiff had inherent power to destroy the structure provided it did not seek to accomplish this objective by trespassing upon lands of the defendant. (Stewart-Fla)
W69-06401

NATURAL RESOURCES.

Minn Stat Ann secs 86.01 to 86.12, 86.31 to 86.35, 86.71, 86.75 (1964).

Descriptors: *Minnesota, *Natural resources, *Conservation, *Appropriations, Legislation, Recreation, Multiple purpose projects, Industries, Land resources, Economics, Forests, State governments, Parks, Federal government, Wildlife, Land use, Algae, Vegetation, Public lands, Public benefits, Legal aspects, Data collections, Administrative agencies, State governments, Local governments.

The Natural Resources and Recreation Act of 1963 provides the legislature with the power to evaluate programs designed to preserve, develop and maintain natural resources. A 14 member Minnesota Resources Commission is created. This agency is

given the following duties: (1) to study the state policy and system of public access, fees, permits and use of recreational facilities; (2) to study the control of noxious aquatic vegetation; (3) to report its findings and recommendations to the legislature; (4) to conduct public hearings to secure data; (5) to investigate the feasibility of land exchanges with the federal government; and (6) to study the timber cutting policy of the state. The Commission must recognize the importance of and plan for the multiple use of natural resources. The Commissioner of Conservation is authorized to employ needy persons in distressed areas on projects for the conservation of natural resources. Money from the Federal Land and Water Fund shall be applied for, accepted and disbursed by the governor or his designated agent. Such funds shall be expended only according to law. Appropriations to local governmental units from the State Natural Resources Fund shall be first reviewed by the local officials and may be expended according to law. (Helwig-Fla)
W69-06403

3B. Groundwater Management

THE ROLE OF GROUNDWATER IN THE DEVELOPMENT OF WATER RESOURCES,
Water Planning for Israel Ltd., Tel Aviv. Research Dept.
Mona Kahana.
Int Conf on Water for Peace, Wash, DC, Vol 2, pp 809-820, 1968. 12 p, 2 ref. For the 8 Volume Proceedings see Vol 2, No 9, Field 06B and W69-03305.

Descriptors: *Water management (Applied), Groundwater, *Arid lands, Aquifers, Systems analysis, Computers, Operations research, Artificial recharge, Water demand, Water distribution (Applied), Water resources, Watershed management, Water utilization, Storage.
Identifiers: *Groundwater management, Comprehensive water plans, Israel.

Groundwater is now generally accepted as a source of water supply; under favorable conditions it may prove to be more economical than surface water, and aquifers may be used for major storage. A groundwater system offers the advantage of equilibrium created by long-term climatic cycles. Development is possible beyond the natural recharge, thus permitting the postponement of decisions which require long periods for planning. Study of the aquifer can be continued to improve estimates while water is withdrawn. Groundwater permits flexible planning, and lends itself conveniently to development by stages. It is possible to supply groundwater to many scattered localities with no need for costly distribution systems, and to provide wells for peak demand. The water usually needs little or no treatment. Aquifers can effectively serve as sources of water, conduits, reservoirs, and media for improving water quality. In arid zones, underground storage with little or no evaporation losses may be of great value; therefore, it would be preferable in many cases, particularly in arid regions, to start developing groundwater even where river water is available. Later, the aquifer may be recharged by floodwater, reclaimed sewage, or even brackish water. The need for a master plan is imperative at as early a stage of development as possible, and it will be in the process of constant re-evaluation. Operations research, the use of analogs, and computers, promise to improve management plans. (Knapp-USGS)
W69-06054

GEOLOGIC STUDIES AS AN AID TO GROUNDWATER MANAGEMENT,
Illinois State Geological Survey, Urbana.
Donald A. Landon.
Illinois State Geol Surv Environ Geol Note No 14, May 1967. 9 p, 2 fig, 7 ref.

Descriptors: *Hydrogeology, *Artificial recharge, *Illinois, Geophysics, Logging (Recording), Surveys, Boreholes, Maps, Water wells, Water management (Applied).
Identifiers: Chicago (Ill).

A preliminary geologic evaluation of an area where managment of groundwater resources is contemplated can be made from existing maps, water well logs, and engineering borings relating to the region. Based on criteria established by the Illinois State Water Survey, geologic studies have been made in northeastern Illinois of the possibilities for natural and artificial groundwater recharge in the Chicago region. Similar studies can be made elsewhere with such criteria where there is available geologic control. (Knapp-USGS)
W69-06082

USE OF GRAVITY SHAFTS FOR GROUND WATER RECHARGE,
North Dakota State Univ., Fargo. Coll. of Civil Engineering.
Marvin T. Skodje.
J Amer Water Works Ass, Vol 61, No 5, pp 246-248, May 1969. 3 p, 1 fig, 2 tab.

Descriptors: *Artificial recharge, *Groundwater, Filtration, Sedimentation, Well filters, Pit recharge, Water management (Applied), Groundwater, Permeability.
Identifiers: Recharge shafts.

Sedimentary clogging of gravity recharge shafts filled with uniformly graded fine sands was shown by laboratory tests to occur only in the upper few miles of the shafts. Piezometer measurements of head loss and sediment deposition patterns showed constant permeability at lower levels. No air-bind losses were found. The permeability of sand size 20 was 14,400 gpd/sq ft; no. 30 sand, 4,500; and no. 40 sand, 3,400. Shafts should have coarser material at the bottom for maximum permeability and fine material at the top to trap sediments, with larger cross-section area at the top to maximize flow rates. (Knapp-USGS)
W69-06202

GROUNDWATER LEVELS AND PUMPAGE IN THE PEORIA-PEKIN AREA; ILLINOIS, 1890-1966,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 02F.
W69-06208

HYDROLOGY OF GROUNDWATER (GENERAL OUTLINE),
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 02F.
W69-06223

ESTIMATION OF GROUNDWATER RESOURCES,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 02F.
W69-06230

H W PEERSON DRILLING CO V SCOGGINS (DEED EXCEPTIONS AND RIGHTS TO SUBTERRANEAN WATERS).
For primary bibliographic entry see Field 06E.
W69-06312

4C. Effects on Water of Man's Non-Water Activities

VOLLRATH V WABASH RAILROAD CO. (DAMAGE DUE TO FLOOD WATER FLOW THROUGH ARTIFICIAL EMBANKMENT CUT).

65 F Supp 766-775 (WD Mo 1946).

Descriptors: *Missouri, *Embankments, *Railroads, *Repulsion (Legal aspects), Flow augmentation, Water law, Relative rights, Flood damage, Eminent domain, Overlying proprietor, Confined water, Surface runoff, Overflow, Overland flow, Open channels, Surface waters, Channel flow, Discharge (Water), Damages, Impounded waters.
Identifiers: *Railroad embankments.

Defendant railroad, in order to prevent washing out of its tracks, made a cut in its embankment which allowed flood water to pass through the opening in a concentrated stream onto plaintiffs' land below. Prior to construction of the cut, the embankment served to impound overflow from a creek above the embankment. Plaintiffs sued for flood damages due to the concentrated flow onto their lands. The court entered judgment for plaintiffs. Flood water is considered surface water, and the court followed the Missouri modification of the common enemy doctrine. This doctrine allows an owner to cast surface waters from his land in any reasonable manner without liability for damage to a neighbor's property. However, even under the common enemy rule a landowner is liable for damages caused by impounding and discharging water in concentrated amounts. The measure of damages is an amount equal to the cost of repairing the injury caused by the concentrated flow, less the cost of the injury which would have occurred had the embankment not been present. A statute requiring openings in railroad embankments was held inapplicable since openings were required only when they would connect with a waterway. (Wheeler-Fla)
W69-06133

LYDA V TOWN OF MARION (UNAUTHORIZED DRAINAGE DITCHES HELD TAKING OF PRIVATE PROPERTY FOR PUBLIC USE).
For primary bibliographic entry see Field 06E.
W69-06169

TENNESSEE COAL, IRON AND RR V RAY (MINING OPERATION CAUSES DESTRUCTION OF WATER SUPPLY).
For primary bibliographic entry see Field 06E.
W69-06172

MAN'S INFLUENCE ON HYDROLOGICAL PHENOMENA,
Research Inst. for Water Resources Development, Budapest (Hungary).
J. Balogh, and I. Matrai.
2nd Int Postgrad Course on Hydrol Methods for Develop Water Resources Manage, Budapest, Hung, Jan-July 1968, Manual No 14, 1968. 213 p, 51 fig, 49 tab, 28 ref.

Descriptors: *Water management (Applied), *Flood control, *River training, Artificial recharge, Irrigation, Drainage systems, Drawdown, Land management, Reservoir operation, Water demand, Watershed management, Water utilization, Water quality, Forest management, Runoff, Streamflow, Ice, Navigation, Water pollution, Urbanization, Industries, Agriculture.
Identifiers: *Textbooks, *Technical manuals.

The effects of human water-controlling activities, both intentional and accidental, including urbanization, agriculture, forestry, industry, and commerce, on the hydrologic cycle, are examined in a technical manual presented as a chapter of a text written for an international postgraduate course in water resources management. Agricultural and forestry activities modify the water budgets of whole drainage basins, greatly changing runoff, precipitation, and other quantitative factors, but have relatively little effect on quality. Commercial, industrial, and urbanization activities have much less effect on quantity but may have

major effects on water quality. Much of man's water demand must be met by use of groundwater. Water levels are declining in many areas. The effects of flood control and river training works on stream hydrology and the effect of human uses of catchment areas are discussed in detail. Water management efficiency and various management techniques are evaluated. (Knapp-USGS)
W69-06233

HOWLETT V CITY OF SOUTH NORFOLK (FLOOD DAMAGE ALLEGEDLY DUE TO STREET ELEVATION).

193 Va 564, 69 SE 2d 346-350 (1952).

Descriptors: *Virginia, *Drainage water, *Surface runoff, *Repulsion (Legal aspects), Flood damage, Storm runoff, Overland flow, Roads, Rainfall disposition, Diversion structures, Cities, Judicial decisions, Overflow, Reasonable use, Natural flow, Storm drains, Riddance (Legal aspects).

Plaintiff brought action against the city for damages allegedly caused by raising the grade of a street in front of plaintiff's residence, thereby causing surface water to flood his lot. This court, in affirming the trial court's judgment for defendant, stated that surface waters are waters which are diffused over the surface of the ground, following no defined course or channel. Surface water is considered a common enemy, and each landowner may fight it off as best he can. An exception to this right is that the landowner cannot collect the water into an artificial channel and discharge it upon the land of another to his injury. Thus, the right to obstruct the flow of surface water is modified by the rule that one must so use his own property as not to injure the rights of another. However, plaintiff failed to prove his allegation that a negligent act by the city directly or proximately caused water to overflow the curbing gutters and flood his property. Judgment for defendant was affirmed. (Reed-Fla)
W69-06308

ZIDEL V STATE (STATE LIABLE FOR EROSION CAUSED BY NEGLIGENTLY PLACED ROAD).
96 NYS 2d 330-338 (Ct Cl 1949).

Descriptors: *New York, *Riprap, *Embankments, *Bank erosion, Judicial decisions, Creep, Damages, Cost repayment, Compensation, Retaining walls, Check structures, Reasonable use, Riparian rights, Obstruction to flow, Diversion, Legal aspects, Surface drainage, Surface runoff.

Plaintiff brought this negligence suit against the state for alleged damage to his lands caused by fill work which altered the cause of a creek. The state, while reconstructing a highway adjacent to the creek and to plaintiff's property, dumped concrete slabs into the creek bed to prevent erosion of the highway. This concrete fill caused considerable erosion of the plaintiff's land and endangered some of the structures thereon. Plaintiff built a temporary retaining wall to prevent the erosion. Although both plaintiff and defendant are riparian owners, their right to reasonable use does not include the right to obstruct the flow of the creek to the detriment of another owner. A political entity has no greater right than a private owner to discharge excess surface water upon the lands of another. The court would not allow the plaintiff to recover the estimated expense of erecting a permanent retaining wall, but did allow reimbursement for the cost of the temporary wall. This wall was constructed under the plaintiff's duty to minimize his damages (Blunt-Fla)
W69-06314

4D. Watershed Protection

KANSAS RIVER, BONNER SPRINGS TO MOUTH, DEGRADATION OF CHANNEL,
Geological Survey, Lawrence, Kans.
For primary bibliographic entry see Field 02J.
W69-06256

POWERS AND FUNCTIONS OF DEPARTMENT OF WATER RESOURCES - FLOOD CONTROL.
For primary bibliographic entry see Field 04A.
W69-06332

POLLUTION OF WATERS BY RAILROADS AND FACTORIES.
For primary bibliographic entry see Field 05G.
W69-06404

ATTORNEY GENERAL V CITY OF WOBURN (POLLUTION OF RIVER BY CITY).
For primary bibliographic entry see Field 05G.
W69-06406

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

GENERAL METHOD FOR DETERMINATION OF ORGANOPHOSPHORUS RESIDUES IN RIVER WATERS AND EFFLUENTS,
Ministry of Technology, London (England). Lab. of Government Chemist.
J. Askew, J. H. Ruzicka, and B. B. Wheals.
Analyst, Vol 94, No 1117, pp 275-283, Apr 1969. 9 p, 1 fig, 4 tab, 23 ref.

Descriptors: *Analytical techniques, *Pesticide residues, *Chemical analysis, *Chromatography, Organophosphorus pesticides, Pollutants, Effluents, Methodology.
Identifiers: *Pesticide analysis.

A general, comprehensive scheme for the extraction of organophosphorus pesticides from river waters and sewage effluents is described. The pesticides, after extraction with chloroform, are determined by gas and thin-layer chromatography. The procedure includes details of an improvement that enables all of the pesticides to be detected on thin-layer chromatoplates with a phosphorus-specific ammonium molybdate spray. The use of gel chromatography on columns of Sephadex LH 20 as an adjunct to identification is also described. (Knapp-USGS)
W69-06023

DETERMINATION OF FREE HYDROGEN CYANIDE IN RIVER WATER BY A SOLVENT-EXTRACTION METHOD,
Water Pollution Research Lab., Stevenage (England).
H. A. C. Montgomery, Deirdre K. Gardiner, and J. G. G. Gregory.
Analyst, Vol 94, No 1117, pp 284-291, Apr 1969. 8 p, 5 tab, 17 ref.

Descriptors: *Analytical techniques, *Chemical analysis, *Pollutants, *Solvent extractions, Industrial wastes, Toxicity, Chemicals, Fishkill, Water pollution effects.
Identifiers: *Cyanide analysis, Hydrogen cyanide.

A method described for the determination of undissociated hydrogen cyanide in river waters is designed to avoid disturbance of the equilibria between hydrogen cyanide, cyanide ion and complex cyanides during the determination. A small proportion of the hydrogen cyanide present is extracted by equilibrating the sample with 1, 1, 1-trichloroethane. The extracted hydrogen cyanide is then transferred into sodium pyrophosphate solution, and the determination is completed colorimetrically by a modification of the method of Bark and Higson. The effect of temperature on the extraction has been studied. Extractions can be carried out in the field, and conditions have been established for bringing extracted samples back to the laboratory for colorimetric analysis. The method can be used in the range 0 to 2 mg of hydrogen cyanide per liter, and less than 0.01 mg per liter is detectable. Satisfactory tests have been carried out on solutions of known hydrogen cyanide content, on solutions of metallic complex cyanides and on river waters containing added cyanide. (Knapp-USGS)
W69-06024

LONGITUDINAL ESTUARINE DIFFUSION IN SAN FRANCISCO BAY, CALIFORNIA,
Oregon State Univ., Corvallis; and California Univ., Berkeley.
G. Glenne, and R. E. Selleck.
Water Res, Vol 3, No 1, pp 1-20, Jan 1969. 20 p, 12 fig, 2 tab, 16 ref.

Descriptors: *Diffusion, *Estuaries, *Path of pollutants, Tracers, Salinity, Currents (Water), Dispersion, Energy transfer, Mixing, Mass transfer, Steady flow, Unsteady flow, Advection, Convection.
Identifiers: *San Francisco Bay (Cal), One-dimensional diffusion models.

The use of the concept of one-dimensional diffusion to evaluate the degree of mixing and dispersion in San Francisco Bay is discussed. Using Fick's first law and the concept of mass continuity, mixing or diffusion coefficients may be calculated using constitutent concentrations, sources, and sinks, as well as the advection of the system. In San Francisco Bay, the diffusion coefficients calculated using silica as a tracer are generally similar to those calculated using chloride and vary considerably with time and location. In the northern part of the bay, advection is significant and diffusion coefficients vary as the 3/4 power of advective velocity. The one-dimensional diffusion model is generally feasible for solving steady and non-steady state constituent transport problems. (Knapp-USGS)
W69-06030

BIBLIOGRAPHY ON THERMAL POLLUTION,
American Society of Civil Engineers, New York, Committee on Thermal Pollution.
For primary bibliographic entry see Field 05C.
W69-06081

LIMNOLOGICAL ORGANIC ANALYSES BY QUANTITATIVE DICHROMATE OXIDATION,
Fish and Wildlife Service, Washington, D. C. Bureau of Sport Fisheries and Wildlife.
John A. Maciolek.
1962, 61 p. RR-60.

Descriptors: *Oligotrophy, *Organic matter, *Analytical techniques, *Limnology, *Water chemistry, Carbohydrates, Amino acids, California, Carbon, Chemical oxygen demand, Lakes, Lipids, Nitrogen, Nitrogen compounds, Oxidation-reduction potential, Periphyton, Proteins, Seston, Daphnia, Trout, Invertebrates.
Identifiers: Cloverleaf L (Calif), Bighorn L (Calif), Dorothy L (Calif), Edith L (Calif), Convict L (Calif), Crowley L (Calif), Sierra Nevada, Nernst equation, Abioseston, Alpine lakes, Carbon compounds, Fatty acids, Net plankton, Neuston, Proximate analysis, Ultimate analysis, Nucleic acids, Aphanizomenon, Gleotrichia.

Presently available methods for organic analysis of limnological samples are tedious, inaccurate, or lack sensitivity. Author adapted a procedure derived from soil chemistry by which a sample can be oxidized by dichromate in a strongly acid medium maintained at 100 deg C. Amount of dichromate reacting (determined titrimetrically as difference between initial and final quantities) is reckoned as weight of oxygen required by sample. Optimally, resistant compounds oxidize with a minimal efficiency of 95%. Oxidation serves as primary step in determination by diffusion of organic carbon (as carbon dioxide) and nitrogen (as ammonia). Author shows how estimates can be

derived from results of such determinations for following characteristics of organic matter: caloric content, total organic matter, experimental oxygen equivalents, proximate groups (crude carbohydrate, crude protein, lipid), ultimate substituents, and carbon calorics. Described procedures require no special apparatus or complex procedures, are sensitive to as little as 0.01 mg organic matter, precise to within plus or minus 1%, and adaptable to various sample materials and to multiple simultaneous determinations. Author presents data describing total organic content, periphyton analysis, and plankton and neuston composition for various highly oligotrophic lakes. Interpretation of oxidative analyses of samples from highly reduced environments is not discussed. (Eichhorn-Wis)
W69-06093

MEASURING ESTUARINE POLLUTION,
Federal Water Pollution Control Administration, Washington, D. C. Estuarine and Oceanographic Programs Branch.
J. A. Wastler.
Oceanology Int, pp 43-45, May-June 1969. 3 p, 3 photo.

Descriptors: *Estuaries, *Estuarine environment, Instrumentation, *Pollution identification, *Pollution abatement, Tidal waters, Mixing, Sea water, Fresh water, Shores, Water circulation, Floods, Density durrents, Measurements, Sewage effluents, Temperature, Oxygen, Salinity, Algae, Mechanical equipment.
Identifiers: *Estuarine pollution.

This article describes briefly the basic elements of estuary pollutions and the common techniques used for the detection and mapping of these pollutants. In general the study shows that actual techniques of data collection in the estuarine zone must be designed to cope with the unique demands of the estuarine environment. The increasing sophistication of instrumentation and data analysis procedures, combined with the national concern about estuarine pollution, offers hope, according to the author, that a viable national basic data collection system may be developed soon to survey the coastal zones. (Gabriel-USGS)
W69-06203

WATER QUALITY CHARACTERISTICS OF WATER SOURCES,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 05G.
W69-06225

COBALT AS AN ESSENTIAL ELEMENT FOR BLUE-GREEN ALGAE,
Wisconsin Univ., Madison. Dept. of Botany.
Gunnund Holm-Hansen, Gerald C. Gerloff, and Folke Skoog.
Physiologia Plantarum, Vol 7, pp 665-675, 1954. 3 fig, 5 tab, 8 ref.

Descriptors: *Cobalt, *Cyanophyta, *Essential nutrients, *Trace elements, Algae, Eutrophication, Molybdenum, Nitrogen fixation, Nuisance algae, Nutrients, Vitamins, Water pollution effects, Water pollution sources, Vitamin B.
Identifiers: *Cyanocobalamin, Algal growth, Algal nutrition, Algal physiology, Calothrix parietina, Coccochloris Peniocystis, Diplocystis aeruginosa, Nostoc muscorum, Vanadium, Vitamin B-12.

Authors, experimenting with Nostoc muscorum, demonstrated that cobalt is an essential nutrient element for this cyanophyte as well as for three additional species: nitrogen-fixing Calothrix parietina; and the non-fixers, Coccochloris Peniocystis and Diplocystis aeruginosa. In Nostoc, quantitative requirement is quite low, increases in yield of nitrogen content obtaining from cobalt concentrations from 0.002 to 0.40 micrograms/liter, the latter level ordinarily required for optimum growth. These data and other evidence indicate that the following essentiality specifications have been met: Element has positive effect on total growth; it exerts a positive physiological effect on algae; it is not replaceable by another element; deficiency is reversible in incipient stages; and response can be demonstrated in representative number of species. There is evidence that cobalt requirement is independent of nitrogen source although it is much easier to demonstrate cobalt response in the two nitrogen fixers than in the two non-fixers, a condition which quite likely results from lower requirement in the latter. Preliminary experiments show that addition of as little as 0.075 microgram of vitamin B-12 per liter of culture eliminates requirement for added cobalt and results in optimum yield referable to added cobalt. (Eichhorn-Wis)
W69-06277

A BIOLOGICAL TEST FOR DETERMINING THE POTENTIAL PRODUCTIVITY OF WATER,
Vermont Univ., Burlington. Dept. of Zoology.
Milton Potash.
Ecology, Vol 37, No 4, pp 631-639, Oct 1956. 5 fig, 1 tab, 24 ref.

Descriptors: *Bioassay, *Primary productivity, Nutrients, Productivity, Fertilization, Farm ponds, Bioindicators, Eutrophication, Water pollution effects.
Identifiers: Nutrient availability, Algal growth, Algal growth potential.

Author presents method for determining quantitatively the nutrients available for plant growth in natural waters using a pure culture of the green alga, Kirchneriella subsolitaria G S West as indicator organism. Method was applied under controlled laboratory conditions to study water from two farm ponds. Water samples were collected from the ponds at approximately 2-week intervals from November 1950 to August 1951. Each time, six 500-ml samples from each pond were inoculated with K subsolitaria. One sample served as a control and either sodium carbonate, calcium carbonate, diacid potassium phosphate, magnesium sulfate, or all four nutrients were added to remainder. Cell counts (Sedgewick-Rafter) were made daily, and population densities were estimated by statistical techniques. Both ponds varied seasonally in ability to support algal growth. As indicated by control cultures, nutrient content reached peaks during November-December and February. Adding sodium carbonate and diacid potassium phosphate did not stimulate growth in cultures. In both ponds, phosphate appeared limiting in winter; nitrate became limiting in March and remained so throughout summer. Pond supporting the greater actual production was shown to have lesser potential for growth as measured by bioassays. Author suggests that inverse correlation between potential and actual productivity may exist. (Uttormark-Wis)
W69-06279

RECOVERY OF ORGANICS FROM A EUTROPHIC LAKE BY THE CARBON ADSORPTION TECHNIQUE,
Wisconsin Univ., Madison. Hydraulic Lab.; and Wisconsin Univ., Madison. Water Chemistry Lab.
G. Fred Lee, Gordon W. Kumke, and Stanley L. Becker.
Int J Air Water Pollution, Vol 9, pp 69-80, 1965. 1 fig, 9 tab, 12 ref.

Descriptors: *Adsorption, *Eutrophication, *Organic compounds, *Water quality, *Water chemistry, Aromatic compounds, Bacteria, Chromatography, Columbia River, Great Lakes, Lakes, Lake Superior, Limnology, Missouri River, Odor, Organic matter, Ohio River, Protozoa, Rivers, Sediments, Taste, Water pollution sources, Wisconsin.
Identifiers: *Carbon adsorption techniques, *Recovery factors, Aliphatic compounds, Carbon alcohol extract, Carbon chloroform extract, Extraction methods, Lake Mendota (Wis), National Water Quality Network, Oxygenated compounds, Vorticella.

A study has been conducted on the recovery of organic compounds from a eutrophic lake by the activated carbon adsorption technique. Lake Mendota, Wisconsin, had an average carbon chloroform extract of 197 micrograms/liter with an average carbon alcohol extract of 424 micrograms/liter. The amount of extractable organic matter was found to be dependent on the total flow and flow rate and independent of temperature. Large populations of micro-organisms were observed on the carbon surface. (Lee-Wis)
W69-06282

5B. Sources of Pollution

OXYGEN PRODUCTION AND LOSS IN A MODEL RIVER,
Texas Univ., Austin.
James M. Eller, and E. F. Gloyna.
Texas Center for Research in Water Resources, Technical Report No 1, April, 1969, Washington, D. C., 81 p, 4 tab, 16 fig, 38 ref. OWRR Project B-044-TEX.

Descriptors: *Model river, *Oxygen production, *Loss of oxygen, Photosynthetic oxygen, Pollution, Productivity.

The purpose of this study was to evaluate the formation and escape of photosynthetically produced gas bubbles. The effects of solar energy, temperature, nutrient concentration, dissolved oxygen levels, and net photosynthetic oxygen production on the magnitude of the bubble loss were investigated. The study was conducted in a model river that provided near optimum conditions for the occurrence of large bubble losses. The escaping gases were collected and analyzed for oxygen content. It was found that the bubble loss phenomenon can be a significant oxygen sink in highly productive waters, which are subject to a low velocity of flow, a high light intensity, a high water temperature, and a high dissolved oxygen saturation level. The dissolved oxygen saturation level of the water was found to be indicative of both the magnitude of bubble loss and the gas composition of the escaping bubbles.
W69-06002

LIMNOLOGICAL INVESTIGATIONS OF TEXAS IMPOUNDMENTS FOR WATER QUALITY MANAGEMENT PURPOSES - LIMNOLOGICAL AND WATER QUALITY DATA FOR THE HIGHLAND LAKES, 1968,
Texas Univ., Austin.
E. Gus Fruh, and Ernst M. Davis.
Texas Center for Research in Water Resources, Technical Project Report No 1, March, 1969. 187 p, 46 tab, 28 fig, 21 ref, 1 append. OWRR Project B-020-TEX.

Descriptors: Highland Lakes, Colorado River, Texas, *Water quality, *Limnology, *Oxygen, *Coliform bacteria, *Phytoplankton, *Limiting nutrient, *Odor problems.

A detailed limnological and water quality investigation was conducted on a chain of seven reservoirs located within a 150 mile reach of the Texas Colorado River near Auston. The morphological characteristics of each reservoir as well as its purpose in the chain affected the water quality. The presence of a thermal stratification as well as the location of the penstock in the dam controlled the water quality of the impoundment release. The most serious water quality problem was the depletion of oxygen in the lower waters of nearly all these impoundments. High numbers of total coliform were found only once in some of the reservoirs, although persistent numbers were found throughout the year in Lakes Town and Decker. The phytoplankton standing crop was small although it increased down the reservoir chain.

From chemical measurement of the water, phosphorus or iron or nitrogen could be limiting phytoplankton growth during the summer. Lakes Austin and Town had a high odor content in the summer during or immediately after an increase in the blue-green algae.
W69-06003

STOCHASTIC MODEL FOR BOD AND DO IN STREAMS,
Virginia Polytechnic Inst., Blacksburg. Dept. of Statistics.
Richard P. Thayer, and Richard G. Krutchkoff.
ASCE Proc, J Sanit Eng Div, Vol 93, No SA3, Pap 5297, pp 59-72, June 1967. 14 p, 4 fig, 2 tab, 4 ref, 1 append. Grant No 8T1 ES33-03 (HEW).

Descriptors: *Mathematical models, *Statistical models, *Stochastic processes, *Dissolved oxygen, *Path of pollutants, Water pollution effects, Biochemical oxygen demand, Oxygen sag, Aeration.
Identifiers: *Sacramento River (Calif).

A stochastic model for pollution and dissolved oxygen in streams is presented. Given the stream parameters and the initial conditions, the model predicts not only the mean amounts of pollution and dissolved oxygen at any point downstream, but also their variability in time. It can determine the proportion of the time that pollution is above any given concentration or that dissolved oxygen is below any given concentration. The theoretical results are tested by comparing them with controlled laboratory experiments and with data from the Sacramento River. It is observed that the means of both pollution and dissolved oxygen follow the equations already obtained by Dobbins in 'BOD and Oxygen Relationships in Streams,' Journal of the Sanitary Engineering Division, ASCE, Vol. 90, No. SA3, Proc. Paper 3949, June 1964, p. 53. A new and unexpected observation is that the greatest variability in dissolved oxygen occurs at the sag, where it is most critical.
W69-06080

BIBLIOGRAPHY ON THERMAL POLLUTION,
American Society of Civil Engineers, New York, Committee on Thermal Pollution.
For primary bibliographic entry see Field 05C.
W69-06081

QUALITY CHARACTERISTICS OF WATER RESOURCES,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 05G.
W69-06225

LONG-TERM TREND ANALYSES OF WATER QUALITY-A MODEL STUDY OF THE PASSAIC RIVER BASIN,
Rutgers - The State Univ., Newark, N. J. Dept. of Environmental Science; and Geological Survey, Trenton, N. J.
Samuel D. Faust, and Peter W. Anderson.
Proc 1st Annu Colon Educ Conf on 'Boundaries of our Environ,' Nat Ass Sanit, May 1-2 1968, pp 35-45. 1968. 11 p, 4 ref

Descriptors: *Water quality, *Water pollution, *Statistical models, *New Jersey, Municipal wastes, Industrial wastes, Dissolved oxygen, Biochemical oxygen demand, Regression analysis, Forecasting, Water pollution control
Identifiers: Passaic River Basin (NJ).

Water-quality trends in the Passaic River Basin, New Jersey, were determined by linear regression analysis. Water quality data have been collected at 6 main stream and 10 tributary sites since 1950. The data include temperature, turbidity, color, pH, chloride, DO, coliforms, BOD, alkalinity and hardness. The basin has an area of about 950 sq mi. About 120 municipal and industrial waste discharges enter the streams and 10 water suppliers use river water. At the end of 1967, 270 mgd were being diverted from the basin and 55 mgd of waste discharged into it. Oxygen saturation is decreasing at the rate of 1% per yr. BOD shows no distinct trend. Linear regression curves showing trends in the measured quality data are presented and used for projections of future conditions. If nothing is done to prevent it, BOD will increase to 18.7 tons/day in 1970, to 23.5 in 1980, and 33.0 in 2000, an increase of 1/2 tons per day every year. Dissolved oxygen will approach the vanishing level by 1980. Water quality management must first determine the proper quality for streams and then undertake the action necessary to achieve it. (Knapp-USGS)
W69-06235

OIL POLLUTION - A REPORT TO THE PRESIDENT.
Department of the Interior, Washington, D. C.; and Department of Transportation, Washington, D. C.

Spec Rep to the Pres By Dep of Interior and Dep of Transportation, Feb 1968. 31 p, 7 charts, 94 ref.

Descriptors: *Oil wastes, *Oily water, *Water pollution sources, *Water pollution treatment, Disasters, Water pollution control, Governments, International commissions, Legislation, Treaties, Legal aspects, Costs, Financing.
Identifiers: *Oil spill control, Oil spills.

A special report by the U.S. Departments of Interior and Transportation discusses the causes, sources, effects, handling and prevention of oil spills at sea and on inland waters. Disposal of waste oil by service stations and industrial plants is also a serious and growing problem. Present capabilities of handling spills and present international regulation of discharges on international waters are inadequate. Legal, technical, industrial, and cost aspects of prevention are discussed. Physical and legal facilities for cleanup of oil spills are described. Present action programs involving study, recommendations, regulations, enforcement, legislation, international conventions, and fiscal support are listed. (Knapp-USGS)
W69-06237

RAIN AS A SOURCE OF VITAMIN (B-12),
Washington Univ., St Louis, Mo. Dept. of Botany.
Bruce C. Parker.
Nature, Vol 219, No 5154, pp 617-618, Aug 10, 1968. 1 tab, 15 ref.

Descriptors: *Rain, *Vitamins, Algae, Bioassay, Bioindicators, Chlamydomonas, Carbon, Ecosystems, Euglena, Eutrophication, Organic matter, Phytoplankton, Primary productivity, Soil chemistry, Water chemistry, Water pollution effects, Water pollution sources.
Identifiers: *Vitamin B-12, Algal growth, Cyanocobalamin, Euglena gracilis Z, Microbiological assay, Species composition.

Forms and concentrations of vitamin B-12 in natural aquatic ecosystems are important in that they may limit primary productivity and influence the species composition of phytoplanktonic populations. Author reports studies stemming from the observation that after spring rains, phytoplanktonic Chlamydomonas became dominant organisms in small experimental ponds concommitantly with increases in their vitamin content. Rain, collected in stainless steel containers, was filtered through Millipore filters (pores, 2 microns), and assayed for vitamin B-12 microbiologically utilizing Euglena gracilis, Z strain. In nine collections taken during 13 months, concentrations ranged from negligible to 20.0 picograms/milliliter. Fragmentary evidence supports the hypothesis that vitamin originates from soil particles borne into atmosphere. Author points out that a hypothetical lake containing Euglena, and rich in all nutrients except B-12, would support growth of a million cells/square centimeter of lake surface after a rain of 1 centimeter containing 20 picograms of vitamin/millilite (Eichhorn-Wis)
W69-06273

THE BIOSYNTHESIS OF VITAMINS OF TH (B-12) GROUP IN MIXED CULTURES OF BAC TERIA,
Poznam Agricultural Academy (Poland). Dept. Agricultural Technology.
Jozef Janicki, and Franciszek Pedziwilk.
Acta Microbiologico Polonica, Vol 15, pp 34 348, 1966. 4 tab, 4 ref.

Descriptors: *Bacteria, *Cultures, *Vitamin Aquatic microbiology, Electrophoresis, Eutroph cation, Microbiology, Pseudomonas, Soil chemis try, Soil microbiology, Solvent extractions, Spec trophotometry, Water chemistry.
Identifiers: *Biosynthesis, *Vitamin B-12, Bacillu mesentericus, Corrinoids, Culture media Cyanocobalamin, Proprionibacterium arabinosur 10, Proprionibacterium freudenreichii Proprionibacterium pentosaceum 1 Proprionibacterium shermanii 1, Proteus vulgaris.

Species composition of bacterial flora synthesizin substances with activity of vitamin B-1 (cyanocobalamin) and conditions of their cultur affect the composition and quantity of these sub stances produced. Authors outline bacteriologica culture methods by which five strains of such bac teria can be cultivated and describe methods fo solvent extraction of corrinoids (cyanocobalami and analogs) from aqueous suspensions of bacteri for quantification by spectrophotometry, and fo separation by electrophoresis. Mixed cultures o different bacterial species produced higher yield of corrinoids as compared with their pure cultures In typical experiment, the following bacteria i pure culture produced (under relatively anaerobi conditions) total corrinoids indicated (in micro grams/milliliter of medium): Proprionibacterium shermanii 1 (PS), 6.47; P freudenreichii 3 (PF) 4.06; P arabinosum 10 (PA), 0.98. Mixed culture of PF+ PS produced 9.64; of PS+ PA, 7.55. I mixed cultures, composition of the corrinoid synthesized varies qualitatively, percentage corri noids corresponding with cyanocobalamin varyin between 12.4 and 47.8. Rate of synthesis o cyanocobalamin was markedly higher in aerobi conditions, although total corrinoids are reduced Thus, PS+ Bacillus mesentericus yield 21.1 cobalamin in total corrinoids of 7.52 anaerobically 47.8% of 2.50 aerobically. (Eichhorn-Wis)
W69-06274

WASTES, WATER, AND WISHFUL THINKING THE BATTLE OF LAKE ERIE,
Case Western Reserve Univ., Cleveland.
For primary bibliographic entry see Field 05G.
W69-06305

SOUTHLAND CO V AARON (ACTION FOR POLLUTION OF DOWNSTREAM WATER SUPPLY).
For primary bibliographic entry see Field 05G.
W69-06345

MASSEY V MASONITE CORP (OVERFLOW OF EFFLUENTS INTO PRIVATE LAKE).
For primary bibliographic entry see Field 05G.
W69-06409

5C. Effects of Pollution

LIMNOLOGICAL INVESTIGATIONS OF TEXAS IMPOUNDMENTS FOR WATER QUALITY MANAGEMENT PURPOSES - THE USE OF ALGAL CULTURES TO ASSESS THE EFFECTS OF NUTRIENT ENRICHMENT ON THE HIGHLAND LAKES OF THE COLORADO RIVER, TEXAS,
Texas Univ., Austin.
Bert A. Floyd, E. Gus Fruh, and Ernst M. Davis.

exas Center for Research in Water Resources, echnical Project Report No 2, January, 1969. 45 , 3 tab, 4 fig, 23 ref. OWRR Project B-020-TEX.

escriptors: Highland Lakes, Colorado River, Tex- , *Nutrient Enrichment Tests, *Nitrogen, Phosphorus, *Iron, *Limnology, *Algae.

his study was an investigation of the effects of in- ganic nitrogen, phosphorus, and iron on algal owth in the Highland Lakes of the Colorado iver, Texas. River water from the upper and lower aches of the reservoir system was used as media r unialgal cultures in laboratory controlled owth experiments. Differences in growth were easured between a control and samples enriched th the three nutritive substances. These measure- ents showed increased algal growth with the addi- n of nitrogen and phosphorus, but no increase th either of the three elements separately. Also, fferences in growth and nutrient requirements re found between green and blue-green species. nally, an increase in the fertility of the water as it ws through the reservoir system was noted. 69-06004

EATED EFFLUENTS AND EFFECTS ON QUATIC LIFE WITH EMPHASIS ON FISHES,
rnell Univ., Ithaca, N. Y. Water Resources and arine Sciences Center.
ward C. Raney, and Bruce W. Menzel.
pt of the Interior, Water Resources Sci Inform nter Bibliogr Pub, Apr 1969. 470 p.

scriptors: *Bibliographies, *Heated water, hermal pollution, *Water pollution effects, sh, Fishkill, Morbidity, Toxicity, Water quality, trophication, Aquatic productivity.

ibliography on the effects of heated effluents on atic life with emphasis on fishes contains erences to 1870 papers. Each title is permuted l alphabetically indexed on each significant rd and identified by a number which refers to a plete listing by author and title. Arrangement key words in context (KWIC) is for the con- ience of the user. (Knapp-USGS) 9-06022

OCHASTIC MODEL FOR BOD AND DO IN TEAMS,
ginia Polytechnic Inst., Blacksburg. Dept. of istics.
primary bibliographic entry see Field 05B. 9-06080

LIOGRAPHY ON THERMAL POLLUTION,
erican Society of Civil Engineers, New York, mittee on Thermal Pollution.
ruce Gerber.
E Proc, J Sanit Eng Div, Vol 93, No SA3, Pap 3, pp 85-113, June 1967. 29 p, 878 ref.

criptors: *Bibliographies, *Thermal pollution, rs, Lakes, Reservoirs, Water supply, Mixing, ersion, Diffusion, Instrumentation, Water pol- n effects, Thermal stratification, Water tem- ture.
tifiers: Thermal pollution bibliography (1966).

initial charge of the ASCE Committee on mal Pollution of the Sanitary Engineering sion was to investigate and correlate available mation regarding the effect, from a sanitary neering standpoint, of the unnatural increase crease of water temperature caused by the in- ial use of water. The general categories of the ting bibliography include (1) general proper- of heat and heat exchange between water and sphere, (2) effects of heated discharges on the ving body of water, and (3) effects of heated arges on uses made of the receiving body of r. Categories (2) and (3) contain the greater ber of articles; specifically studies on cooling s, water supplies, lakes and reservoirs, rivers streams, stratified flow problems, mixing and dispersion, instrumentation methods and devices, and effects on aquatic life. The bibliography is in alphabetic order according to the author. It is not in any order based on the classifications given above.
W69-06081

PRIMARY PRODUCTION, ENERGETICS, AND NUTRIENT UTILIZATION IN A WARM-WATER STREAM,
Michigan State Univ., East Lansing. Dept. of Fisheries and Wildlife.
Alfred R. Grzenda, Robert C. Ball, and Niles R. Kevern.
Inst of Water Research, Red Cedar River Ser, October 1968, 80 p. TR-2.

Descriptors: *Water pollution effects, *Rivers, *Periphyton, *Streams, *Primary productivity, *Energy budget, *Cycling nutrients, Bioindicators, Biological communities, Eutrophication, Michigan, Nitrogen, Phosphorus, Photosynthesis, Plant pigments, Seasonal, Streamflow, Thermodynamics, Trophic level, Water pollution sources.
Identifiers: *Red Cedar River (Mich), Diatoma, Fragellaria, Navicula, Cocconeis, Gomphonema, Williamston (Mich), Warm water streams.

Near Williamston, Mich, the Red Cedar River receives nutrients via agricultural runoff and outfall from town's sewage plant. For year beginning July 1957, a clean-water station was sampled at a frequency (59 dates) dictated by season and flow characteristics of the stream. Information pertaining to primary production and nutrient and energy flow through the periphyton community was derived from following determinations: pH, alkalinity, turbidity, seston, optical absorbancy, phosphorus, nitrogen, periphyton biomass, and diurnal oxygen curves. Seasonal range in net, ash-free primary production (grams/square meter/day on plexiglass substrates) was 0.01-2.28 (mean: 0.56). Photosynthetic efficiencies (%) based on net production and surface radiation ranged 0.003-0.245 (mean: 0.07). Flood periods (about 31 days) accounted for 45% of total import of 16 metric tons of phosphorus. Total inorganic nitrogen imports for nine months were 84 metric tons. Flooding had less pronounced effects than in case of phosphorus, indicating that runoff is primary source of nitrogen. Utilization efficiencies (%) calculated on basis of 100 meters of stream were: total phosphorus, 0.0003-0.41; soluble phosphorus, 0.0007-0.61; inorganic nitrogen, 0.02-0.19. Ratio of phytopigment absorbancy to periphyton colony weight differentiated oligosaprobic and mesosaprobic communities with ranges 10.0-16.9 and 1.84-2.8, respectively. (Eichhorn-Wis)
W69-06092

TUTEN V SHELL OIL CO (SALT WATER DAMAGE TO LAND AND CROPS BY OIL INDUSTRY NEGLIGENCE).

26 So 2d 757-760 (Ct App La 1946).

Descriptors: *Louisiana, *Oil industry, *Saline water, *Land tenure, Damages, Levees, Flooding, Land use, Productivity, Pastures, Judicial decisions, Legal aspects, Oil wastes, Oil fields, Grazing.
Identifiers: *Salt water pits, *Crop damage, Negligence.

Plaintiff filed suit to recover the sum of $1,500 in rents allegedly lost due to the negligence of the defendant in allowing salt water to overflow plaintiff's lands as a result of oil and gas well operations in adjacent oil fields. Plaintiffs alleged that this negligence made crop development impossible for their tenant and rendered the land unfit for grazing for two years. The trial judge held for the defendant on the ground that plaintiff had not proved a negligent break in the levee surrounding the salt water pits. The court of appeal of Louisiana held that plaintiff could recover for lost rent, but that proof of the amount of damage must be more positive. The court also held that the facts showed damage from two sources, only one of which defendant was responsible for, and that a proportional determination would be necessary. A judgment of nonsuit was ordered. (Harris-Fla)
W69-06110

MCKINNEY V DENEEN (LIABILITY FOR DISCHARGE OF MINE WASTES).

231 NC 540, 58 SE 2d 107-109 (1950).

Descriptors: *North Carolina, *Eminent domain, *Aggradation, *Streamflow, Judicial decisions, Streams, Compensation, Natural flow, Alteration of flow, Stream erosion, Riparian rights, Natural use, Water pollution, Mining, Water pollution sources, Legislation, Reasonable use, Sediment, Non-navigable waters, Mine wastes, Legal aspects, Damages.
Identifiers: Non-riparian owner, Fords, Mica, Kaolin.

Plaintiffs owned land lying in part along a non-navigable stream. A private road lead from their land across a ford in the stream to a highway. This road was plaintiffs' only ingress and egress. Defendants were non-riparians who ran a mica-washing machine on a hill upstream from plaintiffs' land. Gravel and river schist from defendants' operation were discharged in large quantities into the stream through pipes. This waste destroyed plaintiffs' ford and caused other damage to their land. Plaintiff sought damages and injunctive relief. Defendant demurred to complaint and defended on the authority of a statute authorizing persons mining mica to discharge waste water into natural watercourses. The trial court sustained the demurrer. The supreme court, reversing, held that the statute did not relieve such persons from liability for damages resulting from such discharge. Governments may restrict use of property for public good and incidental loss is not compensable, but a direct entry on, or appropriation of private property for public use does not come within such rule. (Helwig-Fla)
W69-06111

FISHERIES; CONSERVATION.
For primary bibliographic entry see Field 06E.
W69-06144

OIL POLLUTION - A REPORT TO THE PRESIDENT.
Department of the Interior, Washington, D. C.; and Department of Transportation, Washington, D. C.
For primary bibliographic entry see Field 05B.
W69-06237

HYDROLYSIS OF CONDENSED PHOSPHATES--I: NON-STERILE ENVIRONMENT,
Wisconsin Univ., Madison. Water Chemistry Lab.
For primary bibliographic entry see Field 02K.
W69-06271

AGE AND GROWTH OF WHITE BASS IN ONEIDA LAKE, NEW YORK,
Cornell Univ., Ithaca, N. Y. Dept. of Conservation.
John L. Forney, and Charles B. Taylor.
NY Fish Game J, Vol 10, pp 194-200, 1963. 5 tab, 12 ref.

Descriptors: *Growth rates, *White bass, *Food habits, New York, Fish, Insects, Zooplankton, Amphipoda, Crayfish, Mayflies, Competition.
Identifiers: *Oneida Lake (NY), Gear selectivity, Year classes, Roccus (Morone) chrysops.

Authors describe age, growth, and food habits of white bass, Roccus (now Morone) chrysops, in moderately eutrophic Oneida Lake, New York, based on 1956 through 1961 collections. Growth of all fish except age 0+ was back-calculated; age group 0+ fish were measured directly. Food data were recorded in field as percentage of occurrence.

Sampling gear consisted of gill nets, trap nets, shockers, trawls, and angling. Based on all gear (628 fish), calculated mean total lengths were: 5.3, 10.3, 12.3, 13.3, 14.0, 14.7, 15.4, 16.0, and 17.4 inches at annuli 1-9. Analysis by gear type indicates some bias by gear selectivity. Growth of females is more rapid than males by 0.6 to 0.8 inches at annuli 3-7. Growth of 1951-1953 year calsses was somewhat more rapid than for succeeding year classes; depressed growth is thought due to intraspecific competition resulting from exceptionally large 1954 year class. Food data (322 age-1 and older fish) as percentage of occurrence are: fish, 69; insects, 94; zooplankton, 21; crayfish, 13; amphipoda, 9. Tabular data include age distributions, calculated lengths by sampling gear, lengths of age-0 fish, summary of calculated lengths, and food data by months. (Voigtlander-Wis)
W69-06275

GROWTH EQUATIONS WITH METABOLIC PARAMETERS,
Bureau of Commercial Fisheries, La Jolla, Calif. Biological Lab.
Clyde C. Taylor.
J Cons Int Explor Mer, Vol 27, pp 270-286, 1962. 10 fig, 41 ref.

Descriptors: *Growth rates, *Fish, *Metabolism, Equations, Rainbow trout, Length, Statistical methods, Statistical models, Estimating equations, Fish physiology.
Identifiers: *Growth equations, *von Bertalanffy, *Growth models, Exponential growth, Ford-Walford regression, Parker-Larkin equation, Compensatory growth, Acipenser fulvescens, Salmo gairdneri, Salvelinus alpinus.

Analyses of fish growth patterns may prove useful in determining environmental effects on growth. Growth equation commonly used in fisheries studies is von Bertalanffy's: dw/dt= Hs - kw, where dw/dt= weight increase/unit time, H= weight synthesized/unit surface area, s= total surface area, k= tissue destruction/unit weight, and w= total weight. Author calculates a and b in relationships: log s= log p+ a log L and log w= log q+ b log L, where L= fish length; p and q= proportionality constants, and a and b are not equal to the commonly assumed values 2 and 3, respectively. Examples include: a= b, a greater than b, b greater than a, and b - a= 1. Data treatments indicate that appropriate exponents of L are necessary in Ford-Walford regression, L-sub- (t+ 1)= m (L-sub-t)+ i, to obtain good fit with data. Here, L-sub-t and L-sub- (t+ 1) are lengths at time, t, and at subsequent unit incremental time; and m and i are slope and intercept, respectively. Exponents determined from trial equations permit comparing estimated maximum lengths and maximum ages with observed values. Author applied analysis to growth data for four species. Surface area-weight-metabolism relationships, compensatory growth, and validity of von Bertalanffy theory are briefly discussed. (Voigtlander-Wis)
W69-06280

THE GROWTH RATE OF MICROORGANISMS AS A FUNCTION OF SUBSTRATE CONCENTRATION,
Microbiological Research Establishment, Salisbury (England)
E. O. Powell, C. G. T. Evans, R. E. Strange, and D. W. Tempest
3rd Int Symp. Microbiol Physiology and Continuous Culture, Her Majesty's Stationery Office, pp 34-55, 1967. 6 fig, 1 tab, 35 ref

Descriptors: *Growth rates, *Kinetics, *Microorganisms, Mathematical models, Mathematical studies, Eutrophication, Theoretical analysis, Diffusion, Permeability, Metabolism, Least squares method, Phosphates, Amino acids, Carbohydrates
Identifiers: *Substrate-limited growth, *Chemostats, *Continuous culture, Kinetic theory, Growth kinetics, Microbial kinetics, Microbial nutrition, Microbial physiology, Microbial growth, Endogenous metabolism, Escherichia coli, Aerobacter aerogenes, Nitrosomonas, Mycobacterium tuberculosis, Glucose, Lactose, Mannitol, Arginine, Tryptophane, Monod's equation, Teissier's equation, Moser's equation.

The present-day theories of continuous culture are reviewed in detail with emphasis on the functional relationship between growth rate and substrate concentration under steady-state conditions. The equations of Monod, Moser and Teissier are discussed and compared to a relationship based on the theories of diffusion and permeability developed by the author. The effects of endogenous metabolism and low viability are investigated and it is shown that both effects can be represented (very closely) by the same equation. In cultures where both factors operate, the influence of endogenous metabolism is exhibited at growth rates much above those at which viability is reduced. The equations developed by Monod, Teissier, and the author are fitted to 13 sets of published data by the method of least-squares. Monod's equations gave the poorest fit in 10 of 13 comparisons, indicating that the rectangular hyperbola approaches its asymptote too slowly to represent the observations well. In 9 comparisons the equations of the author were superior to the rest, which suggests that corrections for diffusion and permeability may be significant. (Uttormark-Wis)
W69-06281

HYDROLYSIS OF CONDENSED PHOSPHATES--II: STERILE ENVIRONMENT,
Wisconsin Univ., Madison. Water Chemistry Lab.
For primary bibliographic entry see Field 02K.
W69-06284

SOURCES OF ELEMENTAL NITROGEN IN FERMENTATION GASES,
Wisconsin Univ., Madison. Water Chemistry Lab.
Patrick L. Brezonik, and G. Fred Lee.
Air Water Pollution Int J, Vol 10, pp 145-160, 1966. 4 fig, 4 tab, 32 ref.

Descriptors: *Fermentation, *Nitrogen, Activated sludge, Amino acids, Ammonia, Anaerobic digestion, Analytical techniques, Bacteria, Chemical analysis, Denitrification, Gas chromatography, Hypolimnion, Lakes, Nitrates, Nitrites, Nitrogen cycle, Nitrogen compounds, Sewage treatment, Sludge, Water chemistry, Wisconsin.
Identifiers: *Fermentation gases, Madison (Wis), Mass spectrometry, Nine Springs Sewage Treatment Plant, Nitrate-nitrogen, Nitrogen-15, Van Slyke reaction.

An investigation was conducted on the sources of elemental nitrogen gas in biogenic gases resulting from the anaerobic fermentation of sewage sludge. Gas chromatographic and mass spectrometric studies using labelled (N-15) ammonia showed that nitrogen gas is not produced by any mechanism other than bacterial denitrification of nitrate. The addition of nitrate-nitrogen to anaerobically fermenting sludge resulted in an approximate 50% conversion of its nitrogen to nitrogen gas. The nonenzymatic (Van Slyke) reaction for the conversion of nitrite, ammonia, and amino acids to nitrogen was found only in solutions with a pH less than 3. Studies on activated sludge showed that denitrification took place under anoxic conditions. Nitrate inhibition of methane production in sewage digester sludge was found to be small at 10 ppm of nitrate-nitrogen and virtually complete at 50 ppm nitrate-nitrogen. (Lee-Wis).
W69-06285

ENVIRONMENTAL IMPACT OF BRINE EFFLUENTS ON GULF OF CALIFORNIA,
Arizona Univ., Tuscon.
D. A. Thomson, A. R. Mead, and J. R. Schrieber, Jr
Office of Saline Water, Research and Development Progress Report No. 387, March 1969. 196 p. OSW 14-01-0001-1665

Descriptors: *Brine disposal, *Brines, *Salin water, Water pollution, Waste disposal, Therm pollution, Effluents, Estuaries, Gulf, Oceano raphy, Outlets, Desalination, Hydrology, Hydrolo ic data.
Identifiers: *Marine ecology, Gulf of California.

Available literature has been reviewed for the pu pose of determining the possible effect of introdu ing large volumes of brine effluent from large siz desalting plants on the marine ecology of the Gu of California. Data on the climatology of th northern Gulf region, the temperature, salinity an dissolved oxygen content of the Gulf waters, an the tides and tidal currents were summarized fro existing reports. Heat budget calculations wer made to show annual mean temperature increase above ambient values resulting from the mixing effluent with sea water. The extent of the biologic effect on the environment was assessed from a sumed degree of mixing with respect to diffusin the effluent in sea water to mining thermal an salinity gradients. (Rinne-Office of Saline Water)
W69-06287

BRIGGSON V CITY OF VIROQUA (SEWAG DISCHARGE ACROSS LAND).

264 Wis 47, 58 NW 2d 546-553 (1953).

Descriptors: *Wisconsin, *Cities, *Municipa wastes, *Sewage effluents, Damages, Sewag Domestic wastes, Sewage treatment, Legal aspect Judicial decisions, Property values, Odor, Ston runoff, Eminent domain, Condemnatio Remedies.
Identifiers: Injunctions (Permanent), Injunctio (Prohibitory).

Defendant municipality allowed effluent from sewage disposal plant to be discharged so as t establish a permanent stream across plaintiffs' lan This discharge created a condition which rendere erosion damage from storm runoff more likely t occur. Such erosion damage had not occurre when the land was dry. The plant was designed t allow raw sewage to flow directly across plaintiff land during heavy rains. Plaintiffs, after repeate complaints to the city, brought action to abate th nuisance and to recover damages for injury to lan as a result of such nuisance. The trial cou awarded damages but denied injunctive relief. Th appellate court affirmed the damage award an granted a permanent injunction restraining the cit from allowing sewage to flow over plaintiffs' land such sewage was not treated so as to remove foul o noxious matter. The court held that a municipalit has no right to create a private nuisance. Further more, it noted that plaintiffs' remedies were no confined to eminent domain proceedings; an in junction was proper even though damages wer awarded for diminution in land value. (Wheeler Fla)
W69-06355

VEAZEY V CITY OF DURHAM (PERMANEN DAMAGES RESULTING FROM MUNICIPA SEWAGE DISCHARGE).

59 SE 2d 429-430 (NC 1950).

Descriptors: *North Carolina, *Sewage, *Wate pollution, *Municipal wastes, Effluents, Legisla tion, Cities, Impaired water quality, Water pollu tion effects, Waste water (Pollution), Water law Judicial decisions, Domestic wastes, Streams Water supply, Damages, Sewage treatment, Remedies, Legal aspects, Public rights, Public benefits.
Identifiers: Injunctions (Prohibitory).

Plaintiff was awarded permanent damages for inju ry to his land caused by the discharge of sewage into streams flowing through the property. The lower court also required the city to remedy the conditions found to constitute a nuisance, to refrain from discharging raw sewage into the streams, and to repair certain disposal facilities

The appellate court affirmed the lower court and in denying a petition for rehearing, held that the award of permanent damages was proper. It noted that upon payment of such damages the defendant would acquire a permanent right to operate its present sewage disposal plant so long as it was kept in proper repair. The court further ruled that the prohibition against discharge of raw sewage was proper since that portion of the judgment was designed to prevent future injury to plaintiff. The court also cited a state statute which forbids the discharge of raw sewage into rivers from which a public drinking water supply is taken when the point of such taking is below the point of discharge. (Wheeler-Fla)
W69-06356

5D. Waste Treatment Processes

LIMNOLOGICAL INVESTIGATIONS OF TEXAS IMPOUNDMENTS FOR WATER QUALITY MANAGEMENT PURPOSES - THE DISTRIBUTION OF COLIFORM BACTERIA IN STRATIFIED IMPOUNDMENT,
Texas Univ., Austin.
Alan C. Gravel, E. Gus Fruh, and Ernst M. Davis.
Texas Center for Research in Water Resources, Technical Project Report No 3, February, 1969. 92 p, 4 tab, 8 fig, 44 ref, 5 append. OWRR Project B-020-TEX.

Descriptors: *Stratified impoundments, *Coliform dieoff rate, *Wastewater treatment, *Temperature, *Dissolved oxygen, *pH.

The distribution of coliform bacteria in stratified impoundments was studied in an attempt to define the characteristics and causes for that distribution. A field sampling program was conducted to validate data in the literature which indicated that coliform densities were higher in hypolimnion than in epilimnion waters. The literature was reviewed and laboratory research conducted to evaluate the hypothesis that this coliform stratification was due to differences in death rates resulting from stratification of temperature, pH, and dissolved oxygen. Results showed this hypothesis to be a satisfactory explanation and indicated that differences in temperature and pH were most important.
W69-06005

NITROGEN REMOVAL FROM NATURAL WATERS,
New Mexico State Univ., Las Cruces. Engineering Experiment Station.
J. E. Speece, and R. G. Montgomery.
Final Research Report, August 1968. 71 p, 21 tab, 9 fig, 27 ref. OWRR Project A-013-NMEX.

Descriptors: *Nitrification, Denitrification, Nutrients, *Wastewater, Fish hatcheries.
Identifiers: Nutrient removal, *Nitrogen removal.

Nitrification was accomplished in 3 foot deep columns packed with 1/2 inch gravel. Hydraulic loading rates of 1 to 6 gpm/sq ft. The unit rate of nitrification was about 200 mg/hr/cu ft of gravel at hydraulic loading rates of 2 and 8 gpm/cu ft. At 1 gpm/sq ft, nitrification rate was about 100 mg/hr/cu ft of gravel. Submergence of the lower 2 feet of the column extended the contact time and increased the nitrification capacity of the columns to 400 mg/hr/cu ft of gravel at a hydraulic loading rate of 1 gpm/sq ft. Denitrification was accomplished at hydraulic loading rates of 0.25, 0.45 and 1 gpm/sq ft giving nitrate reductions of 28 mg/1, 21 mg/1, 15 mg/1 and 10 mg/1, respectively. These reductions in nitrate concentration correspond to 700, 540 and 840 gm/hr/cu ft of gravel. About 200 mg/1 of COD was used to accomplish these nitrate reductions.
W69-06012

THE CHICAGO AREA DEEP TUNNEL PROJECT-A USE OF THE UNDERGROUND STORAGE RESOURCE,
Harza Engineering Co., Chicago, Ill.; Bauer Engineering, Inc., Chicago, Ill.; and Metropolitan Sanitary District of Great Chicago, Ill.
For primary bibliographic entry see Field 05G.
W69-06021

5E. Ultimate Disposal of Wastes

MINERAL TASTE IN DOMESTIC WATER,
California Univ., Berkeley. School of Public Health.
William H. Bruvold.
Cal Univ Water Resources Center Contrib No 127, Dec 1968. 128 p, 5 fig, 2 tab, 23 ref, append. OWRR Proj No A-005-CAL.

Descriptors: *Water quality, *Domestic water, *Taste, *Water chemistry, *Dissolved solids, Potable water, Surveys, Statistical methods, Testing.
Identifiers: *Water taste (Mineral).

The taste of water is affected by the common dissolved constituents Ca, Mg, K, Na, bicarbonate, carbonate, Cl, nitrate, and sulfate, which make up most of the dissolved solids in water. Data were collected for use in objectively describing the relationship between mineral content and the general taste quality of water. Objective standards for mineral content are needed to ensure potability for all consumers, particularly in semi-arid regions where water is commonly highly mineralized. A consumer attitude survey technique was developed and taste panels were used to evaluate water taste attitudes. General taste quality and total mineral content showed an inverse linear relationship. Results of panel tests, consumer surveys, and multiple linear regression analyses are tabulated. (Knapp-USGS)
W69-06215

THE FEASIBILITY OF DEEP-WELL INJECTION OF WASTE BRINE FROM INLAND DESALTING PLANTS,
Oak Ridge National Laboratory, Tenn.
W. J. Boegly, Jr., D. J. Jacobs, T. F. Lomenick, and O. M. Sealand.
Office of Saline Water, Research and Development Progress Report No. 432, March 1969. 76 p. OSW-14-01-0001-534.

Descriptors: *Brine disposal, *Brines, *Saline water, *Deep wells, *Injection wells, Waste disposal, Subsurface investigations, Desalination.
Identifiers: *Deep well disposal, Deep well usage, Geologic considerations, Desalting.

Literature pertaining to the use of deep-well injection has been reviewed to determine the feasibility of its use for disposing of brine effluents from inland desalting plants. Deep well injection was found to be technically feasible if satisfactory pretreatment is provided. Brine disposal from oilfield operations ranged from $0.25 to $0.75 per 1000 gallons of brine. A suitable site for deep-well injection requires a permeable sedimentary formation, such as sandstone or limestone, capped by an impermeable formation, such as shale, to prevent pollution of neighboring potable waters. Detailed geologic and hydrologic investigations will be required to assure that the site is satisfactory and to provide data to be used for designing an injection system. (Gransee-Office of Saline Water)
W69-06286

SEWAGE DISPOSAL PLANTS.
For primary bibliographic entry see Field 06E.
W69-06342

5F. Water Treatment and Quality Alteration

CHEMICAL AND PHYSICAL CHARACTER OF MUNICIPAL WATER SUPPLIES IN MARYLAND,
Geological Survey, Washington, D. C.
Jolly D. Thomas, and Sumner G. Heidel.
Maryland Geol Surv Rep of Invest No 9, 1969. 52 p, 1 fig, 5 tab, 8 ref.

Descriptors: *Water quality, *Municipal water, *Maryland, Water supply, Groundwater, Surface waters, Hardness (Water), Potable water, Water analysis, Water purification, Water sources, Water temperature.
Identifiers: Public water supplies.

Data on the quality of municipal waters in Maryland are compiled. The 65 largest public water supplies in Maryland deliver about 378 mgd of water to over 3 million people. More than 80% of 2,444,000 of these people, who use about 320 mgd are supplied by either the Baltimore Bureau of Water Supply or the Washington Suburban Sanitary Commission. Samples of raw and finished water from most facilities were analyzed by the Geological Survey. Sixteen municipal supplies use surface water; 43 use groundwater, and 6 use both surface and groundwater. Surface water serves more than 89% of the population, although more individual communities obtain their supplies from groundwater. Twenty-two public supplies reportedly add fluoride to their water and 10 supplies have natural fluoridation of 0.4 ppm or more. The treated water of most municipalities is soft or moderately hard, and only 7 facilities deliver finished water that is classified as hard water or very hard water. (Knapp-USGS)
W69-06031

AN EVALUATION OF SOME METHODS FOR THE DETERMINATION OF FLUORIDE IN POTABLE WATERS AND OTHER AQUEOUS SOLUTIONS,
Ministry of Technology, London (England). Lab. of Government Chemist.
N. T. Crosby, A. L. Dennis, and J. G. Stevens.
Analyst, Vol 93, No 4, pp 643-652, Oct 1968. 10 p, 9 tab, 24 ref.

Descriptors: *Analytical techniques, *Fluorides, *Evaluation, *Aqueous solutions, Colorimetry, Spectrophotometry, Water analysis, Laboratory tests.
Identifiers: Ion-specific electrodes.

Five spectrophotometric procedures for the determination of fluoride in water have been evaluated with respect to reproducibility, sensitivity, range, stability of coloured products and of reagents, specificity and effect of temperature. The thorium nitrate titration is briefly discussed, and the use of the Orion fluoride-ion electrode for pF measurement has also been investigated. Various samples of water containing natural or added fluoride have been analysed by 4 of the spectrophotometric methods, and the results compared with those obtained by titration and with the electrode. The electrode is shown to be less susceptible than the colorimetric methods to interference from other ions in solution, and it gives theoretical recoveries of fluoride added to several drinking water supplies.
W69-06037

5G. Water Quality Control

ALTERNATE METHODS OF MOSQUITO CONTROL TO REDUCE CHEMICAL POLLUTION OF WATERS FOR RECHARGE OF THE OGALLALA FORMATION,
Texas Technological Coll., Lubbock.
Charles R. Ward, John C. Owens, Ellis W. Huddleston, and Donald Ashdown.

Texas Water Resources Center, Project Completion Report WRC-69-4, April 1969. 38 p, 3 tab, 11 fig, 11 ref, 1 append. OWRR Project B-007-TEX.

Descriptors: *Mosquito control, *Chemical pollution, Surface water, Recharge, Ogallala formation, *Playa lakes, Cultural control, Non-chemical control.

Several cultural controls were evaluated in replicated small plot experiments and in two seasons on whole-lake-bed treatments. Plastic pens prevented larval migration among treatments in replicated small plot treatments which were evaluated by dipper sampling of larvae following two inundations. Cultural methods evaluated and the average numbers (over both inundation periods) of Aedes larvae per dip were as follows: check (8.6), one-way disc plow (2.4), tandem disc plow (2.3), propane burner (1.9), moldboard plow (1.4) and roto-tiller (0.2). In the whole-lake-bed treatments in 1967, the primary species present were in Culex; the cultural methods and the average larvae per dip were: check (0.8), ditches to pits with pumps (0.6), tandem-plowed around a pumping sump (0.1) and lister-plowed (0.0). In 1968, primarily Aedes larvae were present in all study lakes. The cultural methods studied and the average larvae per dip were: check lakes (2.0); pit-modified (0.6); pit-modified plus water-pumped (0.5); tandem-plowed (0.2); pit-modified, water-pumped and basin tandem-plowed (0.1); and lister-plowed (0.0). Plowing should substantially reduce mosquito production and consequently the amount of pesticides applied for control; high turbidity levels may follow plowing.
W69-06001

NITROGEN REMOVAL FROM NATURAL WATERS,
New Mexico State Univ., Las Cruces. Engineering Experiment Station.
For primary bibliographic entry see Field 05D.
W69-06012

ECOLOGICAL RELATIONSHIPS OF ORGANIC MATTER AND BACTERIA IN TUTTLE CREEK RESERVOIR,
Kansas State Univ., Manhattan.
For primary bibliographic entry see Field 02H.
W69-06014

THE CHICAGO AREA DEEP TUNNEL PROJECT-A USE OF THE UNDERGROUND STORAGE RESOURCE,
Harza Engineering Co., Chicago, Ill.; Bauer Engineering, Inc., Chicago, Ill.; and Metropolitan Sanitary District of Great Chicago, Ill.
V. A. Koelzer, W. J. Bauer, and F. E. Dalton.
J Water Pollut Contr Federation, Vol 41, No 4, pp 515-534, Apr 1969. 20 p, 17 fig, 1 tab.

Descriptors: *Water pollution control, *Storm drains, *Underground storage, *Illinois, Water pollution sources, Municipal wastes, Industrial wastes, Sewage, Sewage treatment, Sewage disposal, Subsurface drainage.
Identifiers: Chicago (Ill), Chicago deep tunnel plan.

The Greater Chicago area is plagued with recurring water pollution and flood problems stemming from 3 sources--industry, wastewater treatment plant effluent, and combined storm and sanitary sewer overflows. A solution to all 3 sources is the Deep Tunnel Project. It will capture stormwater overflows from combined sewers, dropping them through vertical shafts to a tunnel network. The polluted water will be conveyed for temporary storage in a large mined underground reservoir 800 ft (242 m) below the surface. Preliminary design studies including project features, feasibility, costs, performance, and benefits, as well as operation, are discussed. Tunneling methods are included. (Knapp-USGS)
W69-06021

EUROPEAN PRACTICE IN WATER QUALITY CONTROL,
Pennsylvania Dept. of Health, Harrisburg. Div. of Sanitary Engineering.
Walter A. Lyon.
ASCE Proc, J Sanit Eng Div, Vol 93, No SA3, Pap 5284, pp 37-45, June 1967. 9 p, 13 ref.

Descriptors: *Water management (Applied), *Water policy, *Water quality control, Water districts, Governments, River basin commissioners, River basin development, Planning, Water resources development, Watershed management.
Identifiers: *Europe, European water quality control.

Changes in European public policy regarding pollution control are examined, including the public response to the pollution problem, a summary of recent legislative activity, and intergovernmental relationships. The use of classification systems and the organization of water-pollution control efforts are evaluated, in addition to permit systems and the role of nongovernmental organizations in shaping water-pollution-control policies. In Europe, there appears to be a movement toward decentralized river-basin management of water-pollution control and waste treatment. Increased pollution of streams in the industrial sectors of most countries has had an adverse effect on many of the uses of rivers, particularly recreational uses. As a result, conservationists, fishermen, and professionals have called for, and received, with the help of an interested press-stricter laws regarding pollution control. (Knapp-USGS)
W69-06078

WATER QUALITY CONTROL - THE ROLE OF THE INTERSTATE AGENCY,
Water Pollution Control Federation, Washington, D. C.
James F. Wright.
Journal, Water Pollution Control Federation, Vol 40, No 8, pp 1403-1407, Aug 1968. 5 p.

Descriptors: *Delaware River Basin Commission, *Inter-agency cooperation, *Interstate commissions, *Water pollution control, Administrative agencies, Coordination, Federal government, Formulation, Governments, Interstate rivers, Water resources development, Organizations.
Identifiers: Interstate agencies.

The Delaware River Basin Commission, an interstate agency, employs two distinct processes: (1) formulation of standards; and (2) implementation of the standards formulated. The formulation of standards includes: (1) a determination of the uses to which a stream could be put; (2) the establishment of a stream quality criteria for these uses; (3) an analysis of different combinations of treatments; and (4) the establishment of effluent requirements. The plan of implementation focusses on: (1) regulations establishing operational conditions; (2) a timetable for implementation; (3) a procedure for allocating available assimilative capacity within the river; (4) programs for attacking the noncarbonaceous inputs; (5) systematic review and revision of the first four areas as experience is gained. The role of an interstate agency is characterized by seven aspects. It is able to: (1) see things in perspective; (2) develop a regional plan; (3) allow states to reinforce each other's position; (4) deal with residual effluents discharged into an interstate stream; (5) provide a forum for reconcilliation of opposing views as to water use; (6) have the advantage of a federal approach; and (7) provide a structure from which a joint political and administrative effort can be launched. (Molica-Fla)
W69-06094

WATER QUALITY STANDARDS: THE FEDERAL PERSPECTIVE PROGRESS TOWARD OBJECTIVES,
Water Pollution Control Federation, Washington, D. C.
Allan Hirsch, James Agee, and Robert Burd.
Journal, Water Pollution Control Federation, Vol 40, No 9, pp 1601-1606, Sept 1968. 6 p.

Descriptors: *Water quality act, *Administrative agencies, *Project planning, *Standards, Water quality control, Water pollution, Administration, Water resources development, State governments, Programs, Federal government, Regulation, Legislation.
Identifiers: FWPCA.

The Water Quality Act of 1965 provided for state establishement of water quality standards. Such an undertaking necessarily involves: (1) determination of the uses to be made of a given body of water; (2) formulation of criteria of water quality necessary to support such uses; and (3) development of a plan to achieve and maintain those criteria. The FWPCA has issued 'Guidelines for Establishing Water Qaulity Standards,' and the Secretary of the Interior has appointed an advisory committee on water quality criteria to help guide the states in establishing acceptable standards. Thus far, the standards submitted have been either too general or too specific. Particular guidelines may reflect policies which seem arbitrary because of major gaps in our knowledge concerning the effects of waste loads on the receiving waters and the behavior of wastes in the environment. The standards implementation plans are now recognizing problems such as thermal pollution, animal feed lots, vessel pollution, etc. Because of the agency's limited time and resources, a major weakness of the standards is their failure to provide for future problems which will necessarily evolve from continued economic development of the nation. (Molica-Fla)
W69-06095

FITTING A STATE PROGRAM TO FEDERAL OBJECTIVES,
Water Pollution Control Federation, Washington, D. C.
Clarence W. Klassen.
Journal, Water Pollution Control Federation, Vol 40, No 10, pp 1702-1710, Oct 1968. 9 p.

Descriptors: *Inter-agency cooperation, *Water pollution control, *Adoption of practices, *Water quality act, Administration, Administrative agencies, Coordination, Federal government, Federal Project Policy, Governments, State governments, Social participation, Project planning.

Adapting a state program of water pollution control to coincide with federal objectives has been difficult because of the evasiveness of the federal objectives. For example, the Federal Clean Water Act does not define 'pollution,' and the courts have had to enforce the laws on the basis of state definitions. However, benefits have also accrued to the states; federal grant programs have helped in getting local support behind bond issues for improvements, and the public attention focused on water pollution has had a salutory effect on industry. The states have also had difficulty in translating the federal guidelines into practical procedures. The requirement that states adopt a comprehensive planning technique for pollution control has been a major contribution of the federal program. A pollution control agency must function in the areas of prevention, abatement and control; and cooperation between the states and the federal government is imperative, especially in the area of prevention. (Mollica-Fla)
W69-06096

SANITARY WATER BOARD V ANTHONY (LEGISLATION TO PREVENT MINE ACID POLLUTION).
Dauphin County Reports Vol 66, pp 250-261 (C P Pa 1954).

Descriptors: *Administrative agencies, *State governments, *Legislation, *Acid mine water, Judicial decisions, Legal aspects, Mine drainage, Coal mine wastes, Strip mine wastes, Public health, Reservoirs, Domestic water, Public rights, Water distribution (Applied), Eminent domain, Condemnation, Water pollution control, Pennsylvania.
Identifiers: Administrative law.

Appellants filed an application with the Sanitary Water Board for a permit to conduct strip mining in the vicinity of Furlong Run. The application was denied by the Board after objection of a local water company who feared acid water pollution of its source streams. The statute creating the Board divides the waters of the Commonwealth into three categories: (1) clean waters which are devoted to public use; (2) clean waters; and (3) polluted or unclean waters. The present case involved conjectural acid pollution of waters in the first category. The defendant contended that the statute should be strictly construed and that a duty existed for the Commonwealth to provide, at its own expense, facilities for the removal of acid mine drainage until such time as, in the opinion of the Board, practical means for the disposal thereof should become known and that, in the meantime, they should be allowed to operate their strip coal mine without a permit. The court held that such a construction of the pertinent statute would defeat the manifested intent of the legislature and affirmed the Board's denial. (Katz-Fla)
W69-06109

MADDOX V INTERNATIONAL PAPER COMPANY (DAMAGES RESULTING FROM BAYOU POLLUTION).

105 F Supp 89-94 (W D La 1951).

Descriptors: *Louisiana, *Water pollution, *Pulp wastes, *Industrial wastes, Pulp and paper industry, Effluents, Water pollution sources, Fishkill, Waste water (Pollution), Wastes, Streams, Odor, Water pollution effects, Pollutants, Judicial decisions, Water law, Legal aspects, Damages.

After the pollution of a bayou, plaintiff brought suit against defendant, paper company to recover damages for the total destruction of his fishing camp and business, for loss of improvements on his property, for loss in property value, and for the permanent loss of a stream. In awarding damages for final settlement of all claims, the court ruled that a prior judgment and later compromise between the parties affected claims only up to a certain date, and did not affect the present suit. The court noted that plaintiff had never been paid for the permanent losses claimed, and that he had been talked into believing that the pollution was to be totally corrected. The court held that no one has a legal right to use a public stream for the discharge of effluent lethal to fish without paying for injuries caused. (Wheeler-Fla)
W69-06112

PUNXSUTAWNEY WATER SERVICE CO V SARICKS (CONTAMINATION FROM STRIP MINING).
354 Pa 106, 46 A 2d 673-674 (1946).

Descriptors: *Pennsylvania, *Water pollution, *Strip mine wastes, *Water supply, Strip mines, Water law, Acid mine water, Coal mines, Water pollution sources, Pollutants, Reservoir storage, Public utilities, Water quality, Mine acids, Mine wastes, Water pollution effects.
Identifiers: Injunctions (Preliminary).

Plaintiff water service company filed suit in equity praying that defendants be enjoined from further strip mining and ordered to replace ground already stripped. Upon affidavit and bond, a preliminary injunction was issued. After hearing to determine whether this injunction should be continued, the lower court ordered the injunction dissolved. Five separate streams lead into plaintiff's reservoir, but plaintiff offered evidence that only one of the five was in danger of contamination. Plaintiff failed to show the amount of the stream's present contamination, the proportion of water from this branch to the reservoir's total intake, and the degree of future contamination anticipated. The appellate court affirmed, ruling that plaintiff failed to show that it was in imminent danger and that the continuance of the preliminary injunction was necessary to preserve the status quo. The preliminary injunction was dissolved, with the case to proceed on the merits. (Wheeler-Fla)
W69-06113

JONES V BREYER ICE CREAM CO (PRESCRIPTIVE RIGHTS TO POLLUTE STREAM WATERS).

1 App Div 2d 253, 149 NYS 2d 426-428 (Sup Ct NY 1956).

Descriptors: *Stream pollution, *Nuisance, *Prescriptive rights, *New York, Judicial decisions, Public health, Water pollution, Ponds, Refuse, Wastes, Domestic wastes, Liquid wastes, Sewage, Waste identification, Riparian ownership, Milk, Legal aspects.
Identifiers: Public nuisance, Private nuisance.

Plaintiff brought suit to enjoin the defendants from polluting the plaintiff's pond. Defendants contend that they acquired a prescriptive right to pollute the pond with waste as long as the pollution amounted to no more than a private nuisance as distinguished from a public nuisance. It is settled law in New York that fresh-water streams may not be polluted and the right to pollute any may not be acquired by prescription. However, this law applies only to a public nuisance. A prescriptive right may be acquired to pollute the waters of a pond if it is only a private nuisance. The defendants were discharging water and waste milk. The court ruled whether this came within the meaning of refuse and sewerage so as to consitute a public nuisance was a question to be determined at trial. (Stewart-Fla)
W69-06114

B AND B OIL CO V TOWNSEND (OIL WASTE POLLUTION).

192 SW 2d 953-955 (Ky Ct App 1946).

Descriptors: *Kentucky, *Water pollution, *Oil wastes, *Saline water, Judicial decisions, Water pollution, Pollutants, Water pollution effects, Fishkill, Oily water, Ponds, Farm ponds, Boundaries (Property), Mineralogy, Natural gas, Oil wells, Stock water.

Plaintiff's property adjoined land upon which defendant maintained storage tanks for oil and salt water. Refuse from the oil and salt water was released from the tanks and allowed to run along the surface of the ground to plaintiff's land, temporarily polluting a pond. The court found defendant liable for damages. If the owner of an oil or gas well negligently permits oil, gas, or salt water to escape, the resulting injury is actionable: (1) if not within the reasonable contemplation of the parties to the lease of the land; or (2) if adjoining land is injured. A new trial was granted as to the issue of damages. The measure of damages for temporary injury to land is an amount equal to the diminution in the value of the use to which the land may be put. Plaintiff had failed to show the value of the use of the polluted pond. (Helwig-Fla)
W69-06115

SMITH V MAGNET COVE BARIUM CORP (BARIUM TAILING POLLUTION).
206 SW 2d 442-446 (Ark 1947).

Descriptors: *Riparian rights, *Arkansas, *Industrial wastes, *Water pollution, Judicial decisions, Impaired water quality, Water pollution effects, Color, Fishkill, Domestic wastes, Municipal wastes, Animal wastes, Sediments, Water pollution sources, Reasonable use, Water rights, Wastes, Relative rights, Damages.
Identifiers: *Barium tailings, Injunctions (Prohibitory).

Defendant used the water of a creek to dispose of tailings, the residue produced from the process of extracting barium from ore-bearing earth. Plaintiff owned riparian land downstream from defendant. Plaintiff alleged that pollutants from defendant's plant injured fish, poisoned plaintiff's cattle, and caused permanent damage to the land due to barium sediment deposits which remained on the stream banks following periodic floods. Plaintiff sought damages and injunctive relief. The court entered judgment for $750 damages, but dismissed the plea for an injunction on the grounds that the plaintiff had an adequate remedy at law. The damage award granted to the plaintiff was the only appropriate relief in these circumstances since there was evidence of other contributing sources of pollution. (Helwig-Fla)
W69-06116

PHILLIPS V SUN OIL CO (GASOLINE POLLUTION OF WATER WELL).

307 NY 328, 121 NE 2d 249-251 (1954).

Descriptors: *New York, *Water wells, *Gasoline, *Water pollution sources, Judicial decisions, Fuels, Wells, Water pollution, Seepage, Groundwater, Percolating water, Well regulations, Percolation, Subsurface drainage, Shallow wells, Subsurface waters, Legal aspects.
Identifiers: Trespass, Injunctions (Prohibitory), Nuisance.

Plaintiff owned land adjacent to defendant's underground gasoline storage tanks. Gasoline traveled underground to plaintiff's land and seeped into his water well, contaminating his water supply. Plaintiff brought this action in trespass to recover damages. The court held that trespass is an intentional harm. The trespasser need not intend or expect the consequence of his action in order to be held liable therefor, but he must intend the act which produces the unlawful intrusion. Even though the pollutant had deliberately been put into the land, defendant is not liable for a neighbor's damage therefrom unless he had good reason to know that there would be seepage to the neighbor's land. Since defendant did not know of the leaking gasoline, he was not liable for damages resulting therefrom. Injunctive relief may have been available to prevent future harm to the water supply. (Helwig-Fla)
W69-06117

PHOENIX V GRAHAM (SALT WATER POLLUTION OF WELLS).

349 Ill App 326, 110 NE 2d 669-673 (1953).

Descriptors: *Illinois, *Saline water, *Wells, Judicial decisions, Oil wastes, Water quality, Salinity, Percolating water, Well spacing, Shallow wells, Groundwater, Water sources, Drainage, Riparian rights, Artesian wells, Ditches, Drainage effects, Seepage, Waste storage, Legal aspects.

Plaintiff was lessor of certain oil producing land upon which defendant lessee had wells. Salt water pumped from the wells and negligently discharged by defendant polluted plaintiff's water wells. Defendant and his predecessor had dug pits to store the salt water, and the wells became unusable soon after enlarging one of the storage pits. While there is a conflict among the jurisdictions regarding liability from salt water damage, the court held that adjoining landowners and other downstream owners have a right to receive water in its natural state. However, lessors have no action for salt damage to their own land from sources on the land unless such damage is caused by lessee's negligence. The lessee well operator is required to use the care of an ordinary prudent operator; he has the right to use that part of the leased land for salt water disposal as is reasonably necessary. There was sufficient evidence in this case to show negligence on the part of the lessee, however, the court remanded on the issue of damages. Plaintiff failed to demonstrate permanent damage to his water supply or to show lack of another water source. (Helwig-Fla)
W69-06118

COMMONWEALTH V BLACK (INJUNCTION RESTRAINING STRIP MINING OPERATIONS).
363 Pa 231, 69 A 2d 376-381 (1949).

Descriptors: *Pennsylvania, *Permits, *Stream pollution, *Strip mine wastes, Water pollution, Water pollution control, Water pollution, Strip mines, Legal aspects, Judicial decisions, Mine acids, Coal mine wastes, Acid mine waters, Wastes, Waste treatment, Water quality, Public benefits, Legislation, Administrative agencies, Discharge (Water).
Identifiers: Injunctions (Prohibitory).

The state filed a bill in equity, praying that an injunction be issued to enjoin discharge of acide mine drainage from defendants' strip mining operation into clear stream waters devoted to public use. The Chancellor refused to permanently enjoin operation of the mine, but did restrain defendants from causing pollution. The Commonwealth then amended its petition and asked that defendants' operations be enjoined until the latter had secured approval from the Sanitation Water Board for a proposed drainage plan as required by statute. The Chancellor ruled that, since pollution was not proven, the Board's approval was not required. The appellate court reversed, ruling that the issue was not whether defendant was causing pollution, but whether approval had been secured from the Sanitary Water Board. (Wheeler-Fla)
W69-06119

MASONITE CORP V WINDHAM (PONDING AND POLLUTION ON UPPER LAND).

48 So 2d 622-625 (Miss 1950).

Descriptors: *Mississippi, *Obstruction to flow, *Ponding, *Water pollution, Dams, Culverts, Riparian rights, Drainage, Land tenure, Judicial decisions, Relative rights, Damages, Surface runoff, Legal aspects, Alteration of flow, Water pollution sources, Industrial wastes.
Identifiers: *Accumulation, *Upper landowner, *Lower landowner.

Suit by upper riparian owner against lower riparian owner for damages allegedly caused by ponding of waters on upper land and the pollution of the pond by oils, greases and other deleterious matter discharged by the defendant masonite company. The plaintiff and defendant are adjacent landowners and riparians as to a creek running through or along their lands. When defendant acquired its land, plaintiff's land was drained by way of trestle openings in a railroad embankment at its boundary. Appellant closed three of these trestles, replacing them with culverts, and constructed a dam which, together with the embankment, formed a triangle where deleterious matter was deposited. This matter caused a noxious stench and the pollution of the ponds caused on plaintiff's land by defendant's obstruction of drainage. A judgment below for plaintiff in the amount of $5,000.00 was appealed. The Supreme Court of Mississippi held that a lower land owner may take necessary steps to carry upper diffused waters away from his land, as long as he does not use upper land in doing so, or so impede the flow of water as to cause accumulation upon the upper land. Even without this law, liability in the present case was validly based on the pollution alone, and the judgment below was affirmed. (Harris-Fla)
W69-06120

QUALITY CHARACTERISTICS OF WATER RESOURCES,
Research Inst. for Water Resources Development, Budapest (Hungary).
I. Bartfai Szabo, I. Felfoldy, and I. Szebelledy
2nd Int Postgrad Course on Hydrol Method for Develop Water Resources Manage, Budapest, Hung, Jun-July 1968, Manual No 6, 1968. 95 p, 9 fig, 8 tab, 195 ref

Descriptors: *Water quality, *Water pollution sources, Water quality control, Water management (Applied), Legislation, Water utilization, Water supplies, Radioactive wastes, Sewage.
Identifiers: *Textbooks, *Technical manuals.

Methods for determining water quality, pollution, and water quality requirements, are discussed in a technical manual presented as a chapter of a text written for an international postgraduate course in water resources management. Surface and groundwater composition are described as functions of the geological, hydrological, and cultural environment. The kinds and sources of water pollution, the process of self-purification, and sewage control are discussed. Biological methods are given for water quality estimation. Radioactive stream pollution and its control are described. Chemical analysis methods are listed and discussed. (Knapp-USGS)
W69-06225

OIL POLLUTION - A REPORT TO THE PRESIDENT.
Department of the Interior, Washington, D. C.; and Department of Transportation, Washington, D. C.
For primary bibliographic entry see Field 05B.
W69-06237

EUFAULA RESERVOIR AERATION RESEARCH-1968,
Robert S. Kerr Water Research Center, Ada, Okla.
Lowell E. Leach.
Fed Water Pollut Contr Admin open-file rep, 1968. 8 p, 5 fig.

Descriptors: *Reaeration, *Reservoirs, *Thermal stratification, Hypolimnion, Epilimnion, Tailwater, Dissolved oxygen, Mixing, Diffusion, Monitoring.
Identifiers: Reservoir aeration, Reservoir destratification.

Aeration experiments were carried out in Eufaula Reservoir, Oklahoma, which has a surface of 102,500 acres and stores 2,800,000 acre-ft. The central pool, in which most of the tests were done, has a surface of 10,800 acre-ft and a volume of 570,000 acre-ft. In January 1968, 17 sampling stations were located by triangulation. Vertical temperature and dissolved oxygen profiles were taken every 2 weeks during winter and spring to determine the progress of stratification. Stratification occurred late, in mid-July, and became stable in late July with a thermocline at 60 ft near the dam and 50 ft upstream. Aeration was by six 40-ft lengths of 4 in pipe, each having 8 equally spaced microporous diffusers, and a 1,200 cfm compressor. Aeration started Aug 2 at 1,200 cfm discharged at 95 ft depth. Oxygen in discharged water increased from 3 mg/l to a range of 4.0 to 5.5, but aerated water was discharged through the generators as fast as it accumulated in the hypolimnion. The aeration was too close to the power intakes to affect a large area, but great benefit to the quality of power discharges and downstream water resulted. (Knapp-USGS)
W69-06255

HARVESTING UNDERWATER WEEDS,
Wisconsin Univ., Madison. Dept. of Mechanical Engineering.
Donald F. Livermore.
Water Works Eng, pp 118-120, 151, Feb 1954. 4 fig, 4 ref.

Descriptors: *Aquatic weed control, *Eutrophication, *Harvesting, Aquatic plants, Aquatic weeds, Economic feasibility, Lakes, Nuisance algae, Water pollution control, Nutrients, Water pollution effects, Water pollution sources, Wisconsin.
Identifiers: Lake Mendota (Wis), Lake Monona (Wis), Lake Kegonsa (Wis), Lake Waubesa (Wis), Madison (Wis), University of Wisconsin, Yahara River (Wis), Nutrient removal.

One approach to eutrophication control is repeated harvesting of a nutrient-laden crop, its removal from the water, and its utilization, transformation, or transfer from the threatened drainage basin. Author presents design for a mechanical harvester developed at University of Wisconsin, which will cut and collect underwater weeds. He describes operation of prototype model which was functional to depth of five feet, operated at speeds of 1-2 miles/hour, and could remove over four tons of drained weeds/hour. Cost of operating machinery of this type would necessarily be quite high. Author estimates, for era when this paper was written, that initial investment for one harvesting machine, three 'shuttle' barges for transportation of harvested plants, and docks and unloading facilities would be in range of $20,000 and that an annual operating budget of $10,000-$15,000 would be required to cover fixed and operating charges. Mechanical harvesting of macrophytes would not only remove plant nutrients but would also eliminate some undesirable end effects of eutrophication by clearing boating and swimming areas and by eliminating scum areas which develop from entrapment by emergent plants of algae and other floating debris. Author suggests that harvested lacustrine plants may have potential commercial value. (Eichhorn-Wis)
W69-06276

WASTES, WATER, AND WISHFUL THINKING: THE BATTLE OF LAKE ERIE,
Case Western Reserve Univ., Cleveland.
Arnold W. Reitze, Jr.
Case W Res L Rev, Vol 20, No 1, pp 5-86, Nov 1968. 82 p, 448 ref.

Descriptors: *Ohio, *Lake Erie, *Water pollution control, *Pollution abatement, Pollutants, Wastes, Thermal pollution, Toxins, Pesticide residues, Phosphates, Algae, Sewage, Water pollution, Water law, Water pollution effects, Water pollution sources, Water pollution treatment, Financing, Grants, Federal government, State governments, Water quality standards.

Lake Erie is seriously polluted, and its continued use as a public water supply is in jeopardy. The pollutants include sewage, phosphates, organic chemicals, and petrolelum products. The federal government has passed pollution statutes which date back to the 19th Century, but the first serious attempt to clean up Lake Erie began in 1965, under the Federal Water Pollution Control Act. Under this act, the states are required to set water quality standards for their navigable waterways. Each jurisdiction must maintain the existing quality of the water and may not allow treatable wastes to be discharged into the water in an untreated state. Ohio has established pollution standards, but these standards are criticized because they assume the water does not have to be pure and because they are too vague and inconsistent. The pollution abatement of Lake Erie requires the efforts of federal and state administrative agencies and of the courts. The attempt at pollution abatement over the last three years has ended in failure. Ohio expends only $239,000 yearly on its river sanitation program; approximately ten billion dollars are needed to clean Lake Erie. (Hoffman-Fla)
W69-06305

MUNICIPAL WATER POLLUTION CONTROL.
Minn Stat Ann secs 115.41 to 115.43, 115.49 (1) (1967).

Descriptors: *Minnesota, *Water pollution control, *Cities, *Water quality, Pollution abatement, Biochemical oxygen demand, Public health, Sewage, Industrial wastes, Water conservation, Classification, Flow characteristics, Flotsam, Colloids, Bacteria, Bodies of water, Water utilization, Contracts, Legislation, Administrative agencies, Administrative regulation.
Identifiers: *Stream gradient.

The Water Pollution Control Commission, in the furtherance of water conservation and public health, shall prevent and abate pollution of state waters. The commission may, after notice and hearing, issue or revoke regulations and orders to

prohibit or abate the discharge of wastes into state waters. No single standard of water purity is applicable to waters of the state; however, after investigation and public hearing, the commission shall classify the state's waters in the public interest. Classification factors shall be size, depth, surface area, volume, direction and rate of flow, stream gradient, temperature, character of the surrounding district, present and future uses, extent of present pollution, and the need of standards for effluent from disposal systems. After classification, standards of purity for each class shall be set after study and public hearing. Consideration is to be given to the extent to which floating solids, suspended solids, and bacteriological organisms may be permitted in the water. Also to be considered is the degree of oxygen demand permitted in the receiving waters, and other chemical and biological properties. Notice for adoption or modification of classifications and standards shall be made according to this act. The commission may, after a hearing, determine that cooperation by contract between two or more municipalities is desirable to prevent pollution. (Harris-Fla)
W69-06316

STATE V TOWN OF GOFFSTOWN (SUIT TO FORCE COMPLIANCE WITH ORDER TO ABATE RIVER POLLUTION).

121 A 2d 317-320 (N H 1956).

Descriptors: *New Hampshire, *Municipal wastes, *Water pollution, *Water pollution sources, Sewage effluents, Public health, Organic wastes, Impaired water quality, Judicial decisions, Administrative agencies, Rivers, Sewage treatment, Tax rate, Legislation, Classification, Recreation, Cities, Adjudication procedure, Remedies, Regulation, Financing.
Identifiers: Injunctions (Mandatory), Delegation doctrine.

The state Water Pollution Commission ordered defendant town to stop discharging inadequately treated sewage into a river. The town's voters refused to approve certain financing arrangements for a treatment plant. No petition for reclassification or variance was filed. The state sued for injunctive relief, praying that defendant be compelled to comply with the order. Determination of whether the state was entitled to such relief was transferred to the appellate court which held the state was so entitled and remanded to the lower court for a determination of how this order should be implemented. The Commission's order was held constitutional as made pursuant to a proper delegation of legislative power. The debt limit of a municipality may be increased in order to promote the state's interest in public health. The increase in tax rate was neither unreasonable nor confiscatory. (Wheeler-Fla)
W69-06330

LEGAL ASPECTS OF NEW JERSEY POTABLE WATER PROGRAM,
John Wilford.
J Amer Water Works Ass'n, Vol 61, No 4, pp 193-197, April 1969. 5 p.

Descriptors: *New Jersey, *Potable water, *Water supply, *Public health, Legislation, Sanitation, Administrative agencies, Project purposes, Water pollution, Water purification, Public utilities, Water treatment, Domestic water, Water quality, Waterworks, Equipment, Water quality control, State governments, Legal aspects, Planning.

New Jersey has recently undertaken to modernize its laws dealing with potable water. The present statutes were enacted in 1890 and need to be replaced by more dynamic and modern provisions. The goal of the planned revision is to make New Jersey's potable water program as modern as any in the country. A great deal of new legislation was introduced, and most bills passed without difficulty. Several desirable statutes were passed to deal with the licensing of superintendents of water supply systems. The definition of public water treatment plants was expanded to include certain water plants not previously covered. Important new amendments were made to allow more control over physical connections which transmit water supplies. The new laws also imposed stricter standards regarding potable water and the disinfection of water supplies. In addition, municipalities now have authority to force residents to connect to the public water supply main. The only evil which the revisions commission did not remedy, is that of selling polluted potable water. The statute needs to be amended to define and set standards applicable to contaminated or impure water. (Stewart-Fla)
W69-06331

CREATION OF DEPARTMENT OF WATER RESOURCES AND WATER RESOURCES COMM'N.
For primary bibliographic entry see Field 06E.
W69-06333

AN ACT RELATING TO LAKES, PERMITTING THE CREATION OF LAKE CONSERVATION DISTRICT WITH CERTAIN POWERS.
For primary bibliographic entry see Field 06E.
W69-06334

AN ACT ESTABLISHING AN INTERIM COMM'N TO STUDY THE PROBLEM OF WATER POLLUTION AND APPROPRIATING MONEY THEREFORE.
Minn Sess Laws, ch 779 (1957).

Descriptors: *Minnesota, *Water pollution control, *Legislation, *Sewage districts, Water pollution, State governments, Legal aspects, Appropriation, Planning, Rivers, Streams, Lakes, Subsurface waters, Long-term planning, Regulation, Financial feasibility, Investigations, Pollutant, Identification.

An interim commission is created to study the problem of water pollution with respect to rivers, streams, lakes, and subsurface waters of the state, to consider the feasibility of establishing sanitation districts were needed and to recommend reasonable methods of controlling the problem of pollution. (Wheeler-Fla)
W69-06335

WATERWORKS, MAIN SEWERS, SEWAGE DISPOSAL PLANTS.
Minn Stat Ann sec 444.075 (1) (1947).

Descriptors: *Minnesota, *Sewage, *Sewage treatment, *Water works, Cities, Legislation, Condemnation, Industrial wastes, Construction, Structures, Sewage disposal, Easements, Sewers, Reservoirs, Sewage systems, Local governments, Legal aspects, Maintenance.

Cities, except those under home rule, and villages are authorized and empowered to build, maintain, and improve waterworks systems and sewers, and to acquire by gift, purchase, lease, condemnation or otherwise any land and easements so required. (Wheeler-Fla)
W69-06336

SEWAGE DISPOSAL: WATER AND SEWAGE.
Minn Stat Ann secs 442.03, 442.24, 442.25 (1947).

Descriptors: *Minnesota, *Water works, *Sewage treatment, *Cities, Legislation, Sewage systems, Construction, Control, Power plants, Pumping, Pumping plants, Damages, Operation and maintenance, Operations, Local governments, Diversion (Water), Administrative agencies, Management, Navigable waters, Regulation, Sewage disposal.
Identifiers: Penalties (Criminal).

In cities of the second class, there is created a board of municipal works, with designated powers and duties, having the power to control and manage all city-owned water works systems, lghting plants, and sewage pumping plants. Cities on a navigable river and having a municipal sewage plant are exempt from requirements of the board so far as pumping and disposal of sewage are concerned. Treble damages are imposed for malicious or willful diversion and corruption of water from waterworks or causing damage to plant property or injury to plant operations. All such acts are declared also to be gross misdemeanors, carrying a maximum fine of $1000 and/or one year imprisonment. The board shall have no powers until the completion and installation of the municiple works. (Wheeler-Fla)
W69-06337

FISH.

Minn Stat Ann secs 101.42 to 101.43, 101.47 (1946), as amended, (Supp 1968).

Descriptors: *Minnesota, Pollution abatement, *Dams, Fish conservation, Dam construction, Obstruction to flow, Piers, Watercourses, Permits, Fish, Wildlife, Fish barriers, Fish passages, Fish toxins, Pesticides, Fish behavior, Fishing, Water pollution effects, Fish management, Wildlife management, Fish migration, Fish populations, Streams, Creeks, Lakes, Rivers, Pollutants, Water pollution, Water pollution control, Wastes, Legislation, Piers, Permits, Administrative agencies.

It shall be unlawful to construct or maintain any dam or other obstruction except a boat pier in public waters without first obtaining a permit to do so and complying with the permit requirements for an adequate fishway. It is unlawful to discharge into the waters of the state any water which causes injury to any fish or wildlife in such waters. If the violation is recurrent, the attorney general may institute action to enjoin and abate such nuisances. No person shall place in any creek, stream, or river a screen or rock which prevents the passage of fish, and any such obstruction shall be removed upon order of the commissioner. The commissioner of conservation may establish a list of lakes and rivers which have been found to contain an unbalanced fish population or a species of fish which, by overcrowding, have become stunted. The seasons, limits, and methods of taking fish from such lakes and rivers may be prescribed by the commissioner. (Shevin-Fla)
W69-06339

OHIO RIVER VALLEY WATER SANITATION COMPACT.
N Y Pub Health Law sec 1190 (McKinney Supp 1968).

Descriptors: *Interstate compacts, *Interstate commissions, *New York, *Water pollution, Legislation, Illinois, Kentucky, Indiana, Ohio, Pennsylvania, Tennessee, West Virginia, River Basin Commissions, Ohio River, Legal aspects, Pollution abatement, River basins, State governments, Water policy, Administrative agencies, Interstate rivers, Industrial wastes, Watershed management, Watersheds (Basins), Water quality control.

This compact was entered into by the states of Illinois, Indiana, Kentucky, New York, Ohio, Pennsylvania, Tennessee and West Virginia for the purpose of abating existing pollution and controlling any future pollution in the Ohio River Drainage Basin. The compact establishes a Water Sanitation Commission which is composed of three representatives from each of the signatory states and three from the federal government. The functions of the Commission include the study of the pollution problems of the Ohio River Valley Water Sanitation District, the submission of reports for the prevention or reduction of stream pollution, and the recommendation of appropriate legislation dealing with water pollution problems. The Com-

pact provides a procedure by which the Commission may order any municipality, corporation, person, or other entity discharging sewage or industrial waste into the Ohio River or any other river to discontinue such discharge, and it provides that such an order shall be enforced by the courts of the signatory states. (Sisserson-Fla)
W69-06344

SOUTHLAND CO V AARON (ACTION FOR POLLUTION OF DOWNSTREAM WATER SUPPLY).
77 So 2d 161-169 (Miss 1954).

Descriptors: *Water pollution, *Riparian rights, *Waste disposal, *Mississippi, Judicial decisions, Legal aspects, Streams, Artificial use, Water pollution control, Pollution abatement, Riparian lands, Oil wastes, Industrial wastes, Water quality, Impaired water quality, Water quality control, Damages, Oil industry, Domestic water, Industrial water.

Appellee claimed that appellant's operation of an oil refinery had caused pollution of appellee's downstream water supply. The Mississippi Supreme Court found in appellee's favor, holding that the law of the state guaranteed a riparian owner the right to have the water of a stream reach his land in its natural state, or, at least, in the condition in which he was accustomed to receiving it. Any pollution of the water constitutes an actionable wrong which the riparian owner may assert in an action against the wrongdoer. In the instant case, although the oil wastes were trapped, and separation of the oil from the water was attempted by appellant, appellee's water supply was nonetheless polluted. Judgment was affirmed on the question of liability, but the case was remanded for a new trial on the issue of damages. (E Kelly-Fla)
W69-06345

POLLUTION OF FRESH WATERS.
N J Stat Ann Secs 58:10-5 to 58:10-12 (1966).

Descriptors: *New Jersey, *Water pollution control, *Legislation, *Fresh water, Potable water, Public health, Effluents, Waste water disposal, Sewage disposal, Legal aspects, Pollution abatement, Water quality control, Waste water (Pollution), Discharge (Water), Water purification, Remedies.
Identifiers: Penalties (Civil), Injunctions (Prohibitory).

No person shall discharge any polluting matter into any fresh water, or permit such discharge. 'Fresh water' includes all water commonly called fresh which may be used for human consumption. Violators shall be liable to a fine of $50 for each offense. This fine is recoverable in an action at law if there is a failure to comply with an order to discontinue. Further necessary relief as the court shall deem proper may be obtained by a civil action. No effluent from any waste disposal or purification system shall be discharged into any potable waters of the state. Any violator may be required to construct improvements sufficient to correct the condition created by his violation, and if he refuses so to do, he may be fined $100 per week until he complies with the order. (Harris-Fla)
W69-06349

POLLUTION OF POTABLE WATERS.

N J Stat Ann secs 58:10-1 to 58:10-4 (1966).

Descriptors: *Legislation, *New Jersey, *Water pollution control, *Domestic water, Potable water, Cities, Public health, Legal aspects, Ice, Banks, Jurisdiction, Fresh water, Pollution abatement, Administrative agencies, Water sources, Water pollution sources, Water supply, Remedies.
Identifiers: *Injunctions (Prohibitory), Penalties (Civil), Standing

No polluting matter of any nature shall be placed or discharged in any waters, or allowed to remain on the banks or ice of any water source above the point where any municipality withdraws water for domestic use. Violators will be fined $100 per week after notice from the Department of Health or any local department, Municipality or corporation whose source of potable water is affected by the offense. Every county district court and municipal court shall have jurisdiction over proceedings under this statute. The Department of Health has general supervisory power over all waters in the state which are a source of domestic water; the Department may examine such waters and inquire into possible pollution of them. Injunctions may be sought in a civil action by any of the parties listed above in order to prevent any actual or threatened violation of this act. (Harris-Fla)
W69-06350

PROTECTION AND IMPROVEMENT OF WATERS.

38 Maine Rev Stat Ann secs 361-454 (1965), 38 Maine Rev Stat Ann secs 361-364, 366-368, 370-371, 411, 415, 451 (Supp 1968-69).

Descriptors: *Maine, *Pollution abatement, *Water pollution, *Water pollution control, Water pollution sources, Legislation, Industrial wastes, Rivers, Coasts, Municipal wastes, Sewage, Sludge, Sewage treatment, Public health, Fish, Beneficial use, Storm drains, Water supply, Recreational facilities, Potable water, Atlantic Ocean, Surface waters.
Identifiers: Sewage surveys, Penalties (Criminal).

A commission is established with power to control and prevent pollution of the state's waters. All the waters of the state are classified according to the degree of purity which must be maintained in such waters and according to the uses to which such waters may be put. Pollution controls are established and the commission is authorized to make pollution surveys and to control the amount of sewage, either municipal or industrial, which may be placed in the waters. The commission has the power to permit limited pollution of the state's waters and to establish the standards by which such limited pollution is to be regulated. The commission is authorized to cooperate with the federal government in abating pollution and may receive federal funds when such funds are available. The Commission is explicitly empowered to enforce the provisions of this statute, and specific penalties are provided. (Shevin-Fla)
W69-06351

ORGANIZATION AND GENERAL PROVISIONS.

38 Maine Rev Stat Ann secs 361-372 (1965).

Descriptors: *Maine, *Pollution abatement, *Water pollution, *Sewage treatment, *Water pollution control, Legislation, Water pollution sources, Industrial wastes, Municipal wastes, Rivers, Coasts, Sewage, Sludge, Public health, Fish, Beneficial use, Storm drains, Sewerage, Water supply, Recreational facilities, Potable water, Atlantic Ocean, Surface water, Chemical wastes.
Identifiers: Water Improvement Comm'n.

A Water Improvement Commission is established to investigate and recommend ways and means of controlling the pollution of the rivers, waters and coastal flats of the state. The Commission is to determine the best methods of purification of disposal of wastes or drainage. Four standards of classification of fresh water are established according to the usage of the waters. Each class is also accorded minimum standards of purity for the determination of pollution abatement. Marine waters are also divided into four distinct classes. A public hearing shall be held in order to classify a particular body of water. All of the river basins of the state are specifically classified by statute. (Shevin-Fla)
W69-06352

POLLUTION CONTROL.

38 Maine Rev Stat Ann secs 411-417 (1965).

Descriptors: *Maine, *Pollution abatement, *Water pollution, *Water pollution control, *Water pollution sources, Legislation, Cities, Streams, Rivers, Lakes, Ponds, Tidal waters, Industrial wastes, Municipal wastes, Sewage, Sewerage, Permits, Public health, Surface waters.
Identifiers: Sewage surveys, Water Improvement Comm'n.

The Commission is authorized to pay an amount equal to the federal contribution to the expense of a municipal pollution abatement program. It is authorized to conduct a sewage survey for a municipality. No one is allowed to discharge wastes into any waters of the state without first obtaining a license from the Commission. The procedures for applying for a license are clearly set forth both as to classified and unclassified waters. There is a provision for an appeal from an unfavorable result on a license application. No one shall be permitted to place or deposit in the waters of the state, or on the banks so that they shall fall or be washed into such waters, any slabs, edgings, sawdust, chips, bark, slash or shavings created in the manufacture of lumber, or deposit of oil, regardless of the source in the state's waters. The depositing of any parts of potatoes, except the pulp resulting from the manufacture of potato starch, in the waters is also specifically declared illegal. (Shevin-Fla)
W69-06353

ENFORCEMENT.

38 Maine Rev Stat Ann secs 451-454.

Descriptors: *Maine, *Pollution abatement, *Water pollution control, *Sewage, Legislation, Industrial wastes, Cities, Municipal wastes, Permits, Pollution, Injunctions, Water pollution sources, Rivers, Streams, Surface waters, Public health.
Identifiers: Enforcement, Penalties, Water Improvement Comm'n.

After adoption of any classification by the Legislature for surface waters or tidal flats, it shall be unlawful for any person to dispose of any sewage, which would have the effect of lowering the quality of the waters below the minimum requirements of such classification, regardless of any license which may have been granted. The Commission members have the authority to enter onto any lands in order to gather information regarding the pollution of waters. Any person violating the provisions of the statute may be punished by fine for each day that the violation persists. The Attorney General may issue an injunction to enjoin further violations of the statute. (Shevin-Fla)
W69-06354

BAYLEN STREET WHARF CO V CITY OF PENSACOLA (DAMAGES TO LAND BY STORM SEWER REFUSE).
For primary bibliographic entry see Field 06E.
W69-06402

POLLUTION OF WATERS BY RAILROADS AND FACTORIES.

N J Stat Ann secs 58:10-13 to 58:10-23 (1966).

Descriptors: *New Jersey, *Water pollution control, *Industries, *Railroads, Permits, Legislation, Potable water, Domestic water, Local governments, Oil wastes, Sludge, Sewage disposal, Watersheds, Water pollution sources, Industrial plants, Pollution abatement, Sludge disposal, Facilities, Water supply, Administrative agencies.
Identifiers: *Injunctions (Prohibitory), *Sludge acid, Penalties (Civil).

The Department of Health shall, on request, proscribe and fix territorial limitations where designating those parts of a railroad line or other

public conveyances which are included in and pass over any watershed from which the public water supply is drawn. Notice of the designation sufficient to identify the territory shall be served on the railroad or its agent, and printed in public newspapers according to this statute. After adequate notice, no railroad or boat company shall discharge, or permit discharge of, any water closet or urinal within the territory. Violators shall be guilty of a misdemeanor and fined up to $100. No factory or manufacturing concern shall be located within any potable watershed unless a permit is obtained from the Department of Health. The requirement may be waived if the concern is adequately serviced by public sewerage facilities. An injunction may issue to stop any violation of this article. No person shall permit discharge of petroleum refuse called 'sludge acide' into any water body within or bordering on the state. Any violation shall constitute a public nuisance, and be punishable as such. (Harris-Fla)
W69-06404

ATTORNEY GENERAL V CITY OF WOBURN (POLLUTION OF RIVER BY CITY).

79 NE 2d 187-189 (Mass 1948).

Descriptors: *Massachusetts, *Water pollution, *Cities, *Legislation, State governments, Pollutants, Public health, Wastes, Waste disposal, Sewage disposal, Municipal wastes, Industrial wastes, Water pollution sources, Sewage, Sewers, Pollution abatement, Legal aspects, Judicial decisions, Administrative agencies, Remedies, Rivers.
Identifiers: Injunctions (Mandatory).

An information was filed by the attorney general, at the request of the Department of Public Health, seeking to enjoin the defendant city from polluting a river. The appellate court felt the evidence warranted the findings that defendant's sewer system was not adequate to meet the city's requirements. This inadequacy caused sewerage to overflow into the river, creating a condition injurious to the public health. The issue arose as to whether the statute authorizing such action by the Department of Health was applicable to a municipality. The court, taking notice of the fact that statutory use of the words 'person' or 'corporation' does not usually include a city or town, held the statute allowing the Attorney General to procede against 'whoever' shall contaminate the river was broad enough to permit action against municipalities. The court affirmed the decree enjoining the municipality's discharge of waste into the river. (Logan-Fla)
W69-06406

POLLUTION OF WATERS.

N J Stat Ann secs 58:10-36 to 58:10-44 (1966).

Descriptors: *New Jersey, *Water pollution control, *Rivers, *Legal aspects, Jurisdiction, Cities, Waste disposal, Sedimentation, Filtration, Public health, Legislation, Pollution abatement, Water pollution sources, Water quality control, Structures, Pollutants, Effluents.
Identifiers: *Hackensack River, *Passaic River, Injunctions (Prohibitory), Penalties (Civil).

No person shall cause or permit the discharge of any offensive or pollutive matter, including dead animals, into the Passaic River or its tributaries above the Great Falls at Paterson. No person shall erect or maintain any structure, the drainage from which would tend to pollute the aforesaid waters. Violators shall be fined $20 per day for each violation. County district courts and municipal courts shall have jurisdiction of violations. Civil actions for injunctions may be also instituted in the Superior Court to abate the pollution. No person or municipality shall, directly or indirectly, discharge any polluting matter into the Hackensack River above Bellmans Creek unless such matter is subjected to sedimentation and sand filtration treatment. For purposes of this article, 'person' means any individual, partnership, association, corporation or joint stock company, their lessees, trustees or receivers. 'Municipality' means any political subdivision of the state. (Harris-Fla)
W69-06407

DYER V SIMS (ENFORCEMENT OF INTERSTATE POLLUTION CONTROL COMPACTS).

341 U S 22-36 (1951).

Descriptors: *West Virginia, *Interstate compacts, *Interstate commissions, *Water pollution control, Ohio River, Political aspects, State governments, River basin commissions, Water resources development, Water law, Interstate rivers, Government finance, Legislation, River basins, Judicial decisions, Legal aspects.
Identifiers: State constitutions, Compact clause.

With Congressional consent, West Virginia entered into a compact with 7 other states to control pollution in the Ohio River system. They created a commission to carry out the purpose of the compact and agreed to appropriate fund to defray operating expenses. The legislature of West Virginia appropriated funds for its annual share of the compact. Respondant state auditor refused to issue a warrant upon the state treasury for payment of the appropriation. The West Virginia Commissioners to the compact brought this mandamus proceeding to compel payment. The state supreme court of appeals denied relief. The United States Supreme Court, after determining its jurisdiction to rule on compacts between states, held that the state constitution did not prohibit the legislature from delegating power to an interstate administrative agency. Nor did the compact conflict with the debt limitation in the state constitution. (Helwig-Fla)
W69-06408

MASSEY V MASONITE CORP (OVERFLOW OF EFFLUENTS INTO PRIVATE LAKE).

219 F 2d 586-588 (5th Cir 1955).

Descriptors: *Effluents, *Fishkill, *Mississippi, *State jurisdiction, Lake beds, Lakes, Judicial decisions, Legislation, Administrative agencies, Boundaries (Property), Water pollution, Water pollution effects, Damages, Industrial wastes, Legal aspects, Overflow.
Identifiers: Compensatory damages, Punitive damages.

Plaintiff sought compensatory and punitive damages for defendant's actions in allowing effluents to escape from his plant's discharge creek and to overflow into plaintiff's allegedly privately owned lake, destroying the game fish therein. The defendant corporation denied any negligence and asserted a certificate issued by the State Game and Fish Commission which evidenced that the effluents it discharged would not destroy fish. This court reversed a summary judgment for the defendant. The Game and Fresh Water Fish Commission is specifically excluded from jurisdiction over lakes or other waters that are wholly landlocked or privately owned. If, in fact, the plaintiff's lake was privately owned, the Commission's certificate could not be used as conclusive evidence that the defendant's effluents did not kill his fish. There was a genuine issue of fact as to whether the plaintiff's lake was privately owned and whether the defendant's effluents caused the fishkill. It was error for the court below to grant a summary judgment in the face of these as yet undecided issues. (Blunt-Fla)
W69-06409

ANTHONY V HUNTLEY ESTATES (DAMAGES FOR POLLUTION OF STREAM).

137 N Y S 2d 664-667 (S Ct 1954).

Descriptors: *New York, *Water pollution, *Streams, *Diversion, Damages, Alteration of flow, Natural flow, Stream flow, Riparian rights, Natural streams, Construction, Riparian land, Obstruction to flow, Drains, Stream pollution, Silts, Sediments, Sediment discharge, Ponds.
Identifiers: Injunctions (Prohibitory).

Plaintiff resided in a dwelling situated on a landscaped plot. A stream flowed through the front lawn of the premises and emptied into a small pond. Prior to the occurence of the acts complained of, the stream and pond contained pure and clear spring water, but, because of defendant's acts, the waters became muddy, discolored and reduced in quantity. A residue of silt, sediments and debris was deposited in the pond. Defendants were developers of a tract of land a mile upstream from plaintiff's land. They were engaged in grading the land, constructing streets, sewers and drains, and erecting homes. Defendants diverted the natural course of the stream, and caused large quantities of dirt and mud to be placed into the stream, making it clogged and stagnant. The court denied plaintiff's request for an injunction, holding that the plaintiff's right to injunctive relief depended upon proof either that the developing or building operations of the defendants caused or threatened to cause unreasonable pollution of the stream by causing or permitting debris to be deposited therein or that their operations brought about an unreasonable diminishing of the natural flow of the stream. Plaintiff failed to prove either of these facts. (Heckerling-Fla)
W69-06410

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

BENEFITS FROM INTEGRATED WATER MANAGEMENT IN URBAN AREAS - THE CASE OF THE NEW YORK METROPOLITAN REGION,
Columbia Univ., New York; Barnard Coll., New York. Dept. of Geography; and Rutgers - The State Univ., New Brunswick, N. J.
For primary bibliographic entry see Field 06B.
W69-06201

MATHEMATICAL STATISTICS AS A METHOD FOR HYDROLOGICAL INVESTIGATIONS,
Research Inst. for Water Resources Development, Budapest (Hungary).
J. L. Bogardi, I. V. Nagy, and Z. Szigyarto.
2nd Int Postgrad Course on Hydrol Method for Develop Water Resources Manage, Budapest, Hung, Jan-July 1968, Manual No 7, 1968. 145 p, 16 fig, 15 tab, 4 ref.

Descriptors: *Statistical methods, *Hydrologic data, *Water management (Applied), Probability, Correlation analysis, Regression analysis, Time series analysis, Estimating, Least squares method, Statistical models, Stochastic processes, Synthetic hydrology, Parametric hydrology, Monte Carlo method, Markov processes.
Identifiers: *Textbooks, *Technical manuals.

The use of statistical methods in hydrological investigations is given in a technical manual presented as a chapter of a text written for an international postgraduate course in water resources management. The statistical principles and methods included are discussed in sufficient detail for use in solving most hydrological problems requiring their use. The topics considered are the fundamentals of probability theory and mathematical statistics, probability estimation, principles of correlation, computation of correlation, synthetic hydrology, and instruction in application of statistics to hydrology. The practical applications covered are: computation, curve fitting, and correlation of parabolic relationships, hyperbolic rela-

tionships, and exponential relationships; extension of short data series; and analysis of extreme values in hydrological records. (Knapp-USGS)
W69-06226

HYDROLOGY OF LAND DRAINAGE,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 04A.
W69-06234

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER IV: INTANGIBLES, UNCERTAINTY, AND CRITERIA,
Rand Corp., Santa Monica, Calif.
For primary bibliographic entry see Field 06B.
W69-06293

6B. Evaluation Process

RECREATIONAL VALUE OF WATER AT ELEPHANT BUTTE AND NAVAJO RESERVOIRS,
New Mexico State Univ., Las Cruces.
Robert O. Coppedge, and James R. Gray.
Agricultural Experiment Station Bulletin 535, October 1968. 25 p, 18 tab, 5 fig, 6 ref. OWRR Project B-001-NMEX.

Descriptors: *Outdoor recreation, *Water value, *Recreation demand, Economic value, Elasticity of demand, Mathematical models, Water level fluctuations, Boating, Water skiing, *New Mexico, Southwest.
Identifiers: *Water level effects, Anderson-Gray Method, Effective market demand.

The quantity of water lost to seepage and evaporation from two major reservoirs in New Mexico attributable to recreational activity varied from 4,000 in the first five months of the year to 26,796 acre-feet in the last seven months. Based on the expenditures of recreationists using the reservoirs, the recreational value of water varied from $394 to $562 per acre-foot. Five different methods were used to calculate the annual recreational values of water. Results indicate the values varied from $195 to $1,065, depending on the method used. Effective market demand for recreation is more elastic in the early than in the latter part of the season. The newer reservoir has a more inelastic demand for recreation than the older established reservoir. Additional study is needed to separate the effects of water levels on recreational use in reservoirs in New Mexico from the seasonal effects.
W69-06010

GOALS AND PERSPECTIVES IN WATER RESOURCES PLANNING,
Office of Science and Technology, Washington, D. C.; and Cornell Univ., Ithaca, N. Y. Water Resources Center.
Leonard B. Dworsky, and David J. Allee.
Proc Water Resources Planning Conf, May 16-17, 1968, Boston, pp 3-25, 1968. 23 p, 1 ref.

Descriptors: *Planning, *Water resources development, New England Interstate WPS Compact, Interstate, International commissions, Decision making, River basin development, Water pollution control, Social aspects, Legal aspects.
Identifiers: Synoptic planning, Fragmented planning.

Two contrasting concepts of planning and policy making are summarized as the synoptic model and the fragmented incrementalist model. In synoptic planning it is assumed that the planner has a good enough overall view of society to allocate social resources wisely. In the fragmented view, planners have options only within their narrow fields of specialty and present society with unrelated programs in competition for selection. It is suggested that as these modes are points on a continuum of management possibilities, a synthesis might be possible. In reality, this is often the case; some planners are more synoptic and some more fragmented. Recent trends are toward the snyoptic. Special attention is given to U.S.-Canadian water resource cooperation, the Water Resources Council, and the U.S. water pollution planning program. A stronger federal control is developing and interstate cooperation is increasing. More attention must be given to U.S.-Canadian cooperation in planning, to prevent inefficiency and promote maximum benefits to both countries. (Knapp-USGS)
W69-06046

WATER RESOURCES PLANNING STRATEGY,
Office of Water Resources Research, Washington, D. C.
E. D. Eaton.
Proc Water Resources Planning Conf, May 16-17, 1968, Boston, pp 27-60, 1968. 34 p, 16 ref.

Descriptors: *Planning, *Water resources development, *New England Interstate WPS Compact, Future planning (Projected), Decision making, Systems analysis, Computers, Economics, Social aspects.
Identifiers: Planning strategy.

Planning operations and difficulties, ways of attaining planning objectives, and the limitations of water resources planning are discussed. Water resources planning is hazardous because it deals with imperfectly understood physical processes and even less understood human behavior. Failure wastes vast amounts of money and deteriorates living conditions for great numbers of people. Planning with incomplete information is nearly always necessary. The strategy of such planning is exactly the same as that of theoretical science or inductive reasoning. Available data are used to generate multiple working hypotheses, which are then tested against reality and rejected or modified as necessary. The final result is a conceptual model against which decisions may be tested. Computers may be used to handle data, but man must make the decisions, because in computer decisions, only programmed factors are examined, whereas a human decision takes in a great range of experience or data invariable considered irrelevant or too complex for inclusion in a computer program, but critical for good decision. A desirable test as well as a criterion for decisions is the democratic process. The various interstate compacts and basin commissions are an expression of a recent trend in this direction. (Knapp-UGSG)
W69-06047

TECHNOLOGY AND PUBLIC DECISION MAKING,
Cornell Univ., Ithaca, N. Y. Center for Environmental Quality Management.
Walter R. Lynn.
Proc Water Resources Planning Conf, May 16-17, 1968, Boston, pp 61-71, 1968. 11 p. Grant ES-00098.

Descriptors: *Decision making, *Planning, *New England Interstate WPS Compact, Economics, Social aspects, Political aspects, Psychological aspects, Data collections, Programs.
Identifiers: Role of technology in planning.

The role of the technologist in public decision making in the solution of water resources problems is surveyed and general recommendations are made of the types of alternatives to be supplied to the decision-making person or political body. If an alternative is recommended by the technologist, then the value system by which he made the choice must be specified in detail; otherwise he must restrict himself to listing alternatives only in terms of possible choices and means of achievement. Social and technical judgments must be separated carefully so that technologists do not preempt public policy decisions and politicans do not make technical judgments. Uncertainty and risk must be clearly marked. (Knapp-USGS)
W69-06048

WATER RESOURCES PLANNING,
Gordon L. Byers
Proc New England Counc Water Center Dir, Boston, May 16-17, 1968. 105 p

Descriptors: *Planning, *Water resources development, *New England Interstate WPS Compact, Interstate, Future planning (Projected), Decision making, Systems analysis, Economics, River basin development, Social aspects, Legal aspects.
Identifiers: Symposium, Planning conference.

A water resources planning conference was held in Boston, May 16-17, 1968, to identify problems in water resources planning and to develop information helpful in solving these problems. The topics of the papers presented are: goals and perspectives in water resources planning, planning strategy, technology and public decision making, economic considerations, and institutional factors. The relations between technologists, social planners, construction agencies, local governments, State governments, and the Federal government are examined to learn the actual course of decision making. (Knapp-USGS)
W69-06049

MOUNTAIN AND DESERT LAKES IN SOUTHERN KAZAKHSTAN, THEIR RESOURCES AND METHODS OF ECONOMIC DEVELOPMENT,
For primary bibliographic entry see Field 02H.
W69-06073

WATER AND CHOICE IN THE COLORADO BASIN: AN EXAMPLE OF ALTERNATIVES IN WATER MANAGEMENT.
National Academy of Sciences--National Research Council, Washington, D. C. Committee on Water.

National Academy of Sciences, Publication 1689, Washington, D. C., 1968. pp 1-65.

Descriptors: Administration, *Decision-making, *Planning, *Methodology, Model studies, *Nonstructural alternatives, *Colorado River Basin.

The report provides a concrete example of the alternatives approach to water management, the theory of which was outlined in an earlier report, Alternatives in Water Management. Colorado River basin and the state of Arizona are selected for illustration. The first chapter (pp 1-4) emphasizes that scientific analysis must allow for potentially practicable alternatives. It states two recommendations toward which the report builds: (1) investigations needed to expand the range of choice for planning purposes in the Colorado basin, thus suggesting a kind of analysis that should be fruitful in any basin; and (2) those designed to improve the planning and decision-making processes. (Gossin-Chicago)
W69-06086

WATER AND CHOICE IN THE COLORADO BASIN: AN EXAMPLE OF ALTERNATIVES IN WATER MANAGEMENT, CH. 2, THE SETTING.
National Academy of Sciences--National Research Council, Washington, D. C. Committee on Water.

National Academy of Sciences, Publication 1689, Washington, D. C., 1968. pp 5-31, 6 fig, 1 tab.

Descriptors: Arizona, Colorado River, *Colorado River basin, Crop production, *Environmental effects, Economics, Human population, Scenery, *Land use, *Land resources, Water control, Climatic zones, Arid lands, *Federal jurisdiction, *State jurisdictions, Prior appropriation, Mexican Water Treaty, Colorado River Compact, Salinity.
Identifiers: Central Arizona Project, Pacific Southwest Water Plan, Lower Colorado River Basin Project, Water rights conflicts between states.

Chapter Two describes: aridity of the basin, its agricultural use, the river's flow and sediment, the range of ecological zones through which the river passes, the Grand Canyon, population growth, economic growth, due mainly to industry, exploitable mineral reserves, the high degree of river control, the water quality problem, mainly one of salinity, and falling groundwater levels. All of these characteristics restrict alternatives for allocation of water. The extensive legal control of the area is not analyzed comprehensively; it is outlined, and controversies that limit alternatives are discussed. Legal aspects covered include the Colorado River Compact, allocations among states, the Mexican Treaty Obligation, the Supreme Court case of Arizona vs. California, the Central Arizona Project, the Pacific Southwest Water Plan, the Lower Colorado River Basin project, and the controversy over proposals for importation of water from the Pacific Northwest. (Gossin-Chicago)
W69-06087

WATER AND CHOICE IN THE COLORADO BASIN: AN EXAMPLE OF ALTERNATIVES IN WATER MANAGEMENT, CH. 3, PROBLEMS OF WATER SUPPLY IN THE BASIN.
National Academy of Sciences--National Research Council, Washington, D. C. Committee on Water.

National Academy of Sciences, Publication 1689, Washington, D. C., 1968. pp 32-40.

Descriptors: *Colorado River basin, Colorado River, Arizona, Water quality control, *Water supply, Water sources, Planning.
Identifiers: Climatic fluctuations.

Quantity and quality of water, and present and future use patterns of the area must be studied before economic and social impacts of future water development can be assessed. The chapter gives various explanations for the uncertainty in estimates of average flow and of extent of variation in flow: fluctuation in flow, steadily decreasing flow, error in measurement, error in method of calculation, and ecological change. The causes of climatic fluctuations are discussed. The chapter recognizes at least three alternatives for full utilization of the river's water: (1) to allow regional development to adjust to available water supplies; (2) to seek new sources of water; and (3) to reduce consumptive uses and wastage and to increase the reuse of water. Knowledge of physical conditions and their social implications is so limited that it prevents detailed comparison of the choices. New developments increasing the feasibility of obtaining water from new sources are discussed. The necessary bases of a water-quality control program for the basin are defined. The chapter recommends future study on control of natural salt sources, reduction of salt input in irrigated areas, reduction of consumptive water use, and the methods and costs of control. (Gossin-Chicago)
W69-06088

WATER AND CHOICE IN THE COLORADO BASIN: AN EXAMPLE OF ALTERNATIVES IN WATER MANAGEMENT, CH. 4, THE RANGE OF OBJECTIVES IN PLANNING FOR THE USE OF COLORADO WATER.
National Academy of Sciences--National Research Council, Washington, D. C. Committee on Water.

National Academy of Sciences, Publication 1689, Washington, D. C., 1968. pp 41-58, 1 fig.

Descriptors: Methodology, *Economic effiency, Control, Scenery, Short-term planning, *Water utilization, *Multiple-purpose projects.
Identifiers: Public aims, Income redistribution, Political obligations.

Contemporary aims of water management have three weaknesses: (1) diversity, (2) ambiguity, and (3) changeability. When aims are diverse and ambiguously stated, there is rarely a rigorous examination of alternative ways to reach any of the aims. When aims change, research that once seemed relevant becomes inadequate. The chapter classifies public aims for the Colorado basin as follows: (1) national economic efficiency; (2) income redistribution; (3) satisfying political obligations; (4) controlling the natural environment; and (5) preservation and esthetics. The chapter examines each of these classes and their relationships to each other. The first is most often a guide for evaluating programs based on the others. The chapter suggests the extensive range of alternative solutions for a number of different goals in the Colorado basin. (Gossin-Chicago)
W69-06089

WATER AND CHOICE IN THE COLORADO BASIN: AN EXAMPLE OF ALTERNATIVES IN WATER MANAGEMENT, CH. 5, ALTERNATIVES FOR PROMOTING REGIONAL ECONOMIC GROWTH.
National Academy of Sciences--National Research Council, Washington, D. C. Committee on Water.

National Academy of Sciences, Publication 1689, Washington, D. C., 1968. pp 59-65.

Descriptors: Arizona, Short-term planning, Future planning (Projected), Economic life, *Investment, *Colorado River basin.
Identifiers: Employment effects, *Regional economic growth.

It is often assumed that water development is essential for local and regional economic growth, but Chapter 5 examines several alternatives for Arizona: (1) Investment in educational institutions with high quality research facilities as a way to attract industry to an area; (2) investment in primary and secondary schools, which train a labor force; (3) investment in such government services as highways and hospitals is considered as it relates to population and income growth; and, (4) investment in industry itself has great income and employment benefits, but the mobility and private ownership of industry may discourage such an investment. The committee prefers a balanced program to any single means. Employment effects of non-agricultural growth are considered. Two major points are stressed: (1) If the economic growth of the state is the aim, alternative forms of investment may yield larger returns at the moment and in the near future than investment in new water supply; and (2) thorough investigation of these alternatives calls for accelerated research on the sectoral and spatial characteristics of regional growth. (Gossin-Chicago)
W69-06090

A FLOOD LOSS REDUCTION PROGRAM,
For primary bibliographic entry see Field 06F.
W69-06097

METROPOLITAN PROBLEMS: METROPOLITAN PUBLIC AUTHORITIES,
Drew Univ., Inst. for Research on Government.
Robert G. Smith.
Lecture Series, Drew University, Institute for Research on Government, Fall 1963, pp 33-42. 9 p.

Descriptors: Local governments, Financing, *Interagency cooperation, Political aspects, Legal aspects, Administrative agencies, Governments.
Identifiers: *Public authorities, Special districts, County governments.

Organization of special districts and public authorities and classification of different units of government need further refinement. The distribution between special districts and public authorities is discussed. Within the public-authority classification itself there are two broad categories: one reaches across existing boundaries to service functions that have not confined themselves to arbitrary boundaries; the other shares boundaries with existing local governments. The latter type are single-purpose authorities created to meet needs occasioned by population shift into suburbs. They are being established in greater numbers than the first type. Discussion is focused on their constituencies, then representation, and then accountability in general. They depend almost completely upon bonding. Legislation protecting the bondholder may turn the agency into a vast private power. Also to protect the bondholder, a public authority committed to one specific function must continue to pursue it. The most striking effect on local governments is fragmentation of governmental responsibilities. Elimination of public authorities cannot be visualized, but in the future we should use established governments, especially counties, for these functions. The proposal of the Advisory Commission on Intergovernmental Relations to establish 'metropolitan service corporations' offers many improvements on the public-authority structure, and needs further study. (Gossen-Chicago)
W69-06098

METROPOLITAN PROBLEMS: THE DELAWARE RIVER BASIN COMMISSION,
Delaware River Basin Commission, Trenton, N. J.
James F. Wright.
Lecture Series, Drew University, Institute for Research on Government, Fall, 1963, pp 55-66. 12 p.

Descriptors: *Delaware River Basin Commission, Programs, *Project planning, Water quality control, History, Inter-agency cooperation, *Water demand, *Water supply, Human population, Recreation demand, Electric power demand, Flood protection, Research and development.
Identifiers: *Delaware River Basin Commission Compact, *Comprehensive program planning.

After briefly describing the historical basis for the Delaware River Basin Commission Compact and the Commission thereby created, the report discusses important features of the Compact, the Commission's staff organization, its objectives, and its problems. Articles I, II, III, and Sections III.3, III.6, and III.8 of the Compact are emphasized. The other articles are described briefly. The majority of Commission staff is in the planning division, which has three branches: program planning, project review, and water quality. The duties of each branch are discussed. The Commission's foremost objective is to develop comprehensive plans and to keep them current. Comprehensive planning includes multi-purpose physical projects and identification of an area's goals. Nine basic planning programs include: a continuing inventory of water supply; population analysis and study of water and land demands; analysis of fish and wildlife and study of recreation demands; analysis of power potential and demand; investigation of projects proposed by others; studying the adequacy of water quality standards; integrating studies into a comprehensive plan; flood loss reduction; and, planning basin operation development. Three major problems are: intergovernmental relations; marking new water; and developing the most effective water quality plan that can be implemented. (Gossen-Chicago)
W69-06099

BENEFITS FROM INTEGRATED WATER MANAGEMENT IN URBAN AREAS - THE CASE OF THE NEW YORK METROPOLITAN REGION,
Columbia Univ., New York; Barnard Coll., New York. Dept. of Geography; and Rutgers - The State Univ., New Brunswick, N. J.
Leonard Zobler, George W. Carey, Michael R. Greenberg, and Robert M. Hordon.
Available from Clearinghouse as PB 184 019; $3.00 in paper copy and $0.65 in microfiche. Columbia Univ-Barnard Coll Final Rep to OWRR, Dep of Interior, Apr 1969. 346 p, 38 fig, 24 tab, 69 ref, 10 append. OWRR Grant No. 14-01-0001-1583.

Descriptors: *Water management (Applied), *Water distribution (Applied), *Distribution systems, *Mathematical models, *New York, Com-

puter models, Linear programming, Optimization, Systems analysis, Networks, Dynamic programming, Public utilities, Water delivery, Water demand, Urbanization, Water shortage, Optimum development plans.
Identifiers: *New York Metropolitan Region, Water distribution network.

The water delivery systems of the New York Metropolitan Region were analyzed hdrologically and topologically for mathematical modeling and computer simulation to study the composite performance of the regional 'system' during a period of stress, the 1962-1966 drought. There are over 400 separately managed and partly connected water agencies in the region, and 16 million customers. To study overall behavior in the drought period, and to make future projections, 3 models were made: An input-output flow model to trace water movement and calculate transfer coefficients; a linear program that used the transfer coefficients to stipulate water exchanges among the agencies; and a linear program that used flexible transfer coefficients and a weighted objective function to direct water surpluses to specified agencies. The network response to projected demands and supplies was observed in 5-yr intervals from 1970-1985 as a system and by individual agencies. In the past and projected droughts, the network was vulnerable to stress. Some agencies were short of water while others had surpluses. This weakness could be relieved by flexible transfer, developing new links to meet needs. With modest source increases, 1985 projected demand could be met. It is concluded the real-world system was not optimal. The optimization program yielded specific design recommendations to improve distribution and to optimize location and timing of new input. Beyond 1985, major subregional transfers will be necessary. An alternative is the development of major new water sources, such as desalination. More system integration is needed to solve present input-variability problems. The models developed may be adapted to any other complex water distribution networks. (Knapp-USGS)
W69-06201

RESERVOIRS: PROBLEMS AND CONFLICTS,
Emery N. Castle.
Partially supported by OWRR-Dept of Interior. Water Resources Res Inst Seminar, Fall Quarter 1968, Oregon State Univ, Jan 1969. 127 p, 5 fig, 4 chart, 1 tab, 65 ref.

Descriptors: *Water management (Applied), *Reservoir operation, *Competing uses, *Columbia River, Management, Electric power, Fish management, Recreation, Flood control, Irrigation, Navigation, Water allocation (Policy), Eutrophication, Cost-benefit, Analysis, Water utilization, Governments, Watershed management.
Identifiers: Reservoir use conflicts.

A seminar held at Oregon State University in 1968 discusses the problems and conflicts of reservoir management in 12 published papers. Their topics are the basis of conflict, upstream watershed management, forest management, eutrophication, water losses, fisheries, water temperatures, payment and benefits, recreation, water use, role of the State, and public issues on the Middle Snake River. Conflicts between competing uses are examined in papers intended for the general non-specialist reader. Although most of the papers concern problems of Washington and Oregon, and particularly Columbia River and tributary reservoirs, the conflicts discussed are general and appear everywhere streams are regulated. The basis of the greatest number of problems in water levels. Recreation demands a constant water level, flood control demands minimum levels, power production demands maximum feasible head with maximum reliability of supply, and irrigation demands maximum pre-season storage. In multiple-use reservoirs these aims are usually in total conflict, so drastic compromise is necessary. Other conflicts arise in water temperature, water quality, and stream-flow regulating effects of reservoirs. (Knapp-USGS)
W69-06207

MINERAL TASTE IN DOMESTIC WATER,
California Univ., Berkeley. School of Public Health.
For primary bibliographic entry see Field 05E.
W69-06215

ECONOMIC EVALUATION OF WATER-PART IV: AN INPUT-OUTPUT AND LINEAR PROGRAMMING ANALYSIS OF CALIFORNIA WATER REQUIREMENTS,
California Univ., Berkeley. Sanitary Engineering Research Lab.; and Calif. Univ., Berkeley. School of Public Health.
E. M. Lofting, and P. H. McGauhey.
Calif Univ Water Resources Center Contrib No 116, Aug 1968. 187 p, 8 fig, 11 tab, 158 ref, 9 append. OWRR No. 14-01-0001-886.

Descriptors: *Water values, *Optimization, *Systems analysis, Water demand, Water utilization, Water costs, California, Economics, Linear programming, Computer programs, Digital computers, Forecasting, Optimum development plans.
Identifiers: *California economic model.

A model of the California economy uses linear programming as an optimizing technique to calculate the real value of wate for optimum distribution of the development at 24 productive water-using economic sectors. The model is based on national and California economic data of 1958. Economic and population projections to 1990 were based on the period 1940-1966. Computer program listings and printouts of 3 solutions for water withdrawals of 43, 52, and 66 million acre-ft/yr are tabulated. (Knapp-USGS)
W69-06220

HYDROLOGICAL ASPECTS OF WATER MANAGEMENT,
Research Inst. for Water Resources Development, Budapest (Hungary).
Gy Kovacs.
2nd Int Postgrad Course on Hydrol Method for Develop Water Resources Manage, Budapest, Hung, Jan-July 1968, Manual No 2, 1968. 59 p, 22 fig, 5 tab.

Descriptors: *Water management (Applied), *Water resources development, *Hydrologic aspects, Government, Planning, Urbanization, Water conservation, Flood control, Channel improvement, Irrigation, Water supply, Sewage, Waste disposal, Hydroelectric power, Economics.
Identifiers: Textbooks, Technical manuals, Lecture notes.

Water management is defined and the hydrological aspects of water management are discussed in the introductory section of a text written for an international post-graduate course in water resources management. The topics introduced are flood control, river training, water control on the catchment, irrigation, water supply and sewage problems, water power, and economics. The objectives of water management and the needs for data of the various branches of water management are outlined and summarized. Various national water management organizations and policies are briefly described. (Knapp-USGS)
W69-06221

ESTIMATION OF SURFACE-WATER RESOURCES,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 02E.
W69-06229

ESTIMATION OF GROUNDWATER RESOURCES,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 02F.
W69-06230

HYDROLOGY OF WATER STORAGE,
Research Inst. for Water Resource Development Budapest (Hungary).
For primary bibliographic entry see Field 02E.
W69-06231

MAN'S INFLUENCE ON HYDROLOGICAL PHENOMENA,
Research Inst. for Water Resources Development Budapest (Hungary).
For primary bibliographic entry see Field 04C.
W69-06233

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT,
Rand Corp., Santa Monica, Calif.
Roland N. McKean.
Publications in Operations Research No. 3, John Wiley and Sons, Inc., New York, March, 1967. 330 p.

Descriptors: *Decision making, *Systems analysis, *Analytical techniques, Economic efficiency, Governments, Methodology, Cost-benefit theory.

Using systematic quantitative analysis to compare alternatives should increase governmental economic efficiency. However, for the analysis to benefit the nation's economy, analytical methods must be improved and use of the analysis must be extended. The report discusses the usefulness and development of analytical aids in economic decision making. Discussing the application of analytical aids in government, the report describes the need for systems analysis, alternative procedures and the impact of systems analysis upon economic decision making. An example of the approach is cost-benefit analysis, which is most used in designing water resource programs. The importance of cost-benefit analysis and its history are described. Possible improvements in its methodology are suggested. The study also proposes to consider general methodological problems of systems analysis, specific problems in water resource analysis, case studies of two analyses prepared by federal agencies, and potential use of analysis in several government activities. The purpose of the study is to suggest improvements and further applications of systems analysis. (Gossen-Chicago)
W69-06290

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTERS I-II: INTRODUCTION; THE CRITERION PROBLEM,
Rand Corp., Santa Monica, Calif.
Roland N. McKean.
John Wiley and Sons, Inc., New York, pp 3-49, March, 1967. 45 p, 2 tab, 61 ref.

Descriptors: *Decision making, *Methodology, *Economic efficiency, *Cost-benefit theory, Budgeting, Cost allocation, Inter-agency cooperation.

Adequate criteria for choosing among alternatives are discussed, including situations which allow use of partial criterion, and situations which demand a definitive test of preferredness. The chapter distinguishes workable criteria from ultimate objectives. It examines in detail the problem of erroneous criteria, discussing the division of an analysis between groups of people and chunks of time, levels of authority in decision making and possible advantages of dividing a single analysis. An important danger is that lower-level decision-makers may adopt criteria unrelated to the aims of upper-level authorities. Some common criterion errors are classified and exemplified, including the idea of simultaneously maximizing gain and minimizing cost or of maximizing two alternative gains, overlooking the absolute size of gain or cost, setting the

wrong size of gain or cost, neglecting the impacts of one agency's action upon other agencies' gains or costs, and using wrong concepts of gain or cost. Suitable criterion forms including maximizing gains minus costs, if the two are measurable in the same unit, and fixing either gain or cost. (Gossen-Chicago)
W69-06291

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER III: THE APPROPRIATE ALTERNATIVES,
Rand Corp., Santa Monica, Calif.
Roland N. McKean.
John Wiley and Sons, Inc., New York, pp 50-57, March 1967. 8 p, 3 ref.

Descriptors: *Systems analysis, *Methodology, Optimization, Creativity, Operations research, Interagency cooperation.
Identifiers: *Alternative actions, *Methodologic criteria.

Alternatives which should be compared are considered; Relevancy of alternatives to their contexts is discussed. Alternative actions differing in nature and in scale, and interrelationships among the courses of action are also considered. Although it is impossible to formulate clear-cut rules, the chapter draws several conclusions. (1) The system calling for possible actions, and hence the level of optimization is related to the criteria devised. Definition of systems and devising of criteria should go hand-in-hand; (2) designing and redesigning alternative courses of action in operations research demand ingenuity; (3) in designing alternative policies, different scales of each project and various combinations of measures are relevant. The addition or removal of extra features or increments in size creates additional alternatives; (4) if more than one of the actions may be taken or if actions are to be ranked for future reference, interrelationships between alternative plans must not be neglected; and (5) researchers must remain constantly aware of the limitations of analysis carried out in different parts by different agencies. Therefore, results must be interrupted critically. (Gossen-Chicago)
W69-06292

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER IV: INTANGIBLES, UNCERTAINTY, AND CRITERIA,
Rand Corp., Santa Monica, Calif.
Roland N. McKean.
John Wiley and Sons, Inc., New York, pp 58-73, March, 1967. 16 p, 1 tab, 13 ref.

Descriptors: *Intangible benefits, *Intangible costs, Decision making, Systems analysis, Operations research, Psychological aspects, Project purposes, Governments, Regional benefits, Preservation.
Identifiers: *Methodologically-linked deficiency.

The non-quantitative aspects of criteria are discussed, and how they complicate the criterion problem. Intangible gains and costs are discussed. Examples of intangibles include the effect of a water resource project on the size of the government, 'balanced' regional development, preservation of natural assets apart from consequences for future production, and many others. Analysis must inform decision-makers of the intangible effects of an action. Another non-quantitative consideration is the degree of uncertainty about an action's cost and benefit. Alternative ranges in costs and benefits, which have different values for different decision-makers, should be explored. The researcher's psychological reactions to uncertainty must not prevent him from recognizing it. Types of uncertainty pervade analysis, including uncertainty about specified gains and costs, about 'given' parts of systems, about the responses of other decision-makers, about technological change, and about the chance element in recurring events. Although use of quantitative indicators is not always possible, concise description of uncertainty must be presented to decision-makers. The existence of intangibles and uncertainty implies partial tests rather than the ideal definitive test as criterion. (Gossen-Chicago)
W69-06293

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER V: TIME STREAMS AND CRITERIA,
Rand Corp., Santa Monica, Calif.
Roland N. McKean.
John Wiley and Sons, Inc., New York, pp 74-95, March 1967. 22 p.

Descriptors: *Time, *Cost-benefit theory, *Methodology, Costs, Benefits, Investment, Capital, Fixed costs, Decision making, Discount rate, Timing, Value.
Identifiers: *Methodologic criteria, Accruement dates, Resale value, Return.

The relationship of time streams to criteria and examined. Cut-off date of cost and gain estimates is discussed. The bulk of the chapter discusses how to treat costs and gains accruing at different dates. One method is to discount future amounts of gains minus costs and covert each time stream to its present value. Circumstances in which this method is appropriate are discussed at length. They include situations in which the investment budget can be varied by borrowing money, situations in which capital is fixed, and situations in which capital is fixed and resale value irrelevant. To implement this method for decision makers the analysist should show the present value of cost-gain streams at many discount rates for a few project sizes and for a few combinations of projects. Another method is ranking the projects by internal rate of return. The difficulty of handling interrelated projects with this method is discussed. Ranking by other rates of return is discussed. If gain or cost is measured in physical rather than monetary units, the most satisfactory method is to fix either the gain or the cost. Future costs should be discounted. In many cases, the researcher must specify a particular time path. (Gossan-Chicago)
W69-06294

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS, ANALYSIS WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER VI: WHAT CAN BE DONE: A RECAPITULATION,
Rand Corp., Santa Monica, Calif.
Roland N. McKean.
John Wiley and Sons, Inc., New York, pp 96-100, March, 1967. 5 p.

Descriptors: *Cost-benefit analysis, *Methodology, *Test procedures, Decision making, Costs, Benefits, Time.
Identifiers: Methodologic criteria, Alternative actions, Intangibles, Methodologic deficiency.

This chapter is a convenient reference for suggestions, relating to cost-benefit analysis, which appear throughout the book. In answer to general criterion-difficulties, McKean warns against particularly treacherous tests, suggests generally suitable forms of criterion, warns that criterion must be consistent with higher-level criteria, and warns against erroneous concepts of cost or gain. In seeking appropriate alternatives, researchers should compare the scope of their systems with the criterion selected; pay attention to the devising of alternatives as well as to their comparison; and watch for effects that policies may have on each other. Regarding intangibles, there are apparent intangibles that may be measurable; if immeasurable, researchers should devise indicators of the magnitude and nature of major intangibles. Regarding uncertainty, researchers should show probable ranges of outcome, present the change in results that would occur from some alteration of the system, or at least emphasize major contingencies substantially affecting outcomes. Researchers should calculate the chance element, and look for a recurring situation which demands a particular action. Regarding time streams, a researcher should discount the streams to their present value or specify the time path and discount the cost stream. While interpreting, researchers should consider limitations of their analytical method. (Gossen-Chicago)
W69-06295

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER VIII: KINDS OF BENEFITS AND COSTS; SPILLOVER EFFECTS,
Rand Corp., Santa Monica, Calif.
Roland N. McKean.
John Wiley and Sons, Inc., New York, pp 134-150, March 1967. 17 p, 9 ref.

Descriptors: *Cost-benefit analysis, Economics, Decision-making, Input-output analysis, Adjusted prices, Salaries, Investment, Methodology, Operations research.
Identifiers: *Spillover effects.

The implications of spillover effects for cost-benefit measurements are examined. Spillover effects are defined as effects of some decision-making units on the activities of others; these effects may be either economics or diseconomies. Technological spillovers are spillovers which effect the physical outputs or the satisfaction that other producers or consumers can get from their physical inputs. Cost-benefit measurements should allow for major technological spillovers. Pecuniary spillovers do not effect the units of output or satisfaction over input, but are external effects occasioned by shift in prices. Four types of pecuniary effects include bidding up factor rates of hire, cutting down prices of substitute products, raising prices of complementary products, and lowering the price of the output. Pecuniary spillovers should not be taken into account in the comparison of projects. McKean discusses repercussions on the profitability of a proposed investment, as well as which repercussions should be considered, and how to estimate them. He clarifies the distinction between technological and pecuniary spillovers, and discusses the consistency of his views with the position that national income should be maximized, the common-sense position regarding duplicate facilities, and official positions. (Gossen-Chicago)
W69-06296

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER IX: KINDS OF BENEFITS: OVER-COUNTING, AND SECONDARY BENEFITS.
Rand Corp., Santa Monica, Calif.
Roland N. McKean.
John Wiley and Sons, Inc., New York, pp 151-167, March 1967. 17 p, 16 ref.

Descriptors: *Methodology, *Cost-benefit analysis, *Benefits, *Federal budgets, Costs, Economic efficiency, Employment Regional analysis, Taxes.
Identifiers: Spillover effects, Incremental outputs.

Errors in calculating the value of benefits are discussed; Examples of double counting are given. A method of counting costs and benefits is given, and is compared to the Federal estimation procedure described in the 'Bureau of Reclamation Manual' of March, 1952. The Federal procedure of counting secondary benefits, the inconsistency of the manual's terms, and the relationship of secondary benefits to spillovers are described. The bulk of the chapter discusses secondary benefits as gains to the waste economy. Situations occurring in private firms of fully employed resources and of partially employed resources, are considered. Implications for cost-benefit measurements are

discussed. McKean examines the recommendation of the Federal Inter-Agency River Basin Committee for the treatment of secondary benefits. His position is that, to help determine the composition of water-resource budgets, benefit measurements should be confined to the values of the incremental outputs. In determining the magnitude of the budget, the effects on employment should be considered, since they can be estimated reliably. Secondary benefits as measures of regional development and treatment of taxes is discussed. Consideration of miscellaneous errors which lead to over-counting complete the chapter. (Gossen-Chicago)
W69-06297

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER X: VALUATION OF BENEFITS,
Rand Corp., Santa Monica, Calif.
Roland N. McKean.
John Wiley and Sons, Inc., New York, pp 168-182, March 1967, 15 p, 3 fig, 7 ref.

Descriptors: *Value engineering, *Benefits, *Prices, *Cost-benefit analysis, Investment, Unit costs, Cost comparisons, Economic efficiency, Distribution, Methodology, Operations research.
Identifiers: General price level.

The chapter discusses how to measure the value of benefits. The first topic is valuation of indivisibilities are present. So long as investment proceeds by small increments, the value of the output attributable to the investment is simply the price of an extra unit. However, if the investment on any factor of production can be provided only in a 'large lump,' it may lower price per unit. Alternative methods of measuring the value of the product to the consumer are disproved and a general method recommended. Efficiency and distributional considerations are discussed. Comparing individual projects, a process that demands cost-benefit measurements, is discussed. The second topic is valuation if actual charges will differ from incremental cost. Situations of output reaching its capacity and of deliberate under-pricing are considered. The third topic is alternative justifiable expenditure as a price. Sometimes, when an output is particularly hard to value, researchers assume benefits equal to the cost of the cheapest alternative way to produce the same service. Advantages and dangers of this procedure are discussed. The fourth topic is valuation and movements of the general price level. General price changes have a calculable effect on the comparison of projects. (Gossen-Chicago)
W69-06298

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER XI: CASE STUDY I: THE GREEN RIVER WATERSHED,
Rand Corp., Santa Monica, Calif.
Roland N. McKean
John Wiley and Sons, Inc., New York, pp 185-213, March, 1967, 29 p, 8 tab, 2 ref.

Descriptors: *Methodology, *Basins, *Project planning, *Cost-benefit analysis, Project purposes, Project benefits, Channel improvement, Flood control, Land reclamation, Land development, Cost analysis, Prices, Time.
Identifiers: *Green River Watershed, *Department of Agriculture

The methodological content of earlier chapters are related to a case study of the Green River Watershed. The program recommended for the watershed by the Department of Agriculture in 1951 is examined. The stated objectives of the program were the alleviation of flood and sediment damages, although the benefits were actually increases of output. The model which it used to estimate benefits is discussed in six parts showing the effects of: channel improvement on peak stages of floods; channel improvement on flood damage; land treatment on peak stages of floods; land treatment on flood damage; land treatment on sedimentation; and land treatment on crop yields and farm income. Cost models, adjustments for relative price changes, and treatment of time in the project are discussed. Changes in cost-benefit analysis are suggested with reference to the Green River Watershed. Changes in the general criterion, the scope of the analysis, treating projects as lumps or small increments, time streams, exhibition of factors of uncertainty and ranges, estimation procedures, secondary benefits, distribution of wealth, and criterion for ranking projects are suggested. (Gossen-Chicago)
W69-06299

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER XII: CASE STUDY II: SANTA MARIA PROJECT,
Rand Corp., Santa Monica, Calif.
Roland N. McKean.
John Wiley and Sons, Inc., New York, pp 214-244, March 1967, 31 p, 1 fig, 9 tab, 5 ref.

Descriptors: *Methodology, *Project planning, *Cost-benefit analysis, *Systems analysis, Project benefits, Irrigation programs, Flood protection, Reservoirs, Water supply, Net income, Channels, Levees, Costs, Time, Cost comparisons.
Identifiers: *Santa Maria Valley, *Army Corps of Engineers, *Bureau of Reclamation.

This chapter relates the methodological content of the first ten chapters to a case study of the Santa Maria Project. The Bureau of Reclamation and the Corps of Engineers planned jointly the irrigation and flood-protection program for California's Santa Maria Valley. Models that describe the project's benefits are described in parts showing the effects of: reservoir on water supply; reservoir on net farm income; reservoir and channel-levee works on flood damage; and secondary benefits. The project's costs, its treatment of time, and its criterion are discussed. Changes in cost-benefit analysis are suggested with reference to the Santa Maria Project. Changes in the general criterion, the scope of the analysis, treating projects as lumps or small increments, time streams, exhibition of factors of uncertainty and ranges, estimation procedures, distribution of wealth, and criterion for ranking projects is discussed. In order to illustrate the use of systems-analysis exhibits, McKean compares the Santa Maria Project with the Green River Program, analyzed in Chapter Eleven. If estimates were taken at face value, the Green River Project would require a smaller social investment and yield larger present worths. Moreover, its redistribution of wealth is preferable. However, the variability of the outcome is greater for the Green River Project. (Gossen-Chicago)
W69-06300

AN EXPLORATION OF COMPONENTS AFFECTING AND LIMITING POLICY MAKING OPTIONS IN LOCAL WATER AGENCIES,
Colorado State Univ., Fort Collins. Dept. of Political Science.
Duane Hill, Charles Garrison, and Phillip O. Foss.
Colorado State Univ Compl. Rpt Phase I, Nov 1968. 162 p, 22 ref. OWRR Project B-006-COLO.

Descriptors: *Water policy, *Administration, *Administrative agencies, *Decision making, Rural areas, Cities, Communication, Community development, Taxes, Social needs, Political aspects, Local governments, Behavior, Financing, Long term planning.
Identifiers: *Public systems, Ideology, Negative perceptions, Peer communication, Socialization agents.

This research touches on the major question of how do internal elements in and output from public systems affect, restrict, and/or facilitate water policymaking and administrative systems. Random samples in five communities, including rural and metropolitan localities, provided a number of major elements in public systems that restrict options of the water policymaker and administrator. (1) Negative perceptions of the water policymakers; (2) peer communication networks; (3) socialization agents which structure restrict orientations toward taxes and funding; (4) management--constituent communication networks; (5) conflicting ideological formations; (6) low levels of social and political skills among the public. These in-system elements manifest themselves to restrict the policymaker in his options. (1) Persons participating in community decisional affairs tend to have restrictive orientations toward funding water programs; (2) Major contributors to the management communications systems are medium to high social status, political activists with negative perceptions of water officials; (3) persons supporting local water administrators do not have the predispositions or social skills required for effective participation; (4) long-range planning goals gain wide acceptance while public willingness to support budgeting and administrative measures necessary for their attainment is narrowly based; (5) traditional identifications and values restrict local systems' ability to meet the needs of their urbanizing environment. (Heckerling-Fla)
W69-06306

IMPROVEMENT AND MODERNIZATION OF N. Y. WATER LAW WITHIN THE FRAMEWORK OF THE RIPARIAN SYSTEM,
Cornell Univ., Ithaca, N. Y.
For primary bibliographic entry see Field 06E.
W69-06341

DELAWARE RIVER BASIN.
For primary bibliographic entry see Field 06E.
W69-06347

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION).
Commission on Marine Science, Engineering and Resources, Washington, D. C.

Our Nation and The Sea (A Plan For National Action), A report Of The Comm'n On Marine Science, Engineering and Resources, pp 121-166; pp 227-249, Jan 1969. 69 p, 4 tab, 12 fig.

Descriptors: *United States, *Mineralogy, *Oil industry, *International waters, International law, Treaties, Foreign waters, Continental shelf, Marine geology, Federal government, Submerged lands act, Legislation, Leases, Rent, Geological surveys, Waste treatment, Desalination, Potable water, Water sources, Groundwater movement, United Nations, Legal aspects, Administrative agencies, Publications.

The Commission on Marine Science, Engineering and Resources urges the federal government to enunciate and establish national policies and objectives concerning United States interests in the development of nonliving marine resources. The Commission foresees a need for various national projects to be undertaken by the government in order to defray the tremendous expense involved in recovery of such resources. Specifically, the Commission calls upon the government to prepare an extensive geological reconnaissance survey of the continental shelf in order to facilitate industrial exploitation. The Commission proposes that appropriate mechanisms be established to insure exchange of technological information between the federal government, industry, and the scientific community. The federal government's practices concerning leasing schedules of offshore areas are criticized as hampering long range planning by private industry. It is recommended that the government revise the accounting system applied to the pipeline industry in order to promote research. A comprehensive international program for exploration and exploitation of mineral

resources underlying deep seas is proposed by the Commission. (KatznFla)
W69-06411

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION, PART III: DEVELOPMENT OF NONLIVING MARINE RESOURCES.
Commission on Marine Science, Engineering and Resources, Washington, D. C.

Report of the Comm's On Marine Science, Engineering and Resources, pp 121-127, Jan 1969. 7 p.

Descriptors: *Investment, *Oil industry, *Research and development, *Mineralogy, International waters, International law, Treaties, Foreign waters, Continental shelf, Marine geology, Federal government, Submerged lands act, Legislation, Leases, Rent, Geological surveys, Waste treatment, Desalination, Potable water, Water sources, Groundwater movement, United States, Administrative agencies, Economic efficiency.

The present world petroleum demand will triple within twenty years. Present capital investment in the domestic offshore oil industry is now over one billion dollars and increases by nearly 18 percent annually. It is estimated that within ten years the offshore oil industry will supply 33 percent of world oil production. The Commission notes that present recovery of offshore oil is necessarily more expensive than land recovery operations; however, forecasted technological innovations will greatly reduce production costs. The Commission urges the federal government to reduce the uncertainty surrounding current leasing practices in offshore areas in order to aid in long range planning by private industry. A thorough new assessment of the adequacy of the nations offshore and land oil reserves is urged as a basis for establishment of a national leasing policy, pacing development at a rate consonant with national interest. (Katz-Fla)
W69-06412

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION, PART III: NATURAL GAS.
Commission on Marine Science, Engineering and Resources, Washington, D. C.

Report of the Comm'n on Marine Science, Engineering And Resources, pp 127-130, Jan 1969. 4 p.

Descriptors: *Natural gas, *Oil industry, *Investment, *United States, International waters, International law, Treaties, Foreign waters, Continental shelf, Marine geology, Federal government, Submerged lands act, Legislation, Leases, Rent, Geological surveys, Waste treatment, Desalination, Potable water, Water resources, United Nations, Legal aspects, Administrative agencies.

The process of bringing natural gas to the consumer involves three sequential functions: production, transmission, and distribution. The petroleum industry explores for and produces the gas while delivery to the consumer is usually undertaken by independent companies. In 1967, natural gas interests paid nearly 300 million dollars to petroleum companies for natural gas produced offshore. The Commission notes that the maximum rates that producers and wholesale distributors of natural gas may charge are subject to Federal Power Commission (FPC) regulation. The Commission recommends that the FPC modify its regulatory policy in regard to pipeline construction and well head prices in order to encourage additional exploration and development of gas reserves, specifically, the Commission recommends that the FPC reexamine its differential price policies for natural gas in order to reflect more accurately the increased cost of offshore production. In order to encourage innovative research within the gas transmission industry, it is recommended that the FPC review its accounting regulations to determine whether such regulations afford clear and realistic guidelines to the industry. (Katz-Fla)
W69-06413

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION), PART III: OTHER MARINE MINERALS.
Commission on Marine Science, Engineering and Resources, Washington, D. C.

Report Of The Comm'n On Marine Science, Engineering And Resources, pp 130-135, Jan 1969. 6 p.

Descriptors: *Mineralogy, *Investment, *United States, *Continental shelf, International waters, International law, Foreign waters, Marine geology, Federal government, Geological surveys, Research and development, Oceans, Stratification, Legal aspects, Costs, Planning, Economic feasibility, Technical feasibility, Productivity, Financing.

Ocean minerals have been acclaimed as an inexhaustible treature trove, yet the inaccessibility of most marine minerals and the expense involved in their recovery have deterred exploitation of these resources. The Commission states that an urgent necessity to develop these minerals does not presently exist. However, an early start in the development of required technology is warranted to provide for future contingencies. Research and exploration in this field will be costly, and the government is expected to play a major role. Deposits of various undersea minerals are found in sea water itself, submerged placer deposits, subbottom or substrata of continental shelf and in various nodules, crusts and oozes along the ocean floor. The total 1967 value of world offshore mineral production was nearly 1 billion dollars of which about 20 percent came from United States waters. The Commission notes that the entire amount of such extraction was accomplished nearshore and admonishes that deepwater mining techniques are presently nonexistent despite the tremendous potential returns if such techniques are developed. (Katz-Fla)
W69-06414

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION, PART III: LEGAL AND REGULATORY CONSIDERATIONS.
Commission on Marine Science, Engineering and Resources, Washington, D. C.

Report Of The Comm'n On Marine Science, Engineering and Resources, pp 135-137, Jan 1969. 3 p.

Descriptors: *Investment, *United States, *Surface investigations, *Research and development, Submerged lands act, Continental shelf, Oceans, International law, Federal government, Administrative agencies, Exploration, Exploitation, Legislation, Legal aspects, Leases.

The Commission noted that, under the Outer Continental Shelf Act, a firm which discovers commercially exploitable undersea deposits does not automatically acquire the privilege to develop these deposits. Under the Act, the government requires that development privileges be acquired by competitive bidding, the discoveror bidding as a newcomer. The Commission regards this practice as particularly onerous in that it deters private industry from expending the required sums for such undersea exploration and development. The Commission favors retention of the competitive bidding system for areas of possible development discovered by government endeavor. The Department of the Interior is responsible for fostering the nations development and utilization of minerals, including undersea minerals. The Commission noted that the Department's Geological Survey and Bureau of Mines expends only seven million dollars annually on discovering and recovering marine minerals. The Commission recommends increased expenditure in this area. (Katz-Fla)
W69-06415

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION), PART III: FRESH WATER RESOURCES.
Commission on Marine Science, Engineering and Resources, Washington, D. C.

Report Of The Comm'n On Marine Science, Engineering and Resources, pp 137-139, Jan 1969. 3 p.

Descriptors: *Desalination, *Potable water, *Surface waters, *Water sources, Foreign countries, Public benefits, Mineralogy, Groundwater movement, Waste treatment, Hydraulic structures, Conveyance structures, Investment, Runoff, Subsurface waters, Legal aspects, Arid lands, Southwest United States.

The Commission views the need for development of fresh water resources as critical to the developing countries. The United States interest in these countries makes water technology, including desalination, a matter of legitimate national concern. While desalination of any type is a much more expensive process than reservoir maintenance, it is essential in areas which cannot provide sufficient surface and ground waters to support additional inhabitants. The capital investment in desalination plants is far less than that required by interregional water transfer projects. The Commission recommends that more research should be directed toward extraction of chemicals from the concentrated brine created in desalination processes. It is strongly urged that research be directed toward the potential fresh water supply in strata underlying the coastal waters. Utilization of such subsurface waters could provide low cost water to arid regions. (Katz-Fla)
W69-06416

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION), PART III: AN INTERNATIONAL LEGAL-POLITICAL FRAMEWORK FOR EXPLORING AND EXPLOITING THE MINERAL RESOURCES UNDERLYING THE HIGH SEAS.
Commission on Marine Science, Engineering and Resources, Washington, D. C.

Report Of The Comm'n On Marine Science, Engineering and Resources, pp 141-147, Jan 1969. 7 p.

Descriptors: *United States, *International law, *International waters, *Treaties, Foreign waters, Legislation, Continental shelf, Marine geology, Leases, Rents, Geological surveys, Administrative agencies, Mineralogy, Oil industry, Exploration, Exploitation, Water resources development.

The Commission recognizes a need to develop an international legal-political framework for exploring the mineral resources beneath the highseas. Such a framework must provide the required incentive for technological development and must insure that all nations will be given a fair chance to engage in undersea mineral exploration and recovery. The Commission views the existing framework under the International Convention on the Continental Shelf as totally inadequate in its uncertainty concerning rights relating to undersea minerals. Private enterprise will be deterred from developing these resources until assured of exclusive access to discovered deposits for a length of time sufficient to realize a profit. Under the Convention, the legal definition of continental shelf is not consistent with geological reality, and the only certainty provided by that Convention is that each coastal state has exclusive shelf mineral rights up to the 200 meter isobath. The Commission recommends that the United States take the initiative and call a convention to affix the continental shelf line at the 200 meter isobath or at a point 50 nautical miles from the baseline used in measuring the territorial sea; whichever line provides the most shelf area should be used in each case. (Katz-Fla)
W69-06417

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION), PART III: AN INTERNATIONAL AUTHORITY TO REGISTER NATIONAL CLAIMS BEYOND THE REDEFINED CONTINENTAL SHELF.
Commission on Marine Science, Engineering and Resources, Washington, D. C.

Report Of The Comm'n On Marine Science, Engineering and Resources, pp 147-156. 10 p.

Descriptors: *Administrative agencies, *International law, *International waters, *Treaties, United States, Foreign countries, Foreign waters, Remedies, Rent, Leases, Exploitation, Development and research, Geological surveys, Mineralogy, Oil industry, Exploration, Continental shelf, Legislation, Legal aspects.

In furtherance of the establishment of a new legal-political international framework, the Commission recommends the negotiation of new international agreements establishing: (1) an International Claims Registry Authority; (2) an international fund and; (3) an intermediate zone. The Registry Authority would be required to register all mineral claims on a 'first come, first registered' basis, requiring only a showing of competency to engage in the undertaking by the registrant. Every nation registering a claim to exploit would be required to pay a portion of the production value into an international fund for distribution and financing of food from the sea programs and related activities. This is a means of providing economic rent to provide for the common welfare of all nations. The International Registry Authority should initially settle any disputes arising under the framework, however, the Authority's decisions should be subject to review by an Arbitration Board. The creation of an intermediate zone is designed to relieve the present uncertainty concerning disputed boundaries of the continental shelves. This zone would be exclusively reserved to the coastal nations or its licensees. (Katz-Fla)
W69-06418

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION), PART IV: GOVERNMENT-INDUSTRY RELATIONSHIPS IN SUPPORT OF RESEARCH DEVELOPMENT.
Commission on Marine Science, Engineering and Resources, Washington, D. C.

Report of the Comm'n On Marine Science, Engineering and Resources, pp 157-166, Jan 1969. 10 p, 2 tab.

Descriptors: *Federal government, *Water resources, *Water resources development, *Industries, Commercial fishing, Mineral industry, Oil industry, Industrial production, Scientific personnel, Costs, Administration, Manpower, Marketing, Oceanography, Continental shelf, Sea water, Engineering, Research facilities, Technology planning, Resource development, Administrative agencies, Financing.

The Federal Government plays an important role in the development of private marine industry. This role should be one of providing incentive and encouragement for greater industrial involvement in the development of marine resources. Since private capital is and will be adequate to finance ocean development, the Commission on Marine Sciences, Engineering and Resources recommends not government subsidies of marine industry but that governmental research and services be made available to encourage investments. The commission recommends that a predictable legal and regulatory environment be established and maintained in order to increase involvement in marine industries. Providing technology and services such as power supply systems for undersea operations and continental shelf studies is a recommended means of governmental involvement to encourage private industry. Interchange of technological and scientific information between governments and the various marine industries is essential to the success of marine programs. Collaboration by federal, and state governments and industry in planning marine programs will help minimize conflicts among potentially incompatible coastal zone uses. Expenditures necessary to implement the commission's recommendations are stated and discussed. (Helwig-Fla)
W69-06419

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION): ORGANIZING A NATIONAL OCEAN EFFORT.
Commission on Marine Science, Engineering and Resources, Washington, D. C.

Our Nation and The Sea (A Plan For National Action), A Report of the Comm'n on Marine Science, Engineering and Resources, pp 227-249, Jan 1969. 23 p, 3 fig.

Descriptors: *Oceanography, *Oceans, *Federal government, *Administrative agencies, Jurisdiction, Legislation, Law of the sea, Resources, Water resources, Federal budget, Political aspects, United States, Weather forecasting, Weather data, Projects, Research equipment, Environment, Water law, Marine geology, Scientific personnel, Atmosphere, Engineering.
Identifiers: U S Navy, National Science Foundation, U S Coast Guard.

In order to effectively carry out the nation ocean program of the Commission on Marine Science, Engineering, and Resources, there must be a planned and manageable governmental organization. The Commission recommends the creation of an independent federal agency for the administration of the civil marine and atmospheric programs. This agency might be called the National Oceanic and Atmospheric Agency (NOAA). The function of NOAA would be to insure wise use of the marine environment. It should be independent and report directly to the President. In order to insure maximum effectiveness and efficiency, certain existing agencies should be consolidated under NOAA control, and certain functions of other agencies should be transferred to NOAA Initially, the functions, programs, and equipment of the Environmental Science Services Administration, the U S Coast Guard, and the Bureau of Commercial Fisheries should be consolidated and placed under NOAA control. A National Advisory Committee for the Oceans, with members selected from outside the government, should be established to advise NOAA. This committee would report directly to the president. Until NOAA could be established, marine activities should remain under the direction of the existing agencies. It is recommended that Congressional committee jurisdiction of marine activities be reviewed in light of the recommended executive agency reorganization. (Helwig-Fla)
W69-06420

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

NIAGARA MOHAWK POWER CORP V FEDERAL POWER COMM'N (USUFRUCTUARY RIGHTS AND THE FEDERAL WATER POWER ACT OF 1920).

202 F 2d 190-211 (D C Cir 1952).

Descriptors: *Usufructuary right, *Diversion, *Hydroelectric plants, *New York, Power operation and maintenance, Hydroelectric project licensing, Permits, Federal Power Act, Navigable waters, Riparian rights, Federal government, State governments, Judicial decisions, Legal aspects, Administrative agencies, Regulation, Leases, Financing, Costs, Financial analysis.
Identifiers: *Niagara River, Operating expenses.

Petitioner power company was licensed under the Federal Water Power Act of 1920. This act provides that accumulated earnings in excess of the reasonable rate of return shall be subject to an amortization reserve, the use of which is controlled by the Federal Power Commission. The company's license under the Act provided for one-half the surplus earnings to go to the reserve. In determining its surplus, the power company excluded as operating expenses $798,000 in rents paid to two riparian owners for usufructuary rights on the Niagara River. The commission disallowed the expenses. The court of appeals reversed, holding that riparian owners have usufructuary rights in navigable waters, subject to paramount rights of federal and state governments. Neither New York acts, a British-American Treaty, nor the Federal Water Power Act had foreclosed these rights in the riparians, but had merely regulated them. The court held such rights were transferable apart from the land as long as they existed. Thus, the expenditure for the rights was a necessary and valid operating expense and was not subject to the amortization reserve. (Harris-Fla)
W69-06405

6D. Water Demand

CONSUMPTIVE IRRIGATION REQUIREMENTS OF SELECTED IRRIGATED AREAS IN NEW MEXICO,
New Mexico Univ., Las Cruces.
For primary bibliographic entry see Field 03F.
W69-06013

EFFECTS OF SMALL STRUCTURES ON WATER YIELD IN TEXAS,
Geological Survey, Austin, Tex.; and Texas Univ., Austin. Dept. of Civil Engineering.
For primary bibliographic entry see Field 03B.
W69-06218

ECONOMIC EVALUATION OF WATER-PART IV: AN INPUT-OUTPUT AND LINEAR PROGRAMMING ANALYSIS OF CALIFORNIA WATER REQUIREMENTS,
California Univ., Berkeley. Sanitary Engineering Research Lab.; and Calif. Univ., Berkeley. School of Public Health.
For primary bibliographic entry see Field 06B.
W69-06220

6E. Water Law and Institutions

GEORGIA WATER LAW,
Georgia Univ., Athens. Inst. of Government.
Robert C. Kates.
Institute of Government, University of Georgia, Athens, 1969, 395 p, 1910 ref, 11 append. OWRR Project B-013-GA.

Descriptors: *Georgia, *Riparian rights, *Water law, *Water rights, *Legislation, *Riparian waters, Natural flow doctrine, Ownership of beds, Prescriptive rights, Prior appropriation, Riparian land, Water transfer, Water courses (Legal), Wells, Surface waters, Groundwater, Navigable waters, Flood water, Administration, State jurisdiction, Tidal waters.

An objective of the monograph is to set forth in systematic and comprehensive form the present water law of Georgia. The statutes and constitutional provisions, together with interpretative law, are analyzed to determine gaps, inconsistencies and overlaps. Numerous recommendations for remedial legislation are made. Emphasis is on the private right of the use of water as it appears in various stages of the hydrological cycle. The legal rights and liabilities pertaining to the various categories of water are discussed briefly in chapter I. Subsequent chapters consider in detail each category. The Georgia Riparian doctrine--its rights and liabilities as well as its history--is developed in depth in chapters II and III. Chapter IV is concerned with water pollution in non-navigable surface streams and chapter V with navigable and tidal waters.

Chapter VI is concerned with lakes and ponds and chapter VII deals with diffused surface waters. Underground waters are discussed in chapter VIII. Procedures and remedies are discussed in chapter IX and chapter X is concerned with administrative structures. (Conway-Ga Tech)
W69-06009

GOALS AND PERSPECTIVES IN WATER RESOURCES PLANNING,
Office of Science and Technology, Washington, D. C.; and Cornell Univ., Ithaca, N. Y. Water Resources Center.
For primary bibliographic entry see Field 06B.
W69-06046

WATER RESOURCES PLANNING,
For primary bibliographic entry see Field 06B.
W69-06049

WATER AND CHOICE IN THE COLORADO BASIN: AN EXAMPLE OF ALTERNATIVES IN WATER MANAGEMENT, CH. 2, THE SETTING.
National Academy of Sciences--National Research Council, Washington, D. C. Committee on Water.
For primary bibliographic entry see Field 06B.
W69-06087

WATER QUALITY CONTROL - THE ROLE OF THE INTERSTATE AGENCY,
Water Pollution Control Federation, Washington, D. C.
For primary bibliographic entry see Field 05G.
W69-06094

WATER QUALITY STANDARDS: THE FEDERAL PERSPECTIVE - PROGRESS TOWARD OBJECTIVES,
Water Pollution Control Federation, Washington, D. C.
For primary bibliographic entry see Field 05G.
W69-06095

FITTING A STATE PROGRAM TO FEDERAL OBJECTIVES,
Water Pollution Control Federation, Washington, D. C.
For primary bibliographic entry see Field 05G.
W69-06096

A FLOOD LOSS REDUCTION PROGRAM,
For primary bibliographic entry see Field 06F.
W69-06097

METROPOLITAN PROBLEMS: METROPOLITAN PUBLIC AUTHORITIES,
Drew Univ., Inst. for Research on Government.
For primary bibliographic entry see Field 06B.
W69-06098

METROPOLITAN PROBLEMS: THE DELAWARE RIVER BASIN COMMISSION,
Delaware River Basin Commission, Trenton, N. J.
For primary bibliographic entry see Field 06B.
W69-06099

UNITED STATES POLICY REGARDING MARINE RESOURCES (IMPLEMENTATION OF THE NEW MARINE POLICY),
Edward Wenk, Jr.
Nat Resources Lawyer, Vol 1, No 2, pp 3-13, June 1968. 11 p.

Descriptors: *Legislation, *Federal government, *Oceanography, *International law, Water utilization, Administration, Foreign waters, Water law, Legal aspects, Technology, Social needs, Federal jurisdiction, Local governments, Political aspects, Public rights, State governments, Conservation, International waters.
Identifiers: *Marine resources, *Marine science, Executive policy.

There has been a notable shift in national marine policy. Formerly the primary emphasis had been on militarism and trade; the present policy emphasizes exploitation of marine resources for the benefit of mankind. This policy shift is evidenced by the Marine Resources and Engineering Development Act of 1966. To implement the new policy, the act provides for the Marine Science Council and Commission. This agency is to assist and advise the President. Priority programs in marine science application are to be controlled by law. The authors point out that law should be employed as a creative instrument and utilized to foster the social and economic gains sought to be achieved. Programs should be implemented which distribute the risks and benefits of oceanic exploration between the several nations. For purposes of discussion, the legal issues involved in oceanic enterprise were divided into the areas of public law, international law and law on the state and local level. Studies are being conducted by the legal profession in the areas of international, state, and local law. The purpose of these studies is to provide a basis for policy decisions and to encourage the evaluation of a legal code which will best serve our national interests. (Holt-Fla)
W69-06100

A CASE FOR THE ADMINISTRATION OF MARINE RESOURCES UNDERLYING THE HIGH SEAS BY THE UNITED NATIONS,
American Bar Association, Chicago, Ill. Section of Natural Resources Law.
Clark M. Eichelberger.
Nat Resources Lawyer, Vol 1, No 2, pp 85-94, June 1968. 10 p.

Descriptors: *Administration, *Oceans, *International law, *Exploitation, Future planning (Projected), United Nations, Governments, Water law, Legal aspects, Jurisdiction, Taxes, Financing, Resource development, Resource allocation.

There is a pressing need for international control of the exploitation of marine resources. Such exploitation must be regulated in such a way as to: (1) avoid a power struggle; (2) provide equitable distribution of resources to all mankind; (3) provide for peace; and (4) assure enterprising individuals and nations that their investments will be protected. The General Assembly's approach to non-national appropriation of outer space is alluded to as constituting valuable precedent for establishing the above control. It is suggested that an international authority could regulate marine exploration and exploitation and collect royalties which would be used to help the have-not nations develop a richer economic and social life for their people. It is proposed that the United Nations create the administrative machinery and acquire the requisite expertise to establish rules governing sea exploitation. The United Nations, has selected an ad hoc committee to study problems of sea exploitation control. A report by this committee was to be presented at the twenty-third session. The author expresses regret that the action taken lacked the comprehensiveness and force of the General Assembly's approach to appropriation of outer space. (Holt-Fla)
W69-06103

A CASE FOR THE ADMINISTRATION OF MINERAL RESOURCES UNDERLYING THE HIGH SEAS BY NATIONAL INTERESTS,
Northcut Ely.
Nat Resources Lawyer, Vol 1, No 2, pp 78-84, June 1968. 7 p.

Descriptors: *International law, *Oceans, *Regime, *Mining, Exploitation, United Nations, Oceanography, Continental shelf, Resource development, Resources, Beds, Beds under water, Water law, Legal aspects, Permits.

A pressing international problem is how to effectively regulate the mining of undersea minerals. Any regulatory body charged with administering this area of international law would necessarily be empowered to grant exclusive mineral rights to the developer of the field and to provide the developer with protection against claim jumpers. For this service, the regulatory body could expect to enact taxes. Proposed to govern mineral exploitation were the flag nation and the supranational agency regimes. The former regime would recognize the right of the discovering nation to appropriate submerged lands much like the regalion system operates as to exposed lands, and the latter regime would vest exclusive jurisdiction over the sea-bed in some agency like the United Nations. The author evaluates the two proposed regimes and concludes that the flag nation system is definitely the more practical. (Holt-Fla)
W69-06104

ALTERNATIVE REGIMES FOR MARINE RESOURCES UNDERLYING THE SEA,
Francis T. Christy, Jr.
Nat Resources Lawyer, Vol 1, No 2, pp 63-77, June 1968. 15 p, 12 ref.

Descriptors: *International law, *Exploitation, *Oceanography, *Law of the sea, Legal aspects, Technology, Manganese, Beds, Economic impact, Economic justification, Administration, Continental shelf, United States, Jurisdiction.

Alternative solutions to the problems raised by future exploitation of marine resources were discussed. The law, as it exists today, is inadequate to cope with the problems currently plaguing the international community. The authors conclude that in order for a regime to be effective, it must be viable over the long-run and encourage the efficient, peaceful, and orderly exploitation of the mineral deposits in the ocean floor. Four alternative courses of action were discussed. The first was to 'wait and see' what problems emerged from continued development under the present provisions. This was deemed the least palatable solution. Next discussed was the 'national lake approach.' This provides for a proportionate division of the sea among the coastal-states. There was superficial appeal here, but the author's discarded this approach as unlikely to solve the problem. The 'flag nation' approach, which in effect allocates rights on a first-come, first-serve basis, was deemed to be remotely feasible. The international regime, which would permit exploitation under the jurisdiction and protection of an international authority, was highly favored. (Holt-Fla)
W69-06105

A NEGATIVE VIEW OF A PROPOSAL FOR UNITED NATIONS OWNERSHIP OF OCEAN MINERAL RESOURCES,
William T. Burke.
Nat Resources Lawyer, Vol 1, No 2, pp 42-62, June 1968. 21 p, 30 ref.

Descriptors: *International law, *Oceanography, *Exploitation, *United Nations, Legal aspects, Resources, Political aspects, United States, Water law, Economic impact, Economic justification, Income, Beds, Mining, Technology, Publications.

Two important issues must be dealt with in the near future. These are: (1) whether the United Nations should be given jurisdiction over deep ocean resources; and (2) what should be considered in developing legal policies regarding exploitation of marine resources. The Soviet Union had proposed an immediate study for recommendations on legal policy for marine exploitation to be presented for adoption by the United Nations. The United States felt that the immediate action proposed was not warranted under existing circumstances. Seven factors to be considered before approving a central jurisdictional control plan over marine resources were listed and discussed. It was indicated that conflicting interests of nation-state and private enterprise should be considered when formulating the

legal policy governing sea exploitation. It was hypothesized that government-to-government communications and negotiations are more likely to determine the use of the sea. The birth of new nation states would have a marked effect on any legal scheme which was established. Possible methods of dealing with this phenomenon were discussed. Wealth, power, and strategic location were listed as the chief objectives of marine exploitation. The feasibility of adopting a unified approach to international legal problems was explained, and the values, strategies, and conditions which would effect the development of such a unified legal policy were enumerated. (Holt-Fla)
W69-06106

THE ROLE OF THE UNITED STATES NAVY IN THE FORMULATION OF FEDERAL POLICY REGARDING THE SEA,
Wilfred A. Hearn.
Nat Resources Lawyer, Vol 1, No 2, pp 23-31, June 1968. 9 p.

Descriptors: *International law, *Continental shelf, *Oceanography, *Law of the Sea, Legal aspects, Water law, Control, Oceans, Beds under water, Navigation, Technology, Projects, Exploitation, Water resources, Exploration.
Identifiers: *United States Navy, North Sea, Marine resources.

The United States Navy is keenly interested in the formulation of federal policy regarding the sea since such policy has a direct bearing on the Navy's role in national defense. In regard to exploiting and exploring for the natural resources in and under the sea, the Navy prefers retention of the 'freedom of the seas' doctrine rather than the extension of the jurisdiction of coastal states over contiguous portions of the continental shelf. The Navy recognizes that disputes between the nations will arise over exploitation of the sea. An area in which a reconciliation of conflicting interests will soon be worked out is in the North Sea. The process of reconciling these conflicting interests will provide the first thorough test of the adequacy and acceptability of the continental shelf doctrine and should add greatly to the precedents available in this developing area of the law. (Holt-Fla)
W69-06107

THE ROLE OF THE STATE DEPARTMENT IN FORMULATING FEDERAL POLICY REGARDING MARINE RESOURCES,
Murray J. Belman.
Natural Resources Lawyer, Vol 1, No 2, pp 14-22, June 1968. 9 p, 5 ref.

Descriptors: *Oceanography, *International law, *Continental shelf, *Administrative agencies, Federal government, United Nations, International waters, Water law, Legal aspects, Political aspects, Treaties, Economic impact, Economics, Exploration, Exploitation, Conservation, Foreign waters.
Identifiers: *State department, *Marine resources.

Prior to 1966, the State Department was unconcerned with international policy in the area of deep sea exploration and exploitation, but, since then, they have begun developing foreign policy with respect to marine science activities. It appears that under the continental shelf doctrine the coastal states have sovereign rights to exploit and explore the contiguous portions of the continental shelf. The shelf includes the seabed adjacent to the coast up to a depth of 200 meters or to the limits of exploitability. Such a description is ambiguous and may lead to attempts by various nations to colonize the deep sea and ocean bottom. It is apparent that there is a need for international cooperation to formulate laws governing the exploitation of the sea. Alternative propositions governing ownership of marine resources beyond the continental shelf are that: they belong to nobody; they belong to everybody. Arguments favoring each proposition were discussed. In conclusion, it was stated that international agreements in marine exploitation were necessary to protect both the have and have-not nations. (Holt-Fla)
W69-06108

SANITARY WATER BOARD V ANTHONY (LEGISLATION TO PREVENT MINE ACID POLLUTION).
For primary bibliographic entry see Field 05G
W69-06109

TUTEN V SHELL OIL CO (SALT WATER DAMAGE TO LAND AND CROPS BY OIL INDUSTRY NEGLIGENCE).
For primary bibliographic entry see Field 05C.
W69-06110

MCKINNEY V DENEEN (LIABILITY FOR DISCHARGE OF MINE WASTES).
For primary bibliographic entry see Field 05C.
W69-06111

MADDOX V INTERNATIONAL PAPER COMPANY (DAMAGES RESULTING FROM BAYOU POLLUTION).
For primary bibliographic entry see Field 05G.
W69-06112

PUNXSUTAWNEY WATER SERVICE CO V SARICKS (CONTAMINATION FROM STRIP MINING).
For primary bibliographic entry see Field 05G.
W69-06113

JONES V BREYER ICE CREAM CO (PRESCRIPTIVE RIGHTS TO POLLUTE STREAM WATERS).
For primary bibliographic entry see Field 05G.
W69-06114

B AND B OIL CO V TOWNSEND (OIL WASTE POLLUTION).
For primary bibliographic entry see Field 05G.
W69-06115

SMITH V MAGNET COVE BARIUM CORP (BARIUM TAILING POLLUTION).
For primary bibliographic entry see Field 05G.
W69-06116

PHILLIPS V SUN OIL CO (GASOLINE POLLUTION OF WATER WELL).
For primary bibliographic entry see Field 05G.
W69-06117

PHOENIX V GRAHAM (SALT WATER POLLUTION OF WELLS).
For primary bibliographic entry see Field 05G.
W69-06118

COMMONWEALTH V BLACK (INJUNCTION RESTRAINING STRIP MINING OPERATIONS).
For primary bibliographic entry see Field 05G.
W69-06119

MASONITE CORP V WINDHAM (PONDING AND POLLUTION ON UPPER LAND).
For primary bibliographic entry see Field 05G.
W69-06120

MILOTTA V PFEIFER (NATURAL FLOW AND RIGHTS TO SURFACE DRAINAGE).

Westmoreland Law Journal Vol 34, pp 33-36 (C P Pa 1952).

Descriptors: *Pennsylvania, *Surface drainage, *Alteration of flow, *Natural flow doctrine, Ditches, Relative rights, Obstruction to flow, Natural streams, Land tenure, Judicial decisions, Diversion, Legal aspects, Natural flow, Surface waters
Identifiers: *Easements, *Adjacent landowners

Plaintiffs and defendants own adjacent tracts of land from which surface water has been drained for forty years by a ditch parallel to the boundary line. Defendants closed the ditch and by pipes and smaller ditches concentrated and diverted water onto plaintiffs' land. Plaintiffs alleged damage to their orchards which would continue if defendants were not restrained. After a situs visit and testimony, the court of common pleas held that surface waters must be allowed to run their natural course and any obstruction or alteration which is injurious is actionable. An 'accustomed flow' for over 21 years raises a presumption of right in the plaintiff to have the flow in the ditch continue. Channels draining from defendant's land into the ditch have with time acquired the character of easements which plaintiff was entitled to see continued. The court granted a restraining order to prevent diversion and ordered the establishment of the drainage ditch as it existed prior to defendants' alterations. (Harris-Fla)
W69-06121

THE WETLANDS COMMITTEE REPORTS, WETLANDS CLASSIFICATION, INVENTORY AND MANAGEMENT.

Journal of Soil and Water Conservation, Vol 17, no 1, pp 41-42, Jan-Feb 1962. 2 p.

Descriptors: *Wetlands, *Land management, *Land classification, *Soil conservation, Federal governments, State governments, Planning, Water resources development, Water conservation, Census, Administrative agencies, Land use, Land development, Land resources, Natural resources, Marshes, Facilities, Drainage, Wildlife conservation, Publications, Surveys.

In areas where facilities exist for cooperation between agencies, both federal and state, considerable progress has been made in reaching agreements on wetland use. A significant effort has been made through individual agencies to inventory, classify, and manage wetlands. This summary report is the work product of the Wetlands Committee. The report was approved by the Soil Conservation Society of America, and was published in an effort to provide some guidelines and to stimulate cooperation in development of a total wetland use program to serve all public interests. Recommendations are made in the areas of: (a) wetland classification, (b) wetland inventories, and (c) special programs of total wetland use. These recommendations are made with a view toward creating facilities for the development of a wetland classification and management program in which conservation or land-use agencies would cooperate. (Heckerling-Fla)
W69-06122

HEREDA V LOWER BURRELL TP (UNNATURAL WATER AND SEWAGE DISCHARGE).
159 Pa Super 262, 48 A 2d 83-85 (Pa Super Ct 1946).

Descriptors: *Pennsylvania, *Water, *Sewage, *Drainage, Pipes, Tile drains, Channels, Ditches, Judicial decisions, Water law, Legal aspects, Eminent domain, Floodwater, Roads, Discharge (Water), Natural flow, Damages, Conduits.

In 1936 plaintiff acquired property to the west of and lower than a private road. A ditch east of the road drained water and sewage. Such ditch had never caused flooding of plaintiff's property. Defendants made the road a public highway in 1937 and inserted a drainage pipe which connected the east side ditch with an artificial channel on the west side of the road. The channel flowed toward plain-

tiff's property. Subsequently, the east side ditch, which had previously carried street water, was closed, and the water and sewage were diverted through the pipe, into the west side artificial channel, and onto plaintiff's land. Plaintiff brought an action for damages caused by this alleged 'taking' by defendant. The court held for plaintiff, finding that defendant had accumulated the water and sewage and diverted it in bulk into an artificial conduit and channel and then discharged it upon plaintiff's land where it would not otherwise have been discharged. (Holt-Fla)
W69-06123

BOECK V YELLOW MEDICINE COUNTY (DRAINAGE DITCHES).
62 NW 2d 80-85 (Minn 1954).

Descriptors: *Minnesota, *Drainage systems, *Ditches, *Assessments, Judicial decisions, Drainage, Surface drainage, Drainage programs, Local government, Legislation, Laterals, Outlets, Pipes, Streams, Riddance (Legal aspects), Surface runoffs, Open channels, Benefits, Legal aspects.
Identifiers: Bull ditches, Sloughs.

Respondent owned land separated from a stream by other riparian land. Water from respondent's land was drained off by means of artificial ditches across the adjacent land and into the natural watercourse. Appellant county proposed to improve an existing drainage ditch and drainage outlet on the natural watercourse. Appellant sought to assess respondent for benefits to her land from the proposed improvement. The supreme court affirmed the trial court, reasoning that in order to assess a person for benefits from a public drainage project, there must be a showing of actual benefit to that person. Whether the land has been benefited is a question of fact. Since respondent's land had previously been adequately drained, the court found the evidence sustained a finding that the land would receive no benefit from the proposed improvements. (Helwig-Fla)
W69-06124

CHAMBERLIN V CIAFFONI (NATURAL FLOW AND SURFACE DRAINAGE IN CITIES).

373 Pa 430, 96 A 2d 140-143 (1953).

Descriptors: *Pennsylvania, *Natural flow doctrine, *Common enemy rule, *Surface drainage, Cities, Drainage systems, Land tenure, Relative rights, Land use, Judicial decisions, Legal aspects, Discharge (Water), Damages, Diversion, Reasonable use, Drainage, Surface runoff, Flow augmentation.
Identifiers: *Regrading, *Damnum absque injuria, *Upper landowners.

Plaintiff and defendant were owners of properties separated by a 10-foot wide alley. Plaintiff alleged that the defendant regraded the surface of his land to cause a diversion of the natural drainage of surface waters, and thereby discharged water onto the alley and into the basement of a building on plaintiff's property. Plaintiff also alleged the deposit of large amounts of earth and fill on the alley. The bill prayed for an injunction and damages. The court of common pleas denied the relief sought. In affirming, the supreme court of Pennsylvania held that even though the improvement of defendant's property caused an increase in natural drainage which plaintiff's disposal facilities could not handle, under the 'common enemy rule' upper landowners may improve his land by regrading without responsibility for consequent diversion of surface waters resulting from his enjoyment of the property. If unavoidable loss is brought on his neighbor, it is damnum absque injuria. The court further held that owners of municipal property own with the condition that municipal improvement may alter the natural surface of the land. (Harris-Fla)
W69-06125

MC KEON V BRAMMER (SUBSURFACE DRAINAGE AND THE NATURAL FLOW DOCTRINE).

29 NW 2d 518-527 (Iowa 1947).

Descriptors: *Iowa, *Subsurface drainage, *Natural flow doctrine, *Easements, Tile drainage, Drains, Watercourses, Artificial watercourses, Natural streams, Drainage systems, Storm drains, Subsurface flow, Subsurface runoff, Drainage districts, Judicial decisions, Legal aspects, Obstruction to flow.
Identifiers: *Lowland proprietor, Upland owners.

Plaintiff brought suit to enjoin the continuance of an obstruction that the defendant, a lowland proprietor, placed in a drainage system which extended from the plaintiff's land across the defendant's land. The defendants challenged the right of the plaintiff to an easement in the drain system. They contended that the creation of a special drainage district had extinguished the easement of the plaintiff. The court ruled that the plaintiff had established a right of easement. In addition, the court found that the water that drained from the plaintiff's upper land did not substantially increase the quantity of water in its natural flow. As a consequence, the defendant was ordered to remove the obstruction. The decision upheld the rule which allows an upper proprietor to drain his land through natural watercourses even if it means increasing the flow over the lowland property; however, it must do so without causing substantial injury. (Stewart-Fla)
W69-06126

POLICH V HERMANN (ABNORMAL DISCHARGE OF SURFACE WATER).

219 SW 2d 849-856 (Mo Ct App 1949).

Descriptors: *Missouri, *Surface water, *Riddance (Legal aspects), *Easements, Judicial decisions, Legal aspects, Remedies, Surface drainage, Roads, Road construction, Obstruction to flow, Natural flow, Outflow, Sewers, Discharge (Water), Slopes, Damages, Repulsion (Legal aspects).

Plaintiff and defendant, adjacent property owners, by agreement created a 15 foot driveway easement between their properties. Each contributed 7 1/2 feet of land to the easement. Prior to the agreement, the 15 foot strip had been level; the agreement provided that each property owner was to surface his side of the driveway creating respective slopes from the centerline to each party's property. Defendant dumped three loads of dirt on his side of the roadway. This dirt caused abnormal amounts of surface water to flow from defendant's side to plaintiff's side of the driveway. The abnormal flow of water carried weeds and dirt into the mouth of a sewer on plaintiff's side of the driveway. Debris finally clogged the sewer completely, causing water to overflow into plaintiff's basement. Plaintiff then sought an injunction to restrain defendant from obstructing the driveway easement. The injunction was granted. The court held that defendant, as upper landowner, had no right to increase the quantity of water discharged upon the lower estate to any greater extent than would have been discharged by the natural course of drainage. (Holt-Fla)
W69-06127

STACY V WALKER (PROTECTION AGAINST SURFACE WATER DRAINAGE).
262 SW 2d 889-891 (Ark 1953).

Descriptors: *Arkansas, *Obstruction to flow, *Surface drainage, *Levees, Natural streams, Drainage ditches, Relative rights, Scour, Natural flow, Judicial decisions, Flooding, Contours, Legal aspects, Rainfall, Rain water, Surface runoff.
Identifiers: *Adjacent landowners.

Plaintiff brought action for damages to his cotton crop and a mandatory injunction directing defendant to breach a levee, which defendant had constructed to repel rain water flowing from plaintiff's land. Plaintiff and defendant owned adjoining farms separated by a fencerow. Rain falling on plaintiff's land followed slight surface depressions and accumulated at a point on the boundary where it emptied onto defendant's land. At no point could the drainage contours be called a natural flowage way. The surface water drainage caused 'scouring' on both plaintiff's and defendant's land. Reversing a judgment for plaintiff, the supreme court of Arkansas held that where water flows through low places not natural streams, a landowner is under no duty to receive it upon his land, and he may repel the water at his boundary if unnecessary and disproportionate harm to others does not result. Defendant had a right to defend his land. The harm to plaintiff's land from water backed up on his side of the boundary could be alleviated at small expense by the construction of a drainage ditch. Both tracts would then be protected. (Harris-Fla)
W69-06128

UNITED STATES V SHAPIRO, INC. (LIABILITY FOR DIVERSION OF SURFACE DRAINAGE BY GRADING).

101 F Supp 27-29 (D D C 1951).

Descriptors: *District of Columbia, *Surface drainage, *Damages, *Diversion, Surface waters, Surface runoff, Drainage, Groundwater movement, Remedies, Legal aspects, Judicial decisions, Water law, Fences.
Identifiers: Debris.

Plaintiff brought suit for injunctive relief, alleging that defendants, in grading their land, diverted the natural flow of drainage water. The change was such as to cause debris to be carried against a wire mesh fence separating the parties' lands. The court held that the plaintiff had not established a cause of action. The damages claimed to have been sustained were damnum absque injuria. A property owner may not cause water, soil, dirt or debris to be deposited on adjoining land. But it has been established that a landowner who is not guilty of negligence may, in the ordinary use of his property, cause a change in the direction of the drainage without liability to the proprietor of the adjoining property. (Gabrielson-Fla)
W69-06129

DENT V ALEXANDER (ACCELERATED FLOW OF SURFACE DRAINAGE).

235 S W 2d 953-955 (Ark 1951).

Descriptors: *Arkansas, *Surface drainage, *Surface waters, *Repulsion (Legal aspects), Diversion, Overflow, Channel, Surface runoff, Alteration of flow, Flow, Overflow, Groundwater movement, Legal aspects, Judicial decisions, Water law, Remedies, Damages.

Appellants alleged that appellees diverted surface water from their own lands into drainage ditches and caused such water to flow upon the lands of appellants in an unnatural channel and in increased volume. The chancellor found that this surface water drained into a large lake on the appellants' property. He ruled that, even if it were established that the small ditch diverted surface water into the lake, the amount diverted was so minute in comparison with the size of the lake as to make any increase in the level of the lake negligible. The court held that the chancellor's finding that the acceleration of the natural drainage did not warrant the intervention of an equity court was not against the preponderance of the evidence. The common enemy doctrine applies in Arkansas. Thus, a landowner has the right to fend off surface waters as best he can, and he is not liable for damages resulting from such diversion unless he unnecessarily injures another. Here, the testimony showed the ap-

pellants were neither substantially nor unnecessarily injured by the accelerated flow of surface waters. (Gabrielson-Fla)
W69-06130

SMEDBERG V MOXIE DAM CO. (DAMAGE CAUSED BY LOWERING POND LEVEL).
92 A 2d 606-611 (Me 1952).

Descriptors: *Maine, *Great ponds, *Ownership of beds, *Water level fluctuations, Dams, Public rights, Lumbering, Lumber, Remedies, Ponds, State governments, Relative rights, Legal aspects, Judicial decisions, Damages, Fishkill, Fish.
Identifiers: Standing.

In 1911, defendant was authorized by charter to maintain dams at Lake Moxie for the purpose of accumulating and storing water for log driving purposes. Defendant, the owner of a hotel and sporting camps near the great pond, sought to enjoin the defendant from causing the level of the lake to fluctuate, claiming that such fluctuations depleted the supply of fish in the lake. This fish-kill, in turn, destroyed plaintiff's rental business. From a decree dismissing his bill, plaintiff appealed. The court held that the alleged damage to fishing was not peculiar to plaintiff, and, since plaintiff's right to fish in the lake was no greater than the right of the public generally, the claimed loss was damnum injuria. An individual who chooses to engage in a business based on the use of a resource held in trust by the state does not create for himself a private right which will support his cause of action as an individual. The state is the owner of the great ponds, and only it has standing to maintain action to abate a public nuisance affecting the ponds. (Gabrielson-Fla)
W69-06131

BOHANNON V CAMDEN BEND DRAINAGE DISTRICT (TAKING OF PROPERTY BY WATER DISTRICT).

208 S W 2d 794-802 (Ct App Mo 1948).

Descriptors: *Missouri, *Drainage districts, *Eminent domain, *Condemnation, Reasonable use, Riparian rights, Hydraulic structures, Impounded waters, Detention reservoirs, Easements, Low water mark, Water level fluctuations, Statutes, Lakes, Streams, State governments, Water resources development, Legal aspects, Judicial decisions, Ditches.

Plaintiff brought action against the defendant drainage district, a public corporation, to enjoin defendants from constructing and maintaining a ditch and from lowering the level of a private lake thereby, to the detriment of plaintiff's property bordering the lake. Though contiguous with the district boundaries and subject to a greater volume of overflow than the lands within the district, plaintiff's property was not included as part of the district. Plaintiff contends that in times of drought, the defendants' plan will lower the water level in the lake to such an extent that a swamp will exist in place of the lake. Plaintiff alleged in the alternative that in times of thaw, the ditch would be inadequate and insufficient to remove waters coming into the lake, and that a holding basin would be so created which would flood the plaintiff's land. The court, reversing the lower courts decision dismissing the complaint, held that taking plaintiffs' property for use by the district without payment for damages or without prior condemnation was in contravention of state law and public policy. (Katz-Fla)
W69-06132

VOLLRATH V WABASH RAILROAD CO. (DAMAGE DUE TO FLOOD WATER FLOW THROUGH ARTIFICIAL EMBANKMENT CUT).
For primary bibliographic entry see Field 04C.
W69-06133

KEELER V TUBBS (LIMITATIONS UNDER WATER CONTRACTS).
147 NYS 2d 166-172 (SC 1955).

Descriptors: *New York, *Wells, *Distribution, *Water contracts, Proprietary power, Usufructuary rights, Water rights, Remedies, Legal aspects, Judicial decisions, Water law, Relative rights, Pipes.

In 1934, plaintiffs and defendants entered into a water rights contract with one Peckham, which allowed them to pipe water from a well on Peckham's property. No other persons were to be permitted to connect lines without permission from the parties involved. Subsequently, plaintiff acquired the land upon which the well was situated. Later, both plaintiffs and defendants extended their water lines to other adjacent tracts. Plaintiffs sought an injunction to restrain defendants' from piping water through their extension lines; defendants countered with a similar suit. The court held that when plaintiffs acquired the property and the well, they acquired the right to full enjoyment of the land and its underground waters. Defendant could only complain if his water supply was diminished. The court also found that one of defendant's extensions had been used openly for ten years without objection. This failure to object amounted to tacit consent by plaintiffs. However, defendants' recent extension of the water line to a new tract was immediately objected to by plaintiffs and was a clear violation of the contract. An injunction was granted, but was made applicable to only the latter extension. (Gabrielson-Fla)
W69-06134

DROEGMILLER V OLSON (DIVERSION OF NATURAL FLOW).
40 NW 2d 292-303 (Iowa 1949).

Descriptors: *Iowa, *Natural flow doctrine, *Diversion structures, *Relative rights, Water law, Judicial decisions, Natural flow, Obstruction to flow, Diversion, Routing, Dikes, Ditches, Silts, Administrative agencies, Public rights, Prescriptive rights, Floodgates, Alteration of flow.

Plaintiff diverted water from its natural course to a highway bridge leading to a neighbor's land. The neighbor complained to the defendant county of the increased flow. Defendant then built a dike at the bridge which returned waters via a ditch to their natural course. Plaintiffs sued to compel removal of the dike, silt from highway ditches under bridges, and the installation of floodgates in ditches. Defendant asked that plaintiffs be enjoined from diverting water onto a public highway. The trial court required to remove the silt and to install floodgates. The appellate court held that plaintiff must remove his dike which caused the diversion, and that defendant could not be compelled to provide floodgates since there was no showing that the highway construction caused any injury to plaintiff. The court further ruled that neither the statute of limitations nor prescriptive right can be urged against the public. Defendant was compelled to remove silt obstructing the natural flow at the bridge where defendant's dike was placed, but was not compelled to remove the dike. (Wheeler-Fla)
W69-06135

PROUTY V CITIZENS UTILITIES CO. (SALE OF PROPERTY ALONG NAVIGABLE RIVER).
150 F Supp 892-900 (D Vt 1957).

Descriptors: *Vermont, *Navigable water, *Federal Power Act, *Contracts, Condemnation, Real property, Judicial decisions, Rivers, Legislation, Federal government, Hydroelectric plants, Mill dams, Riparian land, Banks.
Identifiers: Specific performance, Clyde River.

Plaintiffs brought suit for specific performance of a contract providing that lessee (defendant) was to purchase a piece of property if an option to purchase had not already been exercised when the lease terminated. A price was to be agreed upon at that time, and, if no price could be agreed upon, the lessee was to institute condemnation proceedings within six months. If no such proceedings were instituted, the price was to be $300,000. The property consisted of land bordering on the Clyde River, a dam, mill, and various water rights. The court held that, merely because the case required an interpretation of the Federal Power Act, the proceedings did not have to be brought by the Federal Power Commission. However, since the Clyde River was navigable, defendant should have been licensed by the Federal Power Commission to carry out its activities. The court held that the Vermont Public Service Commission had no jurisdiction to allow defendant to condemn the property. The court concluded that the contract had been breached and ordered specific performance. (Williams-Fla)
W69-06136

SEWAGE CONNECTION FACILITIES.

Mich Comp Laws Ann secs 123.191-123.195 (1967).

Descriptors: *Michigan, *Legislation, *Sewage treatment, *Sewage disposal, Treatment facilities, Wastes, Water pollution sources, Waste water treatment, Water resources, Treatment, Legal aspects, Sewage.
Identifiers: *Sewage connection facilities.

In counties exceeding 300,000 in population, any property from which sanitary sewage emanates shall be connected to an available public sanitary sewage collection facility. The connection shall be completed within 18 months after the date of the availability of such public facility. When any property has not been connected within 18 months the owner or operator of the facility shall require the connection to be made by a written demand on the owner of the property. If the property is not connected within 90 days after the date of the mailing of the written demand, the owner or operator of the facility may forthwith enter upon the property and install, construct and make such connections to abate the nuisance. The owner of the property shall be liable for the costs incurred in making the connection. Whenever the owner or operator of any public sanitary collection facility deems it necessary to enter upon any property to ascertain if it is property from which sanitary sewage emanates, and is refused such entry, the owner or operator shall make complaint in writing to any judge. The judge may issue a warrant directed to the sheriff commanding him to take sufficient aid to enter upon the property for the duration required to enforce the provisions of this act. (Dean-Fla)
W69-06137

REGULATION OF USE OF WATER RESOURCES.

NC Gen Stat sec 143-215.11 to 215.37 (1967 Supp).

Descriptors: *North Carolina, *Administrative agencies, *Groundwater, *Surface water, Dams, Regulation, Permits, Real property, Dam construction, Design, Operation and Maintenance, Engineering structures, Legislation.
Identifiers: Capacity use areas, Penalties (Criminal).

The Board of Water Resources is authorized to determine 'capacity use areas.' These are areas where use of groundwater and surface water have developed so as to require regulation or where such uses threaten to exceed renewal or replenishment levels. Procedures are set out for such declarations. The Board may make regulations within these areas. Permits must be acquired from the Board for withdrawals in excess of 100,000 gallons per day within capacity use areas. The right to notice and hearing is provided for. Duration of permits, transferability of permits, reports by permitees, and penalties for violations are provided for. The Board has right of entry upon all lands in performance of

its duties. This statute is not to be construed as modifying the riparian doctrine. Sections 215.23 et seq constitute the Dam Safety Law of 1967. Application must be filed with the Department before any person begins construction of a dam. Certain federal dams are exempt. Application must also be made before commencing any repair, alteration, or removal of a dam. Projects must be supervised by qualified engineers, and these engineers may be required to report to the Department. Upon completion of the project, notice must be given to the Department, accompanied by drawings and descriptive matter. The Board is empowered to supervise maintenance and operation of dams and has the right to inspect the structure at any time. (Williams-Fla)
W69-06138

PUBLIC UTILITIES: CARRIERS AND WATER COMPANIES.

Me Rev Stat Ann tit 35, secs 3201-3210, 3241-3252, 3291-3296 (1965); Me Rev Stat Ann tit 35, secs 3241, 3291, 3294 (Supp 1968-69).

Descriptors: *Maine, *Eminent domain, *Public utilities, Legislation, Proprietary power, Aqueducts, Pipes, Administrative agencies, Adjudication procedure, Local governments, Water distribution, Water districts.
Identifiers: *Incorporation, Corporate water company, Contracts, Damages, Injunction, Public utilities commissions.

The first section deals with the incorporation of water companies by proprietors of aqueducts for conveying fresh water into towns. The procedures to be followed in order to incorporate are described. After incorporation the proprietors are to operate in accordance with the corporate charter and by-laws. In addition, the powers and authority of directors and proprietors are enumerated. The statute declares that all contracts made by or with the corporation are in force after its dissolution. Water companies are authorized to exercise the right of eminent domain under the prescribed procedures. The county commissioners are to estimate the amount of the damages to be paid for the condemned land. An appeal of this estimate may be made to the Superior Court. An injunction may be had when damages are not paid within 30 days after they are due. The owner of the property subject to appropriation by eminent domain is allowed to have the necessity of such taking determined by the Public Utilities Commission. (Stewart-Fla)
W69-06139

MUNICIPALITIES: PUBLIC WORKS, DEVELOPMENT.

Me Rev Stat Ann tit 30, secs 5103, 5106 (1965), Me Rev Stat Ann tit 30, secs 5103.6, 5106.9 (Supp 1968-69).

Descriptors: *Maine, *Cities, *Utilities, *Expenditures, Public benefits, Legislation, Local governments, Water supply, Sewers, Drains, Bridges, Flood control, Water districts, Public utility districts, Wetlands, Swamps, Marshes, Fish, Recreation, Fish management, Recreation facilities, Conservation, Financing.

A municipality may raise or appropriate money for public buildings, ways, bridges, parks, parking places, sewers, and drains. It may provide for projects which have been approved by the Governor for improving navigation or preventing property damage by erosion or flood. It may also provide financial assistance to a water or sewer district which is a quasi municipal corporation situated entirely within the municipality. A municipality may raise or appropriate money for the following purposes: (1) to purchase real estate and personal property from the Federal Government for municipal purposes; (2) to provide real and personal property for recreational purposes; (3) to propagate and protect fish in public waters located wholly or partially within its boundaries; and (4) to provide for and acquire open areas, including marshlands, swamps or wet lands, as defined in section 3851. (Heckerling-Fla)
W69-06140

REVENUE PRODUCING MUNICIPAL FACILITIES ACT.
Me Rev Stat Ann tit 30, secs 4251-4264 (Supp 1968-69).

Descriptors: *Maine, *Public utilities, *Public benefits, *Water supply, Income, Sewage disposal, Municipalities, Facilities, Treatment facilities, Rates, Use rates, Contracts, Eminent domain, Local governments, Expenditures, Legislation, Water rates.

The Revenue Producing Municipal Facilities Act grants to a municipality the power to acquire, construct, or improve any revenue producing municipal facility consisting of a water system or a sewer system. It may pledge the revenue derived from any water or sewer system to pay for such systems. The municipality may acquire rights in land or water rights in connection with the construction, etc, of the facility. A municipality has the power to enter on any water to make surveys, soundings, etc. Once a sewage disposal system is in operation, each owner or occupant shall connect with it. (Heckerling-Fla)
W69-06141

DRAINAGE AND WATERCOURSES.
Me Rev Stat Ann, tit 23, secs 3251 to 3255 (1965).

Descriptors: *Maine, *Highways, *Drainage, *Watercourses (Legal), Legislation, Ditches, Drains, Culverts, Roads, Administrative agencies, Local governments, Damages, Bridges, Bridge construction, Road construction, Cities, Roads, Obstruction of flow, Drainage, Permits, Legal aspects.
Identifiers: Penalties (Civil), Public way.

The municipal officers of a town may construct ditches, drains and culverts to carry water away from any highway through any lands when they deem it necessary for public convenience or for proper care of the highway. Such ditches, etc, shall be under the control of said officers, and interference therewith is punishable by a fine or imprisonment. The town is liable for damages to the owner of the land if it does not maintain the ditches, etc. No person not having legal supervision of a public way shall cultivate any portion of the wrought part of any public way so as to change or obstruct drainage. With written permission, any person may maintain a bridge across such ditch or drain for egress or regress to and from lands occupied by him. Violation of any provision of this section subjects the violator to a fine. No road commissioner, without written permission from the municipal officers, shall cause a watercourse to be so constructed by the side of a way as to incommode or obstruct any house or other building. (Heckerling-Fla)
W69-06142

DEPARTMENT OF HEALTH AND WELFARE.

Me Rev Stat Ann, tit 22, secs 1, 3 (1968-69 Supp).

Descriptors: *Maine, *Public health, *Administrative agencies, *Social aspects, Legislation, Water supply, Cities, Water purification, State governments, Water sources, Water quality, Regulation.
Identifiers: *Department of Health and Welfare.

The Department of Health and Welfare shall consist of such bureaus and divisions as may be required to carry out the work of the department. The department shall have the general supervision of the interests of health and life of the citizens of the State. The department shall consult with and advise municipalities and persons and corporations having systems of water supply, as to the most appropriate source of supply and best method of assuring its purity, and shall approve all new water supply sources, purification systems and plants. The Advisory Committee of Health and Welfare shall make investigation of social problems, recommend enactment of laws, advise with reference to the policy of the department, and recommend the issuance of rules and regulations. (Heckerling-Fla)
W69-06143

FISHERIES; CONSERVATION.

Me Rev Stat Ann tit 12, secs 3451, 3452, 3703, 3704 (Supp 1968-69), Me Rev Stat Ann tit 12, secs 3452, 3501, 3503, 3602, 3701, 3702 (1965).

Descriptors: *Maine, *Fish conservation, *Commercial shellfish, *Legislation, Research and development, Clams, Oysters, Mussels, Salmon, Land classification, Environment, Epizootiology, Aquatic environment, Legal aspects, Water pollution, Dams.

Section 3452 permits the fisheries department to take shellfish from polluted waters and to experiment in an effort to find a commercially feasible method for purifying them to salable grade. The Commissioner of Sea and Shore Fisheries may inspect and close any shores or waters which are found to be polluted. This may be done without first conducting a public hearing. Section 3602 empowers the Salmon Commission to purchase or lease any lands, dams, and flowage rights which are needed to promote the conservation of salmon. Sections 3701-3703 permit the commissioner to take any flats or waters needed for research relative to fish, provided the amount of land taken shall not be over 2 acres in any one location and the written permission of adjacent riparian owners is obtained prior to such appropriation. Areas larger than 2 acres may be taken under written lease from the owner. It is unlawful to take any marine species from such research areas. (Blunt-Fla)
W69-06144

HATCHERIES, SCREENS AND GAME MANAGEMENT AREAS.
Me Rev Stat Ann tit 12, secs 2151-2153, 2155 (1965); sec 1951 (1968-69 Supp).

Descriptors: *Wildlife management, *Fish management, *Maine, *Legislation, Fisheries, Public benefits, Recreation, Lakes, Ponds, Streams, Marshes, Condemnation, Natural resources, Public lands, Hunting, Boating, Fishing, Camping, Parks, Regulation.

The commissioner for the location, construction, maintenance, and operation of a game management area, fish hatchery, or feeding station may acquire and survey property for such purposes in the name of the state. The United States Fish and Wildlife Service may conduct such fish culture operations and scientific investigations in the waters of the state as it deems necessary. The state may authorize, alter, or remove the screening of any inland waters, and may make provision for passage of logs and pulpwood, may prohibit fishing in the vicinity of the screens, and may punish for injury to screens. The state commissioner may regulate hunting, fishing, trapping, boating, camping, and other public use of game management areas. This authority extends to lakes, ponds, marshes, and sections of streams lying within the area. The Commissioner may sell the natural products of the land for the state. The Commissioner of Inland Fisheries and Game is appointed by the governor and may designate a deptuy. The Commissioner serves a term of three years and must make annual reports to the governor. (Kelly-Fla)
W69-06145

FORESTS, PARKS, LAKES, AND RIVERS.
Me Rev Stat Ann Tit 12, secs 501, 504, 514 (1968-69 Supp).

Descriptors: *Maine, *Forest management, *Legislation, *Public lands, Legal aspects, Forestry, Lumber, Ponds, Islands, Submerged lands, Camp sites, Ownership of beds, Dams, Dredging, Waste disposal, Riparian rights, Bridges, Great ponds.

A Forest Commissioner shall be appointed by the governor. He must be trained as a forester or be skilled and experienced in the care and preservation of forest lands. He may not have direct or indirect interest in the purchase of state land when he is appointed or during his term of office. The commissioner has supervisory and administrative control over the public domain including unconveyed islands, unconveyed land beneath great ponds, and other lands the management of which is not provided for by law. The commissioner may sell timber rights, grass rights, and gravel for highways or other public use. He may lease camp sites, mill privileges, dam sites, flowage rights, and certain construction privileges. He may grant mining rights and permits for dredging and waste disposal, provided adequate hearings are given and abutting owners and affected water users receive notice. He may further grant permits to riparian owners for construction of causeways, bridges, marinas, or fills, provided the statutory requirements are met. (Kelly-Fla)
W69-06146

PALMER V MASSENGILL (OBSTRUCTION TO FLOW OF ARTIFICIAL WATERCOURSE).
58 So 2d 918-922 (Miss 1952).

Descriptors: *Mississippi, *Surface runoff, *Obstruction to flow, *Artificial watercourses, Damages, Surface waters, Drainage systems, Drainage, Relative rights, Watercourses (Legal), Water law, Judicial decisions, Dams, Alteration of flow, Ditches, Dam construction, Backwater, Channels, Surface drainage, Repulsion (Legal aspects).

Plaintiffs brought action for damages allegedly due to defendants' construction of a dam across their lands which caused flooding of the adjacent lands of plaintiff. The dam was built following plaintiffs' construction of an artificial water channel on their land which increased surface water flow onto defendants' land. The lower court held for the defendant, and this court affirmed. The law regarding natural watercourses was found inapplicable. The court held that defendants' action was reasonable even though a drainage ditch at the base of the dam on defendants' side could have been placed on plaintiffs' side. Had the ditch been so placed, the excess water would have been carried off. (Wheeler-Fla)
W69-06147

HERMANSEN V CITY OF LAKE GENEVA (RIPARIAN RIGHT TO REQUIRE REMOVAL OF PIERS).
272 Wis 293, 75 NW 2d 439-444 (1956).

Descriptors: *Piers, *Wisconsin, *Riparian rights, *Ownership of beds, Riparian waters, Water law, Judicial decisions, Relative rights, Riparian land, Competing uses, River beds, Banks, Legal aspects, Preferences (Water rights), Docks.
Identifiers: Injunctions (Mandatory).

Plaintiffs brought action against defendant municipal corporation, alleging that maintenance of piers and boat slips on the edge of property claimed by plaintiffs constituted an invasion of riparian rights. Plaintiffs asked that defendant be permanently enjoined from further interference with plaintiff's lawful activities. The court held for the plaintiff, emphasizing the fact that plaintiffs had title to the shore property while the state owned the river bed. Riparian rights rest on title to the shore, not upon title to the underwater soil. Clearly the state did not possess the rights of a riparian owner. This being so, the continued maintenance of the piers and boat slips constituted an invasion of plaintiff's riparian rights. The permanent injunction was properly entered. (Wheeler-Fla)
W69-06148

SAELENS V POLLENTIER (SUIT TO ENJOIN DEFENDANT'S INTERFERENCE WITH THE FLOW OF SURFACE WATERS).

7 Ill 2d 556, 131 NE 2d 479-483 (1956).

Descriptors: *Illinois, *Prescriptive rights, *Surface drainage, *Ditches, Surface waters, Drainage, Easements, Watercourses (Legal), Channels, Natural streams, Water law, Judicial decisions.

Surface waters flowed from plaintiffs' to defendants' property by means of a 50 year-old ditch running across both pieces of land. Defendants had attempted to fill in the ditch where it entered their property. Action was brought to enjoin defendants' interference with the flow of surface waters. In finding for the plaintiffs the Illinois Supreme Court held that where, for over fifty years and since construction of a railroad, a ditch had existed across defendants' land through which water from plaintiffs' land had drained, defendants' land was subject to a prescriptive easement of drainage. That the ditch in question was an artificial ditch rather than a natural stream was held to be immaterial. (Logan-Fla)
W69-06149

LEWIS V CLARK (CREEK BED AS PROPERTY BOUNDARY).
133 NYS 2d 880-900 (SC 1954).

Descriptors: *Boundaries (Property), *Streams, *Accretion, *New York, Lakes, Flood protection, Dredging, Channel excavation, Thalweg, Legal aspects, Judicial decisions, Gravels, Sediments, Banks, Ownership of beds, Riparian rights, Riparian lands, Beds under water, Relative rights.
Identifiers: Presumptions.

Plaintiffs sought to perpetually enjoin defendants from entering upon their lands and from dredging in or along the creek embankment constituting the common boundary between the litigants' properties. The defendants denied that the plaintiffs owned up to the center line of the creek and, therefore, alleged that the rights claimed to have been violated actually did not exist. The court held that where a deed purports to convey property bordering on a small inland body of water, a very strong presumption arises that the grantor intended to convey his ownership under water, at least to the center, and that nothing short of an express reservation will overcome the forces of such presumption. The plaintiffs were held to be seized of the creek bed subject to an easement in favor of the public for navigational purposes. A permanent injunction was issued to prevent further dredging operations. Accreted lands resulting from the defendants' dredging operations were found to inure to the plaintiffs, as such accretions accumulated on their side of the creek bed. (Katz-Fla)
W69-06150

JEFFERSON V DAVIS (OWNERSHIP OF SUBMERGED POND LAND).

25 N J Super 135, 95 A 2d 617-625 (1953).

Descriptors: *New Jersey, *Ponds, *Boundaries (Property), *Underwater, Judicial decisions, Legislation, Legal aspects, Bodies of water, Taxes, Easements, Relative rights, Real property.
Identifiers: Deeds, Land descriptions.

Plaintiffs sought to have set aside and cancelled a certificate of redemption from a tax sale of submerged pond land, and to have their tax sale certificate reinstated. The asserted ground for such relief was that defendants failed to meet statutory definition of owners entitled to redeem. The issue was whether defendants acquired title to the land beneath the pond or merely an easement to pond water. The court found for plaintiffs, holding that defendants' grantors intended to grant no more than an easement and that, therefore, defendants were not 'owners' entitled to redeem. Evidence pointing toward an intent to grant merely an easement included a prior deed which described the land conveyed as that parcel up to the edge of the mill pond, but did not describe land under the pond. (Wheeler-Fla)
W69-06151

STANDARD WAREHOUSE CO V ATLANTIC COAST LINE RR (NEGLIGENT CONSTRUCTION AND MAINTENANCE OF A DRAINAGE SYSTEM).

71 SE 2d 893-897 (SC 1952).

Descriptors: *Discharge (Water), *South Carolina, *Pipes, *Drainage systems, Hydraulic structures, Storm drains, Surface drainage, Canals, Runoff, Storm runoff, Watercourses (Legal), Natural streams, Judicial decisions, Legal aspects, Surface waters.

Plaintiff brought suit for money damages and injunctive relief, predicating its cause of action on the following theories: (1) that the defendant, by means of a drainage system erected along its right of way, collected surface waters in time of storm and discharged them upon the appellee's property through an open gap in its drainage pipe; (2) that the defendant constructed its railroad cut and embankment and, its drainage system in a reckless and negligent manner so as to discharge water on appellee's land; (3) that defendant diverted a natural watercourse, or a canal which had been substituted therefor, by encasing it in inadequate pipes; and (4) that defendant's inadequate drainage system and roadbed facilities constituted a nuisance, continued maintenance of which should be enjoined. These issues were submitted to a jury, and a verdict was returned in favor of the defendant. The trial judge entered judgment for the plaintiff but was reversed by the supreme court, which reinstated the jury verdict. (Katz-Fla)
W69-06152

FIFE V CHESAPEAKE AND OHIO RR (NON-LIABILITY FOR ACTS OF GOD).
307 Ky 541, 211 SW 2d 854-857 (1948).

Descriptors: *Kentucky, *Obstruction to flow, *Flooding, *Surface drainage, Culverts, Cloudbursts, Flood damage, Judicial decisions, Backwater, Legal aspects, Damages, Relative rights, Remedies, Surface runoff, Landfills, Alteration of flow.
Identifiers: *Act of God, *Box culvert, Proximate cause.

Plaintiff brought suit to recover damages for injury to plaintiff's home and personal property caused by flooding allegedly due to defendant's negligence. Plaintiff lives in a hollow, the mouth of which was filled by defendant. A drainage culvert was then constructed. Plaintiff alleged that the culvert was wholly insufficient for natural drainage of the hollow and water backed up on plaintiff's land. At trial, defendant offered evidence to show that the damage was due to an act of God which defendant could neither control nor anticipate. The judge below directed a verdict for defendant based on the evidence adduced. The court of appeals held that where evidence showed plaintiff's land was higher than the fill and that flood waters were still several feet above plaintiff's land, no construction of the culvert could have prevented the damage caused by the act of God in the form of heavy rains. The directed verdict was affirmed. (Harris-Fla)
W69-06153

BELVEAL V H B C DEVELOPMENT CO (OBSTRUCTION OF NATURAL WATERCOURSE AND CONCENTRATION OF FLOW).

279 SW 2d 545-555 (Ct App Mo 1955).

Descriptors: *Missouri, *Obstruction to flow, *Natural streams, *Alteration of flow, Surface waters, Relative rights, Dams, Flooding, Surface

drainage, Springs, Lakes, Settling basins, Natural flow doctrine, Judicial decisions, Fish stocking, Fertilization contours, Common enemy rule, Legal aspects.
Identifiers: *Concentration of surface drainage, *Higher land, *Servient land, Upper landowner, Lower landowner.

Plaintiff alleged that a spring-fed natural watercourse originated on adjacent land and flowed over his land. Plaintiff constructed two dams at the lower end of a ravine on his land, creating an artificial lake and a settling basin to feed clear water into the lake. Plaintiff stocked and fertilized the lake, and constructed beaches on it. Plaintiff alleged defendant purchased the adjacent land above plaintiff's and in constructing a housing project and street, obstructed the natural watercourse which supplied the lake. He further alleged that defendant collected surface drainage and released it in large quantities onto plaintiff's land, causing erosion and deposit of debris in the lake. The trial court awarded damages to plaintiff. Reversing on procedural points, the court of appeals defined 'natural watercourses' as usually flowing in a particular direction, with a bed, banks and discharging into another body of water; but not surface water flowing in natural hollows after the rains. The court further stated the law that a higher landowner may not collect and concentrate the 'common enemy' surface water and release it on the servient estate. (A discussion of damages also was made.) (Harris-Fla)
W69-06154

GRISWOLD V TOWN SCHOOL DISTRICT (DAMAGE TO SPRING).

88 A 2d 829-831 (Vt 1952).

Descriptors: *Vermont, *Springs, *Eminent domain, *Underground streams, Judicial decisions, Artesian wells, Groundwater, Groundwater movement, Spring waters, Streams, Subsurface waters, Percolating water, Subsurface flow, Condemnation, Compensation, Legal aspects.

Plaintiff owned a spring and an aqueduct leading therefrom. The spring was located on defendant's land and supplied water for plaintiff's domestic use. The spring was fed by an underground stream flowing in a definite channel. Defendant, while exploring for water for a public school, exploded dynamite near the spring, diverting the flow and rendering the spring useless. The trial court dismissed plaintiff's action against defendant. In reversing the decision, this court held that the right to take water from a spring located on the land of another is a property right. Since the water supplying the spring flowed in a definite underground channel, it was not subject to the rules pertaining to percolating water. Defendant could not interfere with plaintiff's property rights by unlawful diversion of the water. The defendant could not claim governmental immunity from liability since the immunity does not apply when the injury complained of is taking private property without compensation. A property owner may only be excluded from the beneficial use of his property by eminent domain, and he must receive compensation for the exclusion. (Helwig-Fla)
W69-06155

WHEATLEY V CASS COUNTY (DIVERSION OF NATURAL FLOW OF FLOOD WATERS BY THE STATE FOLLOWED BY SUBSEQUENT RESUMPTION OF SAME FLOW).
31 NW 2d 871-875 (Iowa 1948).

Descriptors: *Floodwater, *Drainage systems, *Iowa, *Culverts, Flood control, Streams, Watersheds (Divides), Surface waters, Hydraulic structures, Drainage engineering, Water spreading, Highways, Embankments, Roadbanks, Road construction, Irrigation ditches, Grading, Judicial decisions, Legal aspects, Artificial watercourses, Natural streams.

Prior to 1937, appellant's lands were subject to periodic flooding by surface waters from an upper estate. In 1937, the state constructed a graded highway which separated the dominant and servient estates and made drainage control of the runoff feasible. Later, such control measures were actually undertaken by the appellants. Eleven years later, the county proposed to install a culvert beneath the highway. The result of this installation would be to return the servient estates to the pre-1937 norm of periodic flooding. The appellants sought injunctive relief, alleging that the county was equitably estopped from installing the culvert and that material damage would result. The trial court refused to grant the injunction. The supreme court affirmed the lower court's decision, stating that the appellants had failed to adequately demonstrate the likelihood of irreparable damage to their property in excess of the pre-1937 level. The court also held that the equitable estoppel will only be where a fraudulent act or result is established, and that reliance alone is not sufficient to constitute an estoppel. The court noted that the artificial ditch in controversy could not become a natural watercourse by passage of time since prescriptive rights cannot be claimed or urged against the public. (Katz-Fla)
W69-06156

NUNNINGHOFF V WISCONSIN CONSERV COMM'N (ACTION TO SECURE LICENSE FOR USE OF PRIVATE LAND UNDER NAVIGABLE WATERS).
255 Wis 252, 38 NW 2d 712-716 (1949).

Descriptors: *Permits, *Navigable waters, *Riparian rights, *Muskrats, Reasonable use, Farms, Beds under water, Ownership of beds, Dams, Streambeds, Natural use, Running water, Standing waters, Judicial decisions, Wisconsin, Legal aspects, Water law, Submerged lands.

Appellant challenged appellee's right to a license to operate a muskrat farm utilizing part of the navigable waters of the Wisconsin River. The lands under the navigable waters were owned by appellee; the waters had become navigable due to construction of a dam downstream from appellee's land. Appellant, the state conservation commission, contended that the statute authorizing licensing of lands for muskrat farms was intended to include only those under private waters. The court found that the waters in question were navigable since they were usable for limited navigation during certain periods of the year. The court held, however, that a riparian owner has the right to make reasonable use of abutting navigable waters, and that, since appellee owned the submerged land, he could use it for the purpose of muskrat farming. Use of the bed for float trapping was found not to be incident to navigation. The court decided that appellee's use of the land and waters would not restrict navigation and permitted the licensing. (Kelly-Fla)
W69-06157

STATE V LONGYEAR HOLDING CO (ACTION TO DETERMINE RIGHTS TO ORE BENEATH LAKE BED).
29 NW 2d 657-673 (Minn 1947).

Descriptors: *Navigable waters, *Riparian rights, *Ownership of beds, *Property boundaries, Judicial decisions, Minnesota, Low water mark, Watercourses (Legal), Accretion (Legal aspects), Lakes, Mining, Public benefits, Beds under water, Channels, Iron, Docks, Legal aspects, State governments, Contracts.

The State of Minnesota brought this action to determine the merit of adverse claims to a lake bed below the low water mark. The state had made an agreement with a mining company whereby the company was to temporarily drain the lake, mine deposits of iron ore from its bed, and refill it. This court upheld the lower court's decision that the state had absolute rights to the ore on the ground that the lake was a navigable watercourse under the state's control. The court determined navigability by the de facto capability of the lake to support water traffic. The fact that the usability of the lake for navigation was limited and that, in fact, the lake was not used for navigation had no bearing since capability of use, rather than actual use, is the controlling test. The riparian owners were found to be entitled to compensation for deprivation of their right to use the lake. Their claims to royalty proceeds from the mining operations, however, were dismissed since they have no vested interest in the lake bed itself. (Kelly-Fla)
W69-06158

CARPENTER V OHIO RIVER SAND AND GRAVEL CORP (ACTION TO ENJOIN DREDGING ON PROPERTY BELOW PRESENT WATER LINE, BUT ABOVE OLD LOW WATER MARK).
60 SE 2d 212-217 (W Va 1950).

Descriptors: *Boundaries (Property), *Low water mark, *Ohio River, *Riparian lands, Surveys, West Virginia, Judicial decisions, Dredging, Beds under water, Federal government, Dams, Riparian rights, Locks, Navigable waters, Legal aspects, High water mark, Rivers, Sands, Banks.

Plaintiff, a riparian owner, sought to enjoin defendant corporation from dredging sand and gravel which allegedly was located on plaintiff's property. The supreme court found for the plaintiff, holding that plaintiff's land extended to the low water mark of the Ohio River. The low water mark was defined as the lowest level of the river prior to construction of certain locks and dams by the federal government. The trial court erred in measuring the low water mark since it used surveys conducted subsequent to the dam and lock erection. The supreme court reversed and remanded, directing the lower court to enjoin further dredging and to make specific findings on the issue of damages. (Kelly-Fla)
W69-06159

KIMBERLY V PRESLEY (TITLE TO ACCRETED MATERIALS).
245 SW 2d 72-75 (Miss 1952).

Descriptors: *Missouri, *Boundaries (Property), *Accretion (Legal aspects), *Banks, Riparian rights, Riparian land, Legal aspects, Judicial decisions, Streams, Erosion, Remedies, Scour, Degradation, Alluvium, Silts, Colluvium, Relative rights, Islands.

Plaintiff brought action in ejectment and to quiet title to certain accreted land lying between defendants' island which was situated in a river, and plaintiff's land, which abutted on the river. The trial court held that title to the accreted land was in defendants, and the supreme court affirmed. The supreme court opinion focused on the narrow factual determination of to whom the lands in question accreted. The evidence demonstrated that the accretions were silt deposited by slough and river waters, and that they were peculiarly attributable to dredging and sand pumping operations carried on by the government. These accreted materials were found to be property of the defendant island owned. (Katz-Fla)
W69-06160

BEGNAUD V GRUBB AND HAWKINS (ACTION TO DETERMINE NAVIGABILITY OF BAYOU AS TEST OF OWNERSHIP).
209 La 826, 25 So 2d 606-619 (1946).

Descriptors: *Louisiana, *Navigable water, *Nonnavigable waters, *Ownership of beds, On-site investigations, Judicial decisions, Legal aspects, Silting, Sedimentation, Saline water, Riparian rights, Riparian lands, Mapping, Peat, Soil erosion, Geologic formations.

The basis of appellee's original claim was that a bayou passing through his land was not a navigable

stream and, therefore, that the title to the streambed vested in him rather than in the state. The supreme court agreed that if the stream was non-navigable the riparian owner was entitled to ownership of the bed to the thread or middle of the stream. The court traced the chain of title to the land in question and found that appellee's deed was valid. The court then examined and discussed extensive evidence regarding the navigability of the bayou in 1812, when Louisiana entered the Union. Appellant urged that the effects of erosion, the increase of water salinity, and the presence of fossil layers indicated that the bayou was navigable in 1812 and that the title to the bed should remain in the state. The court, however, found appellee's evidence was more convincing and held that the bayou was disconnected from the river, shallow, choked with vegetation, and that it had been in this condition for hundreds of years. Judgment for appellee was affirmed. (Kelly-Fla)
W69-06161

KEYTON V MISSOURI-KANSAS-TEXAS RR (ACTION FOR DAMAGES CAUSED BY OBSTRUCTING NATURAL FLOW OF SURFACE WATER).
224 SW 2d 616-623 (Ct App Mo 1949).

Descriptors: *Obstruction to flow, *Flood damage, *Surface waters, *Missouri, Drainage engineering, Drainage, Floods, Natural flow, Ditches, Water conveyance, Hydrologic cycle, Water levels, Snow, Rain, Springs, Soil erosion, Judicial decisions, Legal aspects, Surface runoff.

Appellant brought this action against appellee railroad, alleging that appellee's roadbed was constructed above ground level and that it acted as a dam, causing water to back up over appellant's fields and ruin his crops. Appellant further contended that an improperly designed culvert built by appellee was not adequate to handle the water flow and to conduct it into natural drainage ditches on the other side of the roadbed; this condition eventually caused washouts and soil erosion on that side. Appellant's defended on the ground that appellee's land would have been flooded by unobstructed surface water whether the roadbed existed or not, and that natural drainage was inadequate to handle this surface water. The appellate court found that appellee's defense was too generally stated and that the jury had been improperly instructed. The court distinguished 'surface waters' from 'general overflow,' stating that indiscriminate use of these terms results in confusion of the jury. The former term refers to all water diffused over the ground and not in any natural watercourse; the latter term includes only surface waters which overflow from a natural watercourse. (Kelly-Fla)
W69-06162

CASANOVER V VILLANOVA REALTY CO (DIKE REMOVAL AND RUNOFF).
209 SW 2d 556-560 (Ct App Mo 1948).

Descriptors: *Surface runoff, *Overland flow, *Silt, *Missouri, Diversion dam, Dikes, Erosion, Slopes, Runoff, Sediments, Clays, Drainage systems, Legal aspects, Judicial decisions, Easements, Floods, Grading, Repulsion (Legal aspects), Relative rights, Riddance (Legal aspects).

Plaintiff brought action seeking an injunction to restrain defendant from permitting flowage of surface water and silt from its land onto the plaintiff's lower land and to recover for injuries previously caused by such flowage. Plaintiff also sought to recover for an alleged trespass by the defendant in connection with certain grading activities which set the flow in motion. The court recognized that the 'common enemy' doctrine applied in Missouri That doctrine recognizes the right of a landowner to protect his property from surface water flow by whatever means possible, even though by such actions he should divert water onto the land of his neighbor. This right is qualified in that the owner of higher land cannot collect the surface water and then discharge it upon his neighbor's estate. The court awarded damages for the trespass which occurred during the grading operations and denied injunctive relief as to future flowage. The evidence indicated that steps had been taken by defendant to prevent such future flowage. Damages for flooding were not awarded due to appreciation of the common enemy doctrine. (Katz-Fla)
W69-06163

TOBIAS V TOBIAS (SUIT TO ENJOIN EXERCISE OF RIPARIAN RIGHT TO FISH IN LAKE).
345 Mich 263, 75 NW 2d 802-804 (1956).

Descriptors: *Michigan, *Riparian rights, *Lakes, *Fishing, Water law, Judicial decisions, Bodies of water, Ownership of beds, Iced lakes, Boundary disputes, Recreation, Riparian land, Riparian waters, Third party effects, Legal aspects.
Identifiers: Injunctions (Mandatory), Estoppel.

Plaintiffs brought suit in equity to enjoin defendants from exercising their riparian right to fish in a lake. Dispute arose when defendants, who owned land adjacent to plaintiffs' allowed others to fish in the lake. The issue at trial was whether the lake shore was owned completely by plaintiff. A fence had been placed on winter ice, separating defendants' property from the larger portion of the lake. The trial court ruled in favor of defendants. On appeal, plaintiffs contended that defendants' acquiescence in the erection of the fence estopped them from asserting any riparian rights at this point. The appellate court affirmed the lower court, holding that evidence was sufficient to support a finding that defendants owned some part of the lake shore and that riparian rights attaching by virtue of such ownership included the right to allow others to fish in the lake. The court dismissed the estoppel claim, ruling that plaintiffs had not shown detrimental reliance on defendants' failure to assert his rights. Further, the record tended to show that the parties mutually undertook to erect the fence in order to keep defendants' cattle from crossing the lake and that the strand wire construction did not prevent others from entering the lake. (Wheeler-Fla)
W69-06164

IMPROVED REALTY CORP V SOWERS (ADVERSE POSSESSION OF POND).

195 Va 317, 78 SE 2d 588-593 (1953).

Descriptors: *Virginia, *Prescriptive rights, *Relative rights, *Non-navigable waters, Ponds, Competing uses, Riparian land, Lake fisheries, Negotiations, Boating, Fishing, Legislation, Riparian rights, Boundaries (Property).
Identifiers: *Adverse possession, *Statute of limitations, Marketable title.

Plaintiff vendor brought suit for specific performance of a written contract for the sale of real estate adjoining a fish pond. While plaintiff had no record title to the pond, he claimed ownership by prescription of the exclusive fishing rights. The parcels of land surrounding the pond were owned by several different persons. The court noted that this fact made the establishment of prescriptive rights by plaintiff peculiarly difficult of proof. In the case of inland lakes where the titles of the several riparian owners include the land covered by the water, they may, together with their lessees and licensees, use the surface of the lake for boating and fishing, so long as they do not interfere with the reasonable use of the water by other riparian owners. Since this is so, the evidence of possession here does not establish such title as equity ought to compel the defendant to accept. Possession and use of the surface of the lake by Plaintiff is consistent with his rights as a riparian owner and is not, in this situation, such open and notorious adverse use as to start the running of the prescriptive period. (Reed-Fla)
W69-06165

CITY OF MACON V CANNON (SURFAC WATER RUNOFF).

89 Ga App 484, 79 SE 2d 816-826 (1954).

Descriptors: *Georgia, *Storm drains, *Floodin *Drainage water, Subsurface drains, Drainage en gineering, Highways, Roadbeds, Drainage system Overland flow, Natural flow doctrine, Precipitatio excess, Rainwater, Storm runoff, Legal aspects, Ju dicial decisions, Local governments.

Plaintiff brought action to recover for damage resulting from defendant city's maintenance of nuisance. The alleged nuisance consisted of a sewe beneath plaintiff's land which lacked the capacit to handle increased surface runoff. Judgment wa entered for the plaintiff and city appealed. Th reviewing court affirmed the lower court, holdin that the evidence presented by the plaintiff was su ficient to establish: (1) that plaintiff's premise became flooded even during normal rain due to th inadequate capacity of the sewer; (2) that the pav ing of a nearby highway greatly increased the ru noff into the sewer in question; and that (3) the cit was guilty of maintaining a nuisance by failure t enlarge the sewer system after notification by plain tiff of the increased flowage into the sewer. (Katz Fla)
W69-06166

TAYLOR V HARRISON CONSTR CO (ARTIFI CIAL INCREASE OF SURFACE WATERS).
178 Pa Super 544, 115 A 2d 757-760 (1955).

Descriptors: *Pennsylvania, *Drainage water *Surface waters, *Invasion, Drainage systems, Sur face runoff, Groundwater, Rainfall-runoff relation ships, Diffused surface water, Precipitation excess Slopes, Storm runoff, Standing waters, Earth fills Judicial decisions, Legal aspects.
Identifiers: *Negligence, *Upper landowners *Lower landowners.

Plaintiffs brought suit to recover damages for inva sion of the use and enjoyment of their land caused by defendant's interference with the flow of surface water. While constructing a plant near the foot of a hill below the plaintiffs' property, the defendant at tempted to obtain permission to deposit excavated dirt on the property of all the neighboring landowners. The plaintiffs refused and as a consequence a bank of earth was erected along the base of plaintiffs' property. It was then necessary for defendant to install drain pipes at considerable expense to provide drainage from the higher ground. Nevertheless, the flow of the surface water was sometimes impeded during heavy rainfall causing pools of water to accumulate on the plaintiffs' property. The court upheld the trial court ruling in favor of the defendant on the basis of the jury finding that the invasion was neither intentional nor unreasonable. The defendant did not obstruct the natural flow nor did he gather surface water and discharge it upon the land of the plaintiffs. A lower landowner may shut out the flow of surface water without liability to an upper landowner so long as he does not proceed negligently. (Stewart-Fla)
W69-06167

RICHARDSON AND BASS V BOARD OF LEVEE COMM'RS OF THE ORLEANS LEVEE DIST (ADVERSE POSSESSION).

226 La 761, 77 So 2d 32-39 (1954).

Descriptors: *Louisiana, *Mississippi River, *Boundaries (Property), *Prescriptive rights, Riparian rights, Riparian lands, Easements, Administrative agencies, Streams, Real property, Remedies, Hydraulic structures, Spillways, Mineralogy, Judicial decisions, Legal aspects.
Identifiers: Concursus proceeding.

Plaintiff brought a concursus proceeding to determine which of two rival claimants was entitled to certain mineral royalties by virtue of being the true owner of a certain piece of land. The defendants

claimed the disputed property through their remote ancestor, and the court admitted that their chain of title was clear. The defendant Levee Board claims the property by adverse possession, asserting that the defendant had not disturbed the maintenance by the Board of a spillway on the property during the prescriptive period. The court found for the defendant, stating that there are certain showings which must be made in order to establish title by adverse possession. These are: (1) good faith on part of the possessor; (2) a little translative of the property; (3) possession during the time required by law; and (4) an object which may be acquired by prescription. The court held that the Board had failed to demonstrate that it was possessed of title translative of the property and that it had acted in good faith. (Katz-Fla)
W69-06168

LYDA V TOWN OF MARION (UNAUTHORIZED DRAINAGE DITCHES HELD TAKING OF PRIVATE PROPERTY FOR PUBLIC USE).

239 NC 265, 79 SE 2d 726-730 (1954).

Descriptors: *North Carolina, *Road construction, *Damages, *Ditches, Compensation, Relative rights, Legal aspects, Culverts, Drainage, Local governments, Land tenure, Judicial decisions, Eminent domain, Condemnation.
Identifiers: Inverse condemnation, Limitation of actions.

Plaintiff property owners brought action for damages allegedly caused by defendant town's street paving operations. Plaintiffs alleged that defendant's workmen constructed culverts and ditches across his land without permission. As a result of the ditching, water was cast onto plaintiffs' land causing injury thereto and allegedly amounting to a partial 'taking' thereof by defendant. Prior to the paving, water ran off the property all along the street and was not concentrated upon plaintiffs' lot. Defendant contended that the claim was barred by a provision in the town charter requiring notice of injury within 180 days. The superior court held for defendant. On appeal, the supreme court held that plaintiffs had failed to make out a case for relief in respect to alleged casting of waters upon the land, since they were barred from asserting a cause of action for continuing trespass by virtue of the limitation clause. The court upheld the second cause of action based on a partial taking of land by the digging of unauthorized drainage ditches. The court reasoned that the town charter limitation did not apply to a claim arising out of physical appropriation of private property for public use. (Harris-Fla)
W69-06169

GREENBURG V CITY OF STEUBENVILLE (DAMAGE CAUSED BY AN ACT OF GOD AND CONCURRENT NEGLIGENCE).

72 NE 2d 125-128 (Ohio Ct App 1945).

Descriptors: *Ohio, *Drainage, *Obstruction to flow, *Diversion, Damages, Legal aspects, Culverts, Cities, Excessive precipitation, Flood damage, Judicial decisions, Precipitation excess, Diversion structures.
Identifiers: *Act of God, *Negligence, Proximate cause, Finding of fact.

Plaintiff sought to recover for injury to two dwellings. The damage was allegedly caused by defendant's obstruction and diversion of a waterway used for drainage and sewage collection. Plaintiff contended that defendant's officers had knowledge that the waterway was in a state of disrepair. Defendant answered, asserting that the walls of plaintiff's dwellings extended into and over the waterway, causing the channel to narrow. Defendant contended that this rendered the waterway insufficient to accommodate rainfall which injured plaintiff's property. A jury returned a verdict for defendant. The court of appeals held that if it could be established that the injury to the plaintiff's property would not have occurred in absence of defendant's negligence, the defendant would be liable. But if the superior force would have caused the damage with or without the negligence, then the defendant's negligence could not be said to have been the direct and proximate cause of the injury and defendant could not be held liable. The court found that the evidence was not sufficient to show an improper finding by the jury below and affirmed the lower court. (Harris-Fla)
W69-06170

ACCURATE DIE CASTING CO V CITY OF CLEVELAND (FLOOD DAMAGE FROM SUBSURFACE DRAINAGE).

113 NE 2d 401-407 (Ohio Ct App 1953).

Descriptors: *Ohio, *Flood damage, *Cities, *Sewers, Drainage systems, Judicial decisions, Flood control, Flood protection, Overflow, Storm drains, Excessive precipitation, Natural flow, Subsurface drainage, Surface waters, Drainage waters, Local governments, Outlets.
Identifiers: *Evidence, Proximate cause.

The plaintiff brought suit to recover for the flooding of his manufacturing plant, allegedly caused by the defendant's negligent sewer construction. The court found that the sewer outlets were not large enough to handle the accelerated water flow from a heavy rainfall. As a result of this condition, water was cast upon plaintiff's land in substantial quantities. The court found that the inadequacy of the drain to handle the accelerated waterflow was the proximate cause of the flooding and entered judgment for the plaintiff. (Stewart-Fla)
W69-06171

TENNESSEE COAL, IRON AND RR V RAY (MINING OPERATION CAUSES DESTRUCTION OF WATER SUPPLY).

28 So 2d 726-729 (Ala 1946).

Descriptors: *Alabama, *Mining, *Water-wells, *Damages, Water supply, Compensation, Land tenure, Legal aspects, Water loss, Judicial decisions.
Identifiers: *Before and after test, Pleading.

As a result of coal mining operations by the defendant, plaintiff's water-well went dry. This left plaintiff's land and dwelling without a water supply unless water was hauled in from the nearest town. No question of liability was raised; it was conceded that the mining operation caused the damage. The supreme court upheld a jury verdict determining the amount of damage by use of the 'before and after test.' Evidence of the value of the land with and without water was conflicting, but the court permitted the jury to base their verdict on their own experience. The court held that compensation for annoyance, discomfort, and inconvenience suffered by the plaintiff was proper if allegations relating thereto were properly pleaded. (Harris-Fla)
W69-06172

GENERAL GEOPHYSICAL CO V BROWN (DESTRUCTION OF WATER-WELL BY GEOPHYSIC EXPLOSIONS).

38 So 2d 703-706 (Miss 1949).

Descriptors: *Mississippi, *Exploration, *Explosions, *Water wells, Damages, Oil industry, Geophysics, Legal aspects, Land tenure, Relative rights, Water loss, Judicial decisions, Permits, Explosives, Seismic studies, Drilling, Seismic waves.
Identifiers: *Trespass, *Negligence, License.

Plaintiff sought damages for the destruction of a water-well on his farm by explosives set off at an unauthorized point on plaintiff's property. Plaintiff alleged that defendant's limited license to make geophysical explorations for oil did not sanction the use of explosives in an area near the well. The defendant geophysical company nevertheless exploded its 'shot-point' 550 feet from the well, and, by virtue of such explosion, plaintiff's well was destroyed. Loss of the well greatly reduced the value of plaintiff's farm land. Following introduction of evidence tending to show that the well had ceased to produce and that wells in general in the area became difficult to tap, the jury found damages in amount of $1000. The Supreme Court affirmed, holding that proof of damage after violation of a limited license sustained a contention that the defendant was a trespasser ab initio. He was thus liable for any damage to the well without regard to the degree of care exercised in his exploration. (Harris-Fla)
W69-06173

CITY OF JACKSON V COOK (COMPENSATION FOR DAMAGES FROM NEGLIGENT DISPOSAL OF DRAINAGE WATER).

58 So 2d 498-504 (Miss 1952).

Descriptors: *Eminent domain, *Mississippi, *Drainage water, *Flood damage, Surface runoff, Ditches, Paving, Storm drains, Cities, Drainage, Damages, Compensation, Pipes, Surface waters, Conduits, Judicial decisions, Discharge (Water), Flooding, Legal aspects.
Identifiers: Constitutions, Negligence.

Plaintiffs owned land within the city of Jackson. In paving a street, defendant built a storm sewer to carry water from the street. The drainage water was discharged upon the surface of the ground some 50 feet from plaintiffs' land. Large quantities of water flowed across plaintiffs' land, causing damage. Plaintiffs brought suit, alleging that defendant, by causing flooding had taken the plaintiffs' property for a public use and was liable for damages under the state constitution. Defendant's motion to require an election of a cause of action was denied. Judgment was entered for plaintiffs. On appeal, the court held that since the negligence charge was an enlargement of the charge of taking without negligence, the two were not inconsistent. The court held that whether the drain pipe emptied into a ditch or onto the ground, and whether the water in fact flooded plaintiffs' land were questions for the jury. If the water drained onto the ground, such disposal was negligent, and anyone damaged thereby had a right to recover on a negligence theory. (Helwig-Fla)
W69-06174

DUVALL V 20TH CENTURY COAL CO (PERCOLATING WATERS).

104 F Supp 725-729 (W D Ky 1952).

Descriptors: *Kentucky, *Drainage water, *Percolation, *Strip mines, Underground mines, Coal mines, Infiltration, Subsurface drainage, Mine water, Mine drainage, Damages, Ditches, Drains, Rainfall, Groundwater movement, Judicial decisions, Legal aspects.
Identifiers: Negligence, Proximate cause, Burden of proof.

Plaintiff brought suit to recover for the destruction of his underground mine. Inundation of the mine was allegedly caused by water from the defendant's ditch. The ditch, containing several feet of accumulated water, was a result of the defendant's adjacent strip mining operations. It was alleged that the percolation of water from the defendant's ditch caused the roof of plaintiff's mine tunnel to fall. The court held that the defendant had a right to the enjoyment of his land. He could use it for any purpose so long as such use did not interfere or invade the rights of his neighbors. The burden was on the plaintiff to prove that the water from the defendant's ditch was the direct and proximate cause of the damage. The origin of percolating water is ex-

tremely difficult to establish. The court entered judgment for the defendant on the ground that plaintiff failed to sustain his burden of proof. (Stewart-Fla)
W69-06175

PETER WENDEL AND SONS V CITY OF NEWARK (DAMAGE FROM ARTIFICIAL DRAINAGE SYSTEM).

46 A 2d 793-794 (NJ Ct Ch 1946).

Descriptors: *New Jersey, *Drainage systems, *Surface drainage, *Storm drains, Cities, Streams, Drainage water, Drainage, Laterals, Artificial watercourses, Ditches, Riparian rights, Outlets, Urbanization, Surface runoff, Culverts, Storm runoff, Navigable waters.

Plaintiff's land was located downstream from defendant's storm drain outlet. Prior to 1928, drainage water from the outlet traveled over undeveloped farm land and emptied into 2 natural books. By the time the water reached plaintiff's land, it was in a navigable state. In 1928, defendant constructed a surface drainage system causing the drainage water to flow in greater quantity and force, inundating portions of plaintiff's land. The court held that where a city deliberately enters upon a scheme of drainage and, by artificial means, casts drainage water on private property which would not otherwise receive such water, it commits a wrong which equity will restrain. (Helwig-Fla)
W69-06176

MAYOR OF AMERICUS V BRIGHTWELL (SURFACE DRAINAGE AND ALTERATION OF FLOW).
90 Ga App 341, 82 SE 2d 732-735 (1954).

Descriptors: *Alteration of flow, *Georgia, *Surface drainage, *Flood damage, Natural flow, Local governments, Rainfall, Surface waters, Obstruction to flow, Watercourses, Diversion, Routing, Cities, Diversion structures, Natural flow doctrine, Drainage water, Topography, Judicial decisions, Legal aspects.

Plaintiff brought action to recover for damage to her land. She alleged that the regrading of an adjacent street had diverted drainage water from its natural course and caused it to flow upon her land in unusual quantities. The defendant contended that the flow was due to the natural topography. The court entered a judgment for the plaintiff. It found that the defendant had gathered the water and diverted it from its natural course onto the land of the plaintiff. Consequently, the defendant was liable for resulting damage to the property. (Stewart-Fla)
W69-06177

AMERICAN BARGE LINE V KOONTZ (TAXATION OF INTERSTATE AND INTRASTATE COMMERCE OVER NAVIGABLE WATERS).
68 SE 2d 56-64 (W Va 1951).

Descriptors: *West Virginia, *Taxes, *State governments, *Transportation, Navigable waters, Income, Judicial decisions, Interstate rivers, Ohio River, Federal government, Legislation, Boats, Regulation, Permits.
Identifiers: *Common carriers, *Interstate commerce, Taxing power, Privilege tax

Plaintiff brought an action to determine whether a tax on the transportation of freight and passengers on navigable waters was valid. The plaintiff was a common carrier engaged in the transportation business on navigable waters. His business included both interstate and intrastate deliveries. The defendant imposed an annual privilege tax on the gross income from the business. The plaintiff contended that the tax was not a lawful exaction under the defendant's taxing power. This contention was based on the fact that the plaintiff had no office in West Virginia nor was any employee stationed there. In addition, since the plaintiff was licensed by the Interstate Commerce Commission, he argues that he was subject to federal laws and regulation. However, the court ruled that, despite the exclusive authority of the federal government to license vessels using navigable waters, certain taxes may be levied and collected by the state. However, the court concluded that the state cannot tax gross income derived from plaintiff's interstate activities. Such a tax would be an unreasonable burden on interstate commerce. The tax imposed on gross income from purely intrastate business was held valid. (Stewart-Fla)
W69-06178

CITY OF JACKSON V ROBERTSON (INJUNCTION AGAINST DISCHARGING DRAINAGE UPON LOWER PROPERTY).

44 So 2d 523-525 (Miss 1950).

Descriptors: *Mississippi, *Surface runoff, *Drainage systems, *Flow augmentation, Surface waters, Overlying proprietor, Drainage water, Culverts, Ditches, Storm drains, Pipes, Legal aspects, Judicial decisions, Relative rights, Riddance (Legal aspects), Jurisdiction, Cities, Flood damage, Flooding, Alteration of flow, Roads.
Identifiers: *Injunction (Mandatory).

Plaintiff owned land which was bounded by public roads and a railway. In 1929, defendant city installed a culvert under one of the roads. The culvert carried drainage water onto plaintiff's lot. The culvert, because it often became clogged, was replaced by a larger drain which increased and accelerated the flow. To remedy this condition, the state and the city installed a still larger culvert which was designed to carry off, by means of a ditch, water flowing onto plaintiff's lot. The new system included a small intake pipe which was to carry water from the drain under the road into the new culvert. The subsequent development of a nearby residential area caused an increase in the flow to the culvert under the road. The intake of the culvert was inadequate to carry off the increased flow with the result that plaintiff's lot was inundated after each heavy rain. The lower court granted plaintiff the mandatory injunction prayed for and commanded that the city adopt measures to prevent the flooding. The appellate court affirmed, holding that no municipal board has the right to create a public nuisance. It further held it is not essential that negligence be shown in order for relief to be granted. (Wheeler-Fla)
W69-06179

CRARY V STATE HIGHWAY COMMISSION (TAKING OF STATUTORY RIPARIAN RIGHTS).

68 So 2d 468-472 (Miss 1953).

Descriptors: *Mississippi, *Riparian rights, *Legislation, *Eminent domain, Condemnation, Oysters, Structures, Riparian land, Legal aspects, Judicial decisions, Bridge construction, Ownership of beds, Public benefits, Damages, Relative rights, Navigable waters, Navigation, State governments, Administrative agencies, Compensation.

A state statute granted to riparian owners along the Gulf of Mexico and the Mississippi Sound the exclusive right to plant and gather oysters and to erect structures up to 500 yards from the shore line. The state began construction of a bridge across the Bay of St. Louis within 500 yards of plaintiff's shoreline. Plaintiffs brought suit against the state alleging that construction of the bridge constituted a taking of their property for a public use in that construction of the bridge at such a location effectively destroyed the riparian rights granted by the statute. The appellate court affirmed a lower court's decision in favor of defendants. The court held that the statute granted only a revocable license which was necessarily subject to the superior right of the state to impose an additional public use upon such property already set aside for a public purpose. The exercise of such right was not a 'taking' requiring the payment of compensation. The court said the statute must be interpreted in light of a section of the state constitution prohibiting the legislature from authorizing the permanent obstruction of any navigable state waters and providing for removal of obstructions whenever the public welfare demands. (Wheeler-Fla)
W69-06180

RESORT DEVELOPMENT CO V PARMELE (OWNERSHIP OF LAND COVERED BY NAVIGABLE WATERS).
235 NC 689, 71 SE 2d 474-480 (1952).

Descriptors: *North Carolina, *Navigable waters, *Public lands, *Ownership of beds, Tides, Bays, Property boundaries, Judicial decisions, Tidal waters, Inlets, Shores, Legislation, State governments, Real property.
Identifiers: *Marketable title, Land-sales contracts.

Plaintiff brought action to compel specific performance of a land sales contract. Defendant contended that the plaintiff did not have a clear and marketable title. The land is located on a sound. At high tide, the land is entirely covered by navigable waters. The court found in favor of the defendant. Its decision was based on the common law rule that beds under navigable waters are owned by the state. In addition, a state statute made it unlawful to enter or convey any land covered by navigable waters. As a result, the court held that the plaintiff could not convey good title to the property since he himself had never received title. The land belonged to the public. (Stewart-Fla)
W69-06181

HOLDEN V MOSER (SURFACE DRAINAGE EASEMENTS).

175 Pa Super 206, 103 A 2d 464-467 (1954).

Descriptors: *Pennsylvania, *Roads, *Surface drainage, *Easements, Judicial decisions, Surface runoff, Relative rights, Drainage systems, Obstruction to flow, Legal aspects, Right of way, Real property.
Identifiers: Injunctions (Prohibitory).

Plaintiff and defendant purchased adjacent land from a common grantor. These parcels of land were once part of a single tract which was divided when the grantor constructed a road separating the two lots. Defendant's northerly portion was made subject to the grantor's right to drain surface water from other portions of the grantor's estate, including the parcel subsequently conveyed to plaintiff. Plaintiffs sought an injunction to restrain any attempt to deny plaintiffs the use of the easement. The court held that the injunction should not issue. The easement to which defendant's land was subjected was not intended to benefit plaintiff's land because at the time it was created plaintiff's land lay beyond the roadway constructed by the common grantor, which created a natural barrier to drainage. (Molica-Fla)
W69-06182

KLOOCK V RUSNACK (VALIDITY OF WATER USE EASEMENT).

164 Pa Super 67, 63 A 2d 377-380 (1949).

Descriptors: *Pennsylvania, *Easements, *Springs, *Water rights, Judicial decisions, Adjudication procedure, Legal aspects, Water contracts, Fresh water, Spring waters.
Identifiers: Deeds.

Representatives of a church brought an action in equity to enjoin the defendants from interfering with the plaintiff's right to use water from a spring

on the defendants' land. The defendants had conveyed the plaintiff's lot to it with an easement to use a spring on the defendants' property. After an order of injunction had been rendered in favor of the plaintiff, plaintiff conveyed its land to a third party. The defendants then petitioned for an order restraining the purchasers from taking water from the spring. The trial court granted the defendants' petition, but the Superior Court of Pennsylvania reversed the lower court. The superior court held that the water rights inured to the benefit of the purchasers of the tract belonging to the church, regardless of the fact that no reference to the water rights was contained in the deed to the purchasers. An easement created by a grant or its equivalent is not lost by failure of a particular deed in the chain of title to refer to the easement. (Watson-Fla)
W69-06183

CLOUGH V STATE (ARTIFICIAL DIVERSION OF NATURAL WATERCOURSES).

208 Misc 499, 144 NYS 2d 392-398 (Ct Cl NY 1955).

Descriptors: *New York, *Natural streams, *Diversion structures, *Appropriation, Judicial decisions, Water rights, Routing, Alteration of flow, Flood control, Natural flow doctrine, Obstruction to flow, Eminent domain, State governments, Riparian rights, Stream flow, Compensation, Watercourses, Structures.

Plaintiff brought suit for damages caused by the defendant's diversion of a creek by the construction of a flood control project. The plaintiff operated a sand and gravel processing plant which was dependent upon a continuous flow of the creek. As a result of the temporary diversion, the plaintiff was forced to shut down his plant. The court rendered a judgment for the plaintiff. It held that because of the diversion of the waters from their natural course, the defendant made a temporary appropriation for which it must make compensation. The court also found that the plaintiff, through lease and contract agreements, had a property interest in the creek and the use of its waters. (Stewart-Fla)
W69-06184

CHESAPEAKE BAY BRIDGE AND TUNNEL DIST V LAURITZEN (ACTION FOR DAMAGES TO SHIP CAUSED BY STRIKING SUBMERGED TOWER).
404 F 2d 1001-1008 (4th Cir 1968).

Descriptors: *Virginia, *Tunnels, *Navigation, *Admirality, Channels, Navigable waters, Charts, Judicial decisions, Legal aspects, State governments, Damages, Remedies, Relative rights, Ships, Low water mark, Bays.
Identifiers: Chesapeake Bay.

Appellee sued the tunnel district for damages caused when its ship struck a submerged light tower affixed to appellant's tunnel beneath Chesapeake Bay. The lower court found that a negligence action could be maintained against the state, that the tower had been negligently maintained and that compensation for damages should be paid. The court of appeals, however, held that the appellee had been contributorily negligent. The ship's master had turned control of the vessel over to a harbor pilot who failed to use any of the navigation devices available to him, relying only on visual markers in the channel. The master, according to the court, was also negligent for failure to post a bow lookout. A lookout could have observed that the vessel was leaving the center of the channel. Since both the master and the tunnel district were negligent, the court apportioned damages according to the applicable rule of admiralty law. (Kelly-Fla)
W69-06185

SOUTHERN RR V JEFFERSON (FLOODING ABOVE RAILROAD FILL).

185 Va 384, 38 SE 2d 334-336 (1946).

Descriptors: *Virginia, *Floods, *Culverts, *Railroads, Flood damage, Damages, Maximum probable flood, Overflow, Flood protection, Alteration of flow, Judicial decisions, Legal aspects, Drainage, Rain, Streams, Natural flow, Natural streams.
Identifiers: Negligence, Proximate cause, Act of God, Duty to act.

Plaintiff brought an action for loss of his barn which was washed away by high waters. Plaintiff maintained that the high waters were caused by the railway company's negligence in not providing a larger culvert under its tracks. The trial court held for the plaintiff, but the Supreme Court reversed. The court stated that although the railway had a duty to provide an adequate culvert to accomodate the natural flow and such abnormal flow as may reasonably have been anticipated, it was not required to anticipate and provide against unprecedented floods and high water. The evidence was sufficient to show that the direct and proximate cause of the loss of the barn was an unprecedented flood which could not reasonably had been anticipated. In addition, the barn would have been lost if there had been no culvert or railway. (Watson-Fla).
W69-06186

KENNEDY V UNION ELECTRIC CO OF MISSOURI (SILT ACCRETION AND FLOODING).

216 SW 2d 756-764 (Mo 1948).

Descriptors: *Missouri, *River beds, *Flood damages, *Dams, Upstream, Channels, Roughness (Hydraulic), Waterflow, Silts, Sedimentation, Riparian rights, Riparian lands, Flooding, Floodwater, Real property, Hydraulic structures, Reservoirs, Legal aspects, Lakes, Streams, Judicial decisions, Precipitation excess, Excessive precipitation, Overland flow.
Identifiers: *Act of God.

Defendant constructed a dam across the Osage River creating a large reservoir known as the Lake of the Ozarks. Plaintiff brought action for damages, contending that the impounding of this body of water slowed the rate of flowage in the Osage River and its tributaries, resulting in the accumulation of great silt deposits in the river and its tributaries. This silt accumulation reportedly raised the stream beds and therefore retarded flowage causing an unprecedented overflow during the year 1943, such overflow flooding plaintiff's building. Defendant disclaimed liability as to damages on the premise that the extraordinary rains of 1943 were vis major. The court recognized that under local law, the term act of God applies only to events so extraordinary in history that no reasonable warning against such events is possible. The court also determined that an act of God combining with an act of man does not exonerate the human actor from liability for ensuing damages. (Katz-Fla)
W69-06188

RONADE ASSOCIATES V DEPARTMENT OF CONSERVATION (DENIAL OF PERMIT TO CONSTRUCTION BUILDING ACROSS STREAM).

7 NJ Super, 72 A 2d 355-360 (NJ Super Ct 1950).

Descriptors: *New Jersey, *Administrative agencies, *Public interest, *Buildings, Legislation, Legal aspects, Construction, Flood control, Permits, Regulation, State governments, Construction, Alteration of flow, Streams, Ownership of beds, Cities, Structures, Water policy, Administrative regulation.

Appellant filed application with the State Department of Conservation and Economic Development for a permit to construct a building over a small stream. A supporting pier in the middle of the stream was required. The stream flowed through appellant's tract of land. Municipalities bordering the stream protested, alleging that, this would interfere with stream flow under flood conditions, cause a dangerous impoundment, and conflict with municipal plans. The Water Policy and Supply Division denied the application, concluding that the granting of the permit would be contrary to public interest, and that the construction would create a flood hazard. The court affirmed the agency's decision, holding that there was sufficient evidence to support the finding that the proposed structure was inimical to life and property of others, and that the agency's determination was not an unreasonable or arbitrary exercise of its regulatory power, but was in furtherance of its police power to promote public safety. (Wheeler-Fla)
W69-06189

PASSAIC VALLEY WATER COMM'N V DEPARTMENT OF CONSERVATION (STATUTORY INTERPRETATION OF EXCESS DIVERSION ASSESSMENT FORMULA).
55 A 2d 225-227 (NJ 1947).

Descriptors: *New Jersey, *Administrative agencies, *Legislation, *Water allocation (Policy), Water supply, Municipal water, Water control, Water management (Applied), Watershed management, Judicial decisions, Legal aspects, Withdrawal, Diversion, Water utilization, Rivers, Streams, Streamflow.

The State Department of Conservation denied a request of a local water supply and distribution commission for reduction of charges for excess water diversion from a river watershed during a particular year. The only issue before the court was the proper judicial construction of the applicable state statute in order to determine the lawful formula on which the state agency could base its assessment. The court ruled that the assessment was erroneous, even though the contested formula had been adopted in charges made to other diverters over a period of years. The court said the legislature intended to increase the assessment for excess diversion proportionally as the stream flow was decreased by reason of the diversion. By the express wording of the statute, the assessment was to be based on the average daily flow for the driest month as shown by existing records or, if no records exist, then on a fixed formula. The assessment was set aside, and the agency ordered to compute its assessment on the basis of the flow of the driest month, since records were available. (Wheeler-Fla)
W69-06190

GROBERT V PASSAIC VALLEY WATER COMM'N (RIGHT TO DIVERT RIVER WATER - AMOUNT).
61 A 2d 166-167 (NJ 1948).

Descriptors: *New Jersey, *Administrative agencies, *Water management (Applied), *Water utilization, Withdrawal, Water supply, Relative rights, Judicial decisions, Diversion, Streamflow, Easements, Legal aspects, Average flow, Average, Prior appropriation, Grants.
Identifiers: Peak diversion.

The Court of Errors and Appeals remanded the case of Grobart v Passaic Valley Water Commission, 134 N J L 325, 47 A 2d 600, to the Supreme Court to take proofs and determine whether the Passaic Valley Water Commission, the appellant, had the derivitative right to divert 75,000,000 gallons of water daily form the Passaic River. On remand, it was established that appellant acquired easements and rights from six separate grantors to divert a total of 75,000,000 gallons daily. The court noted, however, that the quantity of water which appellant had a vested right to divert was expressly limited by terms of the various grants to its predecessors in title to such quantities as may be

necessary for certain specified uses. Proofs showed the peak of the average daily diversion to meet these specified uses was only 71,622,000 gallons, and the court stated this figure was the maximum right of diversion established by prior use. The court held that appellant had the right to divert not more than 71,622,000 gallons daily, and that consent from other organizations did not establish any right beyond the maximum amount established by prior use. (Wheeler-Fla)
W69-06191

CARR V UNITED STATES (DAMAGES TO OYSTER BED DUE TO DRAGGING OPERATIONS).

136 F Supp 527-538 (E D Va 1955).

Descriptors: *United States, *Oysters, *Commerical shellfish, *Dredging, Virginia, Judicial decisions, Damages, Legal aspects, Navigation, Federal jurisdiction, Federal government, Admiralty, Aircraft, Boats, Ships.
Identifiers: Dragging operation, Negligence, Governmental immunity.

Libellant sought to recover for damages to oyster beds. He alleged that the beds were negligently destroyed by dragging operations of the government in recovering wreckage of an Air Force plane. Evidence was introduced before the court sitting in admiralty that the dragging was more extensive than necessary, that the command of the salvage ship had notice of the beds, and that no efforts were made to protect libellant's property interest. The court, in awarding recovery, held that the government failed to exercise its duty of reasonable care to avoid damage. The court ruled that performance of an act deemed to be a necessary governmental function afforded no immunity under the Public Vessels Act, and that the paramount right of navigation was not intended to cover operations of this nature. Damages were awarded on the basis of calculated crop loss not entirely speculative. (Wheeler-Fla)
W69-06192

HARGADINE V SHARKEY (DIVERSION OF WATER FROM ITS NATURAL COURSES).

8 Ill App 2d 209, 131 NE 2d 134-143 (1956).

Descriptors: *Illinois, *Natural flow doctrine, *Surface drainage, *Ditches, Flood damage, Highways, Road banks, Flooding, Overflow, Diversion, Alteration of flow, Obstruction to flow, Drainage water, Rainfall, Surface waters, Surface runoff, Channels, Levees, Dam failure, Judicial decisions, Legal aspects.
Identifiers: Sovereign immunity.

Plaintiff brought an action to recover for damages to his farm land. He based his cause of action on two alleged acts of negligence by the defendant. The first allegation of negligence was that the defendant, while altering and improving a road adjacent to the plaintiff's property, destroyed the roadside ditches. This destruction diverted drainage water from its natural channel and caused it to flow onto plaintiff's land. The second allegation was that the defendant allowed a log farm to back up the river, causing a creek flowing into the river to wash out a levee and flow onto plaintiff's land. The court held that the first allegation stated a good cause of action, but ruled that the second allegation was insufficient. Defendant had no right to divert water from its natural course and discharge it upon the plaintiff's farm land. However, with regard to the second allegation, the court held that a county cannot be sued in tort. The plaintiff's action sounded in tort, and, therefore, the county was not liable for the resulting flood damage. (Stewart-Fla)
W69-06193

DANNER V UNITED STATES (FEDERAL GOVERNMENT'S LIABILITY FOR FLOOD DAMAGES).

114 F Supp 477-480 (W D Mo 1953).

Descriptors: *Federal government, *Flood damage, *Missouri, *Landfills, Floods, Remedies, Discharge (Water), Missouri River, Flood plains, Watercourses (Legal), Judicial decisions, Legal aspects, Construction, Bridge construction, Bridges, Legislation, Damages, Natural streams, Rivers.
Identifiers: *Absolute liability, *Negligence, Federal Tort Claims Act, Corps of Engineers.

Defendant constructed a bridge with an approach fill extending 900 feet from the bridge in a certain area along the Missouri River. This fill was to serve as a form of embankment or barrier against flood water and was laid directly across the flood plain and natural channel of the river. During a flood, water was impounded behind the approach fill, causing it to collapse and resulting in a substantial discharge of water on plaintiff's property. Plaintiff brought suit for damages, basing his cause of action on absolute liability or, in the alternative, on negligence. The court denied relief. Under the Federal Tort Claims Act, the government cannot be held liable unless fault is shown. An agent of the government is liable for a negligent act only if a private person would be liable for such act under the law of the place where the act occurred. Federal law provides that when an agent is performing an act in connection with a discretionary function of government, no liability may be predicated on the negligent performance thereof. The court held that the construction of the approach fill was such a discretionary function. It furthermore noted that another statute expressly precluded governmental liability for damages caused by floods at any place. (Holt-Fla)
W69-06194

PEERLESS SERUM CO V UNITED STATES (LIABILITY FOR FLOOD DAMAGES).

114 F Supp 662-663 (WD Mo 1953).

Descriptors: *Missouri, *United States, *Flood control, *Flood damage, Flood forecasting, Historic flood, Warning systems, Rivers, Mississippi River, River forecasting, Floods, Watersheds, Water control, Water utilization, Navigation, Legislation, Judicial decisions, Legal aspects, Federal government.
Identifiers: Sovereign immunity.

The plaintiff brought this action to recover for damage caused by the Kaw River Flood of 1951. The government moved for a judgment on the pleadings. The plaintiff contended that it was the duty of the government to warn the public of the ensuing flood. The Flood Control Act specifically exempts the United States from liability for damage caused by floods, and this act was applicable in this case to relieve the government of any liability. The plaintiff claimed, however, that the act was limited to the lower Mississippi River projects. This contention was rejected by the court. Congress exempted itself from liability in connection with navigation and navigable waters of the United States. The government's motion for judgment on the pleadings was granted. (Shevin-Fla)
W69-06195

ARCHER V J S COMPTON, INC (INTERFERENCE WITH NATURAL FLOW).

30 NW 2d 92-97 (Iowa 1947).

Descriptors: *Iowa, *Diversion, *Alteration of flow, *Natural flow, Judicial decisions, Ditches, Drainage, Dikes, Embankments, Riparian rights, Repulsion (Legal aspects), Surface water, Surface runoff, Artificial watercourses, Natural use, Stream flow, Floods, Legal aspects, Riddance (Legal aspects), Overland flow.

Plaintiff sought a mandatory injunction against defendant, an adjacent landowner, for the removal of a dike formed by defendant's alteration of a natural ditch between their lands. Plaintiffs further sought damages for the diversion of surface water onto their land in an unnatural manner and quantity by such dike. The trial court found for plaintiffs, and defendant appealed. The supreme court affirmed, holding that a riparian owner cannot lawfully embank against the natural flow of a stream where such embankment would cause an increased volume of water to flow on the land of another to his injury. (Helwig-Fla)
W69-06196

HEPBURN V MADDOX (LIABILITY OF DRAINAGE DISTRICT).

340 Ill App 34, 91 NE 2d 107-111 (Ct App 1950).

Descriptors: *Illinois, *Drainage districts, *Drainage engineering, *Erosion, Judicial decision, Excess water (Soils), Surface drainage, Bridges, Streams, Drainage effects, Drainage, Drainage practices, Legal aspects, Channeling, Ditches, Outlets, Riddance (Legal aspects), Damages.
Identifiers: Lateral support doctrine, Dominant heritage.

Defendant drainage district sought to clean and enlarge a drainage outlet stream. District commissioners engaged an engineering firm to draw plans and hired an independent contractor to do the work on the stream. Due to high water and heavy rains, the contractor stopped work 300 feet downstream from highway bridge maintained by plaintiff. The erosion caused by the drainage improvements caused the bridge to collapse. Plaintiff sought a writ of mandamus to have defendant restore bridge. The court held that a drainage district is not liable for the negligence of an independent contractor except where it was negligent in the selection of such contractor, or where it knew of or should have known of defects in plans used by such contractor. Here, though skillful engineers were employed, defendant knew or by the exercise of ordinary care should have known of the defects in the plans and specifications which caused the injury. Verdict for plaintiff was proper. (Helwig-Fla)
W69-06197

UNITED STATES V SHAPIRO (RIGHT TO REPEL SURFACE WATER).

202 F 2d 459-461 (DC Cir 1953).

Descriptors: *District of Columbia, *Surface water, *Repulsion (Legal aspects), *Reasonable use, Legal aspects, Judicial decisions, Surface runoff, Ditches, Channels, Construction, Grading, Cities, United States, Remedies, Alteration of flow, Riparian rights, Natural streams, Diversion, Riddance (Legal aspects), Damages.

The United States claimed that its zoo had suffered damages as a result of surface water directed onto it from defendant's adjacent property. The two adjacent tracts were located in a metropolitan area. Defendant, by certain grading operations, caused surface water to flow in a different direction than it had previously flowed. The court held that defendant was within his rights to direct surface water in the direction of the zoo. The common enemy rule is in effect in this jurisdiction. This rule provides that surface water may be repelled or directed onto the land of other proprietors if the flow of such water is the result of an ordinary use of the land and is not the result of channels, ditches or other extraordinary diversion structures. The court further held that grading of city land was an 'ordinary use' of such land if not done in a negligent or unusual manner. (Holt-Fla)
W69-06198

RATCLIFFE V INDIAN HILL ACRES (RIGHTS TO DISPOSE OF SURFACE RUNOFF WATERS).
113 NE 2d 30-35 (Ohio Ct App 1952).

Descriptors: *Ohio, *Surface runoff, *Reasonable use, *Riddance (Legal aspects), Surface waters, Ponds, Dams, Mud, Mudflows, Seeds, Water law, Judicial decisions, Damages, Streams, Natural flow, Obstruction to flow, Legal aspects, Riparian rights, Relative rights, Water pollution, Water pollution sources, Grading.
Identifiers: Direct causation.

Plaintiff, owner of the servient estate on a natural stream, constructed a dam across the stream which caused the formation of a pond on his property. Defendant, owner of the dominant estate, graded his property, causing additional mud and seed to flow into the stream. The grading did not alter the natural drainage of surface water into the stream. Plaintiff sought damages, alleging that the defendant had caused mud, seeds, and impurities to be deposited in his pond. The court denied relief, holding that, as a right of ownership, one may dispose of surface water in accordance with the natural contour of the watershed and, absent unreasonable or negligent actions, the servient owner has no right of recovery. Furthermore, the court said that one could use his property for any purpose which is reasonable, and, in ths case, use of the property by the defendant was reasonable. Finally, the court said that plaintiff, by constructing a dam, had retarded the flow of water, thus causing the impurities to be retained in his pond. The plaintiff could not complain of damage caused by his own actions. (Holt-Fla)
W69-06199

UNITED STATES V STATE OF LOUISIANA, TEXAS, MISSISSIPPI, ALABAMA, AND FLORIDA (INTERPRETATION OF SUBMERGED LANDS ACT).

363 US 1, 121; 80 S Ct 961-1037 (1960).

Descriptors: *Federal-state water conflicts, *Boundaries (Property), *Submerged lands act, *Ownership of beds, Texas, Florida, Alabama, Louisiana, Mississippi, State government, Legislation, International Bound and Water Comm'n, United States, Mineralogy, Oil, Natural gas, Oil fields, Natural resources, Exploitation, Public rights, International Waters, Continental shelf, Tidal waters, Public benefits, Public lands.
Identifiers: Off-shore priority (State), Off-shore priority (Federal).

The United States sought a declaration that the federal government was entitled to exclusive possession of, and full dominion and power over the land, minerals, and other things underlying the waters of the Gulf of Mexico more than three geographic miles seaward from the Coast of Texas, Florida, Louisiana, Alabama, and Mississippi and extending to the Continental Shelf. The Supreme Court held that under the Submerged Lands Act the states seeking to assert a boundary in excess of the three-mile limits must demonstrate the existence of such an historical boundary prior ot or at the time of admission of that state to the Union. Texas and Florida were found to have been admitted to the Union with a stipulation to a three marine league limit seaward into the Gulf. The states of Alabama, Mississippi and Louisiana were found to have entered the Union without provision for any kind of seaward boundary. Accordingly, the Court refused to recognize the claims of Louisiana, Mississippi and Alabama beyond the three-mile limit. The Court recognized that the three league coastal boundary of Texas and Florida pertained only in regard to domestic matters and did not have the effect of extending the United States continental waters into previously recognized International Waters. (Katz-Fla)
W69-06200

BENEFITS FROM INTEGRATED WATER MANAGEMENT IN URBAN AREAS - THE CASE OF THE NEW YORK METROPOLITAN REGION,
Columbia Univ., New York; Barnard Coll., New York. Dept. of Geography; and Rutgers - The State Univ., New Brunswick, N. J.
For primary bibliographic entry see Field 06B.
W69-06201

RESERVOIRS: PROBLEMS AND CONFLICTS,
For primary bibliographic entry see Field 06B.
W69-06207

THE LAW OF WATER IN NEW JERSEY,
Rutgers - The State Univ., New Brunswick, N. J. School of Law.
Eva M. Hanks.
Rutgers L Rev, Vol 22, No 4, Part I, pp 621-715, Summer 1968. 96 p, 483 ref.

Descriptors: *New Jersey, *Water law, *Riparian rights, *Surface waters, Judicial decisions, Legal aspects, Water users, Natural flow doctrine, Reasonable use, Prior appropriation, Water pollution, Repulsion (Legal aspects), Riddance (Legal aspects).

The riparian system of water allocation, commonly employed in the eastern states, is distinguished from the prior appropriation system, followed by the majority of western states. A brief comparison is made of riparian rights in watercourses under the English rule of natural flow and the American rule of reasonable use, and the author relates how each rule operates to achieve the peculiar goals of its native water law system. The historical development of New Jersey law in regard to riparian use of surface watercourses and the right to equitable relief, and the factors considered by the court in granting such relief, are considered. After an analysis of court decisions, an attempt is made to classify New Jersey as a jurisdiction following either the natural flow rule or the reasonable use rule in litigation including the use and pollution of watercourses. Further analysis is made of New Jersey cases involving diffused surface water drainage controversies, and New Jersey's usage of the civil law and common enemy rules is considered. (Molica-Fla)
W69-06301

THE LAW OF WATER IN NEW JERSEY,
Rutgers - The State Univ., New Brunswick, N. J. School of Law.
Eva M. Hanks.
Rutgers L Rev, Vol 22, No 4, Part I, pp 621-636, Summer 1968. 16 p.

Descriptors: *New Jersey, *Riparian rights, *Surface waters, *Natural flow doctrine, Judicial decisions, Water law, Legal aspects, Riparian land, Reasonable use, Prior appropriation, Water pollution, Water resources development, Water utilization, Conjunctive use, Non-consumptive use.

New Jersey is a riparian state and, thus, the right to use water is based upon ownership of land contiguous to the particular body of water. There are two distinct theories regarding the exercise of riparian rights. These theories are embodied in: (1) the English rule of natural flow; and (2) the American rule of reasonable use. Unlike the American rule, the English rule prohibits the use of water for nonriparian land or for purposes unconnected with the riparian land and permits a riparian owner to maintain an action without proof of actual damages. The American rule encourages the maximum development of water resources. Both rules seem to offer the same degree of protection to private investment in water resource development. (Molica-Fla)
W69-06302

THE LAW OF WATER IN NEW JERSEY,
Rutgers - The State Univ., New Brunswick, N. J. School of Law.
Eva M. Hanks.
Rutgers L Rev, Vol 22, No 4, Part I, pp 636-687, Summer 1968. 52 p.

Descriptors: *New Jersey, *Natural flow, *Reasonable use, *Consumptive use, Judicial decisions, Water law, Legal aspects, Riparian rights, Surface waters, Natural flow doctrine, Non-consumptive use, Water pollution, Water utilization, Remedies, Water pollution control, Administrative agencies.

New Jersey court decisions show that consumptive water use for riparian land is governed by the English rule of natural flow. However, the results reached by the courts are the same as would be reached in reasonable use jurisdictions. Consumptive use of water on nonriparian land is controlled by the natural flow theory, and the courts will prohibit such use when another riparian owner's water supply is diminished. Nonconsumptive water use is allowed to the extent that the natural flow of a stream is not thereby diminished. Unlike the English procedure, in New Jersey a claimant may seek equitable relief without first establishing his right to relief at law; however, the courts will balance the conveniences of the parties before granting equitable relief. New Jersey has expressly adopted the rule of reasonable use in regard to surface watercourse pollution controversies. Private litigation has failed to deal with pollution control adequately. The enforcement flexibility of administrative agencies makes them an appropriate mechanism for use in this area marked with legal battles. (Molica-Fla)
W69-06303

THE LAW OF WATER IN NEW JERSEY,
Rutgers - The State Univ., New Brunswick, N. J. School of Law.
Eva M. Hanks.
Rutgers L Rev, Vol 22, No 4, Part I, pp 687-715, Summer 1968. 29 p.

Descriptors: *New Jersey, *Surface waters, *Surface runoff, *Reasonable use, Judicial decisions, Water law, Legal aspects, Riparian rights, Surface drainage, Water pollution, Natural flow, Remedies, Alteration of flow, Repulsion (Legal aspects), Riddance (Legal aspects).

Controversies as to the disposition of diffused surface waters have been traditionally decided by the 'civil law' rule or the 'common enemy' rule, depending upon the jurisdiction. Under the civil law rule, a servient landowner may not impede the natural course of drainage water across his land. Most courts have liberalized this rule by applying a 'rule of reason' which allows a consideration of all relevant factors in determining the propriety of contemplated obstruction or diversion of the natural flow. In its strict form, the common enemy rule allows one to protect his land from drainage water without regard to other servient or dominant estates. An examination of the consequences of each rule indicates that, in general, neither can be said to hinder or further the development of land. Recently, courts have supplanted the two rules by the 'reasonable use' doctrine which reflects a 'tort law' approach to the problem rather than the inflexible 'property law' approach previously used for determining riparian rights to surface watercourses. An examination of New Jersey case law reveals that the common enemy rule has been expressly replaced by the reasonable use doctrine. However, the extent to which tort law is applicable in drainage controversies is unsettled. (Molica-Fla)
W69-06304

WASTES, WATER, AND WISHFUL THINKING: THE BATTLE OF LAKE ERIE,
Case Western Reserve Univ., Cleveland.
For primary bibliographic entry see Field 05G.
W69-06305

AN EXPLORATION OF COMPONENTS AFFECTING AND LIMITING POLICY MAKING OPTIONS IN LOCAL WATER AGENCIES,
Colorado State Univ., Fort Collins. Dept. of Political Science.
For primary bibliographic entry see Field 06B.
W69-06306

TAYLOR V TAMPA COAL CO (RIPARIAN RIGHTS IN NON-NAVIGABLE LAKE).

46 So 2d 392-394 (Fla 1950).

Descriptors: *Florida, *Irrigation effects, *Non-navigable waters, *Relative rights, Farm ponds, Drawdown, Riparian waters, Skimming, Diversion, Withdrawal, Artificial use, Citrus fruits, Riparian rights, Dry seasons, Border irrigation, Rainfall disposition, Seepage, Boating, Fishing, Recreation, Judicial decisions, Legal aspects.
Identifiers: Injunctions (Mandatory).

Plaintiff brought suit to enjoin defendant from pumping water from a non-navigable lake to irrigate defendant's citrus grove. The lake was situated on four adjoining tracts of land owned separately by different person including plaintiff and defendant. The lake water came wholly from rainfall and seepage. Under Florida law, each riparian owner had the right to use the water in the lake for all lawful purposes, so long as his use was not detrimental to the rights of the other riparian owners. Plaintiff's use of lands bordering on the lake was reasonable, and he was entitled to seek relief for unlawful interference with the lake's natural condition. The lake, owing its supply solely to rainfall and seepage, was too small, when at normal level, to allow water to be pumped for irrigation purposes without consequent damage to plaintiff's rights. Therefore, defendant was enjoined from taking water for irrigation during the dry season when the lake was either at or below normal level. (Reed-Fla)
W69-06307

HOWLETT V CITY OF SOUTH NORFOLK (FLOOD DAMAGE ALLEGEDLY DUE TO STREET ELEVATION).
For primary bibliographic entry see Field 04C.
W69-06308

PHILLIPS V CHESSON (DIVERSION CAUSED BY EXCAVATED SLOPE).
For primary bibliographic entry see Field 04A.
W69-06309

MESSANA V MAULE INDUSTRIES (NEGLIGENT FLOODING OF FARM LAND).
For primary bibliographic entry see Field 04A.
W69-06310

DAVENPORT V TOWN OF DANVERS (FLOODING OF LAND BY CITY DAM).
For primary bibliographic entry see Field 04A.
W69-06311

H W PEERSON DRILLING CO V SCOGGINS (DEED EXCEPTIONS AND RIGHTS TO SUBTERRANEAN WATERS).

74 So 2d 450-451 (Ala 1954)

Descriptors: *Alabama, *Water wells, *Water pollution, *Diversion, Mineralogy, Drilling, Subsurface waters, Mine wastes, Water quality, Underground reservoirs, Water storage, Natural resources, Shafts, Damages, Percolating water, Water supply, Water rights, Relative rights
Identifiers: *Surface owner, Deeds

Plaintiff surface owner brought action for damages caused by diversion or pollution of water from his well. The minerals and mining rights beneath the surface of the land were excepted in plaintiff's deed. The court held that while it may be conceded that water, in a technical sense, is a mineral, the words 'minerals and mining rights', as used in the conveyance under consideration, should be given the meaning accorded them by common usage. When so viewed, the exception of minerals and mining rights from the conveyance did not deprive plaintiffs of rights to the subterranean waters beneath the surface of their land. (Reed-Fla)
W69-06312

MITCHELL V CITY OF ST PAUL (NEGLIGENT OPERATION OF PUBLIC RESERVOIR).

31 NW 2d 46-55 (Minn 1948).

Descriptors: *Minnesota, *Reservoir operation, *Pumped storage, *Reservoir storage, Water supply, Lakes, Hydraulic structures, Water levels, Surface drainage, Surface runoff, Surface waters, Storm runoff, Rainfall, Cloudbursts, Judicial decisions, Legal aspects, Damages.
Identifiers: Lake Vadnais.

This is an action by the appellant against the respondent city to recover for damages to his land by trespass of water. The trespass was alleged to be the result of improper control of water elevations by appellee in certain lakes used by the city as reservoirs. Appellant appeals from an order denying his motion for new trial after a verdict for the appellee. The court held that although the title of a riparian owner on navigable or public waters extends to the ordinary low water mark, his title is not absolute, except as to the ordinary high water mark. As to the intervening space, his rights are qualified by the right of the public to use the same for public purposes (such as water storage) and navigation. A riparian owner is entitled to recover damages for such overflow as may occur above the ordinary high water mark. Plaintiff below failed to prove overflow above the ordinary high water mark. The court noted that any damage caused to appellant's lands was caused by extraordinary and unprecedented rainfall, rather than negligence on the part of the appellees. (Katz-Fla)
W69-06313

ZIDEL V STATE (STATE LIABLE FOR EROSION CAUSED BY NEGLIGENTLY PLACED ROAD).
For primary bibliographic entry see Field 04C.
W69-06314

SOUTH DAKOTA - MINNESOTA BOUNDARY WATERS COMMISSION TRI-STATE WATERS COMMISSION.

Minn Stat Ann secs 114.01, 114.021, 114.09 (1967).

Descriptors: *Minnesota, *Interstate commissions, *Legislation, *Interstate compacts, South Dakota, North Dakota, Pollution abatement, Flow control, Flood control, Project planning, Artificial use, Eminent domain, Financing, Administrative agencies, Boundaries (Property), Watersheds (Basins), Watershed management.
Identifiers: Red River.

The South Dakota-Minnesota Boundary Waters Commission, and interstate commission, consisting of the South Dakota Game and Fish Commission director, the Minnesota Commissioner of Conservation, and an engineer appointed by mutual consent of the governors, is created. The Commission is empowered to determine and prescribe plans for controlling the level of those boundary waters capable of artificial regulation. Minnesota, by creating a tri-state waters area and commission, agrees with North and South Dakota to cooperate in flood and pollution control in the advantageous usage of the Red River of the North drainage basin. The Commission shall: (1) study water problems in the area; (2) approve all plans for public and private works on boundary waters; (3) maintain the level and flow of waters, except in the Otter Tail River; (4) cooperate with federal and state agencies in water projects; (5) exercise eminent domain and all other powers not inconsistent with the federal and state constitutions; and (6) recommend to the respective legislatures of the signatory states methods to finance its work. There shall be a proportionate sharing of expenses by the two states. (Harris-Fla)
W69-06315

MUNICIPAL WATER POLLUTION CONTROL.
For primary bibliographic entry see Field 05G.
W69-06316

STATE WATER SUPPLY DEVELOPMENT.
For primary bibliographic entry see Field 03D.
W69-06317

LOUISVILLE SAND AND GRAVEL CO V RALSTON (THE 'THREAD OF THE STREAM' AS A BOUNDARY LINE).

266 SW 2d 119-122 (Ky 1954).

Descriptors: *Kentucky, *Ownership of beds, *Boundaries (Property), *Riparian rights, Land tenure, Legal aspects, Damages, Navigable waters, Channels, Low water mark, Shores, Judicial decisions, Leases, Beds, State governments, Ohio River, Dredging, Relative rights, Legislation, River beds, Thalweg.

Defendant company was authorized to remove sand and gravel from the Ohio River 'north of the thread of the stream' under a lease and state statute. The defendant dredged south of the geographical center of the river but north of the center line of the main channel; the center line was close to the south shore at that point. Plaintiffs, who owned land on the south shore, sued to recover damages for trespass to their land. On appeal, the court was faced with the necessity of determining the exact location of the dividing line between the property of the riparian owners and the property between the northern low water mark and the thread of the stream; the latter property was owned by the state. The court held the Kentucky State Boundary to be along the north bank of the Ohio River at the low water mark. Rights of riparians extend to the thread of the stream. The court held the thread to be midway between the low water marks on opposite shorelines, without regard to the main channel or deepest part of the river. The trial court's judgment for plaintiff was affirmed. (Harris-Fla)
W69-06318

RUSSELL V BROWN (TITLE TO LAND AFTER 'ACCRETIONS' AND 'AVULSION').
260 SW 2d 257-260 (Tenn 1953).

Descriptors: *Tennessee, *Avulsion, *Accretion (Legal aspects), Land tenure, Ownership of beds, Mississippi River, Riparian rights, Public rights, Easements, Judicial decisions, Legal aspects, Relative rights, Channels, Beds, Boundaries (Property).
Identifiers: Action to quiet title.

In a suit to quiet title, the chancery court sustained a demurrer of the grantee of the land under a deed. Grantors sought to quiet title, claiming the land had not passed with the deed which purported to convey the land to grantee-defendant. The land in question consisted largely of accretions from the Mississippi River, which, after an avulsion, cut through the land from north to south. The grantors claimed that the land lying to the west of the river was not conveyed by the deed. In construing the deed purporting to convey title to the eastern land and the wester accretions, the supreme court defined 'dereliction' as a recession of waters by which land previously covered is left dry. If dereliction occurs gradually and imperceptibly, the dere-

lict land belongs to the riparian owner from whose shore the water receded. An avulsion, or sudden change in the channel of a stream, works no change of boundary. The court held that the grantor had title to the bed of the river subject to a public easement. Thus the east and west portions were 'contiguous' as conveyed by the deed. (Harris-Fla)
W69-06319

PONELEIT V DUDAS (ZONING REGULATIONS AS AFFECTING RIPARIAN RIGHTS).

41 Conn 413, 106 A 2d 479-482 (1954).

Descriptors: *Connecticut, *Riparian rights, *Zoning, *Navigable waters, Land tenure, Legal aspects, Land reclamation, Cities, Water zoning, Public rights, Local governments, Judicial decisions, Usufructuary rights, Land use, Piers, Land classification, High water mark, Regulation, Harbors, Public benefits.
Identifiers: *Injunctions (Prohibitor), *Constitutional law, Due process.

Defendants owned land bordering on a navigable harbor. They constructed a pier and began operating a boat livery business. City zoning regulations prohibited business in that zone. The regulations further provided that waters within the city limits took on the zoning classification of adjacent land. Plaintiff building inspector brought action for an injunction to restrain defendants from violating the zoning regulations. The court of common pleas held for plaintiff. On appeal, the supreme court of errors affirmed holding that riparian rights, as well as other property rights, could be limited by zoning regulations regardless of whether such regulations were being used to promote the use of navigable waters. Such regulations are constitutional, as long as reasonably related to the public welfare, even if they involve a taking of property to a limited extent. The court further held defendants' reclaimed land was within the city limits and not immune from regulation. (Harris-Fla)
W69-06320

TCHLEY V TENNESSEE VALLEY AUTHORITY (FLOODING OF CROPS CAUSED BY RAISED RESERVOIR WATERS).
For primary bibliographic entry see Field 04A.
W69-06321

ITY OF MERIDAN V SULLIVAN (SUBSURFACE DRAINAGE).
For primary bibliographic entry see Field 04A.
W69-06322

ELUE V CITY OF GREENVILLE (DUTY OF CITY TO PROVIDE DRAINAGE OF THOROUGHFARES).
For primary bibliographic entry see Field 04A.
W69-06323

LL V CITY OF GREENVILLE (DAMAGES RESULTING FROM CITY'S FAILURE TO PROVIDE DRAINAGE).
For primary bibliographic entry see Field 04A.
W69-06324

RITES V UNITED STATES (CLAIMS FOR LOSS IN VALUE OF LAND DUE TO IRRIGATION PROJECT).
For primary bibliographic entry see Field 03F.
W69-06325

ORTH COUNTIES HYDROELECTRIC CO V NITED STATES (DAMAGES RESULTING ROM ICE JAM).

F Supp 900-903 (Ct Cl 1947).

Descriptors: *Illinois, *Streams, *Flooding, *Ice jams, Hydraulic structures, Dams, Ice, Sluch, Hydroelectric plants, Ice breakup, Meanders, Navigable rivers, Locks, United States, Federal government, Judicial decisions, Legal aspects, Damages.

Plaintiff brought this action against the United States to recover damages for impairment of the value of its power plant. Such damage was allegedly caused by defendant's construction of a lock and dam downstream on the Illinois River. The power plant was constructed in 1927, and the dam was constructed in 1933. Ten years after the dam had been completed, an ice jam formed below the plaintiff's power plant. The accumulation of ice behind this jam was allegedly prevented from moving further downstream by defendant's dam. Ice backed up into plaintiff's power plant and the plant was closed for approximately one month because of the ice intrusion. The court held that plaintiff had failed to prove that the construction of the dam caused the backup. Plaintiff also contended that he should recover a prospective damage award since it was likely that such ice jams would recur periodically. The court noted that the damage actually suffered by plaintiff was not shown to be of a permanent nature and was not proved to have been caused by defendant. (Katz-Fla)
W69-06326

STATE V SULLIVAN (REGULATION BY FRESH WATER FISH COMM'N).
30 So 2d 919-920 (Fla 1947).

Descriptors: *Florida, *Administrative agencies, *Fish conservation, *Regulation, Judicial decisions, Nonstructural alteratives, Legislation, Jurisdiction, Freshwater fish, Administrative decisions, Legal aspects, Saline water, Fresh water, Classification, State governments.
Identifiers: Constitutional law, Penalties (Criminal), Police power.

Defendant was arrested for violating a Florida Game and Fresh Water Fish Commission rule prohibiting the manner in which the defendant had taken, transported, and sold fresh water fish. The defendant alleged that he had taken the fish in good faith and in reliance upon the laws enacted by the state legislature which declared that the waters in which he was fishing were salt water and hence not subject to the Commission's rules. The defendant's writ of habeas corpus was discharged by the circuit court; this court affirmed. The Commission was empowered by the state constitution to impose reasonable rules regulating the conservation of fresh water fish. The rule declaring the waters in question as fresh was a reasonable rule, and it was not within the power of the legislature to pass a statute abrogating that rule. The legislature may pass laws in aid of the Commission's regulations, but it cannot contemplate laws which prescribe a method of taking fresh water fish which is different from that prescribed by the Commission. (Blunt-Fla).
W69-06327

BECK V GAME AND FRESH WATER FISH COMM'N (JURISDICTION OF FRESH WATER FISH COMM'N).

33 So 2d 594-596 (Fla 1948).

Descriptors: *Florida, *Administrative agencies, *Nonstructural alternatives, *Jurisdiction, State governments, Judicial decisions, Water types, Fish conservation, Regulation, Saline water, Fresh water, Classification, Administrative decisions, Legislation, Legal aspects, Fresh water fish.
Identifiers: Constitutional law.

The Florida Fresh Water Fish Commission brought this action seeking to declare unconstitutional certain statutes which classified waters as 'salt water'. The Commission's rules regulating the taking of fresh water fish from the waters in question were adopted in 1944; the legislative acts contrary to these rules were passed in 1947. The statutes, in effect, removed the waters from the jurisdiction of the Commission and placed them under the Board of Conservation. This court affirmed a lower decree declaring the subsequently enacted statutes unconstitutional. The constitutional provision which created the Commission vested it with exclusive powers to regulate the state's fresh water fishing industry and divested the Legislature of the power to control the taking of fresh water fish. Even if the waters in question had been classified as salt prior to the creation of the Commission, the constitutional amendment expressly provides that all existing laws inconsistent with the Commission's jurisdiction would be void. Therefore, it was unconstitutional for the Legislature to pass laws effectively ousting the Commission's jurisdiction over the waters in question. (Blunt-Fla)
W69-06328

HAUGHTON V LANKFORD (CONSTITUTIONALITY OF CONSERVATION REGULATION).

189 Va 183, 52 SE 2d 111-122 (1949).

Descriptors: *Virginia, *Legislation, *Oysters, *Administrative agencies, Fish conservation, Wildlife conservation, Permits, State governments, Inland waterways, Tidal marshes, Tax rate, Beds, Shoals, Judicial decisions, Legal aspects, Ownership of beds, Administrative regulation.
Identifiers: *Constitutional law, Delegation doctrine.

Plaintiff brought this action for a declaratory judgment to determine the constitutionality of a statute prohibiting the removal of seed oysters from the waters of Virginia without a permit from the Commissioner of Fisheries. The Commissioner had determined that the seed oyster beds were greatly depleted and that the projected demand for seed oysters for the coming season would result in destruction of these beds if permits were issued. The plaintiff contended that the legislation enabling the Commissioner to withhold permits and thereby curtail the taking of oysters was unconstitutional in that it impaired the obligation of contracts held by the plaintiffs, unlawfully restrained interstate commerce, and deprived the plaintiff of property without due process of law. The court held that contracts of this type are always subject to the implied condition of countinuing legality of the service contracted for and that the obligation was not impaired by the exercise of the state police power. The court struck down plaintiff's contention that the order illegally restrained interstate commerce, saying that the state has absolute ownership of beds under inland waters and absolute ownership of the oysters therein and can subject same to necessary regulation. (Katz-Fla)
W69-06329

STATE V TOWN OF GOFFSTOWN (SUIT TO FORCE COMPLIANCE WITH ORDER TO ABATE RIVER POLLUTION).
For primary bibliographic entry see Field 05G.
W69-06330

LEGAL ASPECTS OF NEW JERSEY POTABLE WATER PROGRAM,
For primary bibliographic entry see Field 05G.
W69-06331

POWERS AND FUNCTIONS OF DEPARTMENT OF WATER RESOURCES - FLOOD CONTROL.
For primary bibliographic entry see Field 04A.
W69-06332

CREATION OF DEPARTMENT OF WATER RESOURCES AND WATER RESOURCES

COMM'N.

Md Ann Code Art 96A:1-5 (1957), as amended, (Supp 1968).

Descriptors: *Maryland, *Administrative agencies, *Water resources development, *Water policy, Legislation, Regulation, Water resources, Water quality control, Water conservation, State governments, Water pollution control, Planning, Future planning (Projected), Long-term planning, Short-term planning, Social function, Supervisory control (Power), Public health, Public benefits.

Maryland has created a State Department of Water Resources for purposes of water resources planning, development, and conservation. Powers and duties formerly exercised by the Water Pollution Control Commission and Department of Mines, Geology, and Water Resources are transferred to the Department of Water Resources. The state has also created a Water Resources Commission representing general fields of public health, industry, agriculture, municipalities, and natural resources. The Commission has the following powers and duties: (1) to act in an advisory capacity to the Director of the Department; (2) to keep informed of the Department's activities; (3) to consider further development needs from points of view of the several interests of the public; (4) to promulgate rules and regulations pursuant to statutory authority; (5) to approve programs of the Department; (6) to assist the Director in fostering public understanding, participation, and interest; and (7) to hold public hearings when necessary. (Wheeler-Fla)
W69-06333

AN ACT RELATING TO LAKES, PERMITTING THE CREATION OF LAKE CONSERVATION DISTRICT WITH CERTAIN POWERS.
Minn Sess Laws ch 907 (1967).

Descriptors: *Minnesota, *Lakes, *Water conservation, *Administrative agencies, Project purposes, Water resources development, Conservation, Legislation, Resources, Preservation, Cities, Regulation, Organizations, Water pollution control, Coordination, Budgeting, Water management (Applied), Pollution abatement, Local governments, Boating, Docks, Recreation, Marinas, Water control.
Identifiers: Conservation districts.

If, after holding public hearings, the governing bodies of two-thirds of the municipalities bordering on Lake Minnetonka determine that a lake conservation district shall be established, all the municipalities bordering the lake shall establish such a lake conservation district. The district shall be governed by a board composed of members elected by the governing bodies of each municipality and shall have the power to regulate boating, public facilities, lake use, docks, de-icing, and commercial marinas. The district shall also be empowered to contract with other law enforcement agencies to police the lake and its shore, to contract with other governmental bodies to perform district functions, to undertake lake research and report to water pollution authorities, to develop a pollution abatement program, to receive financial assistance from and join in projects of other agencies for pollution abatement, and to construct and operate water control structures. Duties and procedural guidelines of the district are established by the state. (Wheeler-Fla)
W69-06334

AN ACT ESTABLISHING AN INTERIM COMM'N TO STUDY THE PROBLEM OF WATER POLLUTION AND APPROPRIATING MONEY THEREFORE.
For primary bibliographic entry see Field 05G.
W69-06335

WATERWORKS, MAIN SEWERS, SEWAGE DISPOSAL PLANTS.
For primary bibliographic entry see Field 05G.
W69-06336

SEWAGE DISPOSAL: WATER AND SEWAGE.
For primary bibliographic entry see Field 05G
W69-06337

STATE FORESTS; TREE PLANNING.
For primary bibliographic entry see Field 03F.
W69-06338

FISH.
For primary bibliographic entry see Field 05G.
W69-06339

IRRIGATION.
For primary bibliographic entry see Field 03F.
W69-06340

IMPROVEMENT AND MODERNIZATION OF N. Y. WATER LAW WITHIN THE FRAMEWORK OF THE RIPARIAN SYSTEM,
Cornell Univ., Ithaca, N. Y.
William H. Farnham.
Cornell Univ Water Resources Center, Feb 1968. 56 p, 194 ref. OWRR Project B-003-NY.

Descriptors: *New York, *Water law, *Riparian rights, *Reasonable use, Legislation, Judicial decisions, Planning, Consumptive use, Water rights, Reservoirs, State governments, Water resources development, Legal aspects, Natural flow doctrine, Natural use, Prescriptive rights, Diversion, Prior appropriation, Riparian land, Riparian water, Domestic water, Severance.
Identifiers: Police powers, Constitutionality.

It is submitted that the elimination of uncertainties in New York water law in order to encourage the development of the state's water resources, and the preparation for governmental projects by clarifying the extent of private water rights, could be effectively expedited through legislation which would fit naturally into the existing riparian doctrine framework. The proposed legislation would: (1) protect the investor in riparian land by preserving unused and used riparian rights; (2) encourage dam and reservoir construction by allowing lower riparian owners to share in the increased water supply only on equitable terms; (3) define domestic use and riparian land; (4) legalize harmful uses when reasonable under all the circumstances and authorize consideration of the public interest when determining reasonableness; (5) facilitate alteration in water use in response to changing conditions by making it clear that riparian rights are transferable and by retaining the riparian principle of variability; (6) achieve a balance between certainty and flexibility by permitting a guarantee that the use declared reasonable may be continued for a specified time; and (7) relax to a reasonable degree the restrictions on non-riparian uses. (Childs-Fla)
W69-06341

SEWAGE DISPOSAL PLANTS.

Mich Comp Laws Ann secs 123.201-123.220 (1967).

Descriptors: *Michigan, *Legislation, *Sewage disposal, *Local governments, Sewage, Municipal wastes, Sanitary engineering, Sewage treatment, Waste water disposal, Cities, Financing, Costs, Treatment facilities, Utilities, Construction, Use rates, Condemnation, Waste disposal, Sewers, Legal aspects.
Identifiers: *Sewage disposal plants.

Every city is authorized to construct, operate, and maintain sewage disposal works and the necessary connecting systems. Cities may acquire property and issue revenue bonds to finance such works. Before construction may begin, a city shall adopt an ordinance setting forth the description, cost, useful life, and other data concerning the facility. The ordinance shall be approved by 3/5 of the electors. Control of the works shall be the responsibility of the city legislative body. Any city is empowered to enter into all contracts necessary to carry out the provisions of this act. This act shall constitute full authority to finance, construct, and operate sewage disposal works. (Helwig-Fla)
W69-06342

SEWERS IN PRIVATE PROPERTY: ACQUISITION OF PROPERTY RIGHTS.

Mich Comp Laws Ann sec 123.181 (1967).

Descriptors: *Legislation, *Sewers, *Sanitary engineering, *Michigan, Sewage, Cities, Legal aspects, Eminent domain, Municipal wastes, Sewage disposal, Local governments, Real property, Condemnation, Operation and maintenance.

The common council of any city and the board of trustees of any village are authorized to construct and maintain sewers on private property; their representatives may enter upon private property and make examinations and surveys to enable them to determine the necessity for using the private property for a sewer. No action is maintainable to present or to recover damages for such an entry. Before constructing a sewer on private property, the right to take and use such property shall be acquired by agreement or purchase, or in the manner provided by law. (Dean-Fla)
W69-06343

OHIO RIVER VALLEY WATER SANITATION COMPACT.
For primary bibliographic entry see Field 05G.
W69-06344

SOUTHLAND CO V AARON (ACTION FOR POLLUTION OF DOWNSTREAM WATER SUPPLY).
For primary bibliographic entry see Field 05G.
W69-06345

CHAPMAN V FEDERAL POWER COMM'N (PRIVATE CONSTRUCTION OF HYDROELECTRIC PLANT AND RIVER BASIN PROJECT).
For primary bibliographic entry see Field 08C.
W69-06346

DELAWARE RIVER BASIN.
N J Stat Ann secs 58:18-18 to 58:18-23 (1966).

Descriptors: *New Jersey, *Delaware River Basin Commission, *River basin commissions, *Project feasibility, New York, Pennsylvania, Interstate rivers, Delaware River, Project purposes, River basins, Project planning, Water supply, Reservoir construction, Reservoir sites, Dam construction, Dam sites, State governments, Administrative agencies, Costs, Legislation, River basin development.

The Interstate Commission of the Delaware River Basin is designated as the State Agency of New Jersey to cooperate with New York and Pennsylvania in making a study to determine the advisability of implementing an integrated water project within the Delaware River Basin. The project, comprised of dams and reservoirs, would be designed to meet the prospective water supply needs of New Jersey, New York, and Pennsylvania. The Commission shall require any person, firm, or corporation engaged by it to enter into a written agreement which will require such person, firm or corporation to pay all damages arising from the work to be performed for the Commission. The members of the Commission and its agents, engineers, or contractors may enter upon any lands, structures, or waters within

the state to survey proposed dam or reservoir locations. The Commission is to file a full report of its findings, conclusions, and recommendations to the Governors and Legislatures of New Jersey, New York and Pennsylvania. (Stewart-Fla)
W69-06347

INLAND WATERWAYS.
NJ Stat Ann secs 12:6-1 to 12:6-20 (1968).

Descriptors: *New Jersey, *Legislation, *Inland waterways, *Canals, Administrative agencies, Channels, Harbors, Inlets (Waterways), Rivers, Transportation, Administration, Navigation, Riparian lands, State governments, Water law, Tributaries, Regulation.
Identifiers: *Harbor masters, Navigation aids.

This statute deals with the administration and control of the inland waterways within the state. The powers and duties of the Board of Commerce and Navigation in regard to inland waterways are: (1) to investigate and make annual reports to the governor concerning the condition of the waterways, recommending any improvement or additional construction deemed appropriate; (2) to maintain existing waterways and construct new ones as authorized; (3) to make and enforce waterway rules; (4) to maintain navigation aids on the waterways; and (5) to appoint harbor masters as needed. The duties of the harbor masters are: (1) to supervise the maintenance and use of the waterways; (2) to act as special officers for the enforcement of the laws of the state and rules of the Board; and (3) to regulate traffic upon the waterways. The Board of Commerce and Navigation may improve any tributaries to the inland waterway as it deems advisable. Any tributary so improved shall become part of the waterway system. The Board may apply for federal aid to improve tributaries with state moneys. The Commissioner of Conservation and Economic Development is authorized to convey the title of the state in the New Jersey Intracoastal Waterway to the United States. (Helwig-Fla)
W69-06348

POLLUTION OF FRESH WATERS.
For primary bibliographic entry see Field 05G.
W69-06349

POLLUTION OF POTABLE WATERS.
For primary bibliographic entry see Field 05G.
W69-06350

PROTECTION AND IMPROVEMENT OF WATERS.
For primary bibliographic entry see Field 05G.
W69-06351

ORGANIZATION AND GENERAL PROVISIONS.
For primary bibliographic entry see Field 05G.
W69-06352

POLLUTION CONTROL.
For primary bibliographic entry see Field 05G.
W69-06353

ENFORCEMENT.
For primary bibliographic entry see Field 05G.
W69-06354

BRIGGSON V CITY OF VIROQUA (SEWAGE DISCHARGE ACROSS LAND).
For primary bibliographic entry see Field 05C.
W69-06355

VEAZEY V CITY OF DURHAM (PERMANENT DAMAGES RESULTING FROM MUNICIPAL SEWAGE DISCHARGE).
For primary bibliographic entry see Field 05C.
W69-06356

GOULD AND EBERHARDT, INC V CITY OF NEWARK (DISCHARGE OF SURFACE WATERS FROM STORM SEWER).
For primary bibliographic entry see Field 04A.
W69-06357

STATE V BOSTIAN (EMINENT DOMAIN AND MUNICIPAL WATER SUPPLY).

272 SW 2d 857-863 (Mo Ct App 1954).

Descriptors: *Missouri, *Eminent domain, *Public utilities, *Water supply, Underground streams, Subsurface waters, Streams, Running waters, Condemnation, Underflow, State governments, Nonnavigable waters, Water rights, Legislation, Judicial decisions, Municipal water, Cities, Local governments, Legal aspects, Appropriation.

Plaintiff brought condemnation proceedings against defendant's property for the purpose of taking water from certain underground streams. The streams were to be used for municipal water supply. Plaintiff based its suit on a statute which authorized a municipal water supplier to take water from any 'non-navigable stream.' Defendant contended that the reference to 'non-navigable streams' contemplates surface streams, not underground streams. Furthermore, defendant contended that since the right of eminent domain comes from the Legislature and constitutes an invasion of private property, a statute granting such right should be strictly construed. The statute did not authorize plaintiff to appropriate private lands in order to obtain a source of underground water. The court agreed that the right of eminent domain should be strictly construed and that any doubt should be resolved in favor the taxpayer. The trial court's judgment for the defendant was affirmed. (Stewart-Fla)
W69-06358

WOODWARD IRON CO V MUMPOWER (DAMAGE TO SURFACE OWNERS RIGHTS FROM MINING OPERATIONS).
For primary bibliographic entry see Field 04A.
W69-06359

STIGALL V SHARKEY COUNTY (DESTRUCTION OF DRAINAGE FACILITIES CAUSING FLOOD DAMAGE).
For primary bibliographic entry see Field 04A.
W69-06360

HALL V CITY OF GREENVILLE (STATUTORY DUTY OF CITY TO PROVIDE ADEQUATE STREET DRAINAGE).
For primary bibliographic entry see Field 04A.
W69-06361

BOARD OF LEVEE COMM'RS OF ORLEANS LEVEE DIST V KELLY (PUBLIC RIGHTS IN RE FLOOD CONTROL).
For primary bibliographic entry see Field 04A.
W69-06362

MCKEE V HASLER (LEVEE CONSTRUCTION FOR FLOOD CONTROL).
For primary bibliographic entry see Field 04A.
W69-06363

UNITED STATES V INGRAM (BRIDGE CONSTRUCTION AND RIPARIAN OBLIGATIONS).
For primary bibliographic entry see Field 04A.
W69-06364

CITY OF IRVINE V SMITH (FLOODING CAUSED BY BREAK IN SEWER).
For primary bibliographic entry see Field 04A.
W69-06365

MARINE AIR WAYS, INC V STATE (DEPRIVATION OF ACCESS ROUTES DUE TO BRIDGE CONSTRUCTION).
For primary bibliographic entry see Field 04A.
W69-06366

MCCAUSLAND V JARRELL (OBSTRUCTION OF THE FLOW OF A NATURAL STREAM).
For primary bibliographic entry see Field 04A.
W69-06367

MAGEE V TEXAS CONSTRUCTION CO (FLOODING ABOVE COFFER DAM).
For primary bibliographic entry see Field 04A.
W69-06368

JARVIS V CORNETT (DAMAGES CAUSED BY DIVERSION OF SURFACE WATER).
For primary bibliographic entry see Field 04A.
W69-06369

GRANGER V ELM TREE VILLAGE (DISCHARGE OF EXCESS SURFACE WATER).
For primary bibliographic entry see Field 04A.
W69-06370

DE PIETRO V TRIANO (ESTABLISHMENT OF EASEMENT FOR SURFACE WATER DRAINAGE).
For primary bibliographic entry see Field 04A.
W69-06371

EFNER V KETTERINGHAM (VALIDITY OF EASEMENT TO DRAIN RAIN WATER ONTO ADJOINING LAND).
For primary bibliographic entry see Field 04A.
W69-06372

DIXON V CITY OF NASHVILLE (DAMAGES CAUSED BY DEFLECTION OF SURFACE WATER FLOW).
For primary bibliographic entry see Field 04A.
W69-06373

JOHNSON V CITY OF WINSTON-SALEM (SURFACE WATER DRAINAGE - PIPES).
For primary bibliographic entry see Field 04A.
W69-06374

HORN V BRATTON (SUIT TO ENJOIN MAINTENANCE OF DAM AND DITCH FACILITIES).
For primary bibliographic entry see Field 04A.
W69-06375

NATIONAL MFG CO V UNITED STATES (SOVEREIGN IMMUNITY FROM SUIT FOR FLOOD DAMAGE).
For primary bibliographic entry see Field 04A.
W69-06376

LE CLAIR V SWIFT (ENFORCEMENT OF CONSERVATION STATUTES).
76 F Supp 729-734 (E D Wis 1948).

Descriptors: *Wisconsin, *Lake Michigan, *Fish conservation, *Commercial fishing, Great Lakes, Legislation, Administrative agencies, State governments, Federal government, United States, Wildlife conservation, Nets, Trawling, Lakes, Judicial decisions, Legal aspects, Navigation, Remedies, Damages.
Identifiers: Concurrent jurisdiction, Police powers, Commerce power.

Plaintiff, a commercial fisherman, sought to enjoin the defendant, Director of the State Conservation Commission, from enforcing certain Wisconsin conservation laws which enabled the defendant to seize any wildlife unlawfully taken. Specifically

outlawed was the use of any unlicensed net and the use of any boat in violation of conservation laws. The plaintiff contended that the enforcement of these laws contravened a federal statute prohibiting interference with navigation on the Great Lakes. The court held that the right of the federal government to control navigation on the Great Lakes and the right of the State of Wisconsin to regulate fishing on those waters within its boundaries were concurrent and not in conflict. Plaintiff's contentions were found to be without merit. (Katz-Fla)
W69-06377

FEDERAL POWER COMMISSION V NIAGARA MOHAWK POWER CORPORATION (STATUS OF STATE WATER RIGHTS UNDER FEDERAL WATER POWER ACT OF 1920).

347 US 239-259 (1954).

Descriptors: *United States, *Federal-state water rights conflicts, *Usufructuary rights, *Amortization, Powerplants, Legislation, Obstruction to flow, Navigable rivers, River regulation, Running waters, Federal jurisdiction, State jurisdiction, Water permits, Diversion, Federal project policy, Water utilization, Proprietary power, Hydroelectric power.
Identifiers: *Federal Power Commission, Niagara River, Corporal hereditaments, Dominant servitudes.

The Federal Power Commission brought this proceeding to determine defendant's amortization reserve liability required under the Federal Water Power Act of 1920. Defendant had secured a license from the Commission authorizing diversion of water from the Niagara River for power purposes. Defendant's license required a reserve of 50% of its surplus earnings. In computing defendant's reserve, the Commission disallowed certain expenses paid for defendant's use of private water rights existing under state law and included these amounts in defendant's required reserve. While the court recognized the dominant servitude in favor of the United States under which private persons hold physical properties obstructing navigable waters of the United States, the exercise of that servitude without making allowance for pre-existing rights under state law required clear authorization. The court declared that neither the Federal Water Power Act nor defendant's license expressly abolished existing property rights in the use of the Niagara River. The Act merely imposed upon owners of riparian water rights an obligation to use them in compliance with the Act. The court concluded that, although defendant's water rights were within the scope of the government's dominant servitude, the government had not exercised its power to abolish them, and, therefore, defendant's expenses were not unreasonable. (Reed-Fla)
W69-06378

NIAGARA MOHAWK POWER CORP V FEDERAL POWER COMM'N (USUFRUCTUARY RENTAL AS AN OPERATING EXPENSE).

202 F 2d 190-211 (DC Cir 1952).

Descriptors: *United States, *New York, *Usufructuary right, *Federal Power Act, Legislation, Operation and maintenance, Streams, Administrative agencies, Riparian rights, Hydroelectric power, Hydroelectric plants, State governments, Public use, Easements, Water falls, Judicial decisions, Legal aspects, Utilities, Public utilities.
Identifiers: Water Power Act, Federal Power Commission.

Under the Water Power Act of 1920, the petitioner was required to set aside an amortization reserve in proportion to surplus earnings. The petitioner deducted, as operating expense, the amount of certain rental payments to the owners of certain usufructuary rights which were interfered with by petitioners. The Federal Power Commission refused to allow this dedication and ordered the petitioner to increase its amortization reserve accordingly. The Commission asserted that the alleged usufructuary rights did not exist since there cannot be private ownership of the waters of a navigable stream. The court held that, under the laws of New York, usufructuary rights existed but were subject to the paramount right of the state to utilize the waters for a public purpose without payment of compensation therefor. The court refused to recognize the Commission's decision that a usufructuary right was the equivalent of ownership of the water. The Commission contended the Water Power Act declared the waters of the Niagara to be essential to navigation, thereby extinguishing these usufructuary rights. The court, examined a 1910 treaty with Canada and determined that the Water Power Act was not intended to extinguish these private rights. (Katz-Fla)
W69-06379

CROSS V PACE (DAMAGE TO UNITED STATES CITIZENS BY FOREIGN DAM).
For primary bibliographic entry see Field 04A.
W69-06380

JACKSON V UNITED STATES (PRIVATE PROPERTY RIGHTS IN FISHING GROUNDS).

103 F Supp 1019-1021 (Ct Cl 1952).

Descriptors: *Commercial fishing, *Maryland, *Eminent domain, *Damages, Property values, Navigable waters, Fishing, Federal government, Navigation, Remedies, Judicial decisions, Legal aspects, Permits, Eminent domain, United States, Compensation.
Identifiers: Fishing rights, Spesutic Island, Chesapeake Bay, Commerce clause.

Plaintiff, on the basis of his earlier fishing activity, obtained a license from the State of Maryland allowing him to continue fishing off the eastern shore of Spesutic Island, in Chesapeake Bay. This license could be sold or devised, or passed to his estate upon his death. In 1943, defendant enlarged a nearby weapons proving ground which included plaintiff's fishing area. Plaintiff was unable to get a license to fish elsewhere and filed a claim against the United States. The court of claims found that the plaintiff had a property right in his fishing ground. While the government may forbid the private use of navigable waters to protect and improve navigability, it may not do so for purposes unrelated to commerce. Therefore, plaintiff was entitled to compensation. (Gabrielson-Fla)
W69-06381

GUNN V BERQUIST (ADVERSE POSSESSION OF AND RIPARIAN RIGHTS IN TOWN-OWNED RIPARIAN LANDS).

108 NYS 2d 644-647 (Sup Ct 1951).

Descriptors: *New York, *Riparian lands, *Land tenure, *Riparian rights, Cities, Legislation, High water mark, Boundaries (Property), Landfills, Tidal waters, Prescriptive rights, Beds, Bays, Land forming, Legal aspects, Judicial decisions, Relative rights.
Identifiers: *Adverse possession, Tidal lands.

The Town of North Hempstead brought an action to establish its right to possess certain land as fee simple owner. Defendants were the record owners of the property. The western boundary of the land was the mean high water mark of an adjacent bay; all land below this mark was reserved to the town as successor to the sovereign. The town's land, originally submerged, was filled to the extent necessary to support building operations. Defendants asserted title to the filled land by adverse possession. The alleged adverse use was the maintenance of a bathhouse thereon for the required statutory period. The court declared that, since the use of the bathhouse was merely an exercise of defendants' riparian rights and was not hostile to the town's title, no effective adverse possession ha been established. Furthermore, the court observe that tidal lands which a town holds in a governme tal capacity may not be alienated; hence, su lands may not be acquired by adverse possessio The court, therefore, ruled that, since defendan had failed to establish title to the parcel by adver possession, judgment would be directed for t town. (Reed-Fla)
W69-06382

WHITSON V MORRIS (TITLE TO RE-FORME ALLUVIAL LAND).

304 Ky 447, 201 SW 2d 193-197 (1946).

Descriptors: *Kentucky, *Islands, *Mississip River, *Land forming, Alluvium, Erosion, Accr tion (Legal aspects), Proprietary power, Bed Riparian land, Patents, Boundaries (Property Low water mark, Watercourses (Legal), Washou Relative rights, Ownership of beds, Land tenu River beds.
Identifiers: *Adverse possession.

Plaintiffs brought action to quiet title to alluv land which had been reformed after the origi soil had been submerged by the Mississippi Riv The river had cut a deep semicircle in the locus quo and submerged much land. At approximat the same time, plaintiffs' predecessors in title c tained patents to an island which had formed acr from the lands in question. Later, the river return to its original bed, most of the island disappeare and the washed out sections of the mainland rea peared. Plaintiffs claimed the reformed lands accretions to the island. Defendants also claim the land and charged that no part of the tract volved was embraced by the grants to plaintif predecessors. The court declared that where a p manent island has been patented apart from t mainland, the mainland owner's title to the strea bed extends to the center line between the isla and the shore. Therefore, the right to accretio belongs equally to the owners of the island and t owners of the mainland. The evidence showed th the island patented to plaintiffs' predecessors w not contiguous to the mainland, and that the allu al land was formed by accretion to the mainla and not to the island. Title was quieted in defe dants. (Reed-Fla)
W69-06383

ANDERSON-TULLY CO V MURPHR (OWNERSHIP OF PROPERTY LOST BY AVU SION).

153 F 2d 874-883 (8th Cir 1946).

Descriptors: *Arkansas, *Land tenure, *Islan *Avulsion, Boundaries (Property), Riparian la Riparian rights, Judicial decisions, Taxes, Navi ble rivers, Mississippi River, Ownership of be High water mark, Public lands, Beds, Naviga waters, Legislation, Accretion (Legal aspects).
Identifiers: Adverse possession.

Plaintiff brought an action to quiet title to land a to eject the defendant. Land which the plaintiff l due to avulsion had subsequently reappeared in form of an island. The defendant then acquired t to this island from the State and began to pay ta on it. The defendant based his title on a stat which declared that all islands which formed in navigable waters of the State were the property the State. However, the court entered a judgm for the plaintiff on the basis of a subsequent statu This later statute provided that all islands form in navigable waters became property of the sta except in the case of avulsion. If an island formed by avulsion, the owner retained title to submerged land and to any islands subsequen formed therefrom. The island in question form within the original boundaries of the plaintiff's p perty; therefore, it still belonged to the plaint The State could not take away what it had pre ously unconditionally granted. (Stewart-Fla)
W69-06384

WUNDERLICH V CATES (DISPUTE OVER TITLE TO AN ISLAND IN THE MISSISSIPPI RIVER).

212 SW 2d 556-565 (Ark 1948).

Descriptors: *Arkansas, *Islands, *Land tenure, *State governments, Boundary disputes, Judicial decisions, Mississippi River, Navigable rivers, Taxes, Tennessee, Public lands, Land use, Invasion, Avulsion, High water mark, State jurisdiction, Boundaries (Property), Accretion (Legal aspects).
Identifiers: *Adverse possession, *Injunctions (Prohibitory).

Plaintiff brought suit to restrain the defendant from trespassing upon an island in the Mississippi River. The plaintiff contended that the island was in Arkansas. The defendant claimed ownership of the property by virtue of a Tennessee deed. The plaintiff introduced evidence tending to show that Tennessee had acquiesced in the possession of the land by Arkansas citizens and residents. The residents of the island had served on Arkansas juries, paid Arkansas taxes, and sent their children to Arkansas schools. In addition, the residents refused to recognize Tennessee sovereignty. Despite all this, the court entered a judgment for the defendant, ruling that the land belong to Tennessee. It held that the Tennessee deed was prima facie evidence of ownership and that Tennessee's right to the property could not be lost by adverse possession or acquiescence. Furthermore, a recent property survey showed the land to be in Tennessee. (Stewart-Fla)
W69-06385

HAUBER V GENTRY (OWNERSHIP OF LAND FORMED BY ACCRETION).

215 SW 2d 754-759 (Mo 1948).

Descriptors: *Missouri, *Land tenure, *Riparian lands, *Islands, Accretion (Legal aspects), Judicial decisions, Missouri River, Navigable rivers, Banks, Embankments, Channels, Low water mark, Riparian rights, Watercourses, Alluvion, State governments, Shores, Land forming, Boundaries (Property).
Identifiers: Ejectment.

Plaintiff brought suit to eject the defendant from land formed by accretion. The plaintiff's land was located on a river bank; defendant owned an island in that river. The accretion formed on one side of the island, and the island eventually became attached to the shore. The court affirmed a judgment for the defendant, holding that riparian owners do not own below the low water mark of the Missouri River. Therefore, the plaintiff did not acquire title to accretion which joined the island to the shore. If an island, by reason of accretion, unites with the shore, the accretion is part of the island, not the mainland. The riparian owner's land is not extended. Since the soil build-up began on the island gradually extending shoreward, the contiguity is with the island, not the mainland. (Stewart-Fla)
W69-06386

PETERSON V HARPST (ADVERSE POSSESSION OF ISLAND AND ACCRETIONS THERETO).

247 SW 2d 663-668 (Mo 1952).

Descriptors: *Missouri, *Accretion (Legal aspects), *Islands, *Missouri River, Judicial decisions, Prescriptive rights, Patents, Silts, River beds, Proprietary power, Sedimentation, Legislation, Relative rights, Boundaries (Property), Local governments, Land tenure.
Identifiers: *Adverse possession.

Successors in interest of the record owner of an island instituted action to determine title to the island. Plaintiffs supported their claim with evidence of various conveyances made by the county to their predecessor in title. Defendant claimed title by adverse possession, alleging that he had been in possession of and had erected improvements on the island and on accretions thereto. Plaintiffs countered that defendant did not have color of title and that neither they nor their predecessor had notice of defendant's claim of ownership. The court stated, that while some writing should be shown purporting to convey land in order to establish 'color of title,' there is no necessity that an adverse claimant shall have had color of title to land actually possessed. The court was of the opinion that the evidence sustained the finding that defendant possessed the island for more than the prescriptive period and, thus, that defendant's title had been established by adverse possession. Moreover, the court held that accretions became part of the land to which they become affixed. Thus, title to the island, whether acquired by deed or by adverse possession, constitutes good title to any accretions which subsequently became a part thereof. (Reed-Fla)
W69-06387

LAKE FRONT EAST 55TH STREET CO V CITY OF CLEVELAND (ESTABLISHMENT OF BOUNDARY LINES).

66 NE 2d 328-329 (Ohio Ct App 1941).

Descriptors: *Ohio, *Boundaries (Property), *Boundary disputes, *Accretion (Legal aspects), Legal aspects, Judicial decisions, Navigable waters, Great Lakes, Damages, Riparian rights, Cities, Local governments, Shores, Relative rights, Land tenure, Compensation, Competing uses.

Plaintiff brought this action to establish the boundary lines of land formed by accretion on the shore of Lake Erie. An earlier decision by the state supreme court had established that plaintiff owned the land but had failed to set out the boundaries. In the present case, the court held that a decree should be entered quieting title in the plaintiff. The court established the easterly and westerly boundaries of the property in the same locations as were fixed in an earlier action. The boundary line, as established, included gradual accretions within the tract, and plaintiff was held to possess riparian rights in respect of this land. The court remanded for a decision on the issue of compensation to the plaintiff for land taken and for any damages to the residue. (Shevin-Fla)
W69-06388

AMERADA PETROLEUM CORPORATION V CASE (ACCRETION OF LAND).
210 La 630, 27 So 2d 431-432 (1946).

Descriptors: *Louisiana, *Lakes, *Ownership of beds, *Accretion (Legal aspects), Shores, Streams, Navigable waters, Running waters, Sediments, Mineralogy, Oil, Oil wells, Legal aspects, Judicial decisions, State governments, Standing water, Alluvion, Adjudication procedure, Riparian land, Relative rights.
Identifiers: Concursus proceeding.

Plaintiff brought this concursus proceeding to determine the ownership of a sum of money deposited by the plaintiff in the registry of the court. The fund was the royalty due from oil produced in a well drilled in the alluvion of a certain lake. Since the plaintiff company had leased the land from both the state and the defendant, the contest for the royalties was actually between the state and the defendant. The lower court had determined that the land on which the well was located was formed by accretion and that the alluvion belonged to the defendant. The state claimed that the land was part of the lake bed and was not accretion; if this was true, then the state had title to the property since it was located under navigable waters. The court held that the land on which the well was located was alluvion formed on the shore of the stream and, therefore, that it belonged to the defendant. The court rejected the state's contention that the land was a deposit of sediment in a sluggish body of water. Judgment was for the defendant. (Shevin-Fla)
W69-06389

SWAN ISLAND CLUB, INC V WHITE (TITLE TO SUBMERGED LANDS UNDER NAVIGABLE WATERS).

114 F Supp 95-105 (E D NC 1953).

Descriptors: *United States, *Ownership of beds, *Navigable waters, *Non-navigable waters, Hunting, Beds under water, Waterfowl, Legislation, Atlantic Ocean, Judicial decisions, Inland waterways, Shoals, Shallow water, Reefs, Public rights, Tidal waters, Navigation, Legal aspects, Adjudication procedure, Remedies, State governments, Land tenure.
Identifiers: *Torrens proceedings, Collateral attack, Injunctions (Prohibitory).

Plaintiff brought this action to have hunters enjoined from trespassing upon submerged lands adjoining an inland waterway. Plaintiff relied upon state grants and a judgment following a Torrens proceeding to establish title to the submerged lands. The court declared that the waters covering the property were navigable waters, even though they were very shallow in depth. Furthermore, the court pointed out that, at common law, land covered by non-navigable waters could be granted by the state; land covered by navigable waters could not be so conveyed. Since no statute had abrogated the common law rule, the state never had power to grant lands under navigable waters. Therefore, the court concluded that insofar as the court in the Torrens proceeding adjudged plaintiff to be the fee simple owner of the shoal lands under navigable waters, that decree transcended the court's power and thus was open to attack in this action. The court held that the evidence failed to establish plaintiff's title to the submerged lands, and, thus, injunctive relief should be denied. The court further concluded that the public has the right to use navigable waters over privately owned beds, and this right includes the right to hunt and take wild game. (Reed-Fla)
W69-06390

IN RE EASTERN TRANSPORTATION CO (ABANDONMENT OF VESSELS IN NAVIGABLE WATERS).

102 F Supp 913-918 (D Md 1952).

Descriptors: *Maryland, *Navigable waters, *Barriers, *Vessels, Navigation, Legislation, Storms, Federal jurisdiction, Judicial decisions, Legal aspects, Local governments, Federal government, Obsolescence, Cities.
Identifiers: *Obstruction of navigable waters, *Sunken vessels, *Abandonment, *Wreck act, Barges, Bankruptcy.

The referee in bankruptcy issued an order authorizing the bankrupt to abandon four obsolete, worthless barges at their place of anchorage. The order was opposed by the Corps of Engineers and the City of Baltimore. The opponents claimed the order violated the Wreck Act and a certain local ordinance, both of which laws required owners to remove unauthorized obstructions in navigable waters. Removal and sinking in deep water would have cost thousands of dollars, and the trustee claimed the barges were liabilities which could thus be abandoned pursuant to the Bankruptcy Act. The district court held that the referee erred in his decisions and that the Wreck Act applied to all obstructions allowed by the owner to sink, unless such sinking was caused by perils of the sea. The court held that the Bankruptcy Act granted no immunity for abandoning the barges, regardless of bankrupt's financial status. In a supplemental opinion, the court found that one barge had sunk due to a storm and was abandoned prior to the bankruptcy proceedings. Thus, the trustee never took possession of the barge, and the company was exempt

from the requirement to remove it due to the manner in which it sank. (Harris-Fla)
W69-06391

UNITED STATES V 1532.63 ACRES OF LAND (DETERMINATION OF FAIR MARKET VALUE IN CONDEMNATION PROCEEDING).

86 F Supp 467-477 (WD SC 1949).

Descriptors: *Condemnation value, *Property values, *Electric power production, *Federal government, Federal project policy, Legal aspects, Hydroelectric project licensing, Federal power act, Land tenure, Navigable waters, Eminent domain, Judicial decisions, South Carolina, Condemnation, Compensation, Competing uses.
Identifiers: *Constitutionality, Unitary value.

A South Carolina electrical company acquired, by eminent domain, a large tract of land for use in hydroelectric development. In condemnation proceedings by the United States to acquire and use the tract for the same purpose, the issue of just compensation arose. The district court held that the Fifth Amendment prohibited federal taking of private property for public use without just compensation. Compensation is measured by the value of land for the most profitable purpose for which it is suited, provided that there is sufficient evidence that the land is capable of being used for that purpose. The forum or identity of the condemnor is irrelevant. The fact that land must be combined with other land does not foreclose a valuation based on the combined use. The court held that, although the condemnee acquired the land contingent upon a federal license to use it for power development, a failure to obtain the license did not prevent valuation for hydro-electric purposes. The condemnee has no private property right in power potential, but he is entitled to valuation based on power development of the properties as a unit rather than as separated tracts of agricultural land. (Harris-Fla)
W69-06392

SOLOMON V SIOUX CITY (ACCRETION).

51 NW 2d 472-478 (Iowa 1952).

Descriptors: *Iowa, *Accretion (Legal aspects), *Boundaries (Property), *Riparian rights, Missouri River, Dikes, Jetties, Banks, Obstruction to flow, Municipal water, Local governments, Judicial decisions, Eminent domain, Channel flow, Channels, Public rights, Legal aspects, Barriers.

Plaintiff brought action to quiet title to land claimed as accretion. Defendant city claimed the land was not accretion and that public rights superseded those of individual owners. The court found that the doctrine of accretion applied to the Missouri River, notwithstanding its rapid channel shifts, and that the accretion involved met the 'gradual and imperceptible growth' test adopted by the Iowa Courts. The accretion was caused by dikes built by the government. Plaintiff was not barred by the fact that the accretion was caused byartificial means since he had no control over the artificial barriers. A 1940 patent issued to the city by the state did not grant to the city any right to the accreted land since government lands lose and gain by accretion the same as land of individual owners and a channel shift prior to the 1940 patent had vested title in the riparian owners. The court held that public rights do not supersede those of individual riparian owners. Riparian owners rights can be taken from them only through exercise of the power of eminent domain. The court remanded to the lower court to establish exact boundary lines. (Kahle-Fla)
W69-06393

WILLIAMS V DIEDERICH (SUIT TO ENJOIN RECREATIONAL TRESPASS ON RESERVOIR).
233 SW 2d 402-404 (Mo 1949).

Descriptors: *Missouri, *Land tenure, *Reservoir sites, *Recreation, Railroads, Boating, Fishing, Reservoirs, Preferences (Water rights), Priorities, Judicial decisions, Legal aspects, Competing uses, Prescriptive rights, Leases.
Identifiers: Trespass, Injunctions (Prohibitory), Adverse possession.

Plaintiff brought this suit against defendant to determine whether fishing and boating rights in a reservoir to be constructed were assignable and inheritable. Both plaintiff and respondent asked for injunctive relief to prohibit trespassing on the tract of land where the reservoir was to be situated. The grantors of the land had separately conveyed adjoining tracts of land to a railroad, reserving to themselves, jointly, the exclusive boating and fishing privileges on any reservoir which the railroad constructed. Plaintiff initially filed a claim seeking the injunctive relief based upon his purchase of land from one of the original grantors and on a 20 year lease with the railroad for exclusive use of the reservoir. The court held that since the original deed between grantors and railroad did not contain the words 'heirs and assigns' and since neither grantor named the other as grantee, the privileged use of fishing and boating rights upon the reservoir was personal and not assignable or inheritable. Therefore, defendants had no valid claim. Furthermore, in response to defendant's claim of ownership by adverse possession, the court reasoned that evidence of past fishing and boating on the reservoir constituted merely occasional trespasses and were insufficient to give defendants title. (Logan-Fla)
W69-06394

SHAFFER V WILKINSON (WATER RIGHTS AND EASEMENT).

Cambria County Reports Vol 16, pp 101-110 (C P Pa 1949).

Descriptors: *Pennsylvania, *Streams, *Pipelines, *Spring waters, Coal mines, Legal aspects, Judicial decisions, Easements, Hydraulic structures, Competing uses, Pipes, Mineral industry, Land tenure, Water supply, Water sources, Easements.

The plaintiff brought this action in trespass for destruction of a spring and a pipeline which supplied water to plaintiff's residence. The plaintiff's deed, given by the common grantor of all the parties, expressly ceded to plaintiff the right to use the waters of the spring and to maintain the pipeline across defendant's property. The court noted that defendant knew of plaintiff's rights and, through the exercise of reasonable care could have avoided injuring plaintiff. The court felt that defendant had commenced coal mining excavation in disregard of plaintiff's interests. The court awarded damages to plaintiff on the basis of the cost of restoration of the spring and pipeline. (Katz-Fla)
W69-06395

ANDERSON-TULLY CO V TINGLE (ACCRETION TO LAND LOCATED WITHIN THE FORK OF TWO RIVERS).
166 F 2d 224-229 (5th Cir 1948).

Descriptors: *Mississippi, *Accretion (Legal aspects), *Boundaries (Property), *Riparian land, State jurisdiction, Thalweg, Mississippi River, Navigation, Avulsion, Erosion, Degradation (Stream), Scour, Creep, Streams, Judicial decisions, Legal aspects, Federal jurisdiction, Riparian rights, Land forming, Geomorphology.

Plaintiffs brought this action to recover the value of timber cut from lands adjacent to the Mississippi River. Plaintiff claimed title to the property on which the timber was located. The defendants claimed title to the same land on the theory that where there is one owner of all the land in a fork between two rivers which constitute the boundaries of that tract, all accretions which form between the two rivers belong to the owner of the land in the fork and not to the owner of the lands across either river. The court found that, in determining title to the accretions, the same rules are applicable as where one river forms a boundary. Imperceptible accumulations of soil inure to the benefit of the riparian owner on whose side of the thalweg, or stream thread, the accreted material accumulates. In the instant case, as one river had ceased to flow, the court found it necessary to permanently affix the location of the thalweg as of the date at which the river ceased to flow. (Katz-Fla)
W69-06396

PERSON V JOHNSON (TITLE TO BEDS UNDER NON-NAVIGABLE LAKES).
235 SW 2d 876-881 (Ark 1950).

Descriptors: *Arkansas, *Ownership of beds, *Riparian land, *Non-navigable waters, Judicial decisions, Legal aspects, Lakes, Riparian rights, Water law, Beds under water, Boundaries (Property), Fences, Shores.
Identifiers: Recording acts, Chain of title, Partition suits.

Appellant claimed that his property, located on the southern side of a non-navigable lake, was circumscribed by the northern shore of the lake. Appellee owned the property bordering on the northern shore. The source of each party's claim of title was a partition suit in which the agreed separation line was a fence constructed in the center of the lake. Appellant based his claim of ownership to the northern shore on transactions subsequent to the partition suit in which his boundary was expressly described as the north shoreline. The court held that appellee's title extended to the center of the lake. The court upheld the conveyances relied on by appellant but indicated that none of the parties to such conveyances had intended an obvious invasion of appellee's riparian rights. The general rule is that, when a tract of land borders on a non-navigable stream or lake, the riparian proprietor is deemed to own the bed to the center of the water body. (Holt-Fla)
W69-06397

JOHNSON V SMITH (TITLE TO BEDS UNDER NON-NAVIGABLE LAKES).

219 SW 2d 926-929 (Ark 1949).

Descriptors: *Arkansas, *Beds under water, *Ownership of beds, *Riparian land, Judicial decisions, Legal aspects, Water law, Non-navigable waters, Lake beds, Riparian rights, Remedies, Boundaries (Property), Relative rights, Lakes.
Identifiers: Recording acts, Constructive notice, Implied actual notice.

Appellants owned property on the east side of a non-navigable lake, and appellees owned the property bordering on the west side of the lake. Appellees had previously owned the property on both sides, but, through purchase at a foreclosure sale, appellants predecessor in interest obtained title to the east side tract. Through an agreement, and according to a recorded deed, this property was to extend to the eastern border of the lake. When appellants obtained title, the property was again described as extending to the eastern border of the lake. Appellants contended that, as riparian owners, they owned to the center of the lake bed. Appellees claimed title to the entire bed of the lake. The court stated that, as to riparian owners on each side of a non-navigable lake, the presumption is that each riparian owner owns to the center of the lake; however, the court held that the appellees owned title to the entire bed based on the description in their recorded deed. (Holt-Fla)
W69-06398

LOUGHRAN V MATYLEWICZ (EASEMENTS ON NON-NAVIGABLE WATERS).

367 Pa 593, 81 A 2d 879-882 (1951).

Descriptors: *Ownership of beds, *Pennsylvania, *Prescriptive rights, *Backwater, Dams, Easements, Overflow, Water rights, Riparian rights, Ponds, Non-navigable waters, Remedies, Legal aspects, Judicial decisions, Recreation, Relative rights, Fishing, Boating.
Identifiers: Injunctions (Prohibitory).

Plaintiffs sought to enjoin interference with their lawful possession of a certain non-navigable pond. Plaintiffs charged the defendants, owners of land bordering on the pond, with trespassing by attempting to transform the pond into an amusement center. The lower court held for the plaintiff. This court affirmed, holding that the plaintiff had good title to the pond and that mere casual and sporatic use of the pond by appellants did not ripen into an easement by prescription. The court found that defendant's claim that plaintiff's construction of a two foot dam at the pond's outlet caused it to overflow onto defendant's land was invalid since, at the time defendants purchased their land, a six foot dam was already in existence. (Gabrielson-Fla)
W69-06399

KRAFT V MILLER (ARTIFICIAL CONTROL OF SURFACE WATERS).
For primary bibliographic entry see Field 04A.
W69-06400

STATE V SENSENBRENNER (RIPARIAN RIGHTS REGARDING ? \TURAL DAMS).
For primary bibliographi- ntry see Field 04A.
W69-06401

BAYLEN STREET WHARF CO V CITY OF PENSACOLA (DAMAGES TO LAND BY STORM SEWER REFUSE).

39 So 2d 66-68 (Fla 1949).

Descriptors: *Florida, *Storm drains, *Fisheries, *Cities, Commercial fishing, Docks, Sewage disposal, Landfills, Municipal wastes, Oil wastes, Beds, Boats, Taxes, Damages, Legal aspects, Judicial decisions, Real property, Ownership of beds, Silts, Remedies.
Identifiers: Injunctions (Mandatory).

The respondent city filed a complaint against the petitioner to foreclose certain tax liens. After his counterclaim was dismissed, petitioner filed a complaint asking that the city be enjoined from operating a certain storm sewer that was discharging refuse onto the petitioner's land. This complaint was also dismissed, and this appeal followed. The court ackowledged the general rule that a counterclaim will not be permitted as a defense to a tax lien suit; however, this case was an exception. The petitioners alleged that their property was suited only for maritime purposes, that the refuse from the storm sewer was destroying its usefulness and that the value of the land was continually declining. The court stated that if the claims were proven, the petitioner would be entitled to relief. The court held that a municipality cannot set in motion an agency which continually destroys ones property and at the same time insist on the payment of taxes thereon. The court further stated that water bottoms rendered worthless are not taxable. The court reinstated petitioner's counterclaim and remanded the case to the lower court for a verdict on the evidence. (Shevin-Fla)
W69-06402

NATURAL RESOURCES.
For primary bibliographic entry see Field 04A.
W69-06403

POLLUTION OF WATERS BY RAILROADS AND FACTORIES.
For primary bibliographic entry see Field 05G.
W69-06404

NIAGARA MOHAWK POWER CORP V FEDERAL POWER COMM'N (USUFRUCTUARY RIGHTS AND THE FEDERAL WATER POWER ACT OF 1920).
For primary bibliographic entry see Field 06C.
W69-06405

ATTORNEY GENERAL V CITY OF WOBURN (POLLUTION OF RIVER BY CITY).
For primary bibliographic entry see Field 05G.
W69-06406

POLLUTION OF WATERS.
For primary bibliographic entry see Field 05G.
W69-06407

DYER V SIMS (ENFORCEMENT OF INTERSTATE POLLUTION CONTROL COMPACTS).
For primary bibliographic entry see Field 05G.
W69-06408

MASSEY V MASONITE CORP (OVERFLOW OF EFFLUENTS INTO PRIVATE LAKE).
For primary bibliographic entry see Field 05G.
W69-06409

ANTHONY V HUNTLEY ESTATES (DAMAGES FOR POLLUTION OF STREAM).
For primary bibliographic entry see Field 05G.
W69-06410

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION).
Commission on Marine Science, Engineering and Resources, Washington, D. C.
For primary bibliographic entry see Field 06B.
W69-06411

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION, PART III: DEVELOPMENT OF NONLIVING MARINE RESOURCES.
Commission on Marine Science, Engineering and Resources, Washington, D. C.
For primary bibliographic entry see Field 06B.
W69-06412

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION, PART III: NATURAL GAS.
Commission on Marine Science, Engineering and Resources, Washington, D. C.
For primary bibliographic entry see Field 06B.
W69-06413

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION), PART III: OTHER MARINE MINERALS.
Commission on Marine Science, Engineering and Resources, Washington, D. C.
For primary bibliographic entry see Field 06B.
W69-06414

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION, PART III: LEGAL AND REGULATORY CONSIDERATIONS.
Commission on Marine Science, Engineering and Resources, Washington, D. C.
For primary bibliographic entry see Field 06B.
W69-06415

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION), PART III: FRESH WATER RESOURCES.
Commission on Marine Science, Engineering and Resources, Washington, D. C.
For primary bibliographic entry see Field 06B.
W69-06416

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION), PART III: AN INTERNATIONAL LEGAL-POLITICAL FRAMEWORK FOR EXPLORING AND EXPLOITING THE MINERAL RESOURCES UNDERLYING THE HIGH SEAS.
Commission on Marine Science, Engineering and Resources, Washington, D. C.
For primary bibliographic entry see Field 06B.
W69-06417

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION), PART III: AN INTERNATIONAL AUTHORITY TO REGISTER NATIONAL CLAIMS BEYOND THE REDEFINED CONTINENTAL SHELF.
Commission on Marine Science, Engineering and Resources, Washington, D. C.
For primary bibliographic entry see Field 06B.
W69-06418

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION), PART IV: GOVERNMENT-INDUSTRY RELATIONSHIPS IN SUPPORT OF RESEARCH DEVELOPMENT.
Commission on Marine Science, Engineering and Resources, Washington, D. C.
For primary bibliographic entry see Field 06B.
W69-06419

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION): ORGANIZING A NATIONAL OCEAN EFFORT.
Commission on Marine Science, Engineering and Resources, Washington, D. C.
For primary bibliographic entry see Field 06B.
W69-06420

6F. Nonstructural Alternatives

FLOOD PLAIN INFORMATION, UPPER FLINT RIVER, MUD AND JESTER CREEKS, METROPOLITAN ATLANTA, GEORGIA.
Corps of Engineers, Mobile, Ala.
For primary bibliographic entry see Field 04A.
W69-06057

FLOOD PLAIN INFORMATION, CASEY CANAL NORTH, SAVANNAH AND CHATHAM COUNTY, GEORGIA.
Corps of Engineers, Savannah, Ga.
For primary bibliographic entry see Field 04A.
W69-06058

FLOOD PLAIN INFORMATION, TAR RIVER AND STONY CREEK, ROCKY MOUNT, NORTH CAROLINA.
Corps of Engineers, Wilmington, N. C.
For primary bibliographic entry see Field 04A.
W69-06059

FLOOD PLAIN INFORMATION, COBBS CREEK-FOWLER BRANCH, DEKALB COUNTY, GEORGIA.
Corps of Engineers, Savannah, Ga.
For primary bibliographic entry see Field 04A.
W69-06060

FLOOD PLAIN INFORMATION, ROCK RIVER AT JANESVILLE, WISCONSIN.
Corps of Engineers, Rock Island, Ill.
For primary bibliographic entry see Field 04A.
W69-06061

FLOOD PLAIN INFORMATION, BIG WALNUT CREEK, VICINITY OF COLUMBUS, OHIO.
Corps of Engineers, Huntington, W. Va.
For primary bibliographic entry see Field 04A.
W69-06062

FLOOD PLAIN INFORMATION, HUNNICUTT CREEK, ATHENS, CLARKE COUNTY, GEORGIA.
Corps of Engineers, Savannah, Ga.
For primary bibliographic entry see Field 04A.
W69-06063

FLOOD PLAIN INFORMATION, TAR RIVER AT LOUISBURG, NORTH CAROLINA.
Corps of Engineers, Wilmington, N. C.
For primary bibliographic entry see Field 04A.
W69-06064

FLOOD PLAIN INFORMATION, DICKINSON BAYOU, DICKINSON, TEXAS.
Corps of Engineers, Galveston, Tex.
For primary bibliographic entry see Field 04A.
W69-06065

FLOOD PLAIN INFORMATION, ELLERBE, GOOSE, WARREN, SANDY AND THIRD FORK CREEKS, DURHAM, NORTH CAROLINA.
Corps of Engineers, Wilmington, N. C.
For primary bibliographic entry see Field 04A.
W69-06066

FLOOD PLAIN INFORMATION, TURTLE CREEK, ROCK COUNTY, WISCONSIN.
Corps of Engineers, Rock Island, Ill.
For primary bibliographic entry see Field 04A.
W69-06067

FLOOD PLAIN INFORMATION, BEAVERDAM CREEK, PRINCE GEORGES COUNTY, MARYLAND.
Corps of Engineers, Baltimore, Md.
For primary bibliographic entry see Field 04A.
W69-06068

FLOOD PLAIN INFORMATION, OTTAWA RIVER, ALLEN COUNTY, OHIO.
Corps of Engineers, Detroit, Mich.
For primary bibliographic entry see Field 04A.
W69-06069

FLOOD PLAIN INFORMATION, OHIO RIVER, JEFFERSON COUNTY, KENTUCKY.
Corps of Engineers, Louisville, Ky.
For primary bibliographic entry see Field 04A.
W69-06070

WATER AND CHOICE IN THE COLORADO BASIN: AN EXAMPLE OF ALTERNATIVES IN WATER MANAGEMENT.
National Academy of Sciences--National Research Council, Washington, D. C. Committee on Water.
For primary bibliographic entry see Field 06B.
W69-06086

A FLOOD LOSS REDUCTION PROGRAM,
Gilbert F. White.
Civil Engineering ASCE, Vol 38, No 8, pp 60-62, Aug 1968. 3 p, 1 tab.

Descriptors: *Flood plain zoning, *Flood plain insurance, *Land use, *Flood damage, Flood protection, Flood control, Federal government, Nonstructural alternatives, Public benefits, Legislation, Regulation, Engineering structures, Damages, Environmental engineering.

The efforts of state and federal agencies to secure an integrated flood control program may be jeopardized by hasty action in two areas. (1) A federally subsidized flood damage insurance program may lead to the establishment of premium levels having no relation to risk exposure. If premium rates are not set in relation to hazard, wasteful use of flood plain's would be rewarded. (2) Land use regulations, local zoning and ordinances, should not be thought of as exclusively negative instruments foreclosing the use of flood plains. If proper safeguards are established, these lands can be utilized. Land use regulation is aimed at preventing threats to public health and not at preventing foolish investment. Private engineering firms will benefit from the dissemination of flood hazard information and technical advice by the Corps of Engineers; such a program will enable private enterprise to intelligently choose between diverse land use alternatives. (Molica-Fla)
W69-06097

07. RESOURCES DATA

7A. Network Design

SURFACE WATER HYDROLOGY (GENERAL OUTLINE),
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 02E.
W69-06222

HYDROLOGICAL FORECASTING,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 02A.
W69-06228

HYDROLOGICAL BENCH MARKS,
Geological Survey, Washington, D. C.
W. B. Langbein.
World Meteorol Organ, Int Hydrol Decade Rep No 8, 1968. 8 p, 4 ref.

Descriptors: *Networks, *Hydrologic data, International Hydrological Decade, Regional analysis, Hydrologic budget, Streamflow, Water levels, Discharge (Water), Climatic data, Statistical methods, Water quality.
Identifiers: *Hydrological Bench Marks.

Hydrological bench marks are established to provide a continuing series of consistent observations on climatic and hydrometric data. They are established in areas relatively uninfluenced by past or future artificial changes. Methods of analyzing the hydrological structures of natural catchments are discussed. Stationary time series and analysis of the statistical structure of hydrological time series are briefly described and references are given for more detailed study. The problems of change of hydrological regimen may be solved only by use of internal evidence in the stream in question or by comparison with standard or bench mark streams. An alternative is the use of derived homogeneous data from gaging networks or the use of estimates of ungaged flow derived from climatological networks. The general principles of site selection for bench marks are lack of man-made storage, lack of pumping wells, conditions favorable for gaging and climatic data collecting, and likelihood of small natural changes with time. The catchment area should be between 10 and 100 sq mi. Data to be collected include streamflow, water table level, water chemical analyses, sediment, precipitation, temperatures, evaporation, solar radiation, and stream channel shape changes. The relations of bench marks to climatological reference stations, representative catchments, and vigil stations are described. (Knapp-USGS)
W69-06252

7B. Data Acquisition

A PORTABLE RAINFALL SIMULATOR AND RUNOFF SAMPLER,
New Mexico State Univ., Las Cruces.
J. U. Anderson, A. E. Stewart, and P. C. Gregory.
N Mex Ag Ex Station Res Rept 143, October 1968. 8 p, 7 photo, 1 table, 5 ref. OWRR Project A-004-NMEX.

Descriptors: *Rainfall simulators, *Samplers, Surface runoff, Water yield, Sediment yield, Equipment.

The device applies water to 16 x 20 foot plots at rates up to 8 inches per hour with kinetic energy approximating that of natural rainfall. It also samples and records the rate of runoff in such a way that sediment production can be measured accurately. The major components are: (1) a 1500 gallon tank truck for transporting water and apparatus, (2) a demountable aluminum framework and moving spray assembly for applying water, and (3) a device for sampling and measuring the rate of runoff. Two men can assemble it and put it in operation in one and a half hours. The sampler takes representative 1.76 plus or minus .03% or 10.68 plus or minus .04% samples.
W69-06011

CONSTRUCTION OF PIEZOMETERS, AND METHOD OF INSTALLATION FOR GROUND WATER OBSERVATIONS IN AQUIFERS,
Commonwealth Scientific and Industrial Research Organization, Merbein (Victoria). Div. of Horticultural Research.
J. Groot Obbink.
J Hydrol, Vol 7, No 4, pp 434-443, Apr 1969. 10 p, 9 fig.

Descriptors: *Piezometers, *Observation wells, *Operation and maintenance, Instrumentation, Well casings, Well filter, Wellpoints, Wells, Well screens, Drilling, Aquifers.
Identifiers: Well drilling, Well jetting (Drilling).

Over the period 1952-1963, groundwater studies were carried out by C.S.I.R.O. in various irrigation districts in South Australia, Victoria, and New South Wales. Piezometers were installed to observe the behaviour of groundwater in aquifers underlying these areas. A description if given of 2 types of screens which have been used and the methods of installation by jetting or rotary drilling. A detailed description of jetting equipment is given and the use of both types of screens discussed. The material encountered was recent riverine clays, and sand and one particular piezometer site is illustrated. Testing and maintenance of the installed piezometers are described. (Knapp-USGS)
W69-06019

MEASUREMENT OF PEAK DISCHARGE BY INDIRECT METHODS,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02E.
W69-06251

TRITIUM CONTENT IN THE FIRN LAYERS OF AN ALPINE GLACIER,
Innsbruck Univ. (Austria). Dept. of Physics; and International Atomic Energy Agency (Vienna).
For primary bibliographic entry see Field 02C.
W69-06262

7C. Evaluation, Processing and Publication

NUMERICAL EXPERIMENTS WITH THE STANFORD WATERSHED MODEL ON SMALL AGRICULTURAL WATERSHEDS IN VIRGINIA,
Virginia Polytechnic Inst., Blacksburg. Dept. of Agricultural Engineering; and Agricultural Research Service, Blacksburg, Va. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 02E.
W69-06032

SOLUTION OF ESTUARY PROBLEMS AND NETWORK PROGRAMS,
Rice Univ., Houston. Dept. of Environmental Science and Engineering; and Texas Univ., Austin. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02L.

W69-06077

MATHEMATICAL STATISTICS AS A METHOD FOR HYDROLOGICAL INVESTIGATIONS,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 06A.
W69-06226

THE HYDROLOGIC CYCLE AND THE WATER BALANCE IN NATURE,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 02A.
W69-06227

08. ENGINEERING WORKS

8A. Structures

CARBONATE SCALE IN ROMAN AND MODERN CANALS IN THE JORDAN VALLEY,
Food and Agriculture Organization of the United Nations, Iraklion (Crete).
H. W. Underhill.
J Hydrol, Vol 7, No 4, pp 389-403, Apr 1969. 15 p, 4 fig, 2 tab, 15 ref.

Descriptors: *Scaling, *Canals, *Calcium carbonate, Hardness (Water), Irrigation water, Spring waters, Arid lands, Irrigation canals.
Identifiers: *Jordan.

Problems of loss of capacity of canals and pipelines carrying waters heavily charged with carbonates are not new; examples are described from classical and modern times in the Jordan Valley. An outline of the chemistry of carbonates in ground water is followed by a discussion of the chemical analyses of two springs in West Jordan. Different indices of calcium carbonate saturation are examined; as none of these indicates the delayed properties of such waters the addition of an 'aerated saturation index' is proposed. The rate of scale formation in the modern Ain Feseyl canal is estimated from chemical analyses. The relation between scale precipitation in man-made works and its formation under natural conditions is noted, and a historical footnote on the probable origin of the scale-filled Roman canal at Ain Feseyl is included. (Knapp-USGS)
W69-06017

8B. Hydraulics

UNDERGROUND STORAGE OF FLUIDS,
Michigan Univ., Ann Arbor. Dept of Chemical and Metallurgical Engineering; and Texas Univ., Austin. Dept. of Petroleum Engineering.
For primary bibliographic entry see Field 02F.
W69-06055

THE EFFECT OF LOOSE BLOCKS ON THE RATE OF SEDIMENT TRANSPORT,
California Univ., Berkeley. Hydraulic Engineering Lab.
For primary bibliographic entry see Field 02J.
W69-06083

8C. Hydraulic Machinery

NORTH COUNTIES HYDROELECTRIC CO V UNITED STATES (DAMAGES RESULTING FROM ICE JAM).
For primary bibliographic entry see Field 06E.
W69-06326

CHAPMAN V FEDERAL POWER COMM'N (PRIVATE CONSTRUCTION OF HYDROELECTRIC PLANT AND RIVER BASIN PROJECT).

345 US 153-182 (1953).

Descriptors: *River basin development, *Hydroelectric plants, *Flood control, *Administrative agencies, Power plants, Dams, Electric power, Federal power act, Hydroelectric power, Hydroelectric project licensing, Rivers, Multiple purpose projects, Project planning, Legislation, Construction, Flood control, Navigation, Public utilities.
Identifiers: Corps of Engineers, Federal Power Commission, Department of the Interior, Flood Control Act of 1944.

In 1940 the Army Corps of Engineers recommended to Congress that a system of eleven dams in the Roanoke Basin be constructed as part of a flood control program and hydroelectric power project. The Corps recommended that the plan be under the direction of the Corps but did not clearly state that the project should be constructed by federal personnel. The Federal Power Commission knew of and concurred in the recommended plan. The plan was approved by the Flood Control Act of 1944, and 2 of the 11 recommended dams, were authorized for construction. Subsequently, respondent power company applied to the Federal Power Commission for a license to construct a hydroelectric generating plant at one of the sites. Petitioners, Secretary of Interior, and an association of electric cooperatives challenged the authority to issue the license, claiming that Congress had reserved all sites in the plan for public construction. The court held that congressional approval of the recommended plan did not necessarily reserve the site for public construction and withdrew the Commission's licensing authority. The approved plan never actually recommended public construction of the site; it merely provided that direction and supervision was the responsibility of the Corps of Engineers. (Helwig-Fla)
W69-06346

8D. Soil Mechanics

HYDRAULIC OPERATING CHARACTERISTICS OF LOW GRADIENT BORDER IRRIGATION SYSTEMS,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Irrigation Engineering.
For primary bibliographic entry see Field 03F.
W69-06035

SOIL PHYSICS,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 02G.
W69-06224

8F. Concrete

BACTERIAL CORROSION OF CONCRETE IN WATER,
Technical Univ. of Denmark, Copenhagen. Inst. of Hygiene.
Einer Fjerdingstad.
Water Res, Vol 3, No 1, pp 21-30, Jan 1969. 10 p, 6 fig, 3 tab, 15 ref.

Descriptors: *Sulfur bacteria, *Corrosion, *Concretes, Acid bacteria, Aquatic bacteria, Soil bacteria, Sulfur, Sulfates, Acids, Corrosion control.
Identifiers: *Concrete corrosion.

Corrosion of concrete in water occurs in the presence of sulfate and sulfur bacteria. Thiobacillus species can use pyrite as an energy source and release sulfuric acid to the surrounding water, where it corrodes concrete structures. Laboratory tests of concrete-corrosion hazard may be made by inoculating 1 gm of mud from the site with bacterial culture and monitoring pH. Laboratory tests of the growth of various Thiobacillus species show that each has its own narrow pH range, so that with production of acid, there is a succession of species from alkaline-tolerant to acid-tolerant types. (Knapp-USGS)
W69-06029

8H. Rapid Excavation

UNDERGROUND STORAGE OF FLUIDS,
Michigan Univ., Ann Arbor. Dept of Chemical and Metallurgical Engineering; and Texas Univ., Austin. Dept. of Petroleum Engineering.
For primary bibliographic entry see Field 02F.
W69-06055

SUBJECT INDEX

ABANDONMENT
IN RE EASTERN TRANSPORTATION CO (ABANDONMENT OF VESSELS IN NAVIGABLE WATERS).
W69-06391 06E

ABSOLUTE LIABILITY
DANNER V UNITED STATES (FEDERAL GOVERNMENT'S LIABILITY FOR FLOOD DAMAGES).
W69-06194 06E

WOODWARD IRON CO V MUMPOWER (DAMAGE TO SURFACE OWNERS RIGHTS FROM MINING OPERATIONS).
W69-06359 04A

ABSORPTION
DIXON V CITY OF NASHVILLE (DAMAGES CAUSED BY DEFLECTION OF SURFACE WATER FLOW).
W69-06373 04A

ACCESS ROUTES
MARINE AIR WAYS, INC V STATE (DEPRIVATION OF ACCESS ROUTES DUE TO BRIDGE CONSTRUCTION).
W69-06366 04A

ACCRETION
LEWIS V CLARK (CREEK BED AS PROPERTY BOUNDARY).
W69-06150 06E

ACCRETION(LEGAL ASPECTS)
KIMBERLY V PRESLEY (TITLE TO ACCRETED MATERIALS).
W69-06160 06E

RUSSELL V BROWN (TITLE TO LAND AFTER 'ACCRETIONS' AND 'AVULSION').
W69-06319 06E

PETERSON V HARPST (ADVERSE POSSESSION OF ISLAND AND ACCRETIONS THERETO).
W69-06387 06E

LAKE FRONT EAST 55TH STREET CO V CITY OF CLEVELAND (ESTABLISHMENT OF BOUNDARY LINES).
W69-06388 06E

AMERADA PETROLEUM CORPORATION V CASE (ACCRETION OF LAND).
W69-06389 06E

SOLOMON V SIOUX CITY (ACCRETION).
W69-06393 06E

ANDERSON-TULLY CO V TINGLE (ACCRETION TO LAND LOCATED WITHIN THE FORK OF TWO RIVERS).
W69-06396 06E

PETERSON V HARPST (ADVERSE POSSESSION OF ISLAND AND ACCRETIONS THERETO).
W69-06387 06E

LAKE FRONT EAST 55TH STREET CO V CITY OF CLEVELAND (ESTABLISHMENT OF BOUNDARY LINES).
W69-06388 06E

AMERADA PETROLEUM CORPORATION V CASE (ACCRETION OF LAND).
W69-06389 06E

SOLOMON V SIOUX CITY (ACCRETION).
W69-06393 06E

ANDERSON-TULLY CO V TINGLE (ACCRETION TO LAND LOCATED WITHIN THE FORK OF TWO RIVERS).
W69-06396 06E

PETERSON V HARPST (ADVERSE POSSESSION OF ISLAND AND ACCRETIONS THERETO).
W69-06387 06E

LAKE FRONT EAST 55TH STREET CO V CITY OF CLEVELAND (ESTABLISHMENT OF BOUNDARY LINES).
W69-06388 06E

AMERADA PETROLEUM CORPORATION V CASE (ACCRETION OF LAND).
W69-06389 06E

SOLOMON V SIOUX CITY (ACCRETION).
W69-06393 06E

ANDERSON-TULLY CO V TINGLE (ACCRETION TO LAND LOCATED WITHIN THE FORK OF TWO RIVERS).
W69-06396 06E

PETERSON V HARPST (ADVERSE POSSESSION OF ISLAND AND ACCRETIONS THERETO).
W69-06387 06E

LAKE FRONT EAST 55TH STREET CO V CITY OF CLEVELAND (ESTABLISHMENT OF BOUNDARY LINES).
W69-06388 06E

AMERADA PETROLEUM CORPORATION V CASE (ACCRETION OF LAND).
W69-06389 06E

SOLOMON V SIOUX CITY (ACCRETION).
W69-06393 06E

ANDERSON-TULLY CO V TINGLE (ACCRETION TO LAND LOCATED WITHIN THE FORK OF TWO RIVERS).
W69-06396 06E

PETERSON V HARPST (ADVERSE POSSESSION OF ISLAND AND ACCRETIONS THERETO).
W69-06387 06E

LAKE FRONT EAST 55TH STREET CO V CITY OF CLEVELAND (ESTABLISHMENT OF BOUNDARY LINES).
W69-06388 06E

AMERADA PETROLEUM CORPORATION V CASE (ACCRETION OF LAND).
W69-06389 06E

SOLOMON V SIOUX CITY (ACCRETION).
W69-06393 06E

ANDERSON-TULLY CO V TINGLE (ACCRETION TO LAND LOCATED WITHIN THE FORK OF TWO RIVERS).
W69-06396 06E

PETERSON V HARPST (ADVERSE POSSESSION OF ISLAND AND ACCRETIONS THERETO).
W69-06387 06E

LAKE FRONT EAST 55TH STREET CO V CITY OF CLEVELAND (ESTABLISHMENT OF BOUNDARY LINES).
W69-06388 06E

AMERADA PETROLEUM CORPORATION V CASE (ACCRETION OF LAND).
W69-06389 06E

SOLOMON V SIOUX CITY (ACCRETION).
W69-06393 06E

ANDERSON-TULLY CO V TINGLE (ACCRETION TO LAND LOCATED WITHIN THE FORK OF TWO RIVERS).
W69-06396 06E

ACCUMULATION
MASONITE CORP V WINDHAM (PONDING AND POLLUTION ON UPPER LAND).
W69-06120 05G

ACID MINE WATER
SANITARY WATER BOARD V ANTHONY (LEGISLATION TO PREVENT MINE ACID POLLUTION).
W69-06109 05G

ACT OF GOD
PIPE V CHESAPEAKE AND OHIO RR (NON-LIABILITY FOR ACTS OF GOD).
W69-06153 06E

GREENBURG V CITY OF STEUBENVILLE (DAMAGE CAUSED BY AN ACT OF GOD AND CONCURRENT NEGLIGENCE).
W69-06170 06E

KENNEDY V UNION ELECTRIC CO OF MISSOURI (SILT ACCRETION AND FLOODING).
W69-06188 06E

ACTS OF GOD
BELUE V CITY OF GREENVILLE (DUTY OF CITY TO PROVIDE DRAINAGE OF THOROUGHFARES).
W69-06323 04A

ADJACENT LANDOWNERS
MILOTTA V PFEIFER (NATURAL FLOW AND RIGHTS TO SURFACE DRAINAGE).
W69-06121 06E

STACY V WALKER (PROTECTION AGAINST SURFACE WATER DRAINAGE).

W69-06128 06E

ADMINISTRATION
A CASE FOR THE ADMINISTRATION OF MARINE RESOURCES UNDERLYING THE HIGH SEAS BY THE UNITED NATIONS,
W69-06103 06E

AN EXPLORATION OF COMPONENTS AFFECTING AND LIMITING POLICY MAKING OPTIONS IN LOCAL WATER AGENCIES,
W69-06306 06B

ADMINISTRATIVE AGENCIES
WATER QUALITY STANDARDS THE FEDERAL PERSPECTIVE - PROGRESS TOWARD OBJECTIVES,
W69-06095 05G

THE ROLE OF THE STATE DEPARTMENT IN FORMULATING FEDERAL POLICY REGARDING MARINE RESOURCES,
W69-06108 06E

SANITARY WATER BOARD V ANTHONY (LEGISLATION TO PREVENT MINE ACID POLLUTION).
W69-06109 05G

REGULATION OF USE OF WATER RESOURCES.
W69-06138 06E

DEPARTMENT OF HEALTH AND WELFARE.
W69-06143 06E

RONADE ASSOCIATES V DEPARTMENT OF CONSERVATION (DENIAL OF PERMIT TO CONSTRUCTION BUILDING ACROSS STREAM).
W69-06189 06E

PASSAIC VALLEY WATER COMM'N V DEPARTMENT OF CONSERVATION (STATUTORY INTERPRETATION OF EXCESS DIVERSION ASSESSMENT FORMULA).
W69-06190 06E

GROBERT V PASSAIC VALLEY WATER COMM'N (RIGHT TO DIVERT RIVER WATER - AMOUNT).
W69-06191 06E

AN EXPLORATION OF COMPONENTS AFFECTING AND LIMITING POLICY MAKING OPTIONS IN LOCAL WATER AGENCIES,
W69-06306 06B

STATE WATER SUPPLY DEVELOPMENT.
W69-06317 03D

STATE V SULLIVAN (REGULATION BY FRESH WATER FISH COMM'N).
W69-06327 06E

BECK V GAME AND FRESH WATER FISH COMM'N (JURISDICTION OF FRESH WATER FISH COMM'N).
W69-06328 06E

HAUGHTON V LANKFORD (CONSTITUTIONALITY OF CONSERVATION REGULATION).
W69-06329 06E

POWERS AND FUNCTIONS OF DEPARTMENT OF WATER RESOURCES - FLOOD CONTROL.
W69-06332 04A

CREATION OF DEPARTMENT OF WATER RESOURCES AND WATER RESOURCES COMM'N.
W69-06333 06E

AN ACT RELATING TO LAKES, PERMITTING THE CREATION OF LAKE CONSERVATION DISTRICT WITH CERTAIN POWERS.
W69-06334 06E

CHAPMAN V FEDERAL POWER COMM'N (PRIVATE CONSTRUCTION OF HYDROELECTRIC PLANT AND RIVER BASIN PROJECT).
W69-06346 08C

BOARD OF LEVEE COMM'RS OF ORLEANS LEVEE DIST V KELLY (PUBLIC RIGHTS IN RE FLOOD CONTROL).
W69-06362 04A

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION), PART III AN INTERNATIONAL AUTHORITY TO REGISTER NATIONAL CLAIMS BEYOND THE REDEFINED CONTINENTAL SHELF.
W69-06418 06B

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION) ORGANIZING A NATIONAL OCEAN EFFORT.
W69-06420 06B

ADMIRALITY
CHESAPEAKE BAY BRIDGE AND TUNNEL DIST V LAURITZEN (ACTION FOR DAMAGES TO SHIP CAUSED BY STRIKING SUBMERGED TOWER).
W69-06185 06E

ADOPTION OF PRACTICES
FITTING A STATE PROGRAM TO FEDERAL OBJECTIVES,
W69-06096 05G

ADSORPTION
RECOVERY OF ORGANICS FROM A EUTROPHIC LAKE BY THE CARBON ADSORPTION TECHNIQUE,
W69-06282 05A

ADVERSE POSSESSION
IMPROVED REALTY CORP V SOWERS (ADVERSE POSSESSION OF POND).
W69-06165 06E

GUNN V BERQUIST (ADVERSE POSSESSION OF AND RIPARIAN RIGHTS IN TOWN-OWNED RIPARIAN LANDS).
W69-06382 06E

WHITSON V MORRIS (TITLE TO RE-FORMED ALLUVIAL LAND).
W69-06383 06E

WUNDERLICH V CATES (DISPUTE OVER TITLE TO AN ISLAND IN THE MISSISSIPPI RIVER).
W69-06385 06E

PETERSON V HARPST (ADVERSE POSSESSION OF ISLAND AND ACCRETIONS THERETO).
W69-06387 06E

AGGRADATION
MCKINNEY V DENEEN (LIABILITY FOR DISCHARGE OF MINE WASTES).
W69-06111 05C

ALABAMA
TENNESSEE COAL, IRON AND RR V RAY (MINING OPERATION CAUSES DESTRUCTION OF WATER SUPPLY).
W69-06172 06E

H W PEERSON DRILLING CO V SCOGGINS (DEED EXCEPTIONS AND RIGHTS TO SUBTERRANEAN WATERS).
W69-06312 06E

WOODWARD IRON CO V HUMPOWER (DAMAGE TO SURFACE OWNERS RIGHTS FROM MINING OPERATIONS).
W69-06359 04A

ALGAE
LIMNOLOGICAL INVESTIGATIONS OF TEXAS IMPOUNDMENTS FOR WATER QUALITY MANAGEMENT PURPOSES - THE USE OF ALGAL CULTURES TO ASSESS THE EFFECTS OF NUTRIENT ENRICHMENT ON THE HIGHLAND LAKES OF THE COLORADO RIVER, TEXAS,
W69-06004 05C

ALPINE
TRITIUM CONTENT IN THE FIRN LAYERS OF AN ALPINE GLACIER,
W69-06262 02C

CHANGE OF ITALIAN GLACIERS DURING THE DECADE 1957-1966 (FRENCH),
W69-06265 02C

GLACIER MASS BUDGET AND MESOSCALE WEATHER IN THE AUSTRIAN ALPS 1964 TO 1966,
W69-06267 02C

ALPS
INVESTIGATIONS ON FISSION PRODUCTS IN THE ACCUMULATION AREA OF AN ALPINE GLACIER (KESSELWANDFERNER, OETZTAL ALPS),
W69-06261 02C

ALTERATION OF FLOW
MILOTTA V PFEIFER (NATURAL FLOW AND RIGHTS TO SURFACE DRAINAGE).
W69-06121 06E

BELVEAL V H B C DEVELOPMENT CO (OBSTRUCTION OF NATURAL WATERCOURSE AND CONCENTRATION OF FLOW).
W69-06154 06E

MAYOR OF AMERICUS V BRIGHTWELL (SURFACE DRAINAGE AND ALTERATION OF FLOW).
W69-06177 06E

ARCHER V J S COMPTON, INC (INTERFERENCE WITH NATURAL FLOW).
W69-06196 06E

HORN V BRATTON (SUIT TO ENJOIN MAINTENANCE OF DAM AND DITCH FACILITIES).
W69-06375 04A

ALTERNATIVE ACTIONS
EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER III THE APPROPRIATE ALTERNATIVES,
W69-06292 06B

AMORTIZATION
FEDERAL POWER COMMISSION V NIAGARA MOHAWK POWER CORPORATION (STATUS OF STATE WATER RIGHTS UNDER FEDERAL WATER POWER ACT OF 1920).
W69-06378 06E

ANALYTICAL TECHNIQUES
GENERAL METHOD FOR DETERMINATION OF ORGANOPHOSPHORUS RESIDUES IN RIVER WATERS AND EFFLUENTS,
W69-06023 05A

DETERMINATION OF FREE HYDROGEN CYANIDE IN RIVER WATER BY A SOLVENT-EXTRACTION METHOD,
W69-06024 05A

AN EVALUATION OF SOME METHODS FOR THE DETERMINATION OF FLUORIDE IN POTABLE WATERS AND OTHER AQUEOUS SOLUTIONS,
W69-06037 05F

LIMNOLOGICAL ORGANIC ANALYSES BY QUANTITATIVE DICHROMATE OXIDATION,
W69-06093 05A

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT,
W69-06290 06B

ANTARCTIC
THE LONGITUDINAL VELOCITY PROFILE OF LARGE ICE MASSES,
W69-06257 02C

RIFTS AT THE FOOT OF BEARDMORE GLACIER, ANTARCTICA,

W69-06260 02C

ANTARCTIC SHELF ICE
RIFTS AT THE FOOT OF BEARDMORE GLACIER, ANTARCTICA,
W69-06260 02C

APPROPRIATION
CLOUGH V STATE (ARTIFICIAL DIVERSION OF NATURAL WATERCOURSES).
W69-06184 06E

APPROPRIATIONS
NATURAL RESOURCES.
W69-06403 04A

AQUATIC WEED CONTROL
HARVESTING UNDERWATER WEEDS,
W69-06276 05G

AQUEOUS SOLUTIONS
AN EVALUATION OF SOME METHODS FOR THE DETERMINATION OF FLUORIDE IN POTABLE WATERS AND OTHER AQUEOUS SOLUTIONS,
W69-06037 05F

SALTS AND ASSOCIATED PHENOMENA OF THE TERMINI OF THE HOBBS AND TAYLOR GLACIERS, VICTORIA LAND, ANTARCTICA,
W69-06266 02C

AQUIFERS
THE LOCATION OF DEEP AQUIFERS BY RESISTIVITY SOUNDINGS,
W69-06027 02F

THE PIEZOMETRIC SURFACE OF THE COASTAL PLAIN AQUIFER IN GEORGIA, ESTIMATES OF ORIGINAL ELEVATION AND LONG-TERM DECLINE,
W69-06043 02F

UNDERGROUND STORAGE OF FLUIDS,
W69-06055 02F

HYDROGEOLOGY AT SHELBYVILLE, ILLINOIS - A BASIS FOR WATER RESOURCES PLANNING,
W69-06075 02F

ARCTIC
THE GREENLAND MASS BALANCE FLUX DIVERGENCE CONSIDERATIONS,
W69-06268 02C

MASS BALANCE OBSERVATIONS ON THE BARNES ICE CAP, BAFFIN ISLAND, CANADA,
W69-06269 02C

ARID LANDS
THE ROLE OF GROUNDWATER IN THE DEVELOPMENT OF WATER RESOURCES,
W69-06054 04B

ARIZONA
ANNUAL REPORT ON GROUND WATER IN ARIZONA, SPRING 1967 TO SPRING 1968.
W69-06026 02F

ARKANSAS
SMITH V MAGNET COVE BARIUM CORP (BARIUM TAILING POLLUTION).
W69-06116 05G

STACY V WALKER (PROTECTION AGAINST SURFACE WATER DRAINAGE).
W69-06128 06E

DENT V ALEXANDER (ACCELERATED FLOW OF SURFACE DRAINAGE).
W69-06130 06E

UNITED STATES V INGRAM (BRIDGE CONSTRUCTION AND RIPARIAN OBLIGATIONS).
W69-06364 04A

HORN V BRATTON (SUIT TO ENJOIN MAINTENANCE OF DAM AND DITCH FACILITIES).
W69-06375 04A

ANDERSON-TULLY CO V MURPHREE (OWNERSHIP OF PROPERTY LOST BY AVULSION).
W69-06384 06E

WUNDERLICH V CATES (DISPUTE OVER TITLE TO AN ISLAND IN THE MISSISSIPPI RIVER).
W69-06385 06E

PERSON V JOHNSON (TITLE TO BEDS UNDER NON-NAVIGABLE LAKES).
W69-06397 06E

JOHNSON V SMITH (TITLE TO BEDS UNDER NON-NAVIGABLE LAKES).
W69-06398 06E

ARMY CORPS OF ENGINEERS
EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER XII CASE STUDY II SANTA MARIA PROJECT,
W69-06300 06B

ARTIFICIAL RECHARGE
GEOLOGIC STUDIES AS AN AID TO GROUND-WATER MANAGEMENT,
W69-06082 04B

USE OF GRAVITY SHAFTS FOR GROUND WATER RECHARGE,
W69-06202 04B

ARTIFICIAL WATERCOURSES
PALMER V MASSENGILL (OBSTRUCTION TO FLOW OF ARTIFICIAL WATERCOURSE).
W69-06147 06E

ASSESSMENTS
BOECK V YELLOW MEDICINE COUNTY (DRAINAGE DITCHES).
W69-06124 06E

AUSTRALIA
THE LOCATION OF DEEP AQUIFERS BY RESISTIVITY SOUNDINGS,
W69-06027 02F

LOSS RATES ON SELECTED CATCHMENTS IN VICTORIA,
W69-06085 02D

AUSTRIA
ISOTOPE HYDROLOGY OF THE ARTESIAN AQUIFERS OF THE STYRIAN BASIN, AUSTRIA,
W69-06249 02K

AUSTRIAN ALPS
GLACIER MASS BUDGET AND MESOSCALE WEATHER IN THE AUSTRIAN ALPS 1964 TO 1966,
W69-06267 02C

AVULSION
RUSSELL V BROWN (TITLE TO LAND AFTER 'ACCRETIONS' AND 'AVULSION').
W69-06319 06E

ANDERSON-TULLY CO V MURPHREE (OWNERSHIP OF PROPERTY LOST BY AVULSION).
W69-06384 06E

BACKWATER
LOUGHRAN V MATYLEWICZ (EASEMENTS ON NON-NAVIGABLE WATERS).
W69-06399 06E

BACTERIA
THE BIOSYNTHESIS OF VITAMINS OF THE (B-12) GROUP IN MIXED CULTURES OF BACTERIA,
W69-06274 05B

BANK EROSION
ZIDEL V STATE (STATE LIABLE FOR EROSION CAUSED BY NEGLIGENTLY PLACED ROAD).
W69-06314 04C

BANKS
KIMBERLY V PRESLEY (TITLE TO ACCRETED MATERIALS).
W69-06160 06E

BARIUM TAILINGS
SMITH V MAGNET COVE BARIUM CORP (BARIUM TAILING POLLUTION).
W69-06116 05G

BARNES ICE CAP
MASS BALANCE OBSERVATIONS ON THE BARNES ICE CAP, BAFFIN ISLAND, CANADA,
W69-06269 02C

BARRIERS
IN RE EASTERN TRANSPORTATION CO (ABANDONMENT OF VESSELS IN NAVIGABLE WATERS).
W69-06391 06E

BASALT
COASTAL EVIDENCES OF GROUND WATER CONDITIONS IN THE VICINITY OF ANAEHOOMALU AND LALAMILO, SOUTH KOHALA, HAWAII,
W69-06006 03B

BASINS
EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER XI CASE STUDY I THE GREEN RIVER WATERSHED,
W69-06299 06B

BEDS UNDER WATER
JOHNSON V SMITH (TITLE TO BEDS UNDER NON-NAVIGABLE LAKES).
W69-06398 06E

BEFORE AND AFTER TEST
TENNESSEE COAL, IRON AND RR V RAY (MINING OPERATION CAUSES DESTRUCTION OF WATER SUPPLY).
W69-06172 06E

BENEFITS
EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER IX KINDS OF BENEFITS OVERCOUNTING, AND SECONDARY BENEFITS.
W69-06297 06B

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER X VALUATION OF BENEFITS,
W69-06298 06B

BIBLIOGRAPHIES
HEATED EFFLUENTS AND EFFECTS ON AQUATIC LIFE WITH EMPHASIS ON FISHES,
W69-06022 05C

BIBLIOGRAPHY ON THERMAL POLLUTION,
W69-06081 05C

BIOASSAY
A BIOLOGICAL TEST FOR DETERMINING THE POTENTIAL PRODUCTIVITY OF WATER,
W69-06279 05A

BIOSYNTHESIS
THE BIOSYNTHESIS OF VITAMINS OF THE (B-12) GROUP IN MIXED CULTURES OF BACTERIA,
W69-06274 05B

BORDER IRRIGATION
HYDRAULIC OPERATING CHARACTERISTICS OF LOW GRADIENT BORDER IRRIGATION SYSTEMS,
W69-06035 03F

BOUNDARIES(PROPERTY)
LEWIS V CLARK (CREEK BED AS PROPERTY BOUNDARY).
W69-06150 06E

JEFFERSON V DAVIS (OWNERSHIP OF SUBMERGED POND LAND).
W69-06151 06E

CARPENTER V OHIO RIVER SAND AND GRAVEL CORP (ACTION TO ENJOIN DREDGING ON PROPERTY BELOW PRESENT WATER LINE, BUT ABOVE OLD LOW WATER MARK).
W69-06159 06E

KIMBERLY V PRESLEY (TITLE TO ACCRETED MATERIALS).
W69-06160 06E

RICHARDSON AND BASS V BOARD OF LEVEE COMM'RS OF THE ORLEANS LEVEE DIST (ADVERSE POSSESSION).
W69-06168 06E

UNITED STATES V STATE OF LOUISIANA, TEXAS, MISSISSIPPI, ALABAMA, AND FLORIDA (INTERPRETATION OF SUBMERGED LANDS ACT).
W69-06200 06E

LOUISVILLE SAND AND GRAVEL CO V RALSTON (THE 'THREAD OF THE STREAM' AS A BOUNDARY LINE).
W69-06318 06E

LAKE FRONT EAST 55TH STREET CO V CITY OF CLEVELAND (ESTABLISHMENT OF BOUNDARY LINES).
W69-06388 06E

SOLOMON V SIOUX CITY (ACCRETION).
W69-06393 06E

ANDERSON-TULLY CO V TINGLE (ACCRETION TO LAND LOCATED WITHIN THE FORK OF TWO RIVERS).
W69-06396 06E

BOUNDARY DISPUTES
LAKE FRONT EAST 55TH STREET CO V CITY OF CLEVELAND (ESTABLISHMENT OF BOUNDARY LINES).
W69-06388 06E

BOX CULVERT
PIPE V CHESAPEAKE AND OHIO RR (NON-LIABILITY FOR ACTS OF GOD).
W69-06153 06E

BRIDGES
UNITED STATES V INGRAM (BRIDGE CONSTRUCTION AND RIPARIAN OBLIGATIONS).
W69-06364 04A

BRINE DISPOSAL
THE FEASIBILITY OF DEEP-WELL INJECTION OF WASTE BRINE FROM INLAND DESALTING PLANTS,
W69-06286 05E

ENVIRONMENTAL IMPACT OF BRINE EFFLUENTS ON GULF OF CALIFORNIA,
W69-06287 05C

BRINES
DEAD SEA BRINES DEGREE OF HALITE SATURATION BY ELECTRODE MEASUREMENTS,
W69-06038 02K

THE FEASIBILITY OF DEEP-WELL INJECTION OF WASTE BRINE FROM INLAND DESALTING PLANTS,
W69-06286 05E

ENVIRONMENTAL IMPACT OF BRINE EFFLUENTS ON GULF OF CALIFORNIA,
W69-06287 05C

BUILDINGS
RONADE ASSOCIATES V DEPARTMENT OF CONSERVATION (DENIAL OF PERMIT TO CONSTRUCTION BUILDING ACROSS STREAM).
W69-06189 06E

BUREAU OF RECLAMATION
EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER XII CASE STUDY II SANTA MARIA PROJECT,
W69-06300 06B

CALCIUM CARBONATE
CARBONATE SCALE IN ROMAN AND MODERN CANALS IN THE JORDAN VALLEY,
W69-06017 08A

CALIFORNIA ECONOMIC MODEL
ECONOMIC EVALUATION OF WATER-PART IV AN INPUT-OUTPUT AND LINEAR PROGRAMMING ANALYSIS OF CALIFORNIA WATER REQUIREMENTS,
W69-06220 06B

CANADA
CROSS V PACE (DAMAGE TO UNITED STATES CITIZENS BY FOREIGN DAM).
W69-06380 04A

CANALS
CARBONATE SCALE IN ROMAN AND MODERN CANALS IN THE JORDAN VALLEY,
W69-06017 08A

INLAND WATERWAYS.
W69-06348 06E

CARBON ADSORPTION TECHNIQUES
RECOVERY OF ORGANICS FROM A EUTROPHIC LAKE BY THE CARBON ADSORPTION TECHNIQUE,
W69-06282 05A

CESIUM
INVESTIGATIONS ON FISSION PRODUCTS IN THE ACCUMULATION AREA OF AN ALPINE GLACIER (KESSELWANDFERNER, OETZTAL ALPS),
W69-06261 02C

CHANNEL EROSION
THE EFFECT OF LOOSE BLOCKS ON THE RATE OF SEDIMENT TRANSPORT,
W69-06083 02J

CHEMICAL ANALYSIS
GENERAL METHOD FOR DETERMINATION OF ORGANOPHOSPHORUS RESIDUES IN RIVER WATERS AND EFFLUENTS,
W69-06023 05A

DETERMINATION OF FREE HYDROGEN CYANIDE IN RIVER WATER BY A SOLVENT-EXTRACTION METHOD,
W69-06024 05A

CHEMICAL POLLUTION
ALTERNATE METHODS OF MOSQUITO CONTROL TO REDUCE CHEMICAL POLLUTION OF WATERS FOR RECHARGE OF THE OGALLALA FORMATION,
W69-06001 05G

CHEMOSTATS
THE GROWTH RATE OF MICROORGANISMS AS A FUNCTION OF SUBSTRATE CONCENTRATION,
W69-06281 05C

CHROMATOGRAPHY
GENERAL METHOD FOR DETERMINATION OF ORGANOPHOSPHORUS RESIDUES IN RIVER WATERS AND EFFLUENTS,
W69-06023 05A

CITIES
MUNICIPALITIES PUBLIC WORKS, DEVELOPMENT.
W69-06140 06E

ACCURATE DIE CASTING CO V CITY OF CLEVELAND (FLOOD DAMAGE FROM SUBSURFACE DRAINAGE).
W69-06171 06E

MUNICIPAL WATER POLLUTION CONTROL.
W69-06316 05G

BELUE V CITY OF GREENVILLE (DUTY OF CITY TO PROVIDE DRAINAGE OF THOROUGHFARES).
W69-06323 04A

HILL V CITY OF GREENVILLE (DAMAGES RESULTING FROM CITY'S FAILURE TO PROVIDE DRAINAGE).
W69-06324 04A

SEWAGE DISPOSAL WATER AND SEWAGE.
W69-06337 05G

BRIGGSON V CITY OF VIROQUA (SEWAGE DISCHARGE ACROSS LAND).
W69-06355 05C

CITY OF IRVINE V SMITH (FLOODING CAUSED BY BREAK IN SEWER).
W69-06365 04A

BAYLEN STREET WHARF CO V CITY OF PENSACOLA (DAMAGES TO LAND BY STORM SEWER REFUSE).
W69-06402 06E

ATTORNEY GENERAL V CITY OF WOBURN (POLLUTION OF RIVER BY CITY).
W69-06406 05G

CLIMATIC DATA
CLIMATOLOGY OF SEVERE WINTER STORMS IN ILLINOIS,
W69-06210 02C

CLIMATOLOGY
SOME MAPS OF ISANOMALIES IN ENERGY BALANCE CLIMATOLOGY,
W69-06050 02B

GLACIER MASS BUDGET AND MESOSCALE WEATHER IN THE AUSTRIAN ALPS 1964 TO 1966,
W69-06267 02C

CLOUD PHYSICS
RAINSTORMS AND HAIL,
W69-06214 02B

COASTAL SPRING
COASTAL EVIDENCES OF GROUND WATER CONDITIONS IN THE VICINITY OF ANAEHOOMALU AND LALAMILO, SOUTH KOHALA, HAWAII,
W69-06006 03B

COASTAL SPRINGS
COASTAL EVIDENCES OF GROUND WATER CONDITIONS IN THE VICINITY OF ANAEHOOMALU AND LALAMILO, SOUTH KOHALA, HAWAII,
W69-06006 03B

COBALT
COBALT AS AN ESSENTIAL ELEMENT FOR BLUE-GREEN ALGAE,
W69-06277 05A

COLIFORM BACTERIA
LIMNOLOGICAL INVESTIGATIONS OF TEXAS IMPOUNDMENTS FOR WATER QUALITY MANAGEMENT PURPOSES - LIMNOLOGICAL AND WATER QUALITY DATA FOR THE HIGHLAND LAKES, 1968,
W69-06003 05B

COLIFORM DIEOFF RATE
LIMNOLOGICAL INVESTIGATIONS OF TEXAS IMPOUNDMENTS FOR WATER QUALITY MANAGEMENT PURPOSES - THE DISTRIBUTION OF COLIFORM BACTERIA IN STRATIFIED IMPOUNDMENT,
W69-06005 05D

COLORADO RIVER BASIN
WATER AND CHOICE IN THE COLORADO BASIN AN EXAMPLE OF ALTERNATIVES IN WATER MANAGEMENT.
W69-06086 06B

WATER AND CHOICE IN THE COLORADO BASIN AN EXAMPLE OF ALTERNATIVES IN WATER MANAGEMENT, CH. 2, THE SETTING.
W69-06087 06B

WATER AND CHOICE IN THE COLORADO BASIN AN EXAMPLE OF ALTERNATIVES IN WATER MANAGEMENT, CH. 3, PROBLEMS OF WATER SUPPLY IN THE BASIN.
W69-06088 06B

COLUMBIA RIVER
RESERVOIRS PROBLEMS AND CONFLICTS,
W69-06207 06B

COMMERCIAL FISHING
LE CLAIR V SWIFT (ENFORCEMENT OF CONSERVATION STATUTES).
W69-06377 06E

JACKSON V UNITED STATES (PRIVATE PROPERTY RIGHTS IN FISHING GROUNDS).
W69-06381 06E

COMMERCIAL SHELLFISH
FISHERIES CONSERVATION.
W69-06144 06E

COMMERICAL SHELLFISH
CARR V UNITED STATES (DAMAGES TO OYSTER BED DUE TO DRAGGING OPERATIONS).
W69-06192 06E

COMMON CARRIERS
AMERICAN BARGE LINE V KOONTZ (TAXATION OF INTERSTATE AND INTRASTATE COMMERCE OVER NAVIGABLE WATERS).
W69-06178 06E

COMMON ENEMY RULE
CHAMBERLIN V CIAFFONI (NATURAL FLOW AND SURFACE DRAINAGE IN CITIES).
W69-06125 06E

COMPETING USES
RESERVOIRS PROBLEMS AND CONFLICTS,
W69-06207 06B

COMPREHENSIVE PROGRAM PLANNING
METROPOLITAN PROBLEMS THE DELAWARE RIVER BASIN COMMISSION,
W69-06099 06B

COMPUTER MODELS
NUMERICAL EXPERIMENTS WITH THE STANFORD WATERSHED MODEL ON SMALL AGRICULTURAL WATERSHEDS IN VIRGINIA,
W69-06032 02E

COMPUTER PROGRAMS
SOLUTION OF ESTUARY PROBLEMS AND NETWORK PROGRAMS,
W69-06077 02L

CONCENTRATION OF SURFACE DRAINAGE
BELVEAL V H B C DEVELOPMENT CO (OBSTRUCTION OF NATURAL WATERCOURSE AND CONCENTRATION OF FLOW).
W69-06154 06E

CONCRETE CORROSION
BACTERIAL CORROSION OF CONCRETE IN WATER,
W69-06029 08F

CONCRETES
BACTERIAL CORROSION OF CONCRETE IN WATER,
W69-06029 08F

CONDEMNATION
BOHANNON V CAMDEN BEND DRAINAGE DISTRICT (TAKING OF PROPERTY BY WATER DISTRICT).
W69-06132 06E

CRITES V UNITED STATES (CLAIMS FOR LOSS IN VALUE OF LAND DUE TO IRRIGATION PROJECT).
W69-06325 03F

CONDEMNATION VALUE
UNITED STATES V 1532.63 ACRES OF LAND (DETERMINATION OF FAIR MARKET VALUE IN CONDEMNATION PROCEEDING).
W69-06392 06E

CONDENSED PHOSPHATES
HYDROLYSIS OF CONDENSED PHOSPHATES--I NON-STERILE ENVIRONMENT,
W69-06271 02K

HYDROLYSIS OF CONDENSED PHOSPHATES--II STERILE ENVIRONMENT,
W69-06284 02K

CONNECTICUT
WATER RESOURCES INVENTORY OF CONNECTICUT-PART 3, LOWER THAMES AND SOUTHEASTERN COASTAL RIVER BASINS,
W69-06250 02F

PONELEIT V DUDAS (ZONING REGULATIONS AS AFFECTING RIPARIAN RIGHTS).
W69-06320 06E

CONSERVATION
NATURAL RESOURCES.
W69-06403 04A

CONSTITUTIONAL LAW
PONELEIT V DUDAS (ZONING REGULATIONS AS AFFECTING RIPARIAN RIGHTS).
W69-06320 06E

HAUGHTON V LANKFORD (CONSTITUTIONALITY OF CONSERVATION REGULATION).
W69-06329 06E

CONSTITUTIONALITY
CROSS V PACE (DAMAGE TO UNITED STATES CITIZENS BY FOREIGN DAM).
W69-06380 04A

UNITED STATES V 1532.63 ACRES OF LAND (DETERMINATION OF FAIR MARKET VALUE IN CONDEMNATION PROCEEDING).
W69-06392 06E

CONSTRUCTION
MCKEE V HASLER (LEVEE CONSTRUCTION FOR FLOOD CONTROL).
W69-06363 04A

CONSUMPTIVE USE
CONSUMPTIVE IRRIGATION REQUIREMENTS OF SELECTED IRRIGATED AREAS IN NEW MEXICO,
W69-06013 03F

THE LAW OF WATER IN NEW JERSEY,
W69-06303 06E

CONTINENTAL SHELF
THE ROLE OF THE UNITED STATES NAVY IN THE FORMULATION OF FEDERAL POLICY REGARDING THE SEA,
W69-06107 06E

THE ROLE OF THE STATE DEPARTMENT IN FORMULATING FEDERAL POLICY REGARDING MARINE RESOURCES,
W69-06108 06E

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION), PART III OTHER MARINE MINERALS.
W69-06414 06B

CONTINUOUS CULTURE
THE GROWTH RATE OF MICROORGANISMS AS A FUNCTION OF SUBSTRATE CONCENTRATION,
W69-06281 05C

CONTRACTS
PROUTY V CITIZENS UTILITIES CO. (SALE OF PROPERTY ALONG NAVIGABLE RIVER).
W69-06136 06E

CORROSION
BACTERIAL CORROSION OF CONCRETE IN WATER,
W69-06029 08F

COST-BENEFIT ANALYSIS
EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS, ANALYSIS WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER VI WHAT CAN BE DONE A RECAPITULATION,
W69-06295 06B

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER VIII KINDS OF BENEFITS AND COSTS SPILLOVER EFFECTS,
W69-06296 06B

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER IX KINDS OF BENEFITS OVERCOUNTING, AND SECONDARY BENEFITS.
W69-06297 06B

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER X VALUATION OF BENEFITS,
W69-06298 06B

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER XI CASE STUDY I THE GREEN RIVER WATERSHED,
W69-06299 06B

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER XII CASE STUDY II SANTA MARIA PROJECT,
W69-06300 06B

COST-BENEFIT THEORY
EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTERS I-II INTRODUCTION THE CRITERION PROBLEM,
W69-06291 06B

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER V TIME STREAMS AND CRITERIA,
W69-06294 06B

CROP DAMAGE
TUTEN V SHELL OIL CO (SALT WATER DAMAGE TO LAND AND CROPS BY OIL INDUSTRY NEGLIGENCE).
W69-06110 05C

CROP YIELDS
PREDICTION OF CROP YIELDS FROM QUANTITY AND SALINITY OF IRRIGATION WATER,
W69-06007 03C

CROPS
MESSANA V MAULE INDUSTRIES (NEGLIGENT FLOODING OF FARM LAND).
W69-06310 04A

CRYSTALLIZATION
SALTS AND ASSOCIATED PHENOMENA OF THE TERMINI OF THE HOBBS AND TAYLOR GLACIERS, VICTORIA LAND, ANTARCTICA,
W69-06266 02C

CULTURES
THE BIOSYNTHESIS OF VITAMINS OF THE (B-12) GROUP IN MIXED CULTURES OF BACTERIA,
W69-06274 05B

CULVERTS
WHEATLEY V CASS COUNTY (DIVERSION OF NATURAL FLOW OF FLOOD WATERS BY THE STATE FOLLOWED BY SUBSEQUENT RESUMPTION OF SAME FLOW).
W69-06156 06E

SOUTHERN RR V JEFFERSON (FLOODING ABOVE RAILROAD FILL).
W69-06186 06E

CITY OF MERIDAN V SULLIVAN (SUBSURFACE DRAINAGE).
W69-06322 04A

CYANIDE ANALYSIS
DETERMINATION OF FREE HYDROGEN CYANIDE IN RIVER WATER BY A SOLVENT-EXTRACTION METHOD,
W69-06024 05A

CYANOCOBALAMIN
COBALT AS AN ESSENTIAL ELEMENT FOR BLUE-GREEN ALGAE,
W69-06277 05A

CYANOPHYTA
COBALT AS AN ESSENTIAL ELEMENT FOR BLUE-GREEN ALGAE,
W69-06277 05A

CYCLING NUTRIENTS
PRIMARY PRODUCTION, ENERGETICS, AND NUTRIENT UTILIZATION IN A WARM-WATER STREAM,
W69-06092 05C

DAM CONSTRUCTION
KRAFT V MILLER (ARTIFICIAL CONTROL OF SURFACE WATERS).
W69-06400 04A

DAMAGES
UNITED STATES V SHAPIRO, INC. (LIABILITY FOR DIVERSION OF SURFACE DRAINAGE BY GRADING).
W69-06129 06E

LYDA V TOWN OF MARION (UNAUTHORIZED DRAINAGE DITCHES HELD TAKING OF PRIVATE PROPERTY FOR PUBLIC USE).
W69-06169 06E

TENNESSEE COAL, IRON AND RR V RAY (MINING OPERATION CAUSES DESTRUCTION OF WATER SUPPLY).
W69-06172 06E

PHILLIPS V CHESSON (DIVERSION CAUSED BY EXCAVATED SLOPE).
W69-06309 04A

WOODWARD IRON CO V HUMPOWER (DAMAGE TO SURFACE OWNERS RIGHTS FROM MINING OPERATIONS).
W69-06359 04A

JACKSON V UNITED STATES (PRIVATE PROPERTY RIGHTS IN FISHING GROUNDS).
W69-06381 06E

DAMNUM ABSQUE INJURIA
CHAMBERLIN V CIAFFONI (NATURAL FLOW AND SURFACE DRAINAGE IN CITIES).
W69-06125 06E

DAMS
KENNEDY V UNION ELECTRIC CO OF MISSOURI (SILT ACCRETION AND FLOODING).
W69-06188 06E

DAVENPORT V TOWN OF DANVERS (FLOODING OF LAND BY CITY DAM).
W69-06311 04A

FISH.
W69-06339 05G

IRRIGATION.
W69-06340 03F

HORN V BRATTON (SUIT TO ENJOIN MAINTENANCE OF DAM AND DITCH FACILITIES).
W69-06375 04A

CROSS V PACE (DAMAGE TO UNITED STATES CITIZENS BY FOREIGN DAM).
W69-06380 04A

KRAFT V MILLER (ARTIFICIAL CONTROL OF SURFACE WATERS).
W69-06400 04A

STATE V SENSENBRENNER (RIPARIAN RIGHTS REGARDING NATURAL DAMS).
W69-06401 04A

DATA COLLECTION
GROUND-WATER LEVELS IN NEW MEXICO, 1967,
W69-06212 02F

DATA COLLECTIONS
ANNUAL REPORT ON GROUND WATER IN ARIZONA, SPRING 1967 TO SPRING 1968.
W69-06026 02F

RECORDS OF OBSERVATION WELLS AND WATER-LEVEL FLUCTUATIONS I THE ABERDEEN-SPRINGFIELD AREA, BINGHAM AND POWER COUNTIES, IDAHO, IN 1967,
W69-06040 02F

WATER RESOURCE RECORDS OF THE ECONFINA CREEK BASIN AREA, FLORIDA,
W69-06051 02E

TEST WELL EXPLORATION IN THE MYAKKA RIVER BASIN AREA, FLORIDA,
W69-06053 02F

SUMMARY OF MAXIMUM DISCHARGES IN UTAH STREAMS,
W69-06209 02E

SELECTED HYDROLOGIC DATA, SOUTHERN UTAH AND GOSHEN VALLEYS, UTAH,
W69-06211 02F

QUALITY OF SURFACE WATERS FOR IRRIGATION, WESTERN STATES-1961,
W69-06253 03F

QUALITY OF SURFACE WATERS FOR IRRIGATION, WESTERN STATES-1960,
W69-06254 03F

DEAD SEA(ISRAEL)
DEAD SEA BRINES DEGREE OF HALITE SATURATION BY ELECTRODE MEASUREMENTS,
W69-06038 02K

DECISION MAKING
TECHNOLOGY AND PUBLIC DECISION MAKING,
W69-06048 06B

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT,
W69-06290 06B

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTERS I-II INTRODUCTION THE CRITERION PROBLEM,
W69-06291 06B

AN EXPLORATION OF COMPONENTS AFFECTING AND LIMITING POLICY MAKING OPTIONS IN LOCAL WATER AGENCIES,
W69-06306 06B

DECISION-MAKING
WATER AND CHOICE IN THE COLORADO BASIN AN EXAMPLE OF ALTERNATIVES IN WATER MANAGEMENT.
W69-06086 06B

DEEP WELL DISPOSAL
THE FEASIBILITY OF DEEP-WELL INJECTION OF WASTE BRINE FROM INLAND DESALTING PLANTS,
W69-06286 05E

DEEP WELLS
THE FEASIBILITY OF DEEP-WELL INJECTION OF WASTE BRINE FROM INLAND DESALTING PLANTS,
W69-06286 05E

DEGRADATION(STREAM)
KANSAS RIVER, BONNER SPRINGS TO MOUTH, DEGRADATION OF CHANNEL,
W69-06256 02J

DELAWARE
USE OF WATER FOR SUPPLEMENTAL IRRIGATION IN DELAWARE,
W69-06036 03F

DELAWARE RIVER BASIN COMMISSION
WATER QUALITY CONTROL - THE ROLE OF THE INTERSTATE AGENCY,
W69-06094 05G

METROPOLITAN PROBLEMS THE DELAWARE RIVER BASIN COMMISSION,
W69-06099 06B

DELAWARE RIVER BASIN.
W69-06347 06E

DELAWARE RIVER BASIN COMMISSION COMPACT
METROPOLITAN PROBLEMS THE DELAWARE RIVER BASIN COMMISSION,
W69-06099 06B

DENSITY CURRENTS
DENSITY FLOW REGIME OF FRANKLIN D. ROOSEVELT LAKE,
W69-06076 02H

DEPARTMENT OF AGRICULTURE
EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER XI CASE STUDY I THE GREEN RIVER WATERSHED,

W69-06299 06B

DEPARTMENT OF HEALTH AND WELFARE
DEPARTMENT OF HEALTH AND WELFARE.
W69-06143 06E

DESALINATION
OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION), PART III FRESH WATER RESOURCES.
W69-06416 06B

DESALINATION PROCESSES
SECONDARY REFRIGERANT FREEZING DESALTING PROCESS OPERATION OF A 15,000 GPD PILOT PLANT,
W69-06288 03A

DEVELOPED WATERS
MOUNTAIN AND DESERT LAKES IN SOUTHERN KAZAKHSTAN, THEIR RESOURCES AND METHODS OF ECONOMIC DEVELOPMENT,
W69-06073 02H

DIFFUSION
LONGITUDINAL ESTUARINE DIFFUSION IN SAN FRANCISCO BAY, CALIFORNIA,
W69-06030 05A

DISCHARGE MEASUREMENT
MEASUREMENT OF PEAK DISCHARGE BY INDIRECT METHODS,
W69-06251 02E

DISCHARGE(WATER)
STANDARD WAREHOUSE CO V ATLANTIC COAST LINE RR (NEGLIGENT CONSTRUCTION AND MAINTENANCE OF A DRAINAGE SYSTEM).
W69-06152 06E

MEASUREMENT OF PEAK DISCHARGE BY INDIRECT METHODS,
W69-06251 02E

GOULD AND EBERHARDT, INC V CITY OF NEWARK (DISCHARGE OF SURFACE WATERS FROM STORM SEWER).
W69-06357 04A

DISSOLVED OXYGEN
LIMNOLOGICAL INVESTIGATIONS OF TEXAS IMPOUNDMENTS FOR WATER QUALITY MANAGEMENT PURPOSES - THE DISTRIBUTION OF COLIFORM BACTERIA IN STRATIFIED IMPOUNDMENT,
W69-06005 05D

STOCHASTIC MODEL FOR BOD AND DO IN STREAMS,
W69-06080 05B

DISSOLVED SOLIDS
MINERAL TASTE IN DOMESTIC WATER,
W69-06215 05E

DISTRIBUTION
KEELER V TUBBS (LIMITATIONS UNDER WATER CONTRACTS).
W69-06134 06E

DISTRIBUTION SYSTEMS
BENEFITS FROM INTEGRATED WATER MANAGEMENT IN URBAN AREAS - THE CASE OF THE NEW YORK METROPOLITAN REGION,
W69-06201 06B

DISTRICT OF COLUMBIA
UNITED STATES V SHAPIRO, INC. (LIABILITY FOR DIVERSION OF SURFACE DRAINAGE BY GRADING).
W69-06129 06E

UNITED STATES V SHAPIRO (RIGHT TO REPEL SURFACE WATER).
W69-06198 06E

DITCHES
BOECK V YELLOW MEDICINE COUNTY (DRAINAGE DITCHES).
W69-06124 06E

SAELENS V POLLENTIER (SUIT TO ENJOIN DEFENDANT'S INTERFERENCE WITH THE FLOW OF SURFACE WATERS).
W69-06149 06E

LYDA V TOWN OF MARION (UNAUTHORIZED DRAINAGE DITCHES HELD TAKING OF PRIVATE PROPERTY FOR PUBLIC USE).
W69-06169 06E

HARGADINE V SHARKEY (DIVERSION OF WATER FROM ITS NATURAL COURSES).
W69-06193 06E

HORN V BRATTON (SUIT TO ENJOIN MAINTENANCE OF DAM AND DITCH FACILITIES).
W69-06375 04A

DIVERSION
UNITED STATES V SHAPIRO, INC. (LIABILITY FOR DIVERSION OF SURFACE DRAINAGE BY GRADING).
W69-06129 06E

GREENBURG V CITY OF STEUBENVILLE (DAMAGE CAUSED BY AN ACT OF GOD AND CONCURRENT NEGLIGENCE).
W69-06170 06E

ARCHER V J S COMPTON, INC (INTERFERENCE WITH NATURAL FLOW).
W69-06196 06E

H W PEERSON DRILLING CO V SCOGGINS (DEED EXCEPTIONS AND RIGHTS TO SUBTERRANEAN WATERS).
W69-06312 06E

JARVIS V CONNETT (DAMAGES CAUSED BY DIVERSION OF SURFACE WATER).
W69-06369 04A

NIAGARA MOHAWK POWER CORP V FEDERAL POWER COMM'N (USUFRUCTUARY RIGHTS AND THE FEDERAL WATER POWER ACT OF 1920).
W69-06405 06C

ANTHONY V HUNTLEY ESTATES (DAMAGES FOR POLLUTION OF STREAM).
W69-06410 05G

DIVERSION STRUCTURES
DROEGMILLER V OLSON (DIVERSION OF NATURAL FLOW).
W69-06135 06E

CLOUGH V STATE (ARTIFICIAL DIVERSION OF NATURAL WATERCOURSES).
W69-06184 06E

DOMESTIC WATER
MINERAL TASTE IN DOMESTIC WATER,
W69-06215 05E

POLLUTION OF POTABLE WATERS.
W69-06350 05G

DRAINAGE
HEREDA V LOWER BURRELL TP (UNNATURAL WATER AND SEWAGE DISCHARGE).
W69-06123 06E

DRAINAGE AND WATERCOURSES.
W69-06142 06E

GREENBURG V CITY OF STEUBENVILLE (DAMAGE CAUSED BY AN ACT OF GOD AND CONCURRENT NEGLIGENCE).
W69-06170 06E

SURFACE DRAINAGE CHARACTERISTICS IN VOLUSIA COUNTY, FLORIDA,
W69-06216 02E

HYDROLOGY OF LAND DRAINAGE,
W69-06234 04A

HILL V CITY OF GREENVILLE (DAMAGES RESULTING FROM CITY'S FAILURE TO PROVIDE DRAINAGE).
W69-06324 04A

HALL V CITY OF GREENVILLE (STATUTORY DUTY OF CITY TO PROVIDE ADEQUATE STREET DRAINAGE).
W69-06361 04A

DRAINAGE DISTRICTS
BOHANNON V CAMDEN BEND DRAINAGE DISTRICT (TAKING OF PROPERTY BY WATER DISTRICT).
W69-06132 06E

HEPBURN V MADDOX (LIABILITY OF DRAINAGE DISTRICT).
W69-06197 06E

DRAINAGE ENGINEERING
HEPBURN V MADDOX (LIABILITY OF DRAINAGE DISTRICT).
W69-06197 06E

HYDROLOGY OF LAND DRAINAGE,
W69-06234 04A

DRAINAGE PATTERNS(GEOLOGIC)
THE VALLEYS OF IOWA-1 VALLEY WIDTH AND STREAM DISCHARGE RELATIONSHIPS IN THE MAJOR STREAMS,
W69-06034 02E

DRAINAGE SYSTEMS
BOECK V YELLOW MEDICINE COUNTY (DRAINAGE DITCHES).
W69-06124 06E

STANDARD WAREHOUSE CO V ATLANTIC COAST LINE RR (NEGLIGENT CONSTRUCTION AND MAINTENANCE OF A DRAINAGE SYSTEM).
W69-06152 06E

WHEATLEY V CASS COUNTY (DIVERSION OF NATURAL FLOW OF FLOOD WATERS BY THE STATE FOLLOWED BY SUBSEQUENT RESUMPTION OF SAME FLOW).
W69-06156 06E

PETER WENDEL AND SONS V CITY OF NEWARK (DAMAGE FROM ARTIFICIAL DRAINAGE SYSTEM).
W69-06176 06E

CITY OF JACKSON V ROBERTSON (INJUNCTION AGAINST DISCHARGING DRAINAGE UPON LOWER PROPERTY).
W69-06179 06E

GOULD AND EBERHARDT, INC V CITY OF NEWARK (DISCHARGE OF SURFACE WATERS FROM STORM SEWER).
W69-06357 04A

DRAINAGE WATER
CITY OF MACON V CANNON (SURFACE WATER RUNOFF).
W69-06166 06E

TAYLOR V HARRISON CONSTR CO (ARTIFICIAL INCREASE OF SURFACE WATERS).
W69-06167 06E

CITY OF JACKSON V COOK (COMPENSATION FOR DAMAGES FROM NEGLIGENT DISPOSAL OF DRAINAGE WATER).
W69-06174 06E

DUVALL V 20TH CENTURY COAL CO (PERCOLATING WATERS).
W69-06175 06E

HOWLETT V CITY OF SOUTH NORFOLK (FLOOD DAMAGE ALLEGEDLY DUE

TO STREET ELEVATION).
W69-06308 04C

GOULD AND EBERHARDT, INC V CITY OF NEWARK (DISCHARGE OF SURFACE WATERS FROM STORM SEWER).
W69-06357 04A

GRANGER V ELM TREE VILLAGE (DISCHARGE OF EXCESS SURFACE WATER).
W69-06370 04A

DRAINS
CITY OF MERIDAN V SULLIVAN (SUBSURFACE DRAINAGE).
W69-06322 04A

EFNER V KETTERINGHAM (VALIDITY OF EASEMENT TO DRAIN RAIN WATER ONTO ADJOINING LAND).
W69-06372 04A

DRAWNDOWN
THE PIEZOMETRIC SURFACE OF THE COASTAL PLAIN AQUIFER IN GEORGIA, ESTIMATES OF ORIGINAL ELEVATION AND LONG-TERM DECLINE,
W69-06043 02F

DREDGING
CARR V UNITED STATES (DAMAGES TO OYSTER BED DUE TO DRAGGING OPERATIONS).
W69-06192 06E

EASEMENTS
MILOTTA V PFEIFER (NATURAL FLOW AND RIGHTS TO SURFACE DRAINAGE).
W69-06121 06E

MC KEON V BRAMMER (SUBSURFACE DRAINAGE AND THE NATURAL FLOW DOCTRINE).
W69-06126 06E

POLICH V HERMANN (ABNORMAL DISCHARGE OF SURFACE WATER).
W69-06127 06E

HOLDEN V MOSER (SURFACE DRAINAGE EASEMENTS).
W69-06182 06E

KLOOCK V RUSNACK (VALIDITY OF WATER USE EASEMENT).
W69-06183 06E

DE PIETRO V TRIANO (ESTABLISHMENT OF EASEMENT FOR SURFACE WATER DRAINAGE).
W69-06371 04A

EFNER V KETTERINGHAM (VALIDITY OF EASEMENT TO DRAIN RAIN WATER ONTO ADJOINING LAND).
W69-06372 04A

ECONOMIC EFFICIENCY
EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTERS I-II INTRODUCTION THE CRITERION PROBLEM,
W69-06291 06B

ECONOMIC EFFIENCY
WATER AND CHOICE IN THE COLORADO BASIN AN EXAMPLE OF ALTERNATIVES IN WATER MANAGEMENT, CH. 4, THE RANGE OF OBJECTIVES IN PLANNING FOR THE USE OF COLORADO WATER.
W69-06089 06B

ECONOMIC FEASIBILITY
AN ENGINEERING-ECONOMIC ANALYSIS OF SYSTEMS UTILIZING AQUIFER STORAGE FOR THE IRRIGATION OF PARKS AND GOLFCOURSES WITH RECLAIMED WASTEWATER,
W69-06289 03C

ECONOMICS
MOUNTAIN AND DESERT LAKES IN SOUTHERN KAZAKHSTAN, THEIR RESOURCES AND METHODS OF ECONOMIC DEVELOPMENT,
W69-06073 02H

EFFLUENTS
MASSEY V MASONITE CORP (OVERFLOW OF EFFLUENTS INTO PRIVATE LAKE).
W69-06409 05G

ELECTRIC POWER PRODUCTION
UNITED STATES V 1532.63 ACRES OF LAND (DETERMINATION OF FAIR MARKET VALUE IN CONDEMNATION PROCEEDING).
W69-06392 06E

ELECTRICAL PROFILING
COASTAL EVIDENCES OF GROUND WATER CONDITIONS IN THE VICINITY OF ANAEHOOMALU AND LALAMILO, SOUTH KOHALA, HAWAII,
W69-06006 03B

ELECTRICAL RESISTIVITY
COASTAL EVIDENCES OF GROUND WATER CONDITIONS IN THE VICINITY OF ANAEHOOMALU AND LALAMILO, SOUTH KOHALA, HAWAII,
W69-06006 03B

ELECTRICAL SOUNDING
COASTAL EVIDENCES OF GROUND WATER CONDITIONS IN THE VICINITY OF ANAEHOOMALU AND LALAMILO, SOUTH KOHALA, HAWAII,
W69-06006 03B

ELECTRICAL STUDIES
THE LOCATION OF DEEP AQUIFERS BY RESISTIVITY SOUNDINGS,
W69-06027 02F

EMBANKMENTS
VOLLRATH V WABASH RAILROAD CO. (DAMAGE DUE TO FLOOD WATER FLOW THROUGH ARTIFICIAL EMBANKMENT CUT).
W69-06133 04C

ZIDEL V STATE (STATE LIABLE FOR EROSION CAUSED BY NEGLIGENTLY PLACED ROAD).
W69-06314 04C

EMINENT DOMAIN
MCKINNEY V DENEEN (LIABILITY FOR DISCHARGE OF MINE WASTES).
W69-06111 05C

BOHANNON V CAMDEN BEND DRAINAGE DISTRICT (TAKING OF PROPERTY BY WATER DISTRICT).
W69-06132 06E

PUBLIC UTILITIES CARRIERS AND WATER COMPANIES.
W69-06139 06E

GRISWOLD V TOWN SCHOOL DISTRICT (DAMAGE TO SPRING).
W69-06155 06E

CITY OF JACKSON V COOK (COMPENSATION FOR DAMAGES FROM NEGLIGENT DISPOSAL OF DRAINAGE WATER).
W69-06174 06E

CRARY V STATE HIGHWAY COMMISSION (TAKING OF STATUTORY RIPARIAN RIGHTS).
W69-06180 06E

STATE V BOSTIAN (EMINENT DOMAIN AND MUNICIPAL WATER SUPPLY).
W69-06358 06E

JACKSON V UNITED STATES (PRIVATE PROPERTY RIGHTS IN FISHING GROUNDS).
W69-06381 06E

ENERGY BUDGET
SOME MAPS OF ISANOMALIES IN ENERGY BALANCE CLIMATOLOGY,
W69-06050 02B

PRIMARY PRODUCTION, ENERGETICS, AND NUTRIENT UTILIZATION IN A WARM-WATER STREAM,
W69-06092 05C

ENVIRONMENTAL EFFECTS
WATER AND CHOICE IN THE COLORADO BASIN AN EXAMPLE OF ALTERNATIVES IN WATER MANAGEMENT, CH. 2, THE SETTING.
W69-06087 06B

HYDROLYSIS OF CONDENSED PHOSPHATES--I NON-STERILE ENVIRONMENT,
W69-06271 02K

HYDROLYSIS OF CONDENSED PHOSPHATES--II STERILE ENVIRONMENT,
W69-06284 02K

EQUITABLE ESTOPPEL
GOULD AND EBERHARDT, INC V CITY OF NEWARK (DISCHARGE OF SURFACE WATERS FROM STORM SEWER).
W69-06357 04A

EROSION
HEPBURN V MADDOX (LIABILITY OF DRAINAGE DISTRICT).
W69-06197 06E

GLACIAL EROSION,
W69-06258 02C

EROSIVE PROCESSES WHICH ARE LIKELY TO ACCENTUATE OR REDUCE THE BOTTOM RELIEF OF VALLEY GLACIERS,
W69-06259 02J

ESSENTIAL NUTRIENTS
COBALT AS AN ESSENTIAL ELEMENT FOR BLUE-GREEN ALGAE,
W69-06277 05A

ESTUARIES
LONGITUDINAL ESTUARINE DIFFUSION IN SAN FRANCISCO BAY, CALIFORNIA,
W69-06030 05A

SOLUTION OF ESTUARY PROBLEMS AND NETWORK PROGRAMS,
W69-06077 02L

MEASURING ESTUARINE POLLUTION,
W69-06203 05A

ESTUARINE ENVIRONMENT
MEASURING ESTUARINE POLLUTION,
W69-06203 05A

ESTUARINE POLLUTION
MEASURING ESTUARINE POLLUTION,
W69-06203 05A

EUROPE
EUROPEAN PRACTICE IN WATER QUALITY CONTROL,
W69-06078 05G

EUTROPHICATION
HARVESTING UNDERWATER WEEDS,
W69-06276 05G

RECOVERY OF ORGANICS FROM A EUTROPHIC LAKE BY THE CARBON ADSORPTION TECHNIQUE,
W69-06282 05A

EVALUATION
AN EVALUATION OF SOME METHODS FOR THE DETERMINATION OF FLUORIDE IN POTABLE WATERS AND OTHER AQUEOUS SOLUTIONS,
W69-06037 05F

EVAPORATION
PRECISION MEASUREMENTS OF WATER DROPLET EVAPORATION RATES,
W69-06236 02D

EVERGLADES NATIONAL PARK
HYDROGEOLOGIC DATA RELATED TO ESTABLISHMENT OF A PUMPING STATION IN THE EVERGLADES NATIONAL PARK, FLORIDA,
W69-06033 02F

EVIDENCE
ACCURATE DIE CASTING CO V CITY OF CLEVELAND (FLOOD DAMAGE FROM SUBSURFACE DRAINAGE).
W69-06171 06E

EXPENDITURES
MUNICIPALITIES PUBLIC WORKS, DEVELOPMENT.
W69-06140 06E

EXPERIMENTAL LIMNOLOGY
MOVEMENT OF RADIOSODIUM IN A CHEMICALLY STRATIFIED LAKE,
W69-06283 02H

EXPLOITATION
A CASE FOR THE ADMINISTRATION OF MARINE RESOURCES UNDERLYING THE HIGH SEAS BY THE UNITED NATIONS,
W69-06103 06E

ALTERNATIVE REGIMES FOR MARINE RESOURCES UNDERLYING THE SEA,
W69-06105 06E

A NEGATIVE VIEW OF A PROPOSAL FOR UNITED NATIONS OWNERSHIP OF OCEAN MINERAL RESOURCES,
W69-06106 06E

EXPLORATION
GENERAL GEOPHYSICAL CO V BROWN (DESTRUCTION OF WATER-WELL BY GEOPHYSIC EXPLOSIONS).
W69-06173 06E

EXPLOSIONS
GENERAL GEOPHYSICAL CO V BROWN (DESTRUCTION OF WATER-WELL BY GEOPHYSIC EXPLOSIONS).
W69-06173 06E

EXTRACTION METHODS
BEHAVIOR OF HUMIC ACID IN RECENT LAKE SEDIMENTS TOWARD SODIUM HYDROXYDE AQUEOUS SOLUTION AT THE EXTRACTION (IN JAPANESE),
W69-06278 02H

FEDERAL BUDGETS
EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER IX KINDS OF BENEFITS OVERCOUNTING, AND SECONDARY BENEFITS.
W69-06297 06B

FEDERAL GOVERNMENT
UNITED STATES POLICY REGARDING MARINE RESOURCES (IMPLEMENTATION OF THE NEW MARINE POLICY),
W69-06100 06E

DANNER V UNITED STATES (FEDERAL GOVERNMENT'S LIABILITY FOR FLOOD DAMAGES).
W69-06194 06E

NATIONAL MFG CO V UNITED STATES (SOVEREIGN IMMUNITY FROM SUIT FOR FLOOD DAMAGE).
W69-06376 04A

CROSS V PACE (DAMAGE TO UNITED STATES CITIZENS BY FOREIGN DAM).
W69-06380 04A

UNITED STATES V 1532.63 ACRES OF LAND (DETERMINATION OF FAIR MARKET VALUE IN CONDEMNATION PROCEEDING).
W69-06392 06E

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION), PART IV GOVERNMENT-INDUSTRY RELATIONSHIPS IN SUPPORT OF RESEARCH DEVELOPMENT.
W69-06419 06B

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION) ORGANIZING A NATIONAL OCEAN EFFORT.
W69-06420 06B

FEDERAL JURISDICTION
WATER AND CHOICE IN THE COLORADO BASIN AN EXAMPLE OF ALTERNATIVES IN WATER MANAGEMENT, CH. 2, THE SETTING.
W69-06087 06B

FEDERAL POWER ACT
PROUTY V CITIZENS UTILITIES CO. (SALE OF PROPERTY ALONG NAVIGABLE RIVER).
W69-06136 06E

NIAGARA MOHAWK POWER CORP V FEDERAL POWER COMM'N (USUFRUCTUARY RENTAL AS AN OPERATING EXPENSE).
W69-06379 06E

FEDERAL POWER COMMISSION
FEDERAL POWER COMMISSION V NIAGARA MOHAWK POWER CORPORATION (STATUS OF STATE WATER RIGHTS UNDER FEDERAL WATER POWER ACT OF 1920).
W69-06378 06E

FEDERAL-STATE WATER CONFLICTS
UNITED STATES V STATE OF LOUISIANA, TEXAS, MISSISSIPPI, ALABAMA, AND FLORIDA (INTERPRETATION OF SUBMERGED LANDS ACT).
W69-06200 06E

FEDERAL-STATE WATER RIGHTS CONFLICTS
FEDERAL POWER COMMISSION V NIAGARA MOHAWK POWER CORPORATION (STATUS OF STATE WATER RIGHTS UNDER FEDERAL WATER POWER ACT OF 1920).
W69-06378 06E

FERMENTATION
SOURCES OF ELEMENTAL NITROGEN IN FERMENTATION GASES,
W69-06285 05C

FERMENTATION GASES
SOURCES OF ELEMENTAL NITROGEN IN FERMENTATION GASES,
W69-06285 05C

FISH
HEATED EFFLUENTS AND EFFECTS ON AQUATIC LIFE WITH EMPHASIS ON FISHES,
W69-06022 05C

GROWTH EQUATIONS WITH METABOLIC PARAMETERS,
W69-06280 05C

FISH CONSERVATION
FISHERIES CONSERVATION.
W69-06144 06E

STATE V SULLIVAN (REGULATION BY FRESH WATER FISH COMM'N).
W69-06327 06E

LE CLAIR V SWIFT (ENFORCEMENT OF CONSERVATION STATUTES).
W69-06377 06E

FISH MANAGEMENT
HATCHERIES, SCREENS AND GAME MANAGEMENT AREAS.
W69-06145 06E

FISHERIES
BAYLEN STREET WHARF CO V CITY OF PENSACOLA (DAMAGES TO LAND BY STORM SEWER REFUSE).
W69-06402 06E

FISHING
TOBIAS V TOBIAS (SUIT TO ENJOIN EXERCISE OF RIPARIAN RIGHT TO FISH IN LAKE).
W69-06164 06E

FISHKILL
MASSEY V MASONITE CORP (OVERFLOW OF EFFLUENTS INTO PRIVATE LAKE).
W69-06409 05G

FLOOD CONTROL
PEERLESS SERUM CO V UNITED STATES (LIABILITY FOR FLOOD DAMAGES).
W69-06195 06E

MAN'S INFLUENCE ON HYDROLOGICAL PHENOMENA,
W69-06233 04C

ATCHLEY V TENNESSEE VALLEY AUTHORITY (FLOODING OF CROPS CAUSED BY RAISED RESERVOIR WATERS).
W69-06321 04A

POWERS AND FUNCTIONS OF DEPARTMENT OF WATER RESOURCES - FLOOD CONTROL.
W69-06332 04A

CHAPMAN V FEDERAL POWER COMM'N (PRIVATE CONSTRUCTION OF HYDROELECTRIC PLANT AND RIVER BASIN PROJECT).
W69-06346 08C

FLOOD DAMAGE
FLOOD PLAIN INFORMATION, UPPER FLINT RIVER, MUD AND JESTER CREEKS, METROPOLITAN ATLANTA, GEORGIA.
W69-06057 04A

FLOOD PLAIN INFORMATION, CASEY CANAL NORTH, SAVANNAH AND CHATHAM COUNTY, GEORGIA.
W69-06058 04A

FLOOD PLAIN INFORMATION, TAR RIVER AND STONY CREEK, ROCKY MOUNT, NORTH CAROLINA.
W69-06059 04A

FLOOD PLAIN INFORMATION, COBBS CREEK-FOWLER BRANCH, DEKALB COUNTY, GEORGIA.
W69-06060 04A

FLOOD PLAIN INFORMATION, ROCK RIVER AT JANESVILLE, WISCONSIN.
W69-06061 04A

FLOOD PLAIN INFORMATION, BIG WALNUT CREEK, VICINITY OF COLUMBUS, OHIO.
W69-06062 04A

FLOOD PLAIN INFORMATION, HUNNICUTT CREEK, ATHENS, CLARKE COUNTY, GEORGIA.
W69-06063 04A

FLOOD PLAIN INFORMATION, TAR RIVER AT LOUISBURG, NORTH CAROLINA.
W69-06064 04A

FLOOD PLAIN INFORMATION, DICKINSON BAYOU, DICKINSON, TEXAS.
W69-06065 04A

FLOOD PLAIN INFORMATION, ELLERBE, GOOSE, WARREN, SANDY AND THIRD FORK CREEKS, DURHAM, NORTH CAROLINA.

W69-06066 04A

FLOOD PLAIN INFORMATION, TURTLE CREEK, ROCK COUNTY, WISCONSIN.
W69-06067 04A

FLOOD PLAIN INFORMATION, BEAVERDAM CREEK, PRINCE GEORGES COUNTY, MARYLAND.
[illegible] 04A

FLOOD PLAIN INFORMATION, OTTAWA RIVER, ALLEN COUNTY, OHIO.
W69-06069 04A

FLOOD PLAIN INFORMATION, OHIO RIVER, JEFFERSON COUNTY, KENTUCKY.
W69-06070 04A

A FLOOD LOSS REDUCTION PROGRAM,
W69-06097 06F

KEYTON V MISSOURI-KANSAS-TEXAS RR (ACTION FOR DAMAGES CAUSED BY OBSTRUCTING NATURAL FLOW OF SURFACE WATER).
W69-06162 06E

ACCURATE DIE CASTING CO V CITY OF CLEVELAND (FLOOD DAMAGE FROM SUBSURFACE DRAINAGE).
W69-06171 06R

CITY OF JACKSON V COOK (COMPENSATION FOR DAMAGES FROM NEGLIGENT DISPOSAL OF DRAINAGE WATER).
W69-06174 06E

MAYOR OF AMERICUS V BRIGHTWELL (SURFACE DRAINAGE AND ALTERATION OF FLOW).
W69-06177 06E

DANNER V UNITED STATES (FEDERAL GOVERNMENT'S LIABILITY FOR FLOOD DAMAGES).
W69-06194 06E

PEERLESS SERUM CO V UNITED STATES (LIABILITY FOR FLOOD DAMAGES).
W69-06195 06E

FLOOD PLAIN INFORMATION, RICHLAND COUNTY, SOUTH CAROLINA.
W69-06238 04A

FLOOD PLAIN INFORMATION, GUADALUPE RIVER, SPRING CREEK AND LONE TREE CREEK, VICTORIA, TEXAS.
W69-06239 04A

FLOOD PLAIN INFORMATION, SABINE RIVER AND ADAMS BAYOU, ORANGE, TEXAS AREA.
W69-06240 04A

FLOOD PLAIN INFORMATION, DICKINSON, NORTH DAKOTA DRAINAGE DITCH.
W69-06241 04A

FLOOD PLAIN INFORMATION, PIGEON CREEK, BENTLEYVILLE, FALLOWFIELD TOWNSHIP AND SOMERSET TOWNSHIP, PENNSYLVANIA.
W69-06242 04A

FLOOD PLAIN INFORMATION, CUMBERLAND RIVER, ROARING RIVER, AND DOE CREEK, GAINESBORO, TENNESSEE.
W69-06243 04A

FLOOD PLAIN INFORMATION, SKOOKUMCHUCK RIVER, BUCODA, WASHINGTON.
W69-06244 04A

FLOOD PLAIN INFORMATION, LAWSONS FORK CREEK AND FAIRFOREST CREEK, SPARTANBURG, SOUTH CAROLINA.
W69-06245 04A

FLOOD PLAIN INFORMATION, SOUTH FORK OF FORKED DEER RIVER AND SUGAR CREEK, HENDERSON, TENNESSEE.
W69-06246 04A

FLOOD PLAIN INFORMATION, ARROYO DE LOS CHAMISOS AND ARROYO HONDO, SANTA FE, NEW MEXICO.
W69-06247 04A

FLOOD PLAIN INFORMATION, CLARK FORK, MISSOULA, MONTANA.
W69-06248 04A

MESSANA V MAULE INDUSTRIES (NEGLIGENT FLOODING OF FARM LAND).
W69-06310 04A

HALL V CITY OF GREENVILLE (STATUTORY DUTY OF CITY TO PROVIDE ADEQUATE STREET DRAINAGE).
W69-06361 04A

MAGEE V TEXAS CONSTRUCTION CO (FLOODING ABOVE COFFER DAM).
W69-06368 04A

NATIONAL MFG CO V UNITED STATES (SOVEREIGN IMMUNITY FROM SUIT FOR FLOOD DAMAGE).
W69-06376 04A

FLOOD DAMAGES
KENNEDY V UNION ELECTRIC CO OF MISSOURI (SILT ACCRETION AND FLOODING).
W69-06188 06E

FLOOD FORECASTING
NATIONAL MFG CO V UNITED STATES (SOVEREIGN IMMUNITY FROM SUIT FOR FLOOD DAMAGE).
W69-06376 04A

FLOOD MICROBIOLOGY
ECOLOGICAL RELATIONSHIPS OF ORGANIC MATTER AND BACTERIA IN TUTTLE CREEK RESERVOIR,
W69-06014 02H

FLOOD PLAIN INSURANCE
A FLOOD LOSS REDUCTION PROGRAM,
W69-06097 06F

FLOOD PLAIN ZONING
A FLOOD LOSS REDUCTION PROGRAM,
W69-06097 06F

FLOOD PROTECTION
MCKEE V HASLER (LEVEE CONSTRUCTION FOR FLOOD CONTROL).
W69-06363 04A

FLOODING
FIFE V CHESAPEAKE AND OHIO RR (NON-LIABILITY FOR ACTS OF GOD).
W69-06153 06E

CITY OF MACON V CANNON (SURFACE WATER RUNOFF).
W69-06166 06E

DAVENPORT V TOWN OF DANVERS (FLOODING OF LAND BY CITY DAM).
W69-06311 04A

NORTH COUNTIES HYDROELECTRIC CO V UNITED STATES (DAMAGES RESULTING FROM ICE JAM).
W69-06326 06E

STIGALL V SHARKEY COUNTY (DESTRUCTION OF DRAINAGE FACILITIES CAUSING FLOOD DAMAGE).
W69-06360 04A

JOHNSON V CITY OF WINSTON-SALEM (SURFACE WATER DRAINAGE - PIPES).
W69-06374 04A

FLOODS
FLOODS AT JACKSON, OHIO,
W69-06056 02E

FLOOD PLAIN INFORMATION, UPPER FLINT RIVER, MUD AND JESTER CREEKS, METROPOLITAN ATLANTA, GEORGIA.
W69-06057 04A

FLOOD PLAIN INFORMATION, CASEY CANAL NORTH, SAVANNAH AND CHATHAM COUNTY, GEORGIA.
W69-06058 04A

FLOOD PLAIN INFORMATION, TAR RIVER AND STONY CREEK, ROCKY MOUNT, NORTH CAROLINA.
W69-06059 04A

FLOOD PLAIN INFORMATION, COBBS CREEK-FOWLER BRANCH, DEKALB COUNTY, GEORGIA.
W69-06060 04A

FLOOD PLAIN INFORMATION, ROCK RIVER AT JANESVILLE, WISCONSIN.
W69-06061 04A

FLOOD PLAIN INFORMATION, BIG WALNUT CREEK, VICINITY OF COLUMBUS, OHIO.
W69-06062 04A

FLOOD PLAIN INFORMATION, HUNNICUTT CREEK, ATHENS, CLARKE COUNTY, GEORGIA.
W69-06063 04A

FLOOD PLAIN INFORMATION, TAR RIVER AT LOUISBURG, NORTH CAROLINA.
W69-06064 04A

FLOOD PLAIN INFORMATION, DICKINSON BAYOU, DICKINSON, TEXAS.
W69-06065 04A

FLOOD PLAIN INFORMATION, ELLERBE, GOOSE, WARREN, SANDY AND THIRD FORK CREEKS, DURHAM, NORTH CAROLINA.
W69-06066 04A

FLOOD PLAIN INFORMATION, TURTLE CREEK, ROCK COUNTY, WISCONSIN.
W69-06067 04A

FLOOD PLAIN INFORMATION, BEAVERDAM CREEK, PRINCE GEORGES COUNTY, MARYLAND.
W69-06068 04A

FLOOD PLAIN INFORMATION, OTTAWA RIVER, ALLEN COUNTY, OHIO.
W69-06069 04A

FLOOD PLAIN INFORMATION, OHIO RIVER, JEFFERSON COUNTY, KENTUCKY.
W69-06070 04A

SOUTHERN RR V JEFFERSON (FLOODING ABOVE RAILROAD FILL).
W69-06186 06E

FLOODS OF THE 1965 WATER YEAR IN MISSISSIPPI,
W69-06219 02E

FLOOD PLAIN INFORMATION, RICHLAND COUNTY, SOUTH CAROLINA.
W69-06238 04A

FLOOD PLAIN INFORMATION, GUADALUPE RIVER, SPRING CREEK AND LONE TREE CREEK, VICTORIA, TEXAS.
W69-06239 04A

FLOOD PLAIN INFORMATION, SABINE RIVER AND ADAMS BAYOU, ORANGE, TEXAS AREA.
W69-06240 04A

FLOOD PLAIN INFORMATION, DICKINSON, NORTH DAKOTA DRAINAGE DITCH.
W69-06241 04A

FLOOD PLAIN INFORMATION, PIGEON CREEK, BENTLEYVILLE, FALLOWFIELD TOWNSHIP AND SOMERSET TOWNSHIP, PENNSYLVANIA.
W69-06242 04A

FLOOD PLAIN INFORMATION, CUMBERLAND RIVER, ROARING RIVER, AND DOE CREEK, GAINESBORO, TENNESSEE.
W69-06243 04A

FLOOD PLAIN INFORMATION, SKOOKUMCHUCK RIVER, BUCODA, WASHINGTON.
W69-06244 04A

FLOOD PLAIN INFORMATION, LAWSONS FORK CREEK AND FAIRFOREST CREEK, SPARTANBURG, SOUTH CAROLINA.
W69-06245 04A

FLOOD PLAIN INFORMATION, SOUTH FORK OF FORKED DEER RIVER AND SUGAR CREEK, HENDERSON, TENNESSEE.
W69-06246 04A

FLOOD PLAIN INFORMATION, ARROYO DE LOS CHAMISOS AND ARROYO HONDO, SANTA FE, NEW MEXICO.
W69-06247 04A

FLOOD PLAIN INFORMATION, CLARK FORK, MISSOULA, MONTANA.
W69-06248 04A

FLOODWATER
WHEATLEY V CASS COUNTY (DIVERSION OF NATURAL FLOW OF FLOOD WATERS BY THE STATE FOLLOWED BY SUBSEQUENT RESUMPTION OF SAME FLOW).
W69-06156 06E

FLORIDA
HYDROGEOLOGIC DATA RELATED TO ESTABLISHMENT OF A PUMPING STATION IN THE EVERGLADES NATIONAL PARK, FLORIDA,
W69-06033 02F

WATER RESOURCE RECORDS OF THE ECONFINA CREEK BASIN AREA, FLORIDA,
W69-06051 02E

TEST WELL EXPLORATION IN THE HYAKKA RIVER BASIN AREA, FLORIDA,
W69-06053 02F

SURFACE DRAINAGE CHARACTERISTICS IN VOLUSIA COUNTY, FLORIDA,
W69-06216 02E

WATER IN BROWARD COUNTY, FLORIDA,
W69-06217 02E

TAYLOR V TAMPA COAL CO (RIPARIAN RIGHTS IN NON-NAVIGABLE LAKE).
W69-06307 06E

MESSANA V MAULE INDUSTRIES (NEGLIGENT FLOODING OF FARM LAND).
W69-06310 04A

STATE V SULLIVAN (REGULATION BY FRESH WATER FISH COMM'N).
W69-06327 06E

BECK V GAME AND FRESH WATER FISH COMM'N (JURISDICTION OF FRESH WATER FISH COMM'N).
W69-06328 06E

BAYLEN STREET WHARF CO V CITY OF PENSACOLA (DAMAGES TO LAND BY STORM SEWER REFUSE).
W69-06402 06E

FLOW AUGMENTATION
CITY OF JACKSON V ROBERTSON (INJUNCTION AGAINST DISCHARGING DRAINAGE UPON LOWER PROPERTY).
W69-06179 06E

CRITES V UNITED STATES (CLAIMS FOR LOSS IN VALUE OF LAND DUE TO IRRIGATION PROJECT).
W69-06325 03F

FLUORIDES
AN EVALUATION OF SOME METHODS FOR THE DETERMINATION OF FLUORIDE IN POTABLE WATERS AND OTHER AQUEOUS SOLUTIONS,
W69-06037 05F

FOOD HABITS
AGE AND GROWTH OF WHITE BASS IN ONEIDA LAKE, NEW YORK,
W69-06275 05C

FORECASTING
PROBABILITY FORECASTS OF 30-DAY PRECIPITATION,
W69-06205 02B

HYDROLOGICAL FORECASTING,
W69-06228 02A

FOREST FIRES
FACTORS RESTRICTING INFILTRATION RATES ON DECOMPOSED GRANITIC SOILS,
W69-06041 02G

FOREST MANAGEMENT
FORESTS, PARKS, LAKES, AND RIVERS.
W69-06146 06E

STATE FORESTS TREE PLANNING.
W69-06338 03F

FOREST SOILS
FREEZING IN FOREST SOIL AS INFLUENCED BY SOIL PROPERTIES, LITTER, AND SNOW,
W69-06028 02C

FACTORS RESTRICTING INFILTRATION RATES ON DECOMPOSED GRANITIC SOILS,
W69-06041 02G

INFILTROMETER STUDIES ON NON-WETTABLE SOILS ON EAST SIERRA NEVADA,
W69-06042 02G

FREEZE DRYING
TOWARDS STANDARDIZATION OF SOIL EXTRACTS FOR MICROBIAL MEDIA,
W69-06272 02K

FREEZING
FREEZING IN FOREST SOIL AS INFLUENCED BY SOIL PROPERTIES, LITTER, AND SNOW,
W69-06028 02C

SECONDARY REFRIGERANT FREEZING DESALTING PROCESS OPERATION OF A 15,000 GPD PILOT PLANT,
W69-06288 03A

FRESH WATER
POLLUTION OF FRESH WATERS.
W69-06349 05G

GASES
UNDERGROUND STORAGE OF FLUIDS,
W69-06055 02F

GASOLINE
PHILLIPS V SUN OIL CO (GASOLINE POLLUTION OF WATER WELL).
W69-06117 05G

GEOLOGIC INVESTIGATIONS
THE LOCATION OF DEEP AQUIFERS BY RESISTIVITY SOUNDINGS,
W69-06027 02F

GEOMORPHOLOGY
THE VALLEYS OF IOWA-1 VALLEY WIDTH AND STREAM DISCHARGE RELATIONSHIPS IN THE MAJOR STREAMS,
W69-06034 02E

GEORGIA
GEORGIA WATER LAW,
W69-06009 06E

FLOOD PLAIN INFORMATION, UPPER FLINT RIVER, MUD AND JESTER CREEKS, METROPOLITAN ATLANTA, GEORGIA.
W69-06057 04A

FLOOD PLAIN INFORMATION, CASEY CANAL NORTH, SAVANNAH AND CHATHAM COUNTY, GEORGIA.
W69-06058 04A

FLOOD PLAIN INFORMATION, COBBS CREEK-FOWLER BRANCH, DEKALB COUNTY, GEORGIA.
W69-06060 04A

FLOOD PLAIN INFORMATION, HUNNICUTT CREEK, ATHENS, CLARKE COUNTY, GEORGIA.
W69-06063 04A

CITY OF MACON V CANNON (SURFACE WATER RUNOFF).
W69-06166 06E

MAYOR OF AMERICUS V BRIGHTWELL (SURFACE DRAINAGE AND ALTERATION OF FLOW).
W69-06177 06E

GLACIAL EROSION
GLACIAL EROSION,
W69-06258 02C

GLACIAL MASS BUDGET
GLACIER MASS BUDGET AND MESOSCALE WEATHER IN THE AUSTRIAN ALPS 1964 TO 1966,
W69-06267 02C

GLACIAL MELTWATER TRACERS
TRITIUM CONTENT IN THE FIRN LAYERS OF AN ALPINE GLACIER,
W69-06262 02C

GLACIERS
THE LONGITUDINAL VELOCITY PROFILE OF LARGE ICE MASSES,
W69-06257 02C

GLACIAL EROSION,
W69-06258 02C

EROSIVE PROCESSES WHICH ARE LIKELY TO ACCENTUATE OR REDUCE THE BOTTOM RELIEF OF VALLEY GLACIERS,
W69-06259 02J

RIFTS AT THE FOOT OF BEARDMORE GLACIER, ANTARCTICA,
W69-06260 02C

INVESTIGATIONS ON FISSION PRODUCTS IN THE ACCUMULATION AREA OF AN ALPINE GLACIER (KESSELWANDFERNER, OETZTAL ALPS),
W69-06261 02C

TRITIUM CONTENT IN THE FIRN LAYERS OF AN ALPINE GLACIER,
W69-06262 02C

EXPERIENCES IN COMPARING GEOMETRIC ELEMENTS OF GLACIER VARIATIONS,
W69-06264 02C

CHANGE OF ITALIAN GLACIERS DURING THE DECADE 1957-1966 (FRENCH),
W69-06265 02C

GLACIER MASS BUDGET AND MESOSCALE WEATHER IN THE AUSTRIAN ALPS 1964 TO 1966,
W69-06267 02C

THE GREENLAND MASS BALANCE FLUX DIVERGENCE CONSIDERATIONS,
W69-06268 02C

MASS BALANCE OBSERVATIONS ON THE BARNES ICE CAP, BAFFIN ISLAND, CANADA,
W69-06269 02C

GRAVITY
COASTAL EVIDENCES OF GROUND WATER CONDITIONS IN THE VICINITY OF ANAEHOOMALU AND LALAMILO, SOUTH KOHALA, HAWAII,
W69-06006 03B

GREAT PONDS
SMEDBERG V MOXIE DAM CO. (DAMAGE CAUSED BY LOWERING POND LEVEL).
W69-06131 06E

GREEN RIVER WATERSHED
EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER XI - CASE STUDY I - THE GREEN RIVER WATERSHED,
W69-06299 06B

GREENLAND
THE GREENLAND MASS BALANCE FLUX DIVERGENCE CONSIDERATIONS,
W69-06268 02C

GROUNDWATER
GROUND-WATER RESOURCES OF MATAGORDA COUNTY, TEXAS,
W69-06025 02F

ANNUAL REPORT ON GROUND WATER IN ARIZONA, SPRING 1967 TO SPRING 1968.
W69-06026 02F

HYDROGEOLOGIC DATA RELATED TO ESTABLISHMENT OF A PUMPING STATION IN THE EVERGLADES NATIONAL PARK, FLORIDA,
W69-06033 02F

GROUND-WATER RESOURCES OF GREENVILLE COUNTY, SOUTH CAROLINA,
W69-06052 02F

THE ROLE OF GROUNDWATER IN THE DEVELOPMENT OF WATER RESOURCES,
W69-06054 04B

REGULATION OF USE OF WATER RESOURCES.
W69-06138 06E

USE OF GRAVITY SHAFTS FOR GROUND WATER RECHARGE,
W69-06202 04B

WATER RESOURCES IN THE GOOSE CREEK-ROCK CREEK BASINS, IDAHO, NEVADA AND UTAH,
W69-06206 02F

GROUNDWATER LEVELS AND PUMPAGE IN THE PEORIA-PEKIN AREA ILLINOIS, 1890-1966,
W69-06208 02F

GROUND-WATER LEVELS IN NEW MEXICO, 1967,
W69-06212 02F

GROUND-WATER RESOURCES AND RELATED GEOLOGY OF NORTH-CENTRAL SPOKANE AND SOUTHEASTERN STEVENS COUNTIES, WASHINGTON,
W69-06213 02F

WATER IN BROWARD COUNTY, FLORIDA,
W69-06217 02E

ESTIMATION OF GROUNDWATER RESOURCES,
W69-06230 02F

WATER RESOURCES INVENTORY OF CONNECTICUT-PART 3, LOWER THAMES AND SOUTHEASTERN COASTAL RIVER BASINS,
W69-06250 02F

GROUNDWATER MANAGEMENT
THE ROLE OF GROUNDWATER IN THE DEVELOPMENT OF WATER RESOURCES,
W69-06054 04B

GROUNDWATER MOVEMENT
HYDROLOGY OF GROUNDWATER (GENERAL OUTLINE),
W69-06223 02F

ISOTOPE HYDROLOGY OF THE ARTESIAN AQUIFERS OF THE STYRIAN BASIN, AUSTRIA,
W69-06249 02K

GROUND-WATER BASIN
AN ENGINEERING-ECONOMIC ANALYSIS OF SYSTEMS UTILIZING AQUIFER STORAGE FOR THE IRRIGATION OF PARKS AND GOLFCOURSES WITH RECLAIMED WASTEWATER,
W69-06289 03C

GROUND-WATER FLUX
COASTAL EVIDENCES OF GROUND WATER CONDITIONS IN THE VICINITY OF ANAEHOOMALU AND LALAMILO, SOUTH KOHALA, HAWAII,
W69-06006 03B

GROWTH EQUATIONS
GROWTH EQUATIONS WITH METABOLIC PARAMETERS,
W69-06280 05C

GROWTH MODELS
GROWTH EQUATIONS WITH METABOLIC PARAMETERS,
W69-06280 05C

GROWTH RATES
AGE AND GROWTH OF WHITE BASS IN ONEIDA LAKE, NEW YORK,
W69-06275 05C

GROWTH EQUATIONS WITH METABOLIC PARAMETERS,
W69-06280 05C

THE GROWTH RATE OF MICROORGANISMS AS A FUNCTION OF SUBSTRATE CONCENTRATION,
W69-06281 05C

HACKENSACK RIVER
POLLUTION OF WATERS.
W69-06407 05G

HAIL
RAINSTORMS AND HAIL,
W69-06214 02B

HARBOR MASTERS
INLAND WATERWAYS.
W69-06348 06E

HARVESTING
HARVESTING UNDERWATER WEEDS,
W69-06276 05G

HAWAII
COASTAL EVIDENCES OF GROUND WATER CONDITIONS IN THE VICINITY OF ANAEHOOMALU AND LALAMILO, SOUTH KOHALA, HAWAII,
W69-06006 03B

HEATED WATER
HEATED EFFLUENTS AND EFFECTS ON AQUATIC LIFE WITH EMPHASIS ON FISHES,
W69-06022 05C

HIGHER LAND
BELVEAL V H B C DEVELOPMENT CO (OBSTRUCTION OF NATURAL WATERCOURSE AND CONCENTRATION OF FLOW).
W69-06154 06E

HIGHWAYS
DRAINAGE AND WATERCOURSES.
W69-06142 06E

HUMIC ACIDS
BEHAVIOR OF HUMIC ACID IN RECENT LAKE SEDIMENTS TOWARD SODIUM HYDROXYDE AQUEOUS SOLUTION AT THE EXTRACTION (IN JAPANESE),
W69-06278 02H

HYDRAULIC CONDUCTIVITY
THE MEASUREMENT OF THE HYDRAULIC CONDUCTIVITY OF UNSATURATED POROUS MATERIALS UTILIZING A ZONE OF ENTRAPPED AIR,
W69-06071 02G

SOIL-WATER PROPERTIES COMPUTED FROM TRANSIENT FLOW DATA,
W69-06072 02G

HYDRAULIC MODELS
THE EFFECT OF LOOSE BLOCKS ON THE RATE OF SEDIMENT TRANSPORT,
W69-06083 02J

HYDROELECTRIC PLANTS
CHAPMAN V FEDERAL POWER COMM'N (PRIVATE CONSTRUCTION OF HYDROELECTRIC PLANT AND RIVER BASIN PROJECT).
W69-06346 08C

NIAGARA MOHAWK POWER CORP V FEDERAL POWER COMM'N (USUFRUCTUARY RIGHTS AND THE FEDERAL WATER POWER ACT OF 1920).
W69-06405 06C

HYDROGEOLOGY
HYDROGEOLOGY AT SHELBYVILLE, ILLINOIS - A BASIS FOR WATER RESOURCES PLANNING,
W69-06075 02F

GEOLOGIC STUDIES AS AN AID TO GROUND-WATER MANAGEMENT,
W69-06082 04B

SURFACE DRAINAGE CHARACTERISTICS IN VOLUSIA COUNTY, FLORIDA,
W69-06216 02E

HYDROLOGY OF GROUNDWATER (GENERAL OUTLINE),
W69-06223 02F

HYDROLOGIC ASPECTS
HYDROLOGICAL ASPECTS OF WATER MANAGEMENT,
W69-06221 06B

HYDROLOGIC BUDGET
EFFECTS OF SMALL STRUCTURES ON WATER YIELD IN TEXAS,
W69-06218 03B

THE HYDROLOGIC CYCLE AND THE WATER BALANCE IN NATURE,

W69-06227 02A

HYDROLOGIC CYCLE
THE HYDROLOGIC CYCLE AND THE WATER BALANCE IN NATURE,
W69-06227 02A

HYDROLOGIC DATA
GROUND-WATER RESOURCES OF MATAGORDA COUNTY, TEXAS,
W69-06025 02F

ANNUAL REPORT ON GROUND WATER IN ARIZONA, SPRING 1967 TO SPRING 1968.
W69-06026 02F

WATER RESOURCE RECORDS OF THE ECONFINA CREEK BASIN AREA, FLORIDA,
W69-06051 02E

TEST WELL EXPLORATION IN THE MYAKKA RIVER BASIN AREA, FLORIDA,
W69-06053 02F

THE HYDROLOGY OF THE LEXINGTON AND FAYETTE-COUNTY AREA, KENTUCKY,
W69-06084 02F

SUMMARY OF MAXIMUM DISCHARGES IN UTAH STREAMS,
W69-06209 02E

SELECTED HYDROLOGIC DATA, SOUTHERN UTAH AND GOSHEN VALLEYS, UTAH,
W69-06211 02F

GROUND-WATER LEVELS IN NEW MEXICO, 1967,
W69-06212 02F

MATHEMATICAL STATISTICS AS A METHOD FOR HYDROLOGICAL INVESTIGATIONS,
W69-06226 06A

HYDROLOGICAL BENCH MARKS,
W69-06252 07A

HYDROLOGICAL BENCH MARKS
HYDROLOGICAL BENCH MARKS,
W69-06252 07A

HYDROLOGY
HYDROLOGY OF WATER STORAGE,
W69-06231 02E

STATE FORESTS TREE PLANNING.
W69-06338 03F

HYDROLYSIS
HYDROLYSIS OF CONDENSED PHOSPHATES--I NON-STERILE ENVIRONMENT,
W69-06271 02K

HYDROLYSIS OF CONDENSED PHOSPHATES--II STERILE ENVIRONMENT,
W69-06284 02K

HYMATOMELANIC
BEHAVIOR OF HUMIC ACID IN RECENT LAKE SEDIMENTS TOWARD SODIUM HYDROXYDE AQUEOUS SOLUTION AT THE EXTRACTION (IN JAPANESE),
W69-06278 02H

ICE JAMS
NORTH COUNTIES HYDROELECTRIC CO V UNITED STATES (DAMAGES RESULTING FROM ICE JAM).
W69-06326 06E

IDAHO
RECORDS OF OBSERVATION WELLS AND WATER-LEVEL FLUCTUATIONS IN THE ABERDEEN-SPRINGFIELD AREA, BINGHAM AND POWER COUNTIES, IDAHO, IN 1967,
W69-06040 02F

STAGE-DISCHARGE RELATIONS ON BIG LOST RIVER WITHIN NATIONAL REACTOR TESTING STAION, IDAHO,
W69-06204 02E

WATER RESOURCES IN THE GOOSE CREEK-ROCK CREEK BASINS, IDAHO, NEVADA AND UTAH,
W69-06206 02F

ILLINOIS
THE CHICAGO AREA DEEP TUNNEL PROJECT-A USE OF THE UNDERGROUND STORAGE RESOURCE,
W69-06021 05G

HYDROGEOLOGY AT SHELBYVILLE, ILLINOIS - A BASIS FOR WATER RESOURCES PLANNING,
W69-06075 02F

GEOLOGIC STUDIES AS AN AID TO GROUND-WATER MANAGEMENT,
W69-06082 04B

PHOENIX V GRAHAM (SALT WATER POLLUTION OF WELLS).
W69-06118 05G

SAELENS V POLLENTIER (SUIT TO ENJOIN DEFENDANT'S INTERFERENCE WITH THE FLOW OF SURFACE WATERS).
W69-06149 06E

HARGADINE V SHARKEY (DIVERSION OF WATER FROM ITS NATURAL COURSES).
W69-06193 06E

HEPBURN V MADDOX (LIABILITY OF DRAINAGE DISTRICT).
W69-06197 06E

GROUNDWATER LEVELS AND PUMPAGE IN THE PEORIA-PEKIN AREA ILLINOIS, 1890-1966,
W69-06208 02F

CLIMATOLOGY OF SEVERE WINTER STORMS IN ILLINOIS,
W69-06210 02C

NORTH COUNTIES HYDROELECTRIC CO V UNITED STATES (DAMAGES RESULTING FROM ICE JAM).
W69-06326 06E

INCORPORATION
PUBLIC UTILITIES CARRIERS AND WATER COMPANIES.
W69-06139 06E

INDIANA
MCKEE V HASLER (LEVEE CONSTRUCTION FOR FLOOD CONTROL).
W69-06363 04A

INDIRECT DISCHARGE MEASUREMENTS
MEASUREMENT OF PEAK DISCHARGE BY INDIRECT METHODS,
W69-06251 02E

INDUSTRIAL WASTES
MADDOX V INTERNATIONAL PAPER COMPANY (DAMAGES RESULTING FROM BAYOU POLLUTION).
W69-06112 05G

SMITH V MAGNET COVE BARIUM CORP (BARIUM TAILING POLLUTION).
W69-06116 05G

INDUSTRIES
POLLUTION OF WATERS BY RAILROADS AND FACTORIES.
W69-06404 05G

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION), PART IV GOVERNMENT-INDUSTRY RELATIONSHIPS IN SUPPORT OF RESEARCH DEVELOPMENT.
W69-06419 06B

INJECTION WELLS
THE FEASIBILITY OF DEEP-WELL INJECTION OF WASTE BRINE FROM INLAND DESALTING PLANTS,
W69-06286 05E

INJUNCTIONS(MANDATORY)
CROSS V PACE (DAMAGE TO UNITED STATES CITIZENS BY FOREIGN DAM).
W69-06380 04A

INJUNCTIONS(PROHIBITORY)
POLLUTION OF POTABLE WATERS.
W69-06350 05G

WUNDERLICH V CATES (DISPUTE OVER TITLE TO AN ISLAND IN THE MISSISSIPPI RIVER).
W69-06385 06E

POLLUTION OF WATERS BY RAILROADS AND FACTORIES.
W69-06404 05G

INJUNCTIONS(PROHIBITOR)
PONELEIT V DUDAS (ZONING REGULATIONS AS AFFECTING RIPARIAN RIGHTS).
W69-06320 06E

INJUNCTION(MANDATORY)
CITY OF JACKSON V ROBERTSON (INJUNCTION AGAINST DISCHARGING DRAINAGE UPON LOWER PROPERTY).
W69-06179 06E

INLAND WATERWAYS
INLAND WATERWAYS.
W69-06348 06E

INSTRUMENTATION
MEASURING ESTUARINE POLLUTION,
W69-06203 05A

INTANGIBLE BENEFITS
EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER IV INTANGIBLES, UNCERTAINTY, AND CRITERIA,
W69-06293 06B

INTANGIBLE COSTS
EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER IV INTANGIBLES, UNCERTAINTY, AND CRITERIA,
W69-06293 06B

INTERNATIONAL LAW
UNITED STATES POLICY REGARDING MARINE RESOURCES (IMPLEMENTATION OF THE NEW MARINE POLICY),
W69-06100 06E

A CASE FOR THE ADMINISTRATION OF MARINE RESOURCES UNDERLYING THE HIGH SEAS BY THE UNITED NATIONS,
W69-06103 06E

A CASE FOR THE ADMINISTRATION OF MINERAL RESOURCES UNDERLYING THE HIGH SEAS BY NATIONAL INTERESTS,
W69-06104 06E

ALTERNATIVE REGIMES FOR MARINE RESOURCES UNDERLYING THE SEA,
W69-06105 06E

A NEGATIVE VIEW OF A PROPOSAL FOR UNITED NATIONS OWNERSHIP

OF OCEAN MINERAL RESOURCES,
W69-06106 06E

THE ROLE OF THE UNITED STATES NAVY IN THE FORMULATION OF FEDERAL POLICY REGARDING THE SEA,
W69-06107 06E

THE ROLE OF THE STATE DEPARTMENT IN FORMULATING FEDERAL POLICY REGARDING MARINE RESOURCES,
W69-06108 06E

CROSS V PACE (DAMAGE TO UNITED STATES CITIZENS BY FOREIGN DAM).
W69-06380 04A

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION), PART III AN INTERNATIONAL LEGAL-POLITICAL FRAMEWORK FOR EXPLORING AND EXPLOITING THE MINERAL RESOURCES UNDERLYING THE HIGH SEAS.
W69-06417 06B

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION), PART III AN INTERNATIONAL AUTHORITY TO REGISTER NATIONAL CLAIMS BEYOND THE REDEFINED CONTINENTAL SHELF.
W69-06418 06B

INTERNATIONAL WATERS
OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION).
W69-06411 06B

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION), PART III AN INTERNATIONAL LEGAL-POLITICAL FRAMEWORK FOR EXPLORING AND EXPLOITING THE MINERAL RESOURCES UNDERLYING THE HIGH SEAS.
W69-06417 06B

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION), PART III AN INTERNATIONAL AUTHORITY TO REGISTER NATIONAL CLAIMS BEYOND THE REDEFINED CONTINENTAL SHELF.
W69-06418 06B

INTERSTATE COMMERCE
AMERICAN BARGE LINE V KOONTZ (TAXATION OF INTERSTATE AND INTRASTATE COMMERCE OVER NAVIGABLE WATERS).
W69-06178 06E

INTERSTATE COMMISSIONS
WATER QUALITY CONTROL - THE ROLE OF THE INTERSTATE AGENCY,
W69-06094 05G

SOUTH DAKOTA - MINNESOTA BOUNDARY WATERS COMMISSION TRI-STATE WATERS COMMISSION.
W69-06315 06E

OHIO RIVER VALLEY WATER SANITATION COMPACT.
W69-06344 05G

DYER V SIMS (ENFORCEMENT OF INTERSTATE POLLUTION CONTROL COMPACTS).
W69-06408 05G

INTERSTATE COMPACTS
SOUTH DAKOTA - MINNESOTA BOUNDARY WATERS COMMISSION TRI-STATE WATERS COMMISSION.
W69-06315 06E

OHIO RIVER VALLEY WATER SANITATION COMPACT.
W69-06344 05G

DYER V SIMS (ENFORCEMENT OF INTERSTATE POLLUTION CONTROL COMPACTS).
W69-06408 05G

INTER-AGENCY COOPERATION
WATER QUALITY CONTROL - THE ROLE OF THE INTERSTATE AGENCY,
W69-06094 05G

FITTING A STATE PROGRAM TO FEDERAL OBJECTIVES,
W69-06096 05G

METROPOLITAN PROBLEMS METROPOLITAN PUBLIC AUTHORITIES,
W69-06098 06B

INVASION
TAYLOR V HARRISON CONSTR CO (ARTIFICIAL INCREASE OF SURFACE WATERS).
W69-06167 06E

INVESTMENT
OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION, PART III DEVELOPMENT OF NONLIVING MARINE RESOURCES.
W69-06412 06B

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION, PART III NATURAL GAS.
W69-06413 06B

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION), PART III OTHER MARINE MINERALS.
W69-06414 06B

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION, PART III LEGAL AND REGULATORY CONSIDERATIONS.
W69-06415 06B

IOWA
THE VALLEYS OF IOWA-1 VALLEY WIDTH AND STREAM DISCHARGE RELATIONSHIPS IN THE MAJOR STREAMS,
W69-06034 02E

MC KEON V BRAMMER (SUBSURFACE DRAINAGE AND THE NATURAL FLOW DOCTRINE).
W69-06126 06E

DROEGMILLER V OLSON (DIVERSION OF NATURAL FLOW).
W69-06135 06E

WHEATLEY V CASS COUNTY (DIVERSION OF NATURAL FLOW OF FLOOD WATERS BY THE STATE FOLLOWED BY SUBSEQUENT RESUMPTION OF SAME FLOW).
W69-06156 06E

ARCHER V J S COMPTON, INC (INTERFERENCE WITH NATURAL FLOW).
W69-06196 06E

SOLOMON V SIOUX CITY (ACCRETION).
W69-06393 06E

IRON
LIMNOLOGICAL INVESTIGATIONS OF TEXAS IMPOUNDMENTS FOR WATER QUALITY MANAGEMENT PURPOSES - THE USE OF ALGAL CULTURES TO ASSESS THE EFFECTS OF NUTRIENT ENRICHMENT ON THE HIGHLAND LAKES OF THE COLORADO RIVER, TEXAS,
W69-06004 05C

IRRIGATION
IRRIGATION WATER QUALITY AND THE LEACHING REQUIREMENT,
W69-06008 03F

PRELIMINARY REPORT ON THE IRRIGATION POTENTIAL OF DUNN COUNTY, WISCONSIN,
W69-06074 02G

IRRIGATION.
W69-06340 03F

IRRIGATION DESIGN
HYDRAULIC OPERATING CHARACTERISTICS OF LOW GRADIENT BORDER IRRIGATION SYSTEMS,
W69-06035 03F

IRRIGATION EFFECTS
TAYLOR V TAMPA COAL CO (RIPARIAN RIGHTS IN NON-NAVIGABLE LAKE).
W69-06307 06E

IRRIGATION EFFICIENCY
HYDRAULIC OPERATING CHARACTERISTICS OF LOW GRADIENT BORDER IRRIGATION SYSTEMS,
W69-06035 03F

USE OF WATER FOR SUPPLEMENTAL IRRIGATION IN DELAWARE,
W69-06036 03F

IRRIGATION PERMITS
IRRIGATION.
W69-06340 03F

IRRIGATION PROGRAMS
CRITES V UNITED STATES (CLAIMS FOR LOSS IN VALUE OF LAND DUE TO IRRIGATION PROJECT).
W69-06325 03F

IRRIGATION REQUIREMENTS
CONSUMPTIVE IRRIGATION REQUIREMENTS OF SELECTED IRRIGATED AREAS IN NEW MEXICO,
W69-06013 03F

IRRIGATION WATER
PREDICTION OF CROP YIELDS FROM QUANTITY AND SALINITY OF IRRIGATION WATER,
W69-06007 03C

QUALITY OF SURFACE WATERS FOR IRRIGATION, WESTERN STATES-1961,
W69-06253 03F

QUALITY OF SURFACE WATERS FOR IRRIGATION, WESTERN STATES-1960,
W69-06254 03F

ISLANDS
WHITSON V MORRIS (TITLE TO RE-FORMED ALLUVIAL LAND).
W69-06383 06E

ANDERSON-TULLY CO V MURPHREE (OWNERSHIP OF PROPERTY LOST BY AVULSION).
W69-06384 06E

WUNDERLICH V CATES (DISPUTE OVER TITLE TO AN ISLAND IN THE MISSISSIPPI RIVER).
W69-06385 06E

HAUBER V GENTRY (OWNERSHIP OF LAND FORMED BY ACCRETION).
W69-06386 06E

PETERSON V HARPST (ADVERSE POSSESSION OF ISLAND AND ACCRETIONS THERETO).
W69-06387 06E

ISOTOPE FRACTIONATION
OXYGEN ISOTOPIC COMPOSITION OF SULFATE IONS IN WATER FROM THERMAL SPRINGS,
W69-06044 02K

ITALIAN ALPS
CHANGE OF ITALIAN GLACIERS DURING THE DECADE 1957-1966 (FRENCH),
W69-06265 02C

JORDAN
CARBONATE SCALE IN ROMAN AND MODERN CANALS IN THE JORDAN

VALLEY,
W69-06017 08A

JURISDICTION
BECK V GAME AND FRESH WATER FISH COMM'N (JURISDICTION OF FRESH WATER FISH COMM'N).
W69-06328 06E

KANSAS
KANSAS RIVER, BONNER SPRINGS TO MOUTH, DEGRADATION OF CHANNEL,
W69-06256 02J

KANSAS RIVER(KANS)
KANSAS RIVER, BONNER SPRINGS TO MOUTH, DEGRADATION OF CHANNEL,
W69-06256 02J

KENTUCKY
FLOOD PLAIN INFORMATION, OHIO RIVER, JEFFERSON COUNTY, KENTUCKY.
W69-06070 04A

THE HYDROLOGY OF THE LEXINGTON AND FAYETTE-COUNTY AREA, KENTUCKY,
W69-06084 02F

B AND B OIL CO V TOWNSEND (OIL WASTE POLLUTION).
W69-06115 05G

PIPE V CHESAPEAKE AND OHIO RR (NON-LIABILITY FOR ACTS OF GOD).
W69-06153 06E

DUVALL V 20TH CENTURY COAL CO (PERCOLATING WATERS).
W69-06175 06E

LOUISVILLE SAND AND GRAVEL CO V RALSTON (THE 'THREAD OF THE STREAM' AS A BOUNDARY LINE).
W69-06318 06E

CITY OF IRVINE V SMITH (FLOODING CAUSED BY BREAK IN SEWER).
W69-06365 04A

JARVIS V CORNETT (DAMAGES CAUSED BY DIVERSION OF SURFACE WATER).
W69-06369 04A

WHITSON V MORRIS (TITLE TO RE-FORMED ALLUVIAL LAND).
W69-06383 06E

KINETICS
THE GROWTH RATE OF MICROORGANISMS AS A FUNCTION OF SUBSTRATE CONCENTRATION,
W69-06281 05C

LAKE BASINS
MOUNTAIN AND DESERT LAKES IN SOUTHERN KAZAKHSTAN, THEIR RESOURCES AND METHODS OF ECONOMIC DEVELOPMENT,
W69-06073 02H

LAKE ERIE
WASTES, WATER, AND WISHFUL THINKING THE BATTLE OF LAKE ERIE,
W69-06305 05G

LAKE HARUNA(JAPAN)
BEHAVIOR OF HUMIC ACID IN RECENT LAKE SEDIMENTS TOWARD SODIUM HYDROXYDE AQUEOUS SOLUTION AT THE EXTRACTION (IN JAPANESE),
W69-06278 02H

LAKE MICHIGAN
LE CLAIR V SWIFT (ENFORCEMENT OF CONSERVATION STATUTES).
W69-06377 06E

LAKES
TOBIAS V TOBIAS (SUIT TO ENJOIN EXERCISE OF RIPARIAN RIGHT TO FISH IN LAKE).
W69-06164 06E

BEHAVIOR OF HUMIC ACID IN RECENT LAKE SEDIMENTS TOWARD SODIUM HYDROXIDE AQUEOUS SOLUTION AT THE EXTRACTION (IN JAPANESE),
W69-06278 02H

MOVEMENT OF RADIOSODIUM IN A CHEMICALLY STRATIFIED LAKE,
W69-06283 02H

AN ACT RELATING TO LAKES, PERMITTING THE CREATION OF LAKE CONSERVATION DISTRICT WITH CERTAIN POWERS.
W69-06334 06E

AMERADA PETROLEUM CORPORATION V CASE (ACCRETION OF LAND).
W69-06389 06E

LAND CLASSIFICATION
THE WETLANDS COMMITTEE REPORTS, WETLANDS CLASSIFICATION, INVENTORY AND MANAGEMENT.
W69-06122 06E

LAND FORMING
WHITSON V MORRIS (TITLE TO RE-FORMED ALLUVIAL LAND).
W69-06383 06E

LAND MANAGEMENT
THE WETLANDS COMMITTEE REPORTS, WETLANDS CLASSIFICATION, INVENTORY AND MANAGEMENT.
W69-06122 06E

LAND RESOURCES
WATER AND CHOICE IN THE COLORADO BASIN AN EXAMPLE OF ALTERNATIVES IN WATER MANAGEMENT, CH. 2, THE SETTING.
W69-06087 06B

LAND SUBSIDENCE
WOODWARD IRON CO V HUMPOWER (DAMAGE TO SURFACE OWNERS RIGHTS FROM MINING OPERATIONS).
W69-06359 04A

LAND TENURE
TUTEN V SHELL OIL CO (SALT WATER DAMAGE TO LAND AND CROPS BY OIL INDUSTRY NEGLIGENCE).
W69-06110 05C

GUNN V BERQUIST (ADVERSE POSSESSION OF AND RIPARIAN RIGHTS IN TOWN-OWNED RIPARIAN LANDS).
W69-06382 06E

ANDERSON-TULLY CO V MURPHREE (OWNERSHIP OF PROPERTY LOST BY AVULSION).
W69-06384 06E

WUNDERLICH V CATES (DISPUTE OVER TITLE TO AN ISLAND IN THE MISSISSIPPI RIVER).
W69-06385 06E

HAUBER V GENTRY (OWNERSHIP OF LAND FORMED BY ACCRETION).
W69-06386 06E

WILLIAMS V DIEDERICH (SUIT TO ENJOIN RECREATIONAL TRESPASS ON RESERVOIR).
W69-06394 06E

LAND USE
WATER AND CHOICE IN THE COLORADO BASIN AN EXAMPLE OF ALTERNATIVES IN WATER MANAGEMENT, CH. 2, THE SETTING.
W69-06087 06B

A FLOOD LOSS REDUCTION PROGRAM,
W69-06097 06F

LANDFILLS
DANNER V UNITED STATES (FEDERAL GOVERNMENT'S LIABILITY FOR FLOOD DAMAGES).
W69-06194 06E

LAS VEGAS(NEVADA)
AN ENGINEERING-ECONOMIC ANALYSIS OF SYSTEMS UTILIZING AQUIFER STORAGE FOR THE IRRIGATION OF PARKS AND GOLFCOURSES WITH RECLAIMED WASTEWATER,
W69-06289 03C

LAVA FLOW
COASTAL EVIDENCES OF GROUND WATER CONDITIONS IN THE VICINITY OF ANAEHOOMALU AND LALAMILO, SOUTH KOHALA, HAWAII,
W69-06006 03B

LAW OF THE SEA
ALTERNATIVE REGIMES FOR MARINE RESOURCES UNDERLYING THE SEA,
W69-06105 06E

THE ROLE OF THE UNITED STATES NAVY IN THE FORMULATION OF FEDERAL POLICY REGARDING THE SEA,
W69-06107 06E

LEACHING REQUIREMENTS
IRRIGATION WATER QUALITY AND THE LEACHING REQUIREMENT,
W69-06008 03F

LECTURE NOTES
HYDROLOGY OF WATER STORAGE,
W69-06231 02E

LEGAL ASPECTS
POLLUTION OF WATERS.
W69-06407 05G

LEGISLATION
GEORGIA WATER LAW,
W69-06009 06E

UNITED STATES POLICY REGARDING MARINE RESOURCES (IMPLEMENTATION OF THE NEW MARINE POLICY),
W69-06100 06E

SANITARY WATER BOARD V ANTHONY (LEGISLATION TO PREVENT MINE ACID POLLUTION).
W69-06109 05G

SEWAGE CONNECTION FACILITIES.
W69-06137 06E

FISHERIES CONSERVATION.
W69-06144 06E

HATCHERIES, SCREENS AND GAME MANAGEMENT AREAS.
W69-06145 06E

FORESTS, PARKS, LAKES, AND RIVERS.
W69-06146 06E

CRARY V STATE HIGHWAY COMMISSION (TAKING OF STATUTORY RIPARIAN RIGHTS).
W69-06180 06E

PASSAIC VALLEY WATER COMM'N V DEPARTMENT OF CONSERVATION (STATUTORY INTERPRETATION OF EXCESS DIVERSION ASSESSMENT FORMULA).
W69-06190 06E

SOUTH DAKOTA - MINNESOTA BOUNDARY WATERS COMMISSION TRI-

STATE WATERS COMMISSION.
W69-06315 06E

HAUGHTON V LANKFORD (CONSTITUTIONALITY OF CONSERVATION REGULATION).
W69-06329 06E

AN ACT ESTABLISHING AN INTERIM COMM'N TO STUDY THE PROBLEM OF WATER POLLUTION AND APPROPRIATING MONEY THEREFORE.
W69-06335 05G

SEWAGE DISPOSAL PLANTS.
W69-06342 06E

SEWERS IN PRIVATE PROPERTY ACQUISITION OF PROPERTY RIGHTS.
W69-06343 06E

INLAND WATERWAYS.
W69-06348 06E

POLLUTION OF FRESH WATERS.
W69-06349 05G

POLLUTION OF POTABLE WATERS.
W69-06350 05G

UNITED STATES V INGRAM (BRIDGE CONSTRUCTION AND RIPARIAN OBLIGATIONS).
W69-06364 04A

ATTORNEY GENERAL V CITY OF WOBURN (POLLUTION OF RIVER BY CITY).
W69-06406 05G

LEVEES
STACY V WALKER (PROTECTION AGAINST SURFACE WATER DRAINAGE).
W69-06128 06E

BOARD OF LEVEE COMM'RS OF ORLEANS LEVEE DIST V KELLY (PUBLIC RIGHTS IN RE FLOOD CONTROL).
W69-06362 04A

MCKEE V HASLER (LEVEE CONSTRUCTION FOR FLOOD CONTROL).
W69-06363 04A

LIMITING NUTRIENT
LIMNOLOGICAL INVESTIGATIONS OF TEXAS IMPOUNDMENTS FOR WATER QUALITY MANAGEMENT PURPOSES - LIMNOLOGICAL AND WATER QUALITY DATA FOR THE HIGHLAND LAKES, 1968,
W69-06003 05B

LIMNOLOGY
LIMNOLOGICAL INVESTIGATIONS OF TEXAS IMPOUNDMENTS FOR WATER QUALITY MANAGEMENT PURPOSES - LIMNOLOGICAL AND WATER QUALITY DATA FOR THE HIGHLAND LAKES, 1968,
W69-06003 05B

LIMNOLOGICAL INVESTIGATIONS OF TEXAS IMPOUNDMENTS FOR WATER QUALITY MANAGEMENT PURPOSES - THE USE OF ALGAL CULTURES TO ASSESS THE EFFECTS OF NUTRIENT ENRICHMENT ON THE HIGHLAND LAKES OF THE COLORADO RIVER, TEXAS,
W69-06004 05C

LIMNOLOGICAL ORGANIC ANALYSES BY QUANTITATIVE DICHROMATE OXIDATION,
W69-06093 05A

LIQUIDS
UNDERGROUND STORAGE OF FLUIDS,
W69-06055 02F

LOCAL GOVERNMENTS
SEWAGE DISPOSAL PLANTS.
W69-06342 06E

LOSS OF OXYGEN
OXYGEN PRODUCTION AND LOSS IN A MODEL RIVER,
W69-06002 05B

LOUISIANA
TUTEN V SHELL OIL CO (SALT WATER DAMAGE TO LAND AND CROPS BY OIL INDUSTRY NEGLIGENCE).
W69-06110 05C

MADDOX V INTERNATIONAL PAPER COMPANY (DAMAGES RESULTING FROM BAYOU POLLUTION).
W69-06112 05G

BEGNAUD V GRUBB AND HAWKINS (ACTION TO DETERMINE NAVIGABILITY OF BAYOU AS TEST OF OWNERSHIP).
W69-06161 06E

RICHARDSON AND BASS V BOARD OF LEVEE COMM'RS OF THE ORLEANS LEVEE DIST (ADVERSE POSSESSION).
W69-06168 06E

BOARD OF LEVEE COMM'RS OF ORLEANS LEVEE DIST V KELLY (PUBLIC RIGHTS IN RE FLOOD CONTROL).
W69-06362 04A

MAGEE V TEXAS CONSTRUCTION CO (FLOODING ABOVE COFFER DAM).
W69-06368 04A

EPNER V KETTERINGHAM (VALIDITY OF EASEMENT TO DRAIN RAIN WATER ONTO ADJOINING LAND).
W69-06372 04A

AMERADA PETROLEUM CORPORATION V CASE (ACCRETION OF LAND).
W69-06389 06E

LOW WATER MARK
CARPENTER V OHIO RIVER SAND AND GRAVEL CORP (ACTION TO ENJOIN DREDGING ON PROPERTY BELOW PRESENT WATER LINE, BUT ABOVE OLD LOW WATER MARK).
W69-06159 06E

LOWER LANDOWNER
MASONITE CORP V WINDHAM (PONDING AND POLLUTION ON UPPER LAND).
W69-06120 05G

LOWER LANDOWNERS
TAYLOR V HARRISON CONSTR CO (ARTIFICIAL INCREASE OF SURFACE WATERS).
W69-06167 06E

LOWLAND PROPRIETOR
MC KEON V BRAMMER (SUBSURFACE DRAINAGE AND THE NATURAL FLOW DOCTRINE).
W69-06126 06E

LUMBERING
MAGEE V TEXAS CONSTRUCTION CO (FLOODING ABOVE COFFER DAM).
W69-06368 04A

MAINE
SMEDBERG V MOXIE DAM CO. (DAMAGE CAUSED BY LOWERING POND LEVEL).
W69-06131 06E

PUBLIC UTILITIES CARRIERS AND WATER COMPANIES.
W69-06139 06E

MUNICIPALITIES PUBLIC WORKS, DEVELOPMENT.
W69-06140 06E

REVENUE PRODUCING MUNICIPAL FACILITIES ACT.
W69-06141 06E

DRAINAGE AND WATERCOURSES.
W69-06142 06E

DEPARTMENT OF HEALTH AND WELFARE.
W69-06143 06E

FISHERIES CONSERVATION.
W69-06144 06E

HATCHERIES, SCREENS AND GAME MANAGEMENT AREAS.
W69-06145 06E

FORESTS, PARKS, LAKES, AND RIVERS.
W69-06146 06E

PROTECTION AND IMPROVEMENT OF WATERS.
W69-06351 05G

ORGANIZATION AND GENERAL PROVISIONS.
W69-06352 05G

POLLUTION CONTROL.
W69-06353 05G

ENFORCEMENT.
W69-06354 05G

MARINE ECOLOGY
ENVIRONMENTAL IMPACT OF BRINE EFFLUENTS ON GULF OF CALIFORNIA,
W69-06287 05C

MARINE RESOURCES
UNITED STATES POLICY REGARDING MARINE RESOURCES (IMPLEMENTATION OF THE NEW MARINE POLICY),
W69-06100 06E

THE ROLE OF THE STATE DEPARTMENT IN FORMULATING FEDERAL POLICY REGARDING MARINE RESOURCES,
W69-06108 06E

MARINE SCIENCE
UNITED STATES POLICY REGARDING MARINE RESOURCES (IMPLEMENTATION OF THE NEW MARINE POLICY),
W69-06100 06E

MARKET VALUE
PHILLIPS V CHESSON (DIVERSION CAUSED BY EXCAVATED SLOPE).
W69-06309 04A

MARKETABLE TITLE
RESORT DEVELOPMENT CO V PARMELE (OWNERSHIP OF LAND COVERED BY NAVIGABLE WATERS).
W69-06181 06E

MARYLAND
CHEMICAL AND PHYSICAL CHARACTER OF MUNICIPAL WATER SUPPLIES IN MARYLAND,
W69-06031 05F

FLOOD PLAIN INFORMATION, BEAVERDAM CREEK, PRINCE GEORGES COUNTY, MARYLAND.
W69-06068 04A

POWERS AND FUNCTIONS OF DEPARTMENT OF WATER RESOURCES - FLOOD CONTROL.
W69-06332 04A

CREATION OF DEPARTMENT OF WATER RESOURCES AND WATER RESOURCES COMM'N.
W69-06333 06E

JACKSON V UNITED STATES (PRIVATE PROPERTY RIGHTS IN FISHING

GROUNDS).
W69-06381 06E

IN RE EASTERN TRANSPORTATION CO (ABANDONMENT OF VESSELS IN NAVIGABLE WATERS).
W69-06391 06E

MASSACHUSETTS
DAVENPORT V TOWN OF DANVERS (FLOODING OF LAND BY CITY DAM).
W69-06311 04A

ATTORNEY GENERAL V CITY OF WOBURN (POLLUTION OF RIVER BY CITY).
W69-06406 05G

MATAGORDA COUNTY(TEX)
GROUND-WATER RESOURCES OF MATAGORDA COUNTY, TEXAS,
W69-06025 02F

MATHEMATICAL MODELS
NUMERICAL EXPERIMENTS WITH THE STANFORD WATERSHED MODEL ON SMALL AGRICULTURAL WATERSHEDS IN VIRGINIA,
W69-06032 02E

STOCHASTIC MODEL FOR BOD AND DO IN STREAMS,
W69-06080 05B

BENEFITS FROM INTEGRATED WATER MANAGEMENT IN URBAN AREAS - THE CASE OF THE NEW YORK METROPOLITAN REGION,
W69-06201 06B

MELTING
THE HEAT BUDGET OF A MELTING COVER OF SEA ICE,
W69-06263 02C

PLASTIC FLOW AND PRESSURE MELTING IN THE DEFORMATION OF ICE I,
W69-06270 01A

MEROMIXIS
MOVEMENT OF RADIOSODIUM IN A CHEMICALLY STRATIFIED LAKE,
W69-06283 02H

METABOLISM
GROWTH EQUATIONS WITH METABOLIC PARAMETERS,
W69-06280 05C

METHODOLOGIC CRITERIA
EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER III THE APPROPRIATE ALTERNATIVES,
W69-06292 06B

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER V TIME STREAMS AND CRITERIA,
W69-06294 06B

METHODOLOGICALLY-LINKED DEFICIENCY
EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER IV INTANGIBLES, UNCERTAINTY, AND CRITERIA,
W69-06293 06B

METHODOLOGY
WATER AND CHOICE IN THE COLORADO BASIN AN EXAMPLE OF ALTERNATIVES IN WATER MANAGEMENT.
W69-06086 06B

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTERS I-II INTRODUCTION THE CRITERION PROBLEM,
W69-06291 06B

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER III THE APPROPRIATE ALTERNATIVES,
W69-06292 06B

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER V TIME STREAMS AND CRITERIA,
W69-06294 06B

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS, ANALYSIS WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER VI WHAT CAN BE DONE A RECAPITULATION,
W69-06295 06B

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER IX KINDS OF BENEFITS OVERCOUNTING, AND SECONDARY BENEFITS.
W69-06297 06B

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER XI CASE STUDY I THE GREEN RIVER WATERSHED,
W69-06299 06B

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER XII CASE STUDY II SANTA MARIA PROJECT,
W69-06300 06B

MICHIGAN
SEWAGE CONNECTION FACILITIES.
W69-06137 06E

TOBIAS V TOBIAS (SUIT TO ENJOIN EXERCISE OF RIPARIAN RIGHT TO FISH IN LAKE).
W69-06164 06E

SEWAGE DISPOSAL PLANTS.
W69-06342 06E

SEWERS IN PRIVATE PROPERTY ACQUISITION OF PROPERTY RIGHTS.
W69-06343 06E

KRAFT V MILLER (ARTIFICIAL CONTROL OF SURFACE WATERS).
W69-06400 04A

MICROBIOLOGICAL MEDIA
TOWARDS STANDARDIZATION OF SOIL EXTRACTS FOR MICROBIAL MEDIA,
W69-06272 02K

MICROGRAVITY
COASTAL EVIDENCES OF GROUND WATER CONDITIONS IN THE VICINITY OF ANAEHOOMALU AND LALAMILO, SOUTH KOHALA, HAWAII,
W69-06006 03B

MICROORGANISMS
THE GROWTH RATE OF MICROORGANISMS AS A FUNCTION OF SUBSTRATE CONCENTRATION,
W69-06281 05C

MINERALOGY
OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION).
W69-06411 06B

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION, PART III DEVELOPMENT OF NONLIVING MARINE RESOURCES.
W69-06412 06B

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION), PART III OTHER MARINE MINERALS.
W69-06414 06B

MINING
A CASE FOR THE ADMINISTRATION OF MINERAL RESOURCES UNDERLYING THE HIGH SEAS BY NATIONAL INTERESTS,
W69-06104 06E

TENNESSEE COAL, IRON AND RR V RAY (MINING OPERATION CAUSES DESTRUCTION OF WATER SUPPLY).
W69-06172 06E

WOODWARD IRON CO V MUMPOWER (DAMAGE TO SURFACE OWNERS RIGHTS FROM MINING OPERATIONS).
W69-06359 04A

MINNESOTA
BOECK V YELLOW MEDICINE COUNTY (DRAINAGE DITCHES).
W69-06124 06E

MITCHELL V CITY OF ST PAUL (NEGLIGENT OPERATION OF PUBLIC RESERVOIR).
W69-06313 06E

SOUTH DAKOTA - MINNESOTA BOUNDARY WATERS COMMISSION TRI-STATE WATERS COMMISSION.
W69-06315 06E

MUNICIPAL WATER POLLUTION CONTROL.
W69-06316 05G

AN ACT RELATING TO LAKES, PERMITTING THE CREATION OF LAKE CONSERVATION DISTRICT WITH CERTAIN POWERS.
W69-06334 06E

AN ACT ESTABLISHING AN INTERIM COMM'N TO STUDY THE PROBLEM OF WATER POLLUTION AND APPROPRIATING MONEY THEREFORE.
W69-06335 05G

WATERWORKS, MAIN SEWERS, SEWAGE DISPOSAL PLANTS.
W69-06336 05G

SEWAGE DISPOSAL WATER AND SEWAGE.
W69-06337 05G

STATE FORESTS TREE PLANNING.
W69-06338 03F

FISH.
W69-06339 05G

IRRIGATION.
W69-06340 03F

NATURAL RESOURCES.
W69-06403 04A

MISSISSIPPI
MASONITE CORP V WINDHAM (PONDING AND POLLUTION ON UPPER LAND).
W69-06120 05G

PALMER V MASSENGILL (OBSTRUCTION TO FLOW OF ARTIFICIAL WATERCOURSE).
W69-06147 06E

GENERAL GEOPHYSICAL CO V BROWN (DESTRUCTION OF WATER-WELL BY GEOPHYSIC EXPLOSIONS).
W69-06173 06E

CITY OF JACKSON V COOK (COMPENSATION FOR DAMAGES FROM NEGLIGENT DISPOSAL OF DRAINAGE WATER).
W69-06174 06E

CITY OF JACKSON V ROBERTSON (INJUNCTION AGAINST DISCHARGING DRAINAGE UPON LOWER PROPERTY).
W69-06179 06E

CRARY V STATE HIGHWAY COMMISSION (TAKING OF STATUTORY RIPARIAN RIGHTS).
W69-06180 06E

FLOODS OF THE 1965 WATER YEAR IN MISSISSIPPI,
W69-06219 02E

CITY OF MERIDAN V SULLIVAN (SUBSURFACE DRAINAGE).
W69-06322 04A

SOUTHLAND CO V AARON (ACTION FOR POLLUTION OF DOWNSTREAM WATER SUPPLY).
W69-06345 05G

STIGALL V SHARKEY COUNTY (DESTRUCTION OF DRAINAGE FACILITIES CAUSING FLOOD DAMAGE).
W69-06360 04A

ANDERSON-TULLY CO V TINGLE (ACCRETION TO LAND LOCATED WITHIN THE FORK OF TWO RIVERS).
W69-06396 06E

MASSEY V MASONITE CORP (OVERFLOW OF EFFLUENTS INTO PRIVATE LAKE).
W69-06409 05G

MISSISSIPPI RIVER
RICHARDSON AND BASS V BOARD OF LEVEE COMM'RS OF THE ORLEANS LEVEE DIST (ADVERSE POSSESSION).
W69-06168 06E

WHITSON V MORRIS (TITLE TO RE-FORMED ALLUVIAL LAND).
W69-06383 06E

MISSOURI
POLICH V HERMANN (ABNORMAL DISCHARGE OF SURFACE WATER).
W69-06127 06E

BOHANNON V CAMDEN BEND DRAINAGE DISTRICT (TAKING OF PROPERTY BY WATER DISTRICT).
W69-06132 06E

VOLLRATH V WABASH RAILROAD CO. (DAMAGE DUE TO FLOOD WATER FLOW THROUGH ARTIFICIAL EMBANKMENT CUT).
W69-06133 04C

BELVEAL V H B C DEVELOPMENT CO (OBSTRUCTION OF NATURAL WATERCOURSE AND CONCENTRATION OF FLOW).
W69-06154 06E

KIMBERLY V PRESLEY (TITLE TO ACCRETED MATERIALS).
W69-06160 06E

KEYTON V MISSOURI-KANSAS-TEXAS RR (ACTION FOR DAMAGES CAUSED BY OBSTRUCTING NATURAL FLOW OF SURFACE WATER).
W69-06162 06E

CASANOVER V VILLANOVA REALTY CO (DIKE REMOVAL AND RUNOFF).
W69-06163 06E

KENNEDY V UNION ELECTRIC CO OF MISSOURI (SILT ACCRETION AND FLOODING).
W69-06188 06E

DANNER V UNITED STATES (FEDERAL GOVERNMENT'S LIABILITY FOR FLOOD DAMAGES).
W69-06194 06E

PEERLESS SERUM CO V UNITED STATES (LIABILITY FOR FLOOD DAMAGES).
W69-06195 06E

STATE V BOSTIAN (EMINENT DOMAIN AND MUNICIPAL WATER SUPPLY).
W69-06358 06E

NATIONAL MFG CO V UNITED STATES (SOVEREIGN IMMUNITY FROM SUIT FOR FLOOD DAMAGE).
W69-06376 04A

HAUBER V GENTRY (OWNERSHIP OF LAND FORMED BY ACCRETION).
W69-06386 06E

PETERSON V HARPST (ADVERSE POSSESSION OF ISLAND AND ACCRETIONS THERETO).
W69-06387 06E

WILLIAMS V DIEDERICH (SUIT TO ENJOIN RECREATIONAL TRESPASS ON RESERVOIR).
W69-06394 06E

MISSOURI RIVER
PETERSON V HARPST (ADVERSE POSSESSION OF ISLAND AND ACCRETIONS THERETO).
W69-06387 06E

MODEL RIVER
OXYGEN PRODUCTION AND LOSS IN A MODEL RIVER,
W69-06002 05B

MODEL STUDIES
THE EFFECT OF LOOSE BLOCKS ON THE RATE OF SEDIMENT TRANSPORT,
W69-06083 02J

AN ENGINEERING-ECONOMIC ANALYSIS OF SYSTEMS UTILIZING AQUIFER STORAGE FOR THE IRRIGATION OF PARKS AND GOLFCOURSES WITH RECLAIMED WASTEWATER,
W69-06289 03C

MONTANA
FLOOD PLAIN INFORMATION, CLARK FORK, MISSOULA, MONTANA.
W69-06248 04A

MOON
THE MOON'S RESOURCES,
W69-06015 02E

MOSQUITO CONTROL
ALTERNATE METHODS OF MOSQUITO CONTROL TO REDUCE CHEMICAL POLLUTION OF WATERS FOR RECHARGE OF THE OGALLALA FORMATION,
W69-06001 05G

MOVEMENT
THE LONGITUDINAL VELOCITY PROFILE OF LARGE ICE MASSES,
W69-06257 02C

MULTIPLE-PURPOSE PROJECTS
WATER AND CHOICE IN THE COLORADO BASIN AN EXAMPLE OF ALTERNATIVES IN WATER MANAGEMENT, CH. 4, THE RANGE OF OBJECTIVES IN PLANNING FOR THE USE OF COLORADO WATER.
W69-06089 06B

MUNICIPAL WASTES
STATE V TOWN OF GOFFSTOWN (SUIT TO FORCE COMPLIANCE WITH ORDER TO ABATE RIVER POLLUTION).
W69-06330 05G

BRIGGSON V CITY OF VIROQUA (SEWAGE DISCHARGE ACROSS LAND).
W69-06355 05C

VEAZEY V CITY OF DURHAM (PERMANENT DAMAGES RESULTING FROM MUNICIPAL SEWAGE DISCHARGE).
W69-06356 05C

MUNICIPAL WATER
CHEMICAL AND PHYSICAL CHARACTER OF MUNICIPAL WATER SUPPLIES IN MARYLAND,
W69-06031 05F

HYDROGEOLOGY AT SHELBYVILLE, ILLINOIS - A BASIS FOR WATER RESOURCES PLANNING,
W69-06075 02F

DAVENPORT V TOWN OF DANVERS (FLOODING OF LAND BY CITY DAM).
W69-06311 04A

MUSKRATS
NUNNINGHOFF V WISCONSIN CONSERV COMM'N (ACTION TO SECURE LICENSE FOR USE OF PRIVATE LAND UNDER NAVIGABLE WATERS).
W69-06157 06E

NATURAL FLOW
ARCHER V J S COMPTON, INC (INTERFERENCE WITH NATURAL FLOW).
W69-06196 06E

THE LAW OF WATER IN NEW JERSEY,
W69-06303 06E

NATURAL FLOW DOCTRINE
MILOTTA V PFEIFER (NATURAL FLOW AND RIGHTS TO SURFACE DRAINAGE).
W69-06121 06E

CHAMBERLIN V CIAFFONI (NATURAL FLOW AND SURFACE DRAINAGE IN CITIES).
W69-06125 06E

MC KEON V BRAMMER (SUBSURFACE DRAINAGE AND THE NATURAL FLOW DOCTRINE).
W69-06126 06E

DROEGMILLER V OLSON (DIVERSION OF NATURAL FLOW).
W69-06135 06E

HARGADINE V SHARKEY (DIVERSION OF WATER FROM ITS NATURAL COURSES).
W69-06193 06E

THE LAW OF WATER IN NEW JERSEY,
W69-06302 06E

PHILLIPS V CHESSON (DIVERSION CAUSED BY EXCAVATED SLOPE).
W69-06309 04A

NATURAL GAS
OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION, PART III NATURAL GAS.
W69-06413 06B

NATURAL RESOURCES
NATURAL RESOURCES.
W69-06403 04A

NATURAL STREAMS
BELVEAL V H B C DEVELOPMENT CO (OBSTRUCTION OF NATURAL WATERCOURSE AND CONCENTRATION OF FLOW).
W69-06154 06E

CLOUGH V STATE (ARTIFICIAL DIVERSION OF NATURAL WATERCOURSES).
W69-06184 06E

MCCAUSLAND V JARRELL (OBSTRUCTION OF THE FLOW OF A NATURAL STREAM).
W69-06367 04A

NAVIGABLE WATER
PROUTY V CITIZENS UTILITIES CO. (SALE OF PROPERTY ALONG NAVIGABLE RIVER).
W69-06136 06E

BEGNAUD V GRUBB AND HAWKINS (ACTION TO DETERMINE NAVIGABILITY OF BAYOU AS TEST OF OWNERSHIP).
W69-06161 06E

NAVIGABLE WATERS
NUNNINGHOFF V WISCONSIN CONSERV COMM'N (ACTION TO SECURE LICENSE FOR USE OF PRIVATE LAND UNDER NAVIGABLE WATERS).
W69-06157 06E

STATE V LONGYEAR HOLDING CO (ACTION TO DETERMINE RIGHTS TO ORE BENEATH LAKE BED).
W69-06158 06E

RESORT DEVELOPMENT CO V PARMELE (OWNERSHIP OF LAND COVERED BY NAVIGABLE WATERS).
W69-06181 06E

PONELEIT V DUDAS (ZONING REGULATIONS AS AFFECTING RIPARIAN RIGHTS).
W69-06320 06E

SWAN ISLAND CLUB, INC V WHITE (TITLE TO SUBMERGED LANDS UNDER NAVIGABLE WATERS).
W69-06390 06E

IN RE EASTERN TRANSPORTATION CO (ABANDONMENT OF VESSELS IN NAVIGABLE WATERS).
W69-06391 06E

STATE V SENSENBRENNER (RIPARIAN RIGHTS REGARDING NATURAL DAMS).
W69-06401 04A

NAVIGATION
CHESAPEAKE BAY BRIDGE AND TUNNEL DIST V LAURITZEN (ACTION FOR DAMAGES TO SHIP CAUSED BY STRIKING SUBMERGED TOWER).
W69-06185 06E

MARINE AIR WAYS, INC V STATE (DEPRIVATION OF ACCESS ROUTES DUE TO BRIDGE CONSTRUCTION).
W69-06366 04A

NEGLIGENCE
TAYLOR V HARRISON CONSTR CO (ARTIFICIAL INCREASE OF SURFACE WATERS).
W69-06167 06E

GREENBURG V CITY OF STEUBENVILLE (DAMAGE CAUSED BY AN ACT OF GOD AND CONCURRENT NEGLIGENCE).
W69-06170 06E

GENERAL GEOPHYSICAL CO V BROWN (DESTRUCTION OF WATER-WELL BY GEOPHYSIC EXPLOSIONS).
W69-06173 06E

DANNER V UNITED STATES (FEDERAL GOVERNMENT'S LIABILITY FOR FLOOD DAMAGES).
W69-06194 06E

NETWORKS
HYDROLOGICAL BENCH MARKS,
W69-06252 07A

NEW ENGLAND INTERSTATE WPS COMPACT
WATER RESOURCES PLANNING STRATEGY,
W69-06047 06B

TECHNOLOGY AND PUBLIC DECISION MAKING,
W69-06048 06B

WATER RESOURCES PLANNING,
W69-06049 06B

NEW HAMPSHIRE
STATE V TOWN OF GOFFSTOWN (SUIT TO FORCE COMPLIANCE WITH ORDER TO ABATE RIVER POLLUTION).
W69-06330 05G

NEW JERSEY
JEFFERSON V DAVIS (OWNERSHIP OF SUBMERGED POND LAND).
W69-06151 06E

PETER WENDEL AND SONS V CITY OF NEWARK (DAMAGE FROM ARTIFICIAL DRAINAGE SYSTEM).
W69-06176 06E

RONADE ASSOCIATES V DEPARTMENT OF CONSERVATION (DENIAL OF PERMIT TO CONSTRUCTION BUILDING ACROSS STREAM).
W69-06189 06E

PASSAIC VALLEY WATER COMM'N V DEPARTMENT OF CONSERVATION (STATUTORY INTERPRETATION OF EXCESS DIVERSION ASSESSMENT FORMULA).
W69-06190 06E

GROBERT V PASSAIC VALLEY WATER COMM'N (RIGHT TO DIVERT RIVER WATER - AMOUNT).
W69-06191 06E

LONG-TERM TREND ANALYSES OF WATER QUALITY-A MODEL STUDY OF THE PASSAIC RIVER BASIN,
W69-06235 05B

THE LAW OF WATER IN NEW JERSEY,
W69-06301 06E

W69-06302 06E

W69-06303 06E

W69-06304 06E

STATE WATER SUPPLY DEVELOPMENT.
W69-06317 03D

LEGAL ASPECTS OF NEW JERSEY POTABLE WATER PROGRAM,
W69-06331 05G

DELAWARE RIVER BASIN.
W69-06347 06E

INLAND WATERWAYS.
W69-06348 06E

POLLUTION OF FRESH WATERS.
W69-06349 05G

POLLUTION OF POTABLE WATERS.
W69-06350 05G

GOULD AND EBERHARDT, INC V CITY OF NEWARK (DISCHARGE OF SURFACE WATERS FROM STORM SEWER).
W69-06357 04A

GRANGER V ELM TREE VILLAGE (DISCHARGE OF EXCESS SURFACE WATER).
W69-06370 04A

POLLUTION OF WATERS BY RAILROADS AND FACTORIES.
W69-06404 05G

POLLUTION OF WATERS.
W69-06407 05G

NEW MEXICO
RECREATIONAL VALUE OF WATER AT ELEPHANT BUTTE AND NAVAJO RESERVOIRS,
W69-06010 06B

GROUND-WATER LEVELS IN NEW MEXICO, 1967,
W69-06212 02F

FLOOD PLAIN INFORMATION, ARROYO DE LOS CHAMISOS AND ARROYO HONDO, SANTA FE, NEW MEXICO.
W69-06247 04A

NEW YORK
JONES V BREYER ICE CREAM CO (PRESCRIPTIVE RIGHTS TO POLLUTE STREAM WATERS).
W69-06114 05G

PHILLIPS V SUN OIL CO (GASOLINE POLLUTION OF WATER WELL).
W69-06117 05G

KEELER V TUBBS (LIMITATIONS UNDER WATER CONTRACTS).
W69-06134 06E

LEWIS V CLARK (CREEK BED AS PROPERTY BOUNDARY).
W69-06150 06E

CLOUGH V STATE (ARTIFICIAL DIVERSION OF NATURAL WATERCOURSES).
W69-06184 06E

BENEFITS FROM INTEGRATED WATER MANAGEMENT IN URBAN AREAS - THE CASE OF THE NEW YORK METROPOLITAN REGION,
W69-06201 06B

ZIDEL V STATE (STATE LIABLE FOR EROSION CAUSED BY NEGLIGENTLY PLACED ROAD).
W69-06314 04C

IMPROVEMENT AND MODERNIZATION OF N. Y. WATER LAW WITHIN THE FRAMEWORK OF THE RIPARIAN SYSTEM,
W69-06341 06E

OHIO RIVER VALLEY WATER SANITATION COMPACT.
W69-06344 05G

MARINE AIR WAYS, INC V STATE (DEPRIVATION OF ACCESS ROUTES DUE TO BRIDGE CONSTRUCTION).
W69-06366 04A

NIAGARA MOHAWK POWER CORP V FEDERAL POWER COMM'N (USUFRUCTUARY RENTAL AS AN OPERATING EXPENSE).
W69-06379 06E

GUNN V BERQUIST (ADVERSE POSSESSION OF AND RIPARIAN RIGHTS IN TOWN-OWNED RIPARIAN LANDS).
W69-06382 06E

NIAGARA MOHAWK POWER CORP V FEDERAL POWER COMM'N (USUFRUCTUARY RIGHTS AND THE FEDERAL WATER POWER ACT OF 1920).
W69-06405 06C

ANTHONY V HUNTLEY ESTATES (DAMAGES FOR POLLUTION OF STREAM).
W69-06410 05G

NEW YORK METROPOLITAN REGION
BENEFITS FROM INTEGRATED WATER MANAGEMENT IN URBAN AREAS - THE CASE OF THE NEW YORK METROPOLITAN REGION,
W69-06201 06B

NIAGARA RIVER
NIAGARA MOHAWK POWER CORP V FEDERAL POWER COMM'N (USUFRUCTUARY RIGHTS AND THE FEDERAL WATER POWER ACT OF 1920).
W69-06405 06C

NITRIFICATION
NITROGEN REMOVAL FROM NATURAL WATERS,

W69-06012 05D

NITROGEN
LIMNOLOGICAL INVESTIGATIONS OF TEXAS IMPOUNDMENTS FOR WATER QUALITY MANAGEMENT PURPOSES - THE USE OF ALGAL CULTURES TO ASSESS THE EFFECTS OF NUTRIENT ENRICHMENT ON THE HIGHLAND LAKES OF THE COLORADO RIVER, TEXAS,
W69-06004 05C

SOURCES OF ELEMENTAL NITROGEN IN FERMENTATION GASES,
W69-06285 05C

NITROGEN REMOVAL
NITROGEN REMOVAL FROM NATURAL WATERS,
W69-06012 05D

NONNAVIGABLE WATERS
TAYLOR V TAMPA COAL CO (RIPARIAN RIGHTS IN NON-NAVIGABLE LAKE).
W69-06307 06E

NONSTRUCTURAL ALTERNATIVES
BECK V GAME AND FRESH WATER FISH COMM'N (JURISDICTION OF FRESH WATER FISH COMM'N).
W69-06328 06E

NON-EQUILIBRIUM THERMODYNAMICS
NON-EQUILIBRIUM THERMODYNAMICS OF THE SOIL-WATER SYSTEM,
W69-06016 02G

NON-NAVIGABLE WATERS
BEGNAUD V GRUBB AND HAWKINS (ACTION TO DETERMINE NAVIGABILITY OF BAYOU AS TEST OF OWNERSHIP).
W69-06161 06E

IMPROVED REALTY CORP V SOWERS (ADVERSE POSSESSION OF POND).
W69-06165 06E

SWAN ISLAND CLUB, INC V WHITE (TITLE TO SUBMERGED LANDS UNDER NAVIGABLE WATERS).
W69-06390 06E

PERSON V JOHNSON (TITLE TO BEDS UNDER NON-NAVIGABLE LAKES).
W69-06397 06E

NON-STERILE ENVIRONMENT
HYDROLYSIS OF CONDENSED PHOSPHATES--I NON-STERILE ENVIRONMENT,
W69-06271 02K

NON-STRUCTURAL ALTERNATIVES
WATER AND CHOICE IN THE COLORADO BASIN AN EXAMPLE OF ALTERNATIVES IN WATER MANAGEMENT.
W69-06086 06B

NORTH CAROLINA
FLOOD PLAIN INFORMATION, TAR RIVER AND STONY CREEK, ROCKY MOUNT, NORTH CAROLINA.
W69-06059 04A

FLOOD PLAIN INFORMATION, TAR RIVER AT LOUISBURG, NORTH CAROLINA.
W69-06064 04A

FLOOD PLAIN INFORMATION, ELLERBE, GOOSE, WARREN, SANDY AND THIRD FORK CREEKS, DURHAM, NORTH CAROLINA.
W69-06066 04A

MCKINNEY V DENEEN (LIABILITY FOR DISCHARGE OF MINE WASTES).
W69-06111 05C

REGULATION OF USE OF WATER RESOURCES.
W69-06138 06E

LYDA V TOWN OF MARION (UNAUTHORIZED DRAINAGE DITCHES HELD TAKING OF PRIVATE PROPERTY FOR PUBLIC USE).
W69-06169 06E

RESORT DEVELOPMENT CO V PARMELE (OWNERSHIP OF LAND COVERED BY NAVIGABLE WATERS).
W69-06181 06E

PHILLIPS V CHESSON (DIVERSION CAUSED BY EXCAVATED SLOPE).
W69-06309 04A

VEAZEY V CITY OF DURHAM (PERMANENT DAMAGES RESULTING FROM MUNICIPAL SEWAGE DISCHARGE).
W69-06356 05C

JOHNSON V CITY OF WINSTON-SALEM (SURFACE WATER DRAINAGE - PIPES).
W69-06374 04A

NORTH DAKOTA
FLOOD PLAIN INFORMATION, DICKINSON, NORTH DAKOTA DRAINAGE DITCH.
W69-06241 04A

NUISANCE
JONES V BREYER ICE CREAM CO (PRESCRIPTIVE RIGHTS TO POLLUTE STREAM WATERS).
W69-06114 05G

NUTRIENT ENRICHMENT TESTS
LIMNOLOGICAL INVESTIGATIONS OF TEXAS IMPOUNDMENTS FOR WATER QUALITY MANAGEMENT PURPOSES - THE USE OF ALGAL CULTURES TO ASSESS THE EFFECTS OF NUTRIENT ENRICHMENT ON THE HIGHLAND LAKES OF THE COLORADO RIVER, TEXAS,
W69-06004 05C

OBSERVATION WELLS
CONSTRUCTION OF PIEZOMETERS, AND METHOD OF INSTALLATION FOR GROUND WATER OBSERVATIONS IN AQUIFERS,
W69-06019 07B

RECORDS OF OBSERVATION WELLS AND WATER-LEVEL FLUCTUATIONS IN THE ABERDEEN-SPRINGFIELD AREA, BINGHAM AND POWER COUNTIES, IDAHO, IN 1967,
W69-06040 02F

OBSTRUCTION OF NAVIGABLE WATERS
IN RE EASTERN TRANSPORTATION CO (ABANDONMENT OF VESSELS IN NAVIGABLE WATERS).
W69-06391 06E

OBSTRUCTION TO FLOW
MASONITE CORP V WINDHAM (PONDING AND POLLUTION ON UPPER LAND).
W69-06120 05G

STACY V WALKER (PROTECTION AGAINST SURFACE WATER DRAINAGE).
W69-06128 06E

PALMER V MASSENGILL (OBSTRUCTION TO FLOW OF ARTIFICIAL WATERCOURSE).
W69-06147 06E

FIPE V CHESAPEAKE AND OHIO RR (NON-LIABILITY FOR ACTS OF GOD).
W69-06153 06E

BELVEAL V H B C DEVELOPMENT CO (OBSTRUCTION OF NATURAL WATERCOURSE AND CONCENTRATION OF FLOW).
W69-06154 06E

KEYTON V MISSOURI-KANSAS-TEXAS RR (ACTION FOR DAMAGES CAUSED BY OBSTRUCTING NATURAL FLOW OF SURFACE WATER).
W69-06162 06E

GREENBURG V CITY OF STEUBENVILLE (DAMAGE CAUSED BY AN ACT OF GOD AND CONCURRENT NEGLIGENCE).
W69-06170 06E

STIGALL V SHARKEY COUNTY (DESTRUCTION OF DRAINAGE FACILITIES CAUSING FLOOD DAMAGE).
W69-06360 04A

MCCAUSLAND V JARRELL (OBSTRUCTION OF THE FLOW OF A NATURAL STREAM).
W69-06367 04A

OCEANOGRAPHY
UNITED STATES POLICY REGARDING MARINE RESOURCES (IMPLEMENTATION OF THE NEW MARINE POLICY),
W69-06100 06E

ALTERNATIVE REGIMES FOR MARINE RESOURCES UNDERLYING THE SEA,
W69-06105 06E

A NEGATIVE VIEW OF A PROPOSAL FOR UNITED NATIONS OWNERSHIP OF OCEAN MINERAL RESOURCES,
W69-06106 06E

THE ROLE OF THE UNITED STATES NAVY IN THE FORMULATION OF FEDERAL POLICY REGARDING THE SEA,
W69-06107 06E

THE ROLE OF THE STATE DEPARTMENT IN FORMULATING FEDERAL POLICY REGARDING MARINE RESOURCES,
W69-06108 06E

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION) ORGANIZING A NATIONAL OCEAN EFFORT.
W69-06420 06B

OCEANS
A CASE FOR THE ADMINISTRATION OF MARINE RESOURCES UNDERLYING THE HIGH SEAS BY THE UNITED NATIONS,
W69-06103 06E

A CASE FOR THE ADMINISTRATION OF MINERAL RESOURCES UNDERLYING THE HIGH SEAS BY NATIONAL INTERESTS,
W69-06104 06E

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION) ORGANIZING A NATIONAL OCEAN EFFORT.
W69-06420 06B

ODOR PROBLEMS
LIMNOLOGICAL INVESTIGATIONS OF TEXAS IMPOUNDMENTS FOR WATER QUALITY MANAGEMENT PURPOSES - LIMNOLOGICAL AND WATER QUALITY DATA FOR THE HIGHLAND LAKES, 1968,
W69-06003 05B

OHIO
FLOODS AT JACKSON, OHIO,
W69-06056 02E

FLOOD PLAIN INFORMATION, BIG WALNUT CREEK, VICINITY OF COLUMBUS, OHIO.
W69-06062 04A

FLOOD PLAIN INFORMATION, OTTAWA RIVER, ALLEN COUNTY, OHIO.
W69-06069 04A

GREENBURG V CITY OF STEUBENVILLE (DAMAGE CAUSED BY AN ACT OF GOD AND CONCURRENT NEGLIGENCE).
W69-06170 06E

ACCURATE DIE CASTING CO V CITY OF CLEVELAND (FLOOD DAMAGE FROM SUBSURFACE DRAINAGE).
W69-06171 06E

RATCLIFFE V INDIAN HILL ACRES (RIGHTS TO DISPOSE OF SURFACE RUNOFF WATERS).
W69-06199 06E

WASTES, WATER, AND WISHFUL THINKING THE BATTLE OF LAKE ERIE,
W69-06305 05G

LAKE FRONT EAST 55TH STREET CO V CITY OF CLEVELAND (ESTABLISHMENT OF BOUNDARY LINES).
W69-06388 06E

OHIO RIVER
FLOOD PLAIN INFORMATION, OHIO RIVER, JEFFERSON COUNTY, KENTUCKY.
W69-06070 04A

CARPENTER V OHIO RIVER SAND AND GRAVEL CORP (ACTION TO ENJOIN DREDGING ON PROPERTY BELOW PRESENT WATER LINE, BUT ABOVE OLD LOW WATER MARK).
W69-06159 06E

OIL INDUSTRY
TOTEN V SHELL OIL CO (SALT WATER DAMAGE TO LAND AND CROPS BY OIL INDUSTRY NEGLIGENCE).
W69-06110 05C

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION).
W69-06411 06B

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION, PART III DEVELOPMENT OF NONLIVING MARINE RESOURCES.
W69-06412 06B

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION, PART III NATURAL GAS.
W69-06413 06B

OIL SPILL CONTROL
OIL POLLUTION - A REPORT TO THE PRESIDENT.
W69-06237 05B

OIL WASTES
B AND B OIL CO V TOWNSEND (OIL WASTE POLLUTION).
W69-06115 05G

OIL POLLUTION - A REPORT TO THE PRESIDENT.
W69-06237 05B
OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION, PART III DEVELOPMENT OF NONLIVING MARINE RESOURCES.
W69-06412 06B

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION, PART III NATURAL GAS.
W69-06413 06B

OIL SPILL CONTROL
OIL POLLUTION - A REPORT TO THE PRESIDENT.
W69-06237 05B

OIL WASTES
B AND B OIL CO V TOWNSEND (OIL WASTE POLLUTION).
W69-06115 05G

OIL POLLUTION - A REPORT TO THE PRESIDENT.
W69-06237 05B

OILY WATER
OIL POLLUTION - A REPORT TO THE PRESIDENT.
W69-06237 05B

OLIGOTROPHY
LIMNOLOGICAL ORGANIC ANALYSES BY QUANTITATIVE DICHROMATE OXIDATION,
W69-06093 05A

ONEIDA LAKE(NY)
AGE AND GROWTH OF WHITE BASS IN ONEIDA LAKE, NEW YORK,
W69-06275 05C

OPERATION AND MAINTENANCE
CONSTRUCTION OF PIEZOMETERS, AND METHOD OF INSTALLATION FOR GROUND WATER OBSERVATIONS IN AQUIFERS,
W69-06019 07B

UNITED STATES V INGRAM (BRIDGE CONSTRUCTION AND RIPARIAN OBLIGATIONS).
W69-06364 04A

OPTIMIZATION
ECONOMIC EVALUATION OF WATER-PART IV AN INPUT-OUTPUT AND LINEAR PROGRAMMING ANALYSIS OF CALIFORNIA WATER REQUIREMENTS,
W69-06220 06B

ORGANIC COMPOUNDS
RECOVERY OF ORGANICS FROM A EUTROPHIC LAKE BY THE CARBON ADSORPTION TECHNIQUE,
W69-06282 05A

ORGANIC MATTER
THORIUM AND URANIUM CONCENTRATIONS AND ISOTOPE RATIOS IN RIVER SEDIMENTS,
W69-06045 02J

LIMNOLOGICAL ORGANIC ANALYSES BY QUANTITATIVE DICHROMATE OXIDATION,
W69-06093 05A

ORGANIC SOILS
FACTORS RESTRICTING INFILTRATION RATES ON DECOMPOSED GRANITIC SOILS,
W69-06041 02G

INFILTROMETER STUDIES ON NON-WETTABLE SOILS ON EAST SIERRA NEVADA,
W69-06042 02G

OUTDOOR RECREATION
RECREATIONAL VALUE OF WATER AT ELEPHANT BUTTE AND NAVAJO RESERVOIRS,
W69-06010 06B

OVERFLOW
MAGEE V TEXAS CONSTRUCTION CO (FLOODING ABOVE COFFER DAM).
W69-06368 04A

OVERLAND FLOW
CASANOVER V VILLANOVA REALTY CO (DIKE REMOVAL AND RUNOFF).
W69-06163 06E

OWNERSHIP OF BEDS
SMEDBERG V MOXIE DAM CO. (DAMAGE CAUSED BY LOWERING POND LEVEL).
W69-06131 06E

HERMANSEN V CITY OF LAKE GENEVA (RIPARIAN RIGHT TO REQUIRE REMOVAL OF PIERS).
W69-06148 06E

STATE V LONGYEAR HOLDING CO (ACTION TO DETERMINE RIGHTS TO ORE BENEATH LAKE BED).
W69-06158 06E

BEGNAUD V GRUBB AND HAWKINS (ACTION TO DETERMINE NAVIGABILITY OF BAYOU AS TEST OF OWNERSHIP).
W69-06161 06E

RESORT DEVELOPMENT CO V PARMELE (OWNERSHIP OF LAND COVERED BY NAVIGABLE WATERS).
W69-06181 06E

UNITED STATES V STATE OF LOUISIANA, TEXAS, MISSISSIPPI, ALABAMA, AND FLORIDA (INTERPRETATION OF SUBMERGED LANDS ACT).
W69-06200 06E

LOUISVILLE SAND AND GRAVEL CO V RALSTON (THE 'THREAD OF THE STREAM' AS A BOUNDARY LINE).
W69-06318 06E

AMERADA PETROLEUM CORPORATION V CASE (ACCRETION OF LAND).
W69-06389 06E

SWAN ISLAND CLUB, INC V WHITE (TITLE TO SUBMERGED LANDS UNDER NAVIGABLE WATERS).
W69-06390 06E

PERSON V JOHNSON (TITLE TO BEDS UNDER NON-NAVIGABLE LAKES).
W69-06397 06E

JOHNSON V SMITH (TITLE TO BEDS UNDER NON-NAVIGABLE LAKES).
W69-06398 06E

LOUGHRAN V MATYLEWICZ (EASEMENTS ON NON-NAVIGABLE WATERS).
W69-06399 06E

OXYGEN
LIMNOLOGICAL INVESTIGATIONS OF TEXAS IMPOUNDMENTS FOR WATER QUALITY MANAGEMENT PURPOSES - LIMNOLOGICAL AND WATER QUALITY DATA FOR THE HIGHLAND LAKES, 1968,
W69-06003 05B

OXYGEN ISOTOPES
OXYGEN ISOTOPIC COMPOSITION OF SULFATE IONS IN WATER FROM THERMAL SPRINGS,
W69-06044 02K

OXYGEN PRODUCTION
OXYGEN PRODUCTION AND LOSS IN A MODEL RIVER,
W69-06002 05B

OYSTERS
CARR V UNITED STATES (DAMAGES TO OYSTER BED DUE TO DRAGGING OPERATIONS).
W69-06192 06E

HAUGHTON V LANKFORD (CONSTITUTIONALITY OF CONSERVATION REGULATION).
W69-06329 06E

PASSAIC RIVER
POLLUTION OF WATERS.
W69-06407 05G

PATH OF POLLUTANTS
LONGITUDINAL ESTUARINE DIFFUSION IN SAN FRANCISCO BAY, CALIFORNIA,
W69-06030 05A

SOLUTION OF ESTUARY PROBLEMS AND NETWORK PROGRAMS,
W69-06077 02L

STOCHASTIC MODEL FOR BOD AND DO IN STREAMS,
W69-06080 05B

PEAK DISCHARGE
SUMMARY OF MAXIMUM DISCHARGES IN UTAH STREAMS,
W69-06209 02E

MEASUREMENT OF PEAK DISCHARGE BY INDIRECT METHODS,

W69-06251 02E

PENNSYLVANIA
PUNXSUTAWNEY WATER SERVICE CO V SARICKS (CONTAMINATION FROM STRIP MINING).
W69-06113 05G

COMMONWEALTH V BLACK (INJUNCTION RESTRAINING STRIP MINING OPERATIONS).
W69-06119 05G

MILOTTA V PFEIFER (NATURAL FLOW AND RIGHTS TO SURFACE DRAINAGE).
W69-06121 06E

HEREDA V LOWER BURRELL TP (UNNATURAL WATER AND SEWAGE DISCHARGE).
W69-06123 06E

CHAMBERLIN V CIAFFONI (NATURAL FLOW AND SURFACE DRAINAGE IN CITIES).
W69-06125 06E

TAYLOR V HARRISON CONSTR CO (ARTIFICIAL INCREASE OF SURFACE WATERS).
W69-06167 06E

HOLDEN V MOSER (SURFACE DRAINAGE EASEMENTS).
W69-06182 06E

KLOOCK V RUSNACK (VALIDITY OF WATER USE EASEMENT).
W69-06183 06E

FLOOD PLAIN INFORMATION, PIGEON CREEK, BENTLEYVILLE, FALLOWFIELD TOWNSHIP AND SOMERSET TOWNSHIP, PENNSYLVANIA.
W69-06242 04A

DE PIETRO V TRIANO (ESTABLISHMENT OF EASEMENT FOR SURFACE WATER DRAINAGE).
W69-06371 04A

SHAFFER V WILKINSON (WATER RIGHTS AND EASEMENT).
W69-06395 06E

LOUGHRAN V MATYLEWICZ (EASEMENTS ON NON-NAVIGABLE WATERS).
W69-06399 06E

PERCOLATION
DUVALL V 20TH CENTURY COAL CO (PERCOLATING WATERS).
W69-06175 06E

PERIPHYTON
PRIMARY PRODUCTION, ENERGETICS, AND NUTRIENT UTILIZATION IN A WARM-WATER STREAM,
W69-06092 05C

PERMANENT DAMAGES
PHILLIPS V CHESSON (DIVERSION CAUSED BY EXCAVATED SLOPE).
W69-06309 04A

PERMEAMETERS
THE MEASUREMENT OF THE HYDRAULIC CONDUCTIVITY OF UNSATURATED POROUS MATERIALS UTILIZING A ZONE OF ENTRAPPED AIR,
W69-06071 02G

SOIL-WATER PROPERTIES COMPUTED FROM TRANSIENT FLOW DATA,
W69-06072 02G

PERMITS
COMMONWEALTH V BLACK (INJUNCTION RESTRAINING STRIP MINING OPERATIONS).
W69-06119 05G

NUNNINGHOFF V WISCONSIN CONSERV COMM'N (ACTION TO SECURE LICENSE FOR USE OF PRIVATE LAND UNDER NAVIGABLE WATERS).
W69-06157 06E

PESTICIDE ANALYSIS
GENERAL METHOD FOR DETERMINATION OF ORGANOPHOSPHORUS RESIDUES IN RIVER WATERS AND EFFLUENTS,
W69-06023 05A

PESTICIDE RESIDUES
GENERAL METHOD FOR DETERMINATION OF ORGANOPHOSPHORUS RESIDUES IN RIVER WATERS AND EFFLUENTS,
W69-06023 05A

PHOSPHATES
HYDROLYSIS OF CONDENSED PHOSPHATES--I NON-STERILE ENVIRONMENT,
W69-06271 02K

HYDROLYSIS OF CONDENSED PHOSPHATES--II STERILE ENVIRONMENT,
W69-06284 02K

PHOSPHORUS
LIMNOLOGICAL INVESTIGATIONS OF TEXAS IMPOUNDMENTS FOR WATER QUALITY MANAGEMENT PURPOSES - THE USE OF ALGAL CULTURES TO ASSESS THE EFFECTS OF NUTRIENT ENRICHMENT ON THE HIGHLAND LAKES OF THE COLORADO RIVER, TEXAS,
W69-06004 05C

PHYTOPLANKTON
LIMNOLOGICAL INVESTIGATIONS OF TEXAS IMPOUNDMENTS FOR WATER QUALITY MANAGEMENT PURPOSES - LIMNOLOGICAL AND WATER QUALITY DATA FOR THE HIGHLAND LAKES, 1968,
W69-06003 05B

PIERS
HERMANSEN V CITY OF LAKE GENEVA (RIPARIAN RIGHT TO REQUIRE REMOVAL OF PIERS).
W69-06148 06E

PIEZOMETERS
CONSTRUCTION OF PIEZOMETERS, AND METHOD OF INSTALLATION FOR GROUND WATER OBSERVATIONS IN AQUIFERS,
W69-06019 07B

PIPELINES
SHAFFER V WILKINSON (WATER RIGHTS AND EASEMENT).
W69-06395 06E

PIPES
STANDARD WAREHOUSE CO V ATLANTIC COAST LINE RR (NEGLIGENT CONSTRUCTION AND MAINTENANCE OF A DRAINAGE SYSTEM).
W69-06152 06E

PLANNING
GOALS AND PERSPECTIVES IN WATER RESOURCES PLANNING,
W69-06046 06B

WATER RESOURCES PLANNING STRATEGY,
W69-06047 06B

TECHNOLOGY AND PUBLIC DECISION MAKING,
W69-06048 06B

WATER RESOURCES PLANNING,
W69-06049 06B

WATER AND CHOICE IN THE COLORADO BASIN AN EXAMPLE OF ALTERNATIVES IN WATER MANAGEMENT.
W69-06086 06B

PLASTIC DEFORMATION
PLASTIC FLOW AND PRESSURE MELTING IN THE DEFORMATION OF ICE I,
W69-06270 01A

PLAYA LAKES
ALTERNATE METHODS OF MOSQUITO CONTROL TO REDUCE CHEMICAL POLLUTION OF WATERS FOR RECHARGE OF THE OGALLALA FORMATION,
W69-06001 05G

POLLUTANTS
DETERMINATION OF FREE HYDROGEN CYANIDE IN RIVER WATER BY A SOLVENT-EXTRACTION METHOD,
W69-06024 05A

POLLUTION ABATEMENT
MEASURING ESTUARINE POLLUTION,
W69-06203 05A

WASTES, WATER, AND WISHFUL THINKING THE BATTLE OF LAKE ERIE,
W69-06305 05G

PROTECTION AND IMPROVEMENT OF WATERS.
W69-06351 05G

ORGANIZATION AND GENERAL PROVISIONS.
W69-06352 05G

POLLUTION CONTROL.
W69-06353 05G

ENFORCEMENT.
W69-06354 05G

POLLUTION IDENTIFICATION
MEASURING ESTUARINE POLLUTION,
W69-06203 05A

PONDING
MASONITE CORP V WINDHAM (PONDING AND POLLUTION ON UPPER LAND).
W69-06120 05G

PONDS
JEFFERSON V DAVIS (OWNERSHIP OF SUBMERGED POND LAND).
W69-06151 06E

POTABLE WATER
LEGAL ASPECTS OF NEW JERSEY POTABLE WATER PROGRAM,
W69-06331 05G

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION), PART III FRESH WATER RESOURCES.
W69-06416 06B

POTENTIOMETRIC LEVEL
THE PIEZOMETRIC SURFACE OF THE COASTAL PLAIN AQUIFER IN GEORGIA, ESTIMATES OF ORIGINAL ELEVATION AND LONG-TERM DECLINE,
W69-06043 02F

POWERPLANTS
KRAFT V MILLER (ARTIFICIAL CONTROL OF SURFACE WATERS).
W69-06400 04A

PRECIPITATION(ATMOSPHERIC)
PROBABILITY FORECASTS OF 30-DAY PRECIPITATION,
W69-06205 02B

RAINSTORMS AND HAIL,
W69-06214 02B

PRESCRIPTIVE RIGHTS
JONES V BREYER ICE CREAM CO (PRESCRIPTIVE RIGHTS TO POLLUTE STREAM WATERS).
W69-06114 05G

SAELENS V POLLENTIER (SUIT TO ENJOIN DEFENDANT'S INTERFERENCE WITH THE FLOW OF SURFACE WATERS).
W69-06149 06E

IMPROVED REALTY CORP V SOWERS (ADVERSE POSSESSION OF POND).
W69-06165 06E

RICHARDSON AND BASS V BOARD OF LEVEE COMM'RS OF THE ORLEANS LEVEE DIST (ADVERSE POSSESSION).
W69-06168 06E

LOUGHRAN V MATYLEWICZ (EASEMENTS ON NON-NAVIGABLE WATERS).
W69-06399 06E

PRICES
EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER X VALUATION OF BENEFITS,
W69-06298 06B

PRIMARY PRODUCTIVITY
PRIMARY PRODUCTION, ENERGETICS, AND NUTRIENT UTILIZATION IN A WARM-WATER STREAM,
W69-06092 05C

A BIOLOGICAL TEST FOR DETERMINING THE POTENTIAL PRODUCTIVITY OF WATER,
W69-06279 05A

PRIVATE SEWERS
CITY OF IRVINE V SMITH (FLOODING CAUSED BY BREAK IN SEWER).
W69-06365 04A

PROJECT FEASIBILITY
DELAWARE RIVER BASIN.
W69-06347 06E

PROJECT PLANNING
WATER QUALITY STANDARDS THE FEDERAL PERSPECTIVE - PROGRESS TOWARD OBJECTIVES,
W69-06095 05G

METROPOLITAN PROBLEMS THE DELAWARE RIVER BASIN COMMISSION,
W69-06099 06B

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER XI CASE STUDY I THE GREEN RIVER WATERSHED,
W69-06299 06B

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER XII CASE STUDY II SANTA MARIA PROJECT,
W69-06300 06B

PROJECTS
WATER RESOURCES RESEARCH IN VIRGINIA,
W69-06039 02E

PROPERTY BOUNDARIES
STATE V LONGYEAR HOLDING CO (ACTION TO DETERMINE RIGHTS TO ORE BENEATH LAKE BED).
W69-06158 06E

PROPERTY VALUES
UNITED STATES V 1532.63 ACRES OF LAND (DETERMINATION OF FAIR MARKET VALUE IN CONDEMNATION PROCEEDING).
W69-06392 06E

PUBLIC AUTHORITIES
METROPOLITAN PROBLEMS METROPOLITAN PUBLIC AUTHORITIES,
W69-06098 06B

PUBLIC BENEFITS
REVENUE PRODUCING MUNICIPAL FACILITIES ACT.
W69-06141 06E

PUBLIC HEALTH
DEPARTMENT OF HEALTH AND WELFARE.
W69-06143 06E

LEGAL ASPECTS OF NEW JERSEY POTABLE WATER PROGRAM,
W69-06331 05G

PUBLIC INTEREST
RONADE ASSOCIATES V DEPARTMENT OF CONSERVATION (DENIAL OF PERMIT TO CONSTRUCTION BUILDING ACROSS STREAM).
W69-06189 06E

PUBLIC LANDS
FORESTS, PARKS, LAKES, AND RIVERS.
W69-06146 06E

PUBLIC RESORT DEVELOPMENT CO V PARMELE (OWNERSHIP OF LAND COVERED BY NAVIGABLE WATERS).
W69-06181 06E

PUBLIC SEWERS
CITY OF IRVINE V SMITH (FLOODING CAUSED BY BREAK IN SEWER).
W69-06365 04A

PUBLIC SYSTEMS
AN EXPLORATION OF COMPONENTS AFFECTING AND LIMITING POLICY MAKING OPTIONS IN LOCAL WATER AGENCIES,
W69-06306 06B

PUBLIC UTILITIES
PUBLIC UTILITIES CARRIERS AND WATER COMPANIES.
W69-06139 06E

REVENUE PRODUCING MUNICIPAL FACILITIES ACT.
W69-06141 06E

STATE V BOSTIAN (EMINENT DOMAIN AND MUNICIPAL WATER SUPPLY).
W69-06358 06E

PULP WASTES
MADDOX V INTERNATIONAL PAPER COMPANY (DAMAGES RESULTING FROM BAYOU POLLUTION).
W69-06112 05G

PUMPED STORAGE
MITCHELL V CITY OF ST PAUL (NEGLIGENT OPERATION OF PUBLIC RESERVOIR).
W69-06313 06E

PUMPING
MESSANA V MAULE INDUSTRIES (NEGLIGENT FLOODING OF FARM LAND).
W69-06310 04A

RADIOACTIVE DATING
INVESTIGATIONS ON FISSION PRODUCTS IN THE ACCUMULATION AREA OF AN ALPINE GLACIER (KESSELWANDFERNER, OETZTAL ALPS),
W69-06261 02C

TRITIUM CONTENT IN THE FIRN LAYERS OF AN ALPINE GLACIER,
W69-06262 02C

RADIOECOLOGY
MOVEMENT OF RADIOSODIUM IN A CHEMICALLY STRATIFIED LAKE,
W69-06283 02H

RADIOISOTOPES
ISOTOPE HYDROLOGY OF THE ARTESIAN AQUIFERS OF THE STYRIAN BASIN, AUSTRIA,
W69-06249 02K

RADIOSODIUM
MOVEMENT OF RADIOSODIUM IN A CHEMICALLY STRATIFIED LAKE,
W69-06283 02H

RAILROAD EMBANKMENTS
VOLLRATH V WABASH RAILROAD CO. (DAMAGE DUE TO FLOOD WATER FLOW THROUGH ARTIFICIAL EMBANKMENT CUT).
W69-06133 04C

RAILROADS
VOLLRATH V WABASH RAILROAD CO. (DAMAGE DUE TO FLOOD WATER FLOW THROUGH ARTIFICIAL EMBANKMENT CUT).
W69-06133 04C

SOUTHERN RR V JEFFERSON (FLOODING ABOVE RAILROAD FILL).
W69-06186 06E

POLLUTION OF WATERS BY RAILROADS AND FACTORIES.
W69-06404 05G

RAIN
RAINSTORMS AND HAIL,
W69-06214 02B

RAIN AS A SOURCE OF VITAMIN (B-12),
W69-06273 05B

RAINDROPS
PRECISION MEASUREMENTS OF WATER DROPLET EVAPORATION RATES,
W69-06236 02D

RAINFALL
THE AREAL EXTENSION OF RAINFALL RECORDS AN ALTERNATIVE MODEL,
W69-06018 02B

RAINFALL DISPOSITION
LOSS RATES ON SELECTED CATCHMENTS IN VICTORIA,
W69-06085 02D

RAINFALL SIMULATORS
A PORTABLE RAINFALL SIMULATOR AND RUNOFF SAMPLER,
W69-06011 07B

RAINFALL-RUNOFF RELATIONSHIPS
NUMERICAL EXPERIMENTS WITH THE STANFORD WATERSHED MODEL ON SMALL AGRICULTURAL WATERSHEDS IN VIRGINIA,
W69-06032 02E

LOSS RATES ON SELECTED CATCHMENTS IN VICTORIA,
W69-06085 02D

REAERATION
EUFAULA RESERVOIR AERATION RESEARCH-1968,
W69-06255 05G

REASONABLE USE
UNITED STATES V SHAPIRO (RIGHT TO REPEL SURFACE WATER).
W69-06198 06E

RATCLIFFE V INDIAN HILL ACRES (RIGHTS TO DISPOSE OF SURFACE RUNOFF WATERS).
W69-06199 06E

THE LAW OF WATER IN NEW JERSEY,
W69-06303 06E

W69-06304 06E

IMPROVEMENT AND MODERNIZATION OF N. Y. WATER LAW WITHIN THE FRAMEWORK OF THE RIPARIAN SYSTEM,
W69-06341 06E

RECOVERY FACTORS
RECOVERY OF ORGANICS FROM A EUTROPHIC LAKE BY THE CARBON ADSORPTION TECHNIQUE,
W69-06282 05A

RECREATION
WILLIAMS V DIEDERICH (SUIT TO ENJOIN RECREATIONAL TRESPASS ON RESERVOIR).
W69-06394 06E

RECREATION DEMAND
RECREATIONAL VALUE OF WATER AT ELEPHANT BUTTE AND NAVAJO RESERVOIRS,
W69-06010 06B

RED CEDAR RIVER(MICH)
PRIMARY PRODUCTION, ENERGETICS, AND NUTRIENT UTILIZATION IN A WARM-WATER STREAM,
W69-06092 05C

REGIME
A CASE FOR THE ADMINISTRATION OF MINERAL RESOURCES UNDERLYING THE HIGH SEAS BY NATIONAL INTERESTS,
W69-06104 06E

REGIMEN
EXPERIENCES IN COMPARING GEOMETRIC ELEMENTS OF GLACIER VARIATIONS,
W69-06264 02C

GLACIER MASS BUDGET AND MESOSCALE WEATHER IN THE AUSTRIAN ALPS 1964 TO 1966,
W69-06267 02C

THE GREENLAND MASS BALANCE FLUX DIVERGENCE CONSIDERATIONS,
W69-06268 02C

MASS BALANCE OBSERVATIONS ON THE BARNES ICE CAP, BAFFIN ISLAND, CANADA,
W69-06269 02C

REGIONAL ECONOMIC GROWTH
WATER AND CHOICE IN THE COLORADO BASIN AN EXAMPLE OF ALTERNATIVES IN WATER MANAGEMENT, CH. 5, ALTERNATIVES FOR PROMOTING REGIONAL ECONOMIC GROWTH.
W69-06090 06B

REGRADING
CHAMBERLIN V CIAFFONI (NATURAL FLOW AND SURFACE DRAINAGE IN CITIES).
W69-06125 06E

REGRESSION ANALYSIS
EXPERIENCES IN COMPARING GEOMETRIC ELEMENTS OF GLACIER VARIATIONS,
W69-06264 02C

REGULATION
STATE V SULLIVAN (REGULATION BY FRESH WATER FISH COMM'N).
W69-06327 06E

RELATIVE RIGHTS
DROEGMILLER V OLSON (DIVERSION OF NATURAL FLOW).
W69-06135 06E

IMPROVED REALTY CORP V SOWERS (ADVERSE POSSESSION OF POND).
W69-06165 06E

TAYLOR V TAMPA COAL CO (RIPARIAN RIGHTS IN NON-NAVIGABLE LAKE).
W69-06307 06E

REMONSTRANCES
MCKEE V HASLER (LEVEE CONSTRUCTION FOR FLOOD CONTROL).
W69-06363 04A

REPULSION(LEGAL ASPECTS)
DENT V ALEXANDER (ACCELERATED FLOW OF SURFACE DRAINAGE).
W69-06130 06E

VOLLRATH V WABASH RAILROAD CO. (DAMAGE DUE TO FLOOD WATER FLOW THROUGH ARTIFICIAL EMBANKMENT CUT).
W69-06133 04C

UNITED STATES V SHAPIRO (RIGHT TO REPEL SURFACE WATER).
W69-06198 06E

HOWLETT V CITY OF SOUTH NORFOLK (FLOOD DAMAGE ALLEGEDLY DUE TO STREET ELEVATION).
W69-06308 04C

GRANGER V ELM TREE VILLAGE (DISCHARGE OF EXCESS SURFACE WATER).
W69-06370 04A

DE PIETRO V TRIANO (ESTABLISHMENT OF EASEMENT FOR SURFACE WATER DRAINAGE).
W69-06371 04A

JOHNSON V CITY OF WINSTON-SALEM (SURFACE WATER DRAINAGE - PIPES).
W69-06374 04A

RESEARCH AND DEVELOPMENT
OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION, PART III DEVELOPMENT OF NONLIVING MARINE RESOURCES.
W69-06412 06B

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION, PART III LEGAL AND REGULATORY CONSIDERATIONS.
W69-06415 06B

RESEARCH FACILITIES
WATER RESOURCES RESEARCH IN VIRGINIA,
W69-06039 02E

RESERVOIR EVAPORATION
EFFECTS OF SMALL STRUCTURES ON WATER YIELD IN TEXAS,
W69-06218 03B

RESERVOIR MICROBIOLOGY
ECOLOGICAL RELATIONSHIPS OF ORGANIC MATTER AND BACTERIA IN TUTTLE CREEK RESERVOIR,
W69-06014 02H

RESERVOIR OPERATION
RESERVOIRS PROBLEMS AND CONFLICTS,
W69-06207 06B

HYDROLOGY OF WATER STORAGE,
W69-06231 02E

MITCHELL V CITY OF ST PAUL (NEGLIGENT OPERATION OF PUBLIC RESERVOIR).
W69-06313 06E

RESERVOIR POLLUTION
ECOLOGICAL RELATIONSHIPS OF ORGANIC MATTER AND BACTERIA IN TUTTLE CREEK RESERVOIR,
W69-06014 02H

RESERVOIR SITES
WILLIAMS V DIEDERICH (SUIT TO ENJOIN RECREATIONAL TRESPASS ON RESERVOIR).
W69-06394 06E

RESERVOIR STORAGE
MITCHELL V CITY OF ST PAUL (NEGLIGENT OPERATION OF PUBLIC RESERVOIR).
W69-06313 06E

RESERVOIRS
UNDERGROUND STORAGE OF FLUIDS,
W69-06055 02F

DENSITY FLOW REGIME OF FRANKLIN D. ROOSEVELT LAKE,
W69-06076 02H

EUFAULA RESERVOIR AERATION RESEARCH-1968,
W69-06255 05G

ATCHLEY V TENNESSEE VALLEY AUTHORITY (FLOODING OF CROPS CAUSED BY RAISED RESERVOIR WATERS).
W69-06321 04A

RESISTIVITY
THE LOCATION OF DEEP AQUIFERS BY RESISTIVITY SOUNDINGS,
W69-06027 02F

RESOURCE DEVELOPMENT
THE MOON'S RESOURCES,
W69-06015 02E

RESOURCES
THE MOON'S RESOURCES,
W69-06015 02E

RHEOLOGY
THE LONGITUDINAL VELOCITY PROFILE OF LARGE ICE MASSES,
W69-06257 02C

RIDDANCE(LEGAL ASPECTS)
POLICH V HERMANN (ABNORMAL DISCHARGE OF SURFACE WATER).
W69-06127 06E

RATCLIFFE V INDIAN HILL ACRES (RIGHTS TO DISPOSE OF SURFACE RUNOFF WATERS).
W69-06199 06E

JARVIS V CORNETT (DAMAGES CAUSED BY DIVERSION OF SURFACE WATER).
W69-06369 04A

JOHNSON V CITY OF WINSTON-SALEM (SURFACE WATER DRAINAGE - PIPES).
W69-06374 04A

RIGHT-OF-WAY
BOARD OF LEVEE COMM'RS OF ORLEANS LEVEE DIST V KELLY (PUBLIC RIGHTS IN RE FLOOD CONTROL).
W69-06362 04A

RIPARIAN LAND
ANDERSON-TULLY CO V TINGLE (ACCRETION TO LAND LOCATED WITHIN THE FORK OF TWO RIVERS).
W69-06396 06E

PERSON V JOHNSON (TITLE TO BEDS UNDER NON-NAVIGABLE LAKES).
W69-06397 06E

JOHNSON V SMITH (TITLE TO BEDS UNDER NON-NAVIGABLE LAKES).
W69-06398 06E

RIPARIAN LANDS
CARPENTER V OHIO RIVER SAND AND GRAVEL CORP (ACTION TO ENJOIN DREDGING ON PROPERTY BELOW PRESENT WATER LINE, BUT ABOVE OLD LOW WATER MARK).
W69-06159 06E

GUNN V BERQUIST (ADVERSE POSSESSION OF AND RIPARIAN RIGHTS IN TOWN-OWNED RIPARIAN LANDS).
W69-06382 06E

HAUBER V GENTRY (OWNERSHIP OF LAND FORMED BY ACCRETION).
W69-06386 06E

RIPARIAN RIGHTS
GEORGIA WATER LAW,
W69-06009 06E

SMITH V MAGNET COVE BARIUM CORP (BARIUM TAILING POLLUTION).
W69-06116 05G

HERMANSEN V CITY OF LAKE GENEVA (RIPARIAN RIGHT TO REQUIRE REMOVAL OF PIERS).
W69-06148 06E

MUNNINGHOFF V WISCONSIN CONSERV COMM'N (ACTION TO SECURE LICENSE FOR USE OF PRIVATE LAND UNDER NAVIGABLE WATERS).
W69-06157 06E

STATE V LONGYEAR HOLDING CO (ACTION TO DETERMINE RIGHTS TO ORE BENEATH LAKE BED).
W69-06158 06E

TOBIAS V TOBIAS (SUIT TO ENJOIN EXERCISE OF RIPARIAN RIGHT TO FISH IN LAKE).
W69-06164 06E

CRARY V STATE HIGHWAY COMMISSION (TAKING OF STATUTORY RIPARIAN RIGHTS).
W69-06180 06E

THE LAW OF WATER IN NEW JERSEY,
W69-06301 06E

W69-06302 06E

LOUISVILLE SAND AND GRAVEL CO V RALSTON (THE 'THREAD OF THE STREAM' AS A BOUNDARY LINE).
W69-06318 06E

PONELEIT V DUDAS (ZONING REGULATIONS AS AFFECTING RIPARIAN RIGHTS).
W69-06320 06E

IMPROVEMENT AND MODERNIZATION OF N. Y. WATER LAW WITHIN THE FRAMEWORK OF THE RIPARIAN SYSTEM,
W69-06341 06E

SOUTHLAND CO V AARON (ACTION FOR POLLUTION OF DOWNSTREAM WATER SUPPLY).
W69-06345 05G

MARINE AIR WAYS, INC V STATE (DEPRIVATION OF ACCESS ROUTES DUE TO BRIDGE CONSTRUCTION).
W69-06366 04A

JARVIS V CORNETT (DAMAGES CAUSED BY DIVERSION OF SURFACE WATER).
W69-06369 04A

GUNN V BERQUIST (ADVERSE POSSESSION OF AND RIPARIAN RIGHTS IN TOWN-OWNED RIPARIAN LANDS).
W69-06382 06E

SOLOMON V SIOUX CITY (ACCRETION).
W69-06393 06E

STATE V SENSENBRENNER (RIPARIAN RIGHTS REGARDING NATURAL DAMS).
W69-06401 04A

RIPARIAN WATERS
GEORGIA WATER LAW,
W69-06009 06E

RIPRAP
ZIDEL V STATE (STATE LIABLE FOR EROSION CAUSED BY NEGLIGENTLY PLACED ROAD).
W69-06314 04C

RIVER BASIN COMMISSIONS
DELAWARE RIVER BASIN.
W69-06347 06E

RIVER BASIN DEVELOPMENT
CHAPMAN V FEDERAL POWER COMM'N (PRIVATE CONSTRUCTION OF HYDROELECTRIC PLANT AND RIVER BASIN PROJECT).
W69-06346 08C

RIVER BEDS
KENNEDY V UNION ELECTRIC CO OF MISSOURI (SILT ACCRETION AND FLOODING).
W69-06188 06E

RIVER TRAINING
MAN'S INFLUENCE ON HYDROLOGICAL PHENOMENA,
W69-06233 04C

RIVERS
PRIMARY PRODUCTION, ENERGETICS, AND NUTRIENT UTILIZATION IN A WARM-WATER STREAM,
W69-06092 05C

POLLUTION OF WATERS.
W69-06407 05G

ROAD CONSTRUCTION
LYDA V TOWN OF MARION (UNAUTHORIZED DRAINAGE DITCHES HELD TAKING OF PRIVATE PROPERTY FOR PUBLIC USE).
W69-06169 06E

BELUE V CITY OF GREENVILLE (DUTY OF CITY TO PROVIDE DRAINAGE OF THOROUGHFARES).
W69-06323 04A

HILL V CITY OF GREENVILLE (DAMAGES RESULTING FROM CITY'S FAILURE TO PROVIDE DRAINAGE).
W69-06324 04A

HALL V CITY OF GREENVILLE (STATUTORY DUTY OF CITY TO PROVIDE ADEQUATE STREET DRAINAGE).
W69-06361 04A

DIXON V CITY OF NASHVILLE (DAMAGES CAUSED BY DEFLECTION OF SURFACE WATER FLOW).
W69-06373 04A

ROADS
HOLDEN V MOSER (SURFACE DRAINAGE EASEMENTS).
W69-06182 06E

ROBBING
WOODWARD IRON CO V HUMPOWER (DAMAGE TO SURFACE OWNERS RIGHTS FROM MINING OPERATIONS).
W69-06359 04A

ROUTING
THE IUH (INSTANTANEOUS UNIT HYDROGRAPH) OF THE MUSKINGUM CHANNEL REACH,
W69-06020 02E

SACRAMENTO RIVER(CALIF)
STOCHASTIC MODEL FOR BOD AND DO IN STREAMS,
W69-06080 05B

SALINE WATER
TUTEN V SHELL OIL CO (SALT WATER DAMAGE TO LAND AND CROPS BY OIL INDUSTRY NEGLIGENCE).
W69-06110 05C

B AND B OIL CO V TOWNSEND (OIL WASTE POLLUTION).
W69-06115 05G

PHOENIX V GRAHAM (SALT WATER POLLUTION OF WELLS).
W69-06118 05G

THE FEASIBILITY OF DEEP-WELL INJECTION OF WASTE BRINE FROM INLAND DESALTING PLANTS,
W69-06286 05E

ENVIRONMENTAL IMPACT OF BRINE EFFLUENTS ON GULF OF CALIFORNIA,
W69-06287 05C

SALINITY
COASTAL EVIDENCES OF GROUND WATER CONDITIONS IN THE VICINITY OF ANAEHOOMALU AND LALAMILO, SOUTH KOHALA, HAWAII,
W69-06006 03B

PREDICTION OF CROP YIELDS FROM QUANTITY AND SALINITY OF IRRIGATION WATER,
W69-06007 03C

DEAD SEA BRINES DEGREE OF HALITE SATURATION BY ELECTRODE MEASUREMENTS,
W69-06038 02K

SALT WATER PITS
TUTEN V SHELL OIL CO (SALT WATER DAMAGE TO LAND AND CROPS BY OIL INDUSTRY NEGLIGENCE).
W69-06110 05C

SALTS
SALTS AND ASSOCIATED PHENOMENA OF THE TERMINI OF THE HOBBS AND TAYLOR GLACIERS, VICTORIA LAND, ANTARCTICA,
W69-06266 02C

SAMPLERS
A PORTABLE RAINFALL SIMULATOR AND RUNOFF SAMPLER,
W69-06011 07B

SAN FRANCISCO BAY(CAL)
LONGITUDINAL ESTUARINE DIFFUSION IN SAN FRANCISCO BAY, CALIFORNIA,
W69-06030 05A

SANITARY ENGINEERING
SEWERS IN PRIVATE PROPERTY ACQUISITION OF PROPERTY RIGHTS.
W69-06343 06E

SANTA MARIA VALLEY
EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER XII CASE STUDY II SANTA MARIA PROJECT,
W69-06300 06B

SATURATION
DEAD SEA BRINES DEGREE OF HALITE SATURATION BY ELECTRODE MEASUREMENTS,
W69-06038 02K

SCALING
CARBONATE SCALE IN ROMAN AND MODERN CANALS IN THE JORDAN VALLEY,
W69-06017 08A

SCOUR
GLACIAL EROSION,
W69-06258 02C

SEA ICE
THE HEAT BUDGET OF A MELTING COVER OF SEA ICE,

W69-06263 02C

SECONDARY REFRIGERANT FREEZING
SECONDARY REFRIGERANT FREEZING DESALTING PROCESS OPERATION OF A 15,000 GPD PILOT PLANT,
W69-06288 03A

SEDIMENT CONTROL
THE EFFECT OF LOOSE BLOCKS ON THE RATE OF SEDIMENT TRANSPORT,
W69-06083 02J

SEDIMENT TRANSPORT
THE EFFECT OF LOOSE BLOCKS ON THE RATE OF SEDIMENT TRANSPORT,
W69-06083 02J

SEDIMENT TRANSPORTATION IN ALLUVIAL STREAMS,
W69-06232 02J

SEDIMENTS
THORIUM AND URANIUM CONCENTRATIONS AND ISOTOPE RATIOS IN RIVER SEDIMENTS,
W69-06045 02J

BEHAVIOR OF HUMIC ACID IN RECENT LAKE SEDIMENTS TOWARD SODIUM HYDROXYDE AQUEOUS SOLUTION AT THE EXTRACTION (IN JAPANESE),
W69-06278 02H

SERVIENT LAND
BELVEAL V H B C DEVELOPMENT CO (OBSTRUCTION OF NATURAL WATERCOURSE AND CONCENTRATION OF FLOW).
W69-06154 06E

SEWAGE
HEREDA V LOWER BURRELL TP (UNNATURAL WATER AND SEWAGE DISCHARGE).
W69-06123 06E

WATERWORKS, MAIN SEWERS, SEWAGE DISPOSAL PLANTS.
W69-06336 05G

ENFORCEMENT.
W69-06354 05G

VEAZEY V CITY OF DURHAM (PERMANENT DAMAGES RESULTING FROM MUNICIPAL SEWAGE DISCHARGE).
W69-06356 05C

SEWAGE CONNECTION FACILITIES
SEWAGE CONNECTION FACILITIES.
W69-06137 06E

SEWAGE DISPOSAL
SEWAGE CONNECTION FACILITIES.
W69-06137 06E

SEWAGE DISPOSAL PLANTS.
W69-06342 06E

SEWAGE DISPOSAL PLANTS
SEWAGE DISPOSAL PLANTS.
W69-06342 06E

SEWAGE DISTRICTS
AN ACT ESTABLISHING AN INTERIM COMM'N TO STUDY THE PROBLEM OF WATER POLLUTION AND APPROPRIATING MONEY THEREFORE.
W69-06335 05G

SEWAGE EFFLUENTS
BRIGGSON V CITY OF VIROQUA (SEWAGE DISCHARGE ACROSS LAND).
W69-06355 05C

SEWAGE TREATMENT
SEWAGE CONNECTION FACILITIES.
W69-06137 06E

WATERWORKS, MAIN SEWERS, SEWAGE DISPOSAL PLANTS.
W69-06336 05G

SEWAGE DISPOSAL WATER AND SEWAGE.
W69-06337 05G

ORGANIZATION AND GENERAL PROVISIONS.
W69-06352 05G

SEWERS
ACCURATE DIE CASTING CO V CITY OF CLEVELAND (FLOOD DAMAGE FROM SUBSURFACE DRAINAGE).
W69-06171 06E

SEWERS IN PRIVATE PROPERTY ACQUISITION OF PROPERTY RIGHTS.
W69-06343 06E

CITY OF IRVINE V SMITH (FLOODING CAUSED BY BREAK IN SEWER).
W69-06365 04A

SILT
CASANOVER V VILLANOVA REALTY CO (DIKE REMOVAL AND RUNOFF).
W69-06163 06E

SLUDGE ACID
POLLUTION OF WATERS BY RAILROADS AND FACTORIES.
W69-06404 05G

SNOWFALL
CLIMATOLOGY OF SEVERE WINTER STORMS IN ILLINOIS,
W69-06210 02C

SOCIAL ASPECTS
DEPARTMENT OF HEALTH AND WELFARE.
W69-06143 06E

SOIL CONSERVATION
THE WETLANDS COMMITTEE REPORTS, WETLANDS CLASSIFICATION, INVENTORY AND MANAGEMENT.
W69-06122 06E

SOIL EXTRACTS
TOWARDS STANDARDIZATION OF SOIL EXTRACTS FOR MICROBIAL MEDIA,
W69-06272 02K

SOIL MECHANICS
SOIL PHYSICS,
W69-06224 02G

SOIL MICROBIOLOGY
TOWARDS STANDARDIZATION OF SOIL EXTRACTS FOR MICROBIAL MEDIA,
W69-06272 02K

SOIL PHYSICAL PROPERTIES
SOIL PHYSICS,
W69-06224 02G

SOIL PHYSICS
SOIL PHYSICS,
W69-06224 02G

SOIL WATER MOVEMENT
NON-EQUILIBRIUM THERMODYNAMICS OF THE SOIL-WATER SYSTEM,
W69-06016 02G

SOIL-WATER PROPERTIES COMPUTED FROM TRANSIENT FLOW DATA,
W69-06072 02G

SOIL PHYSICS,
W69-06224 02G

SOILS
FREEZING IN FOREST SOIL AS INFLUENCED BY SOIL PROPERTIES, LITTER, AND SNOW,
W69-06028 02C

THE MEASUREMENT OF THE HYDRAULIC CONDUCTIVITY OF UNSATURATE POROUS MATERIALS UTILIZING A ZONE OF ENTRAPPED AIR,
W69-06071 02G

PRELIMINARY REPORT ON THE IRRIGATION POTENTIAL OF DUNN COUNTY, WISCONSIN,
W69-06074 02G

SOLVENT EXTRACTIONS
DETERMINATION OF FREE HYDROGEN CYANIDE IN RIVER WATER BY A SOLVENT-EXTRACTION METHOD,
W69-06024 05A

SOUTH CAROLINA
GROUND-WATER RESOURCES OF GREENVILLE COUNTY, SOUTH CAROLINA
W69-06052 02F

STANDARD WAREHOUSE CO V ATLANTIC COAST LINE RR (NEGLIGENT CONSTRUCTION AND MAINTENANCE OF A DRAINAGE SYSTEM).
W69-06152 06E

FLOOD PLAIN INFORMATION, RICHLAND COUNTY, SOUTH CAROLINA.
W69-06238 04A

FLOOD PLAIN INFORMATION, LAWSONS FORK CREEK AND FAIRFOREST CREEK, SPARTANBURG, SOUTH CAROLINA.
W69-06245 04A

BELUE V CITY OF GREENVILLE (DUTY OF CITY TO PROVIDE DRAINAG OF THOROUGHFARES).
W69-06323 04A

HILL V CITY OF GREENVILLE (DAMAGES RESULTING FROM CITY'S FAILURE TO PROVIDE DRAINAGE).
W69-06324 04A

HALL V CITY OF GREENVILLE (STATUTORY DUTY OF CITY TO PROVID ADEQUATE STREET DRAINAGE).
W69-06361 04A

SOUTHERN KAZAKHSTAN
MOUNTAIN AND DESERT LAKES IN SOUTHERN KAZAKHSTAN, THEIR RESOURCES AND METHODS OF ECONOMIC DEVELOPMENT,
W69-06073 02H

SPILLOVER EFFECTS
EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER VIII KINDS OF BENEFITS AND COSTS SPILLOVER EFFECTS,
W69-06296 06B

SPOKANE(WASH)
GROUND-WATER RESOURCES AND RELATED GEOLOGY OF NORTH-CENTRAL SPOKANE AND SOUTHEASTERN STEVENS COUNTIES, WASHINGTON,
W69-06213 02F

SPRING WATERS
SHAFFER V WILKINSON (WATER RIGHTS AND EASEMENT).
W69-06395 06E

SPRINGS
GRISWOLD V TOWN SCHOOL DISTRICT (DAMAGE TO SPRING).
W69-06155 06E

KLOOCK V RUSNACK (VALIDITY OF WATER USE EASEMENT).
W69-06183 06E

ST LAWRENCE RIVER
CROSS V PACE (DAMAGE TO UNITED STATES CITIZENS BY FOREIGN DAM).
W69-06380 04A

STABLE ISOTOPES
ISOTOPE HYDROLOGY OF THE ARTESIAN AQUIFERS OF THE STYRIAN BASIN, AUSTRIA,
W69-06289 02K

STAGE-DISCHARGE RELATIONS
FLOODS AT JACKSON, OHIO,
W69-06056 02E

STAGE-DISCHARGE RELATIONS ON BIG LOST RIVER WITHIN NATIONAL REACTOR TESTING STAION, IDAHO,
W69-06204 02E

FLOODS OF THE 1965 WATER YEAR IN MISSISSIPPI,
W69-06219 02E

STANDARDS
WATER QUALITY STANDARDS THE FEDERAL PERSPECTIVE - PROGRESS TOWARD OBJECTIVES,
W69-06095 05G

TOWARDS STANDARDIZATION OF SOIL EXTRACTS FOR MICROBIAL MEDIA,
W69-06272 02K

STATE DEPARTMENT
THE ROLE OF THE STATE DEPARTMENT IN FORMULATING FEDERAL POLICY REGARDING MARINE RESOURCES,
W69-06108 06E

STATE GOVERNMENTS
SANITARY WATER BOARD V ANTHONY (LEGISLATION TO PREVENT MINE ACID POLLUTION).
W69-06109 05G

AMERICAN BARGE LINE V KOONTZ (TAXATION OF INTERSTATE AND INTRASTATE COMMERCE OVER NAVIGABLE WATERS).
W69-06178 06E

WUNDERLICH V CATES (DISPUTE OVER TITLE TO AN ISLAND IN THE MISSISSIPPI RIVER).
W69-06385 06E

STATE JURISDICTION
MASSEY V MASONITE CORP (OVERFLOW OF EFFLUENTS INTO PRIVATE LAKE).
W69-06409 05G

STATE JURISDICTIONS
WATER AND CHOICE IN THE COLORADO BASIN AN EXAMPLE OF ALTERNATIVES IN WATER MANAGEMENT, CH. 2, THE SETTING.
W69-06087 06B

STATISTICAL METHODS
MATHEMATICAL STATISTICS AS A METHOD FOR HYDROLOGICAL INVESTIGATIONS,
W69-06226 06A

STATISTICAL MODELS
THE AREAL EXTENSION OF RAINFALL RECORDS AN ALTERNATIVE MODEL,
W69-06018 02B

STOCHASTIC MODEL FOR BOD AND DO IN STREAMS,
W69-06080 05B

PROBABILITY FORECASTS OF 30-DAY PRECIPITATION,
W69-06205 02B

LONG-TERM TREND ANALYSES OF WATER QUALITY-A MODEL STUDY OF THE PASSAIC RIVER BASIN,
W69-06235 05B

STATUTE OF LIMITATIONS
IMPROVED REALTY CORP V SOWERS (ADVERSE POSSESSION OF POND).
W69-06165 06E

STERILE ENVIRONMENT
HYDROLYSIS OF CONDENSED PHOSPHATES--II STERILE ENVIRONMENT,
W69-06284 02K

STOCHASTIC PROCESSES
STOCHASTIC MODEL FOR BOD AND DO IN STREAMS,
W69-06080 05B

STORM DRAINS
THE CHICAGO AREA DEEP TUNNEL PROJECT-A USE OF THE UNDERGROUND STORAGE RESOURCE,
W69-06021 05G

CITY OF MACON V CANNON (SURFACE WATER RUNOFF).
W69-06166 06E

PETER WENDEL AND SONS V CITY OF NEWARK (DAMAGE FROM ARTIFICIAL DRAINAGE SYSTEM).
W69-06176 06E

BAYLEN STREET WHARF CO V CITY OF PENSACOLA (DAMAGES TO LAND BY STORM SEWER REFUSE).
W69-06402 06E

STORM STRUCTURE
CLIMATOLOGY OF SEVERE WINTER STORMS IN ILLINOIS,
W69-06210 02C

STRATIFIED IMPOUNDMENTS
LIMNOLOGICAL INVESTIGATIONS OF TEXAS IMPOUNDMENTS FOR WATER QUALITY MANAGEMENT PURPOSES - THE DISTRIBUTION OF COLIFORM BACTERIA IN STRATIFIED IMPOUNDMENT,
W69-06005 05D

STREAM EROSION
KANSAS RIVER, BONNER SPRINGS TO MOUTH, DEGRADATION OF CHANNEL,
W69-06256 02J

STREAM GRADIENT
MUNICIPAL WATER POLLUTION CONTROL.
W69-06316 05G

STREAM POLLUTION
JONES V BREYER ICE CREAM CO (PRESCRIPTIVE RIGHTS TO POLLUTE STREAM WATERS).
W69-06114 05G

COMMONWEALTH V BLACK (INJUNCTION RESTRAINING STRIP MINING OPERATIONS).
W69-06119 05G

STREAMFLOW
MCKINNEY V DENEEN (LIABILITY FOR DISCHARGE OF MINE WASTES).
W69-06111 05C

STAGE-DISCHARGE RELATIONS ON BIG LOST RIVER WITHIN NATIONAL REACTOR TESTING STAION, IDAHO,
W69-06204 02E

STREAMS
THE VALLEYS OF IOWA-1 VALLEY WIDTH AND STREAM DISCHARGE RELATIONSHIPS IN THE MAJOR STREAMS,
W69-06034 02E

PRIMARY PRODUCTION, ENERGETICS, AND NUTRIENT UTILIZATION IN A WARM-WATER STREAM,
W69-06092 05C

LEWIS V CLARK (CREEK BED AS PROPERTY BOUNDARY).
W69-06150 06E

NORTH COUNTIES HYDROELECTRIC CO V UNITED STATES (DAMAGES RESULTING FROM ICE JAM).
W69-06326 06E

SHAFFER V WILKINSON (WATER RIGHTS AND EASEMENT).
W69-06395 06E

ANTHONY V HUNTLEY ESTATES (DAMAGES FOR POLLUTION OF STREAM).
W69-06410 05G

STRIP MINE WASTES
PUNXSUTAWNEY WATER SERVICE CO V SARICKS (CONTAMINATION FROM STRIP MINING).
W69-06113 05G

COMMONWEALTH V BLACK (INJUNCTION RESTRAINING STRIP MINING OPERATIONS).
W69-06119 05G

STRIP MINES
DUVALL V 20TH CENTURY COAL CO (PERCOLATING WATERS).
W69-06175 06E

SUBMERGED LANDS ACT
UNITED STATES V STATE OF LOUISIANA, TEXAS, MISSISSIPPI, ALABAMA, AND FLORIDA (INTERPRETATION OF SUBMERGED LANDS ACT).
W69-06200 06E

SUBSTRATE-LIMITED GROWTH
THE GROWTH RATE OF MICROORGANISMS AS A FUNCTION OF SUBSTRATE CONCENTRATION,
W69-06281 05C

SUBSURFACE DRAINAGE
MC KEON V BRAMMER (SUBSURFACE DRAINAGE AND THE NATURAL FLOW DOCTRINE).
W69-06126 06E

CITY OF MERIDAN V SULLIVAN (SUBSURFACE DRAINAGE).
W69-06322 04A

SULFATES
OXYGEN ISOTOPIC COMPOSITION OF SULFATE IONS IN WATER FROM THERMAL SPRINGS,
W69-06044 02K

SULFUR BACTERIA
BACTERIAL CORROSION OF CONCRETE IN WATER,
W69-06029 08F

SUNKEN VESSELS
IN RE EASTERN TRANSPORTATION CO (ABANDONMENT OF VESSELS IN NAVIGABLE WATERS).
W69-06391 06E

SUPPLEMENTAL IRRIGATION
USE OF WATER FOR SUPPLEMENTAL IRRIGATION IN DELAWARE,
W69-06036 03F

SURFACE DRAINAGE
MILOTTA V PFEIFER (NATURAL FLOW AND RIGHTS TO SURFACE DRAINAGE).
W69-06121 06E

CHAMBERLIN V CIAFFONI (NATURAL FLOW AND SURFACE DRAINAGE IN

CITIES).
W69-06125 06E

STACY V WALKER (PROTECTION AGAINST SURFACE WATER DRAINAGE).
W69-06128 06E

UNITED STATES V SHAPIRO, INC. (LIABILITY FOR DIVERSION OF SURFACE DRAINAGE BY GRADING).
W69-06129 06E

DENT V ALEXANDER (ACCELERATED FLOW OF SURFACE DRAINAGE).
W69-06130 06E

SAELENS V POLLENTIER (SUIT TO ENJOIN DEFENDANT'S INTERFERENCE WITH THE FLOW OF SURFACE WATERS).
W69-06149 06E

FIFE V CHESAPEAKE AND OHIO RR (NON-LIABILITY FOR ACTS OF GOD).
W69-06153 06E

PETER WENDEL AND SONS V CITY OF NEWARK (DAMAGE FROM ARTIFICIAL DRAINAGE SYSTEM).
W69-06176 06E

MAYOR OF AMERICUS V BRIGHTWELL (SURFACE DRAINAGE AND ALTERATION OF FLOW).
W69-06177 06E

HOLDEN V MOSER (SURFACE DRAINAGE EASEMENTS).
W69-06182 06E

HARGADINE V SHARKEY (DIVERSION OF WATER FROM ITS NATURAL COURSES).
W69-06193 06E

BELUE V CITY OF GREENVILLE (DUTY OF CITY TO PROVIDE DRAINAGE OF THOROUGHFARES).
W69-06323 04A

STIGALL V SHARKEY COUNTY (DESTRUCTION OF DRAINAGE FACILITIES CAUSING FLOOD DAMAGE).
W69-06360 04A

DIXON V CITY OF NASHVILLE (DAMAGES CAUSED BY DEFLECTION OF SURFACE WATER FLOW).
W69-06373 04A

SURFACE INVESTIGATIONS
OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION, PART III LEGAL AND REGULATORY CONSIDERATIONS.
W69-06415 06B

SURFACE OWNER
H W PEERSON DRILLING CO V SCOGGINS (DEED EXCEPTIONS AND RIGHTS TO SUBTERRANEAN WATERS).
W69-06312 06E

SURFACE RUNOFF
PALMER V MASSENGILL (OBSTRUCTION TO FLOW OF ARTIFICIAL WATERCOURSE).
W69-06147 06E

CASANOVER V VILLANOVA REALTY CO (DIKE REMOVAL AND RUNOFF).
W69-06163 06E

CITY OF JACKSON V ROBERTSON (INJUNCTION AGAINST DISCHARGING DRAINAGE UPON LOWER PROPERTY).
W69-06179 06E

RATCLIFFE V INDIAN HILL ACRES (RIGHTS TO DISPOSE OF SURFACE RUNOFF WATERS).
W69-06199 06E

THE LAW OF WATER IN NEW JERSEY,
W69-06304 06E

HOWLETT V CITY OF SOUTH NORFOLK (FLOOD DAMAGE ALLEGEDLY DUE TO STREET ELEVATION).
W69-06308 04C

GRANGER V ELM TREE VILLAGE (DISCHARGE OF EXCESS SURFACE WATER).
W69-06370 04A

DE PIETRO V TRIANO (ESTABLISHMENT OF EASEMENT FOR SURFACE WATER DRAINAGE).
W69-06371 04A

EFNER V KETTERINGHAM (VALIDITY OF EASEMENT TO DRAIN RAIN WATER ONTO ADJOINING LAND).
W69-06372 04A

SURFACE WATER
POLICH V HERMANN (ABNORMAL DISCHARGE OF SURFACE WATER).
W69-06127 06E

REGULATION OF USE OF WATER RESOURCES.
W69-06138 06E

UNITED STATES V SHAPIRO (RIGHT TO REPEL SURFACE WATER).
W69-06198 06E

MCCAUSLAND V JARRELL (OBSTRUCTION OF THE FLOW OF A NATURAL STREAM).
W69-06367 04A

SURFACE WATERS
DENT V ALEXANDER (ACCELERATED FLOW OF SURFACE DRAINAGE).
W69-06130 06E

KEYTON V MISSOURI-KANSAS-TEXAS RR (ACTION FOR DAMAGES CAUSED BY OBSTRUCTING NATURAL FLOW OF SURFACE WATER).
W69-06162 06E

TAYLOR V HARRISON CONSTR CO (ARTIFICIAL INCREASE OF SURFACE WATERS).
W69-06167 06E

WATER IN BROWARD COUNTY, FLORIDA,
W69-06217 02E

SURFACE WATER HYDROLOGY (GENERAL OUTLINE),
W69-06222 02E

ESTIMATION OF SURFACE-WATER RESOURCES,
W69-06229 02E

WATER RESOURCES INVENTORY OF CONNECTICUT-PART 3, LOWER THAMES AND SOUTHEASTERN COASTAL RIVER BASINS,
W69-06250 02F

THE LAW OF WATER IN NEW JERSEY,
W69-06301 06E

W69-06302 06E

W69-06304 06E

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION), PART III FRESH WATER RESOURCES.
W69-06416 06B

SURFACES WATERS
WATER RESOURCES IN THE GOOSE CREEK-ROCK CREEK BASINS, IDAHO, NEVADA AND UTAH,
W69-06206 02F

SURFACE-GROUNDWATER RELATIONSHIPS
LOSS RATES ON SELECTED CATCHMENTS IN VICTORIA,
W69-06085 02D

SYSTEMS ANALYSIS
ECONOMIC EVALUATION OF WATER-PART IV AN INPUT-OUTPUT AND LINEAR PROGRAMMING ANALYSIS OF CALIFORNIA WATER REQUIREMENTS,
W69-06220 06B

AN ENGINEERING-ECONOMIC ANALYSIS OF SYSTEMS UTILIZING AQUIFER STORAGE FOR THE IRRIGATION OF PARKS AND GOLFCOURSES WITH RECLAIMED WASTEWATER,
W69-06289 03C

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT,
W69-06290 06B

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER III THE APPROPRIATE ALTERNATIVES,
W69-06292 06B

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER XII CASE STUDY II SANTA MARIA PROJECT,
W69-06300 06B

TASTE
MINERAL TASTE IN DOMESTIC WATER,
W69-06215 05E

TAXES
AMERICAN BARGE LINE V KOONTZ (TAXATION OF INTERSTATE AND INTRASTATE COMMERCE OVER NAVIGABLE WATERS).
W69-06178 06E

TECHNICAL MANUALS
SOIL PHYSICS,
W69-06224 02G

QUALITY CHARACTERISTICS OF WATER RESOURCES,
W69-06225 05G

MATHEMATICAL STATISTICS AS A METHOD FOR HYDROLOGICAL INVESTIGATIONS,
W69-06226 06A

THE HYDROLOGIC CYCLE AND THE WATER BALANCE IN NATURE,
W69-06227 02A

HYDROLOGICAL FORECASTING,
W69-06228 02A

ESTIMATION OF SURFACE-WATER RESOURCES,
W69-06229 02E

ESTIMATION OF GROUNDWATER RESOURCES,
W69-06230 02F

SEDIMENT TRANSPORTATION IN ALLUVIAL STREAMS,
W69-06232 02J

MAN'S INFLUENCE ON HYDROLOGICAL PHENOMENA,
W69-06233 04C

HYDROLOGY OF LAND DRAINAGE,
W69-06234 04A

TEMPERATURE
LIMNOLOGICAL INVESTIGATIONS OF TEXAS IMPOUNDMENTS FOR WATER QUALITY MANAGEMENT PURPOSES - THE DISTRIBUTION OF COLIFORM BACTERIA IN STRATIFIED IMPOUNDMENT,

W69-06005 05D

TEMPORARY DAMAGES
PHILLIPS V CHESSON (DIVERSION CAUSED BY EXCAVATED SLOPE).
W69-06309 04A

TENNESSEE
FLOOD PLAIN INFORMATION, CUMBERLAND RIVER, ROARING RIVER, AND DOE CREEK, GAINESBORO, TENNESSEE.
W69-06243 04A

FLOOD PLAIN INFORMATION, SOUTH FORK OF FORKED DEER RIVER AND SUGAR CREEK, HENDERSON, TENNESSEE.
W69-06246 04A

RUSSELL V BROWN (TITLE TO LAND AFTER 'ACCRETIONS' AND 'AVULSION').
W69-06319 06E

DIXON V CITY OF NASHVILLE (DAMAGES CAUSED BY DEFLECTION OF SURFACE WATER FLOW).
W69-06373 04A

TENNESSEE VALLEY AUTHORITY PROJECT
ATCHLEY V TENNESSEE VALLEY AUTHORITY (FLOODING OF CROPS CAUSED BY RAISED RESERVOIR WATERS).
W69-06321 04A

TEST PROCEDURES
EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS, ANALYSIS WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER VI WHAT CAN BE DONE A RECAPITULATION,
W69-06295 06B

TEXAS
GROUND-WATER RESOURCES OF MATAGORDA COUNTY, TEXAS,
W69-06025 02F

FLOOD PLAIN INFORMATION, DICKINSON BAYOU, DICKINSON, TEXAS.
W69-06065 04A

EFFECTS OF SMALL STRUCTURES ON WATER YIELD IN TEXAS,
W69-06218 03B

FLOOD PLAIN INFORMATION, GUADALUPE RIVER, SPRING CREEK AND LONE TREE CREEK, VICTORIA, TEXAS.
W69-06239 04A

FLOOD PLAIN INFORMATION, SABINE RIVER AND ADAMS BAYOU, ORANGE, TEXAS AREA.
W69-06240 04A

TEXTBOOKS
SURFACE WATER HYDROLOGY (GENERAL OUTLINE),
W69-06222 02E

QUALITY CHARACTERISTICS OF WATER RESOURCES,
W69-06225 05G

MATHEMATICAL STATISTICS AS A METHOD FOR HYDROLOGICAL INVESTIGATIONS,
W69-06226 06A

THE HYDROLOGIC CYCLE AND THE WATER BALANCE IN NATURE,
W69-06227 02A

HYDROLOGICAL FORECASTING,
W69-06228 02A

ESTIMATION OF SURFACE-WATER RESOURCES,
W69-06229 02E

SEDIMENT TRANSPORTATION IN ALLUVIAL STREAMS,
W69-06232 02J

MAN'S INFLUENCE ON HYDROLOGICAL PHENOMENA,
W69-06233 04C

HYDROLOGY OF LAND DRAINAGE,
W69-06234 04A

THERMAL POLLUTION
HEATED EFFLUENTS AND EFFECTS ON AQUATIC LIFE WITH EMPHASIS ON FISHES,
W69-06022 05C

BIBLIOGRAPHY ON THERMAL POLLUTION,
W69-06081 05C

THERMAL SPRINGS
OXIGEN ISOTOPIC COMPOSITION OF SULFATE IONS IN WATER FROM THERMAL SPRINGS,
W69-06044 02K

THERMAL STRATIFICATION
DENSITY FLOW REGIME OF FRANKLIN D. ROOSEVELT LAKE,
W69-06076 02H

EUPAULA RESERVOIR AERATION RESEARCH-1968,
W69-06255 05G

THERMODYNAMICS
NON-EQUILIBRIUM THERMODYNAMICS OF THE SOIL-WATER SYSTEM,
W69-06016 02G

THORIUM
THORIUM AND URANIUM CONCENTRATIONS AND ISOTOPE RATIOS IN RIVER SEDIMENTS,
W69-06045 02J

TILE DRAINAGE
CITY OF IRVINE V SMITH (FLOODING CAUSED BY BREAK IN SEWER).
W69-06365 04A

TIME
EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER V TIME STREAMS AND CRITERIA,
W69-06294 06B

TIMING
HYDRAULIC OPERATING CHARACTERISTICS OF LOW GRADIENT BORDER IRRIGATION SYSTEMS,
W69-06035 03F

TORRENS PROCEEDINGS
SWAN ISLAND CLUB, INC V WHITE (TITLE TO SUBMERGED LANDS UNDER NAVIGABLE WATERS).
W69-06390 06E

TRACE ELEMENTS
COBALT AS AN ESSENTIAL ELEMENT FOR BLUE-GREEN ALGAE,
W69-06277 05A

TRACERS
ISOTOPE HYDROLOGY OF THE ARTESIAN AQUIFERS OF THE STYRIAN BASIN, AUSTRIA,
W69-06249 02K

TRANSPORTATION
AMERICAN BARGE LINE V KOONTZ (TAXATION OF INTERSTATE AND INTRASTATE COMMERCE OVER NAVIGABLE WATERS).
W69-06178 06E

TREATIES
OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION), PART III AN INTERNATIONAL LEGAL-POLITICAL FRAMEWORK FOR EXPLORING AND EXPLOITING THE MINERAL RESOURCES UNDERLYING THE HIGH SEAS.
W69-06417 06B

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION), PART III AN INTERNATIONAL AUTHORITY TO REGISTER NATIONAL CLAIMS BEYOND THE REDEFINED CONTINENTAL SHELF.
W69-06418 06B

TRESPASS
GENERAL GEOPHYSICAL CO V BROWN (DESTRUCTION OF WATER-WELL BY GEOPHISIC EXPLOSIONS).
W69-06173 06E

TRITIUM
TRITIUM CONTENT IN THE FIRN LAYERS OF AN ALPINE GLACIER,
W69-06262 02C

TUNNELS
CHESAPEAKE BAY BRIDGE AND TUNNEL DIST V LAURITZEN (ACTION FOR DAMAGES TO SHIP CAUSED BY STRIKING SUBMERGED TOWER).
W69-06185 06E

UNDERGROUND STORAGE
THE CHICAGO AREA DEEP TUNNEL PROJECT-A USE OF THE UNDERGROUND STORAGE RESOURCE,
W69-06021 05G

UNDERGROUND STORAGE OF FLUIDS,
W69-06055 02F

UNDERGROUND STREAMS
GRISWOLD V TOWN SCHOOL DISTRICT (DAMAGE TO SPRING).
W69-06155 06E

UNDERWATER
JEFFERSON V DAVIS (OWNERSHIP OF SUBMERGED POND LAND).
W69-06151 06E

UNIT HYDROGRAPHS
THE IUH (INSTANTANEOUS UNIT HYDROGRAPH) OF THE MUSKINGUM CHANNEL REACH,
W69-06020 02E

UNITED NATIONS
A NEGATIVE VIEW OF A PROPOSAL FOR UNITED NATIONS OWNERSHIP OF OCEAN MINERAL RESOURCES,
W69-06106 06E

UNITED STATES
CARR V UNITED STATES (DAMAGES TO OYSTER BED DUE TO DRAGGING OPERATIONS).
W69-06192 06E

PEERLESS SERUM CO V UNITED STATES (LIABILITY FOR FLOOD DAMAGES).
W69-06195 06E

ATCHLEY V TENNESSEE VALLEY AUTHORITY (FLOODING OF CROPS CAUSED BY RAISED RESERVOIR WATERS).
W69-06321 04A

CRITES V UNITED STATES (CLAIMS FOR LOSS IN VALUE OF LAND DUE TO IRRIGATION PROJECT).
W69-06325 03F

FEDERAL POWER COMMISSION V NIAGARA MOHAWK POWER CORPORATION (STATUS OF STATE WATER RIGHTS UNDER FEDERAL WATER POWER ACT OF 1920).
W69-06378 06E

NIAGARA MOHAWK POWER CORP V FEDERAL POWER COMM'N (USUFRUCTUARY RENTAL AS AN OPERATING EXPENSE).
W69-06379 06E

SWAN ISLAND CLUB, INC V WHITE (TITLE TO SUBMERGED LANDS UNDER NAVIGABLE WATERS).
W69-06390 06E

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION).
W69-06411 06B

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION, PART III NATURAL GAS.
W69-06413 06B

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION), PART III OTHER MARINE MINERALS.
W69-06414 06B

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION, PART III LEGAL AND REGULATORY CONSIDERATIONS.
W69-06415 06B

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION), PART III AN INTERNATIONAL LEGAL-POLITICAL FRAMEWORK FOR EXPLORING AND EXPLOITING THE MINERAL RESOURCES UNDERLYING THE HIGH SEAS.
W69-06417 06B

UNITED STATES NAVY
THE ROLE OF THE UNITED STATES NAVY IN THE FORMULATION OF FEDERAL POLICY REGARDING THE SEA,
W69-06107 06E

UNSATURATED FLOW
SOIL-WATER PROPERTIES COMPUTED FROM TRANSIENT FLOW DATA,
W69-06072 02G

UPPER LANDOWNER
MASONITE CORP V WINDHAM (PONDING AND POLLUTION ON UPPER LAND).
W69-06120 05G

UPPER LANDOWNERS
CHAMBERLIN V CIAFFONI (NATURAL FLOW AND SURFACE DRAINAGE IN CITIES).
W69-06125 06E

TAYLOR V HARRISON CONSTR CO (ARTIFICIAL INCREASE OF SURFACE WATERS).
W69-06167 06E

URANIUM
THORIUM AND URANIUM CONCENTRATIONS AND ISOTOPE RATIOS IN RIVER SEDIMENTS,
W69-06045 02J

URANIUM RADIOISOTOPES
THORIUM AND URANIUM CONCENTRATIONS AND ISOTOPE RATIOS IN RIVER SEDIMENTS,
W69-06045 02J

USSR
RAINSTORMS AND HAIL,
W69-06214 02B

USUFRUCTUARY RIGHT
NIAGARA MOHAWK POWER CORP V FEDERAL POWER COMM'N (USUFRUCTUARY RENTAL AS AN OPERATING EXPENSE).
W69-06379 06E

NIAGARA MOHAWK POWER CORP V FEDERAL POWER COMM'N (USUFRUCTUARY RIGHTS AND THE FEDERAL WATER POWER ACT OF 1920).
W69-06405 06C

USUFRUCTUARY RIGHTS
FEDERAL POWER COMMISSION V NIAGARA MOHAWK POWER CORPORATION (STATUS OF STATE WATER RIGHTS UNDER FEDERAL WATER POWER ACT OF 1920).
W69-06378 06E

UTAH
SUMMARY OF MAXIMUM DISCHARGES IN UTAH STREAMS,
W69-06209 02E

SELECTED HYDROLOGIC DATA, SOUTHERN UTAH AND GOSHEN VALLEYS, UTAH,
W69-06211 02F

UTILITIES
MUNICIPALITIES PUBLIC WORKS, DEVELOPMENT.
W69-06140 06E

VALUE ENGINEERING
EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER X VALUATION OF BENEFITS,
W69-06298 06B

VERMONT
PROUTY V CITIZENS UTILITIES CO. (SALE OF PROPERTY ALONG NAVIGABLE RIVER).
W69-06136 06E

GRISWOLD V TOWN SCHOOL DISTRICT (DAMAGE TO SPRING).
W69-06155 06E

VESSELS
IN RE EASTERN TRANSPORTATION CO (ABANDONMENT OF VESSELS IN NAVIGABLE WATERS).
W69-06391 06E

VICTORIA LAND(ANTARCTICA)
SALTS AND ASSOCIATED PHENOMENA OF THE TERMINI OF THE HOBBS AND TAYLOR GLACIERS, VICTORIA LAND, ANTARCTICA,
W69-06266 02C

VIRGINIA
NUMERICAL EXPERIMENTS WITH THE STANFORD WATERSHED MODEL ON SMALL AGRICULTURAL WATERSHEDS IN VIRGINIA,
W69-06032 02E

WATER RESOURCES RESEARCH IN VIRGINIA,
W69-06039 02E

IMPROVED REALTY CORP V SOWERS (ADVERSE POSSESSION OF POND).
W69-06165 06E

CHESAPEAKE BAY BRIDGE AND TUNNEL DIST V LAURITZEN (ACTION FOR DAMAGES TO SHIP CAUSED BY STRIKING SUBMERGED TOWER).
W69-06185 06E

SOUTHERN RR V JEFFERSON (FLOODING ABOVE RAILROAD FILL).
W69-06186 06E

HOWLETT V CITY OF SOUTH NORFOLK (FLOOD DAMAGE ALLEGEDLY DUE TO STREET ELEVATION).
W69-06308 04C

HAUGHTON V LANKFORD (CONSTITUTIONALITY OF CONSERVATION REGULATION).
W69-06329 06E

VITAMIN B-12
RAIN AS A SOURCE OF VITAMIN (B-12),
W69-06273 05B

THE BIOSYNTHESIS OF VITAMINS OF THE (B-12) GROUP IN MIXED CULTURES OF BACTERIA,
W69-06274 05B

VITAMINS
RAIN AS A SOURCE OF VITAMIN (B-12),
W69-06273 05B

THE BIOSYNTHESIS OF VITAMINS OF THE (B-12) GROUP IN MIXED CULTURES OF BACTERIA,
W69-06274 05B

VON BERTALANFFY
GROWTH EQUATIONS WITH METABOLIC PARAMETERS,
W69-06280 05C

WASHINGTON
DENSITY FLOW REGIME OF FRANKLIN D. ROOSEVELT LAKE,
W69-06076 02H

GROUND-WATER RESOURCES AND RELATED GEOLOGY OF NORTH-CENTRAL SPOKANE AND SOUTHEASTERN STEVENS COUNTIES, WASHINGTON,
W69-06213 02F

FLOOD PLAIN INFORMATION, SKOOKUMCHUCK RIVER, BUCODA, WASHINGTON.
W69-06244 04A

WASTE DISPOSAL
SOUTHLAND CO V AARON (ACTION FOR POLLUTION OF DOWNSTREAM WATER SUPPLY).
W69-06345 05G

WASTEWATER
NITROGEN REMOVAL FROM NATURAL WATERS,
W69-06012 05D

WASTEWATER TREATMENT
LIMNOLOGICAL INVESTIGATIONS OF TEXAS IMPOUNDMENTS FOR WATER QUALITY MANAGEMENT PURPOSES - THE DISTRIBUTION OF COLIFORM BACTERIA IN STRATIFIED IMPOUNDMENT,
W69-06005 05D

WATER
HEREDA V LOWER BURRELL TP (UNNATURAL WATER AND SEWAGE DISCHARGE).
W69-06123 06E

WATER ALLOCATION(POLICY)
PASSAIC VALLEY WATER COMM'N V DEPARTMENT OF CONSERVATION (STATUTORY INTERPRETATION OF EXCESS DIVERSION ASSESSMENT FORMULA).
W69-06190 06E

WATER BALANCE
THE HYDROLOGIC CYCLE AND THE WATER BALANCE IN NATURE,
W69-06227 02A

WATER CHEMISTRY
LIMNOLOGICAL ORGANIC ANALYSES BY QUANTITATIVE DICHROMATE OXIDATION,
W69-06093 05A

MINERAL TASTE IN DOMESTIC WATER,
W69-06215 05E

RECOVERY OF ORGANICS FROM A EUTROPHIC LAKE BY THE CARBON ADSORPTION TECHNIQUE,
W69-06282 05A

WATER CIRCULATION
DENSITY FLOW REGIME OF FRANKLIN D. ROOSEVELT LAKE,
W69-06076 02H

SOLUTION OF ESTUARY PROBLEMS AND NETWORK PROGRAMS,
W69-06077 02L

WATER CONSERVATION

AN ACT RELATING TO LAKES, PERMITTING THE CREATION OF LAKE CONSERVATION DISTRICT WITH CERTAIN POWERS.
W69-06334 06E

STATE FORESTS TREE PLANNING.
W69-06338 03F

WATER CONTRACTS
KEELER V TUBBS (LIMITATIONS UNDER WATER CONTRACTS).
W69-06134 06E

WATER DEMAND
METROPOLITAN PROBLEMS THE DELAWARE RIVER BASIN COMMISSION,
W69-06099 06B

WATER DISTRIBUTION(APPLIED)
BENEFITS FROM INTEGRATED WATER MANAGEMENT IN URBAN AREAS - THE CASE OF THE NEW YORK METROPOLITAN REGION,
W69-06201 06B

WATER LAW
GEORGIA WATER LAW,
W69-06009 06E

THE LAW OF WATER IN NEW JERSEY,
W69-06301 06E

IMPROVEMENT AND MODERNIZATION OF N. Y. WATER LAW WITHIN THE FRAMEWORK OF THE RIPARIAN SYSTEM,
W69-06341 06E

WATER LEVEL EFFECTS
RECREATIONAL VALUE OF WATER AT ELEPHANT BUTTE AND NAVAJO RESERVOIRS,
W69-06010 06B

WATER LEVEL FLUCTUATIONS
SMEDBERG V MOXIE DAM CO. (DAMAGE CAUSED BY LOWERING POND LEVEL).
W69-06131 06E

WATER LEVELS
ANNUAL REPORT ON GROUND WATER IN ARIZONA, SPRING 1967 TO SPRING 1968.
W69-06026 02F

RECORDS OF OBSERVATION WELLS AND WATER-LEVEL FLUCTUATIONS IN THE ABERDEEN-SPRINGFIELD AREA, BINGHAM AND POWER COUNTIES, IDAHO, IN 1967,
W69-06040 02F

GROUNDWATER LEVELS AND PUMPAGE IN THE PEORIA-PEKIN AREA ILLINOIS, 1890-1966,
W69-06208 02F

GROUND-WATER LEVELS IN NEW MEXICO, 1967,
W69-06212 02F

WATER LOSS
EFFECTS OF SMALL STRUCTURES ON WATER YIELD IN TEXAS,
W69-06218 03B

WATER MANAGEMENT(APPLIED)
THE ROLE OF GROUNDWATER IN THE DEVELOPMENT OF WATER RESOURCES,
W69-06054 04B

EUROPEAN PRACTICE IN WATER QUALITY CONTROL,
W69-06078 05G

THE HYDROLOGY OF THE LEXINGTON AND FAYETTE-COUNTY AREA, KENTUCKY,
W69-06084 02F

GROBERT V PASSAIC VALLEY WATER COMM'N (RIGHT TO DIVERT RIVER WATER - AMOUNT).
W69-06191 06E

BENEFITS FROM INTEGRATED WATER MANAGEMENT IN URBAN AREAS - THE CASE OF THE NEW YORK METROPOLITAN REGION,
W69-06201 06B

RESERVOIRS PROBLEMS AND CONFLICTS,
W69-06207 06B

HYDROLOGICAL ASPECTS OF WATER MANAGEMENT,
W69-06221 06B

SURFACE WATER HYDROLOGY (GENERAL OUTLINE),
W69-06222 02E

MATHEMATICAL STATISTICS AS A METHOD FOR HYDROLOGICAL INVESTIGATIONS,
W69-06226 06A

HYDROLOGICAL FORECASTING,
W69-06228 02A

ESTIMATION OF SURFACE-WATER RESOURCES,
W69-06229 02E

HYDROLOGY OF WATER STORAGE,
W69-06231 02E

MAN'S INFLUENCE ON HYDROLOGICAL PHENOMENA,
W69-06233 04C

WATER POLICY
EUROPEAN PRACTICE IN WATER QUALITY CONTROL,
W69-06078 05G

AN EXPLORATION OF COMPONENTS AFFECTING AND LIMITING POLICY MAKING OPTIONS IN LOCAL WATER AGENCIES,
W69-06306 06B

CREATION OF DEPARTMENT OF WATER RESOURCES AND WATER RESOURCES COMM'N.
W69-06333 06E

WATER POLLUTION
MADDOX V INTERNATIONAL PAPER COMPANY (DAMAGES RESULTING FROM BAYOU POLLUTION).
W69-06112 05G

PUNXSUTAWNEY WATER SERVICE CO V SARICKS (CONTAMINATION FROM STRIP MINING).
W69-06113 05G

B AND B OIL CO V TOWNSEND (OIL WASTE POLLUTION).
W69-06115 05G

SMITH V MAGNET COVE BARIUM CORP (BARIUM TAILING POLLUTION).
W69-06116 05G

MASONITE CORP V WINDHAM (PONDING AND POLLUTION ON UPPER LAND).
W69-06120 05G

LONG-TERM TREND ANALYSES OF WATER QUALITY-A MODEL STUDY OF THE PASSAIC RIVER BASIN,
W69-06235 05B

H W PEERSON DRILLING CO V SCOGGINS (DEED EXCEPTIONS AND RIGHTS TO SUBTERRANEAN WATERS).
W69-06312 06E

STATE V TOWN OF GOFFSTOWN (SUIT TO FORCE COMPLIANCE WITH ORDER TO ABATE RIVER POLLUTION).
W69-06330 05G

OHIO RIVER VALLEY WATER SANITATION COMPACT.
W69-06344 05G

SOUTHLAND CO V AARON (ACTION FOR POLLUTION OF DOWNSTREAM WATER SUPPLY).
W69-06345 05G

PROTECTION AND IMPROVEMENT OF WATERS.
W69-06351 05G

ORGANIZATION AND GENERAL PROVISIONS.
W69-06352 05G

POLLUTION CONTROL.
W69-06353 05G

VEAZEY V CITY OF DURHAM (PERMANENT DAMAGES RESULTING FROM MUNICIPAL SEWAGE DISCHARGE).
W69-06356 05C

ATTORNEY GENERAL V CITY OF WOBURN (POLLUTION OF RIVER BY CITY).
W69-06406 05G

ANTHONY V HUNTLEY ESTATES (DAMAGES FOR POLLUTION OF STREAM).
W69-06410 05G

WATER POLLUTION CONTROL
THE CHICAGO AREA DEEP TUNNEL PROJECT-A USE OF THE UNDERGROUND STORAGE RESOURCE,
W69-06021 05G

WATER QUALITY CONTROL - THE ROLE OF THE INTERSTATE AGENCY,
W69-06094 05G

FITTING A STATE PROGRAM TO FEDERAL OBJECTIVES,
W69-06096 05G

WASTES, WATER, AND WISHFUL THINKING THE BATTLE OF LAKE ERIE,
W69-06305 05G

MUNICIPAL WATER POLLUTION CONTROL.
W69-06316 05G

AN ACT ESTABLISHING AN INTERIM COMM'N TO STUDY THE PROBLEM OF WATER POLLUTION AND APPROPRIATING MONEY THEREFORE.
W69-06335 05G

POLLUTION OF FRESH WATERS.
W69-06349 05G

POLLUTION OF POTABLE WATERS.
W69-06350 05G

PROTECTION AND IMPROVEMENT OF WATERS.
W69-06351 05G

ORGANIZATION AND GENERAL PROVISIONS.
W69-06352 05G

POLLUTION CONTROL.
W69-06353 05G

ENFORCEMENT.
W69-06354 05G

POLLUTION OF WATERS BY RAILROADS AND FACTORIES.
W69-06404 05G

POLLUTION OF WATERS.
W69-06407 05G

DYER V SIMS (ENFORCEMENT OF INTERSTATE POLLUTION CONTROL COMPACTS).
W69-06408 05G

WATER POLLUTION EFFECTS
HEATED EFFLUENTS AND EFFECTS ON AQUATIC LIFE WITH EMPHASIS ON FISHES,
W69-06022 05C

PRIMARY PRODUCTION, ENERGETICS, AND NUTRIENT UTILIZATION IN A WARM-WATER STREAM,
W69-06092 05C

WATER POLLUTION SOURCES
PHILLIPS V SUN OIL CO (GASOLINE POLLUTION OF WATER WELL).
W69-06117 05G

QUALITY CHARACTERISTICS OF WATER RESOURCES,
W69-06225 05G

OIL POLLUTION - A REPORT TO THE PRESIDENT.
W69-06237 05B

STATE V TOWN OF GOFFSTOWN (SUIT TO FORCE COMPLIANCE WITH ORDER TO ABATE RIVER POLLUTION).
W69-06330 05G

POLLUTION CONTROL.
W69-06353 05G

WATER POLLUTION TREATMENT
OIL POLLUTION - A REPORT TO THE PRESIDENT.
W69-06237 05B

WATER POWER
STATE FORESTS TREE PLANNING.
W69-06338 03F

WATER QUALITY
LIMNOLOGICAL INVESTIGATIONS OF TEXAS IMPOUNDMENTS FOR WATER QUALITY MANAGEMENT PURPOSES - LIMNOLOGICAL AND WATER QUALITY DATA FOR THE HIGHLAND LAKES, 1968,
W69-06003 05B

CHEMICAL AND PHYSICAL CHARACTER OF MUNICIPAL WATER SUPPLIES IN MARYLAND,
W69-06031 05F

MINERAL TASTE IN DOMESTIC WATER,
W69-06215 05E

QUALITY CHARACTERISTICS OF WATER RESOURCES,
W69-06225 05G

LONG-TERM TREND ANALYSES OF WATER QUALITY-A MODEL STUDY OF THE PASSAIC RIVER BASIN,
W69-06235 05B

QUALITY OF SURFACE WATERS FOR IRRIGATION, WESTERN STATES-1961,
W69-06253 03F

QUALITY OF SURFACE WATERS FOR IRRIGATION, WESTERN STATES-1960,
W69-06254 03F

RECOVERY OF ORGANICS FROM A EUTROPHIC LAKE BY THE CARBON ADSORPTION TECHNIQUE,
W69-06282 05A

MUNICIPAL WATER POLLUTION CONTROL.
W69-06316 05G

WATER QUALITY ACT
WATER QUALITY STANDARDS THE FEDERAL PERSPECTIVE - PROGRESS TOWARD OBJECTIVES,
W69-06095 05G

FITTING A STATE PROGRAM TO FEDERAL OBJECTIVES,
W69-06096 05G

WATER QUALITY CONTROL
EUROPEAN PRACTICE IN WATER QUALITY CONTROL,
W69-06078 05G

WATER REQUIREMENTS
ESTIMATION OF SURFACE-WATER RESOURCES,
W69-06229 02E

WATER RESOURCES
THE MOON'S RESOURCES,
W69-06015 02E

GROUND-WATER RESOURCES OF MATAGORDA COUNTY, TEXAS,
W69-06025 02F

WATER RESOURCES RESEARCH IN VIRGINIA,
W69-06039 02E

WATER RESOURCE RECORDS OF THE ECONFINA CREEK BASIN AREA, FLORIDA,
W69-06051 02E

GROUND-WATER RESOURCES OF GREENVILLE COUNTY, SOUTH CAROLINA,
W69-06052 02F

MOUNTAIN AND DESERT LAKES IN SOUTHERN KAZAKHSTAN, THEIR RESOURCES AND METHODS OF ECONOMIC DEVELOPMENT,
W69-06073 02H

THE HYDROLOGY OF THE LEXINGTON AND FAYETTE-COUNTY AREA, KENTUCKY,
W69-06084 02F

WATER RESOURCES IN THE GOOSE CREEK-ROCK CREEK BASINS, IDAHO, NEVADA AND UTAH,
W69-06206 02F

GROUND-WATER RESOURCES AND RELATED GEOLOGY OF NORTH-CENTRAL SPOKANE AND SOUTHEASTERN STEVENS COUNTIES, WASHINGTON,
W69-06213 02F

WATER IN BROWARD COUNTY, FLORIDA,
W69-06217 02E

ESTIMATION OF SURFACE-WATER RESOURCES,
W69-06229 02E

ESTIMATION OF GROUNDWATER RESOURCES,
W69-06230 02F

WATER RESOURCES INVENTORY OF CONNECTICUT-PART 3, LOWER THAMES AND SOUTHEASTERN COASTAL RIVER BASINS,
W69-06250 02F

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION), PART IV GOVERNMENT-INDUSTRY RELATIONSHIPS IN SUPPORT OF RESEARCH DEVELOPMENT.
W69-06419 06B

WATER RESOURCES DEVELOPMENT
GOALS AND PERSPECTIVES IN WATER RESOURCES PLANNING,
W69-06046 06B

WATER RESOURCES PLANNING STRATEGY,
W69-06047 06B

WATER RESOURCES PLANNING,
W69-06049 06B

HYDROLOGICAL ASPECTS OF WATER MANAGEMENT,
W69-06221 06B

SURFACE WATER HYDROLOGY (GENERAL OUTLINE),
W69-06222 02E

STATE WATER SUPPLY DEVELOPMENT.
W69-06317 03D

CREATION OF DEPARTMENT OF WATER RESOURCES AND WATER RESOURCES COMM'N.
W69-06333 06E

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION), PART IV GOVERNMENT-INDUSTRY RELATIONSHIPS IN SUPPORT OF RESEARCH DEVELOPMENT.
W69-06419 06B

WATER RESOURCES RESEARCH
WATER RESOURCES RESEARCH IN VIRGINIA,
W69-06039 02E

WATER RESOURCES RESEARCH ACT
WATER RESOURCES RESEARCH IN VIRGINIA,
W69-06039 02E

WATER REUSE
AN ENGINEERING-ECONOMIC ANALYSIS OF SYSTEMS UTILIZING AQUIFER STORAGE FOR THE IRRIGATION OF PARKS AND GOLFCOURSES WITH RECLAIMED WASTEWATER,
W69-06289 03C

WATER RIGHTS
GEORGIA WATER LAW,
W69-06009 06E

KLOOCK V ROSNACK (VALIDITY OF WATER USE EASEMENT).
W69-06183 06E

WATER SOURCES
HYDROGEOLOGIC DATA RELATED TO ESTABLISHMENT OF A PUMPING STATION IN THE EVERGLADES NATIONAL PARK, FLORIDA,
W69-06033 02F

OXYGEN ISOTOPIC COMPOSITION OF SULFATE IONS IN WATER FROM THERMAL SPRINGS,
W69-06044 02K

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION), PART III FRESH WATER RESOURCES.
W69-06416 06B

WATER SUPPLY
PRELIMINARY REPORT ON THE IRRIGATION POTENTIAL OF DUNN COUNTY, WISCONSIN,
W69-06070 02G

WATER AND CHOICE IN THE COLORADO BASIN AN EXAMPLE OF ALTERNATIVES IN WATER MANAGEMENT, CH. 3, PROBLEMS OF WATER SUPPLY IN THE BASIN.
W69-06088 06B

METROPOLITAN PROBLEMS THE DELAWARE RIVER BASIN COMMISSION,
W69-06099 06B

PUNXSUTAWNEY WATER SERVICE CO V SARICKS (CONTAMINATION FROM STRIP MINING).
W69-06113 05G

REVENUE PRODUCING MUNICIPAL FACILITIES ACT.
W69-06141 06E

STATE WATER SUPPLY DEVELOPMENT.
W69-06317 03D

LEGAL ASPECTS OF NEW JERSEY POTABLE WATER PROGRAM,
W69-06331 05G

STATE V BOSTIAN (EMINENT DOMAIN AND MUNICIPAL WATER SUPPLY).
W69-06358 06E

WATER TABLE
SURFACE DRAINAGE CHARACTERISTICS IN VOLUSIA COUNTY, FLORIDA,
W69-06216 02E

WATER TASTE(MINERAL)
MINERAL TASTE IN DOMESTIC WATER,
W69-06215 05E

WATER UTILIZATION
WATER AND CHOICE IN THE COLORADO BASIN AN EXAMPLE OF ALTERNATIVES IN WATER MANAGEMENT, CH. 4, THE RANGE OF OBJECTIVES IN PLANNING FOR THE USE OF COLORADO WATER.
W69-06089 06B

GROBERT V PASSAIC VALLEY WATER COMM'N (RIGHT TO DIVERT RIVER WATER - AMOUNT).
W69-06191 06E

WATER VALUE
RECREATIONAL VALUE OF WATER AT ELEPHANT BUTTE AND NAVAJO RESERVOIRS,
W69-06010 06B

WATER VALUES
ECONOMIC EVALUATION OF WATER-PART IV AN INPUT-OUTPUT AND LINEAR PROGRAMMING ANALYSIS OF CALIFORNIA WATER REQUIREMENTS,
W69-06220 06B

WATER WELLS
TEST WELL EXPLORATION IN THE MYAKKA RIVER BASIN AREA, FLORIDA,
W69-06053 02F

HYDROGEOLOGY AT SHELBYVILLE, ILLINOIS - A BASIS FOR WATER RESOURCES PLANNING,
W69-06075 02F

PHILLIPS V SUN OIL CO (GASOLINE POLLUTION OF WATER WELL).
W69-06117 05G

GENERAL GEOPHYSICAL CO V BROWN (DESTRUCTION OF WATER-WELL BY GEOPHYSIC EXPLOSIONS).
W69-06173 06E

H W PEERSON DRILLING CO V SCOGGINS (DEED EXCEPTIONS AND RIGHTS TO SUBTERRANEAN WATERS).
W69-06312 06E

WATER WORKS
WATERWORKS, MAIN SEWERS, SEWAGE DISPOSAL PLANTS.
W69-06336 05G

SEWAGE DISPOSAL WATER AND SEWAGE.
W69-06337 05G

WATER YIELD
GROUND-WATER RESOURCES AND RELATED GEOLOGY OF NORTH-CENTRAL SPOKANE AND SOUTHEASTERN STEVENS COUNTIES, WASHINGTON,
W69-06213 02F

HYDROLOGY OF WATER STORAGE,
W69-06231 02E

WATER YIELD IMPROVEMENT
THE STATUS OF PILOT WATERSHED STUDIES IN ARIZONA,
W69-06091 03B

WATERCOURSES(LEGAL)
DRAINAGE AND WATERCOURSES.
W69-06142 06E

WATERSHED MANAGEMENT
POWERS AND FUNCTIONS OF DEPARTMENT OF WATER RESOURCES - FLOOD CONTROL.
W69-06332 04A

WATERSHEDS(BASINS)
THE STATUS OF PILOT WATERSHED STUDIES IN ARIZONA,
W69-06091 03B

WATER-LEVEL FLUCTUATIONS
RECORDS OF OBSERVATION WELLS AND WATER-LEVEL FLUCTUATIONS IN THE ABERDEEN-SPRINGFIELD AREA, BINGHAM AND POWER COUNTIES, IDAHO, IN 1967,
W69-06040 02F

WATER-WELLS
TENNESSEE COAL, IRON AND RR V RAY (MINING OPERATION CAUSES DESTRUCTION OF WATER SUPPLY).
W69-06172 06E

WEATHER FORECASTING
PROBABILITY FORECASTS OF 30-DAY PRECIPITATION,
W69-06205 02B

WELLS
PHOENIX V GRAHAM (SALT WATER POLLUTION OF WELLS).
W69-06118 05G

KEELER V TUBBS (LIMITATIONS UNDER WATER CONTRACTS).
W69-06134 06E

WEST VIRGINIA
AMERICAN BARGE LINE V KOONTZ (TAXATION OF INTERSTATE AND INTRASTATE COMMERCE OVER NAVIGABLE WATERS).
W69-06178 06E

MCCAUSLAND V JARRELL (OBSTRUCTION OF THE FLOW OF A NATURAL STREAM).
W69-06367 04A

DYER V SIMS (ENFORCEMENT OF INTERSTATE POLLUTION CONTROL COMPACTS).
W69-06408 05G

WESTERN U S
QUALITY OF SURFACE WATERS FOR IRRIGATION, WESTERN STATES-1961,
W69-06253 03F

QUALITY OF SURFACE WATERS FOR IRRIGATION, WESTERN STATES-1960,
W69-06254 03F

WETLANDS
THE WETLANDS COMMITTEE REPORTS, WETLANDS CLASSIFICATION, INVENTORY AND MANAGEMENT.
W69-06122 06E

WETTABILITY
FACTORS RESTRICTING INFILTRATION RATES ON DECOMPOSED GRANITIC SOILS,
W69-06041 02G

INFILTROMETER STUDIES ON NON-WETTABLE SOILS ON EAST SIERRA NEVADA,
W69-06042 02G

WHITE BASS
AGE AND GROWTH OF WHITE BASS IN ONEIDA LAKE, NEW YORK,
W69-06275 05C

WILDLIFE MANAGEMENT
HATCHERIES, SCREENS AND GAME MANAGEMENT AREAS.
W69-06145 06E

WILKES DOME
THE LONGITUDINAL VELOCITY PROFILE OF LARGE ICE MASSES,
W69-06257 02C

WINTER STORMS
CLIMATOLOGY OF SEVERE WINTER STORMS IN ILLINOIS,
W69-06210 02C

WISCONSIN
FLOOD PLAIN INFORMATION, ROCK RIVER AT JANESVILLE, WISCONSIN.
W69-06061 04A

FLOOD PLAIN INFORMATION, TURTLE CREEK, ROCK COUNTY, WISCONSIN.
W69-06067 04A

PRELIMINARY REPORT ON THE IRRIGATION POTENTIAL OF DUNN COUNTY, WISCONSIN,
W69-06074 02G

HERMANSEN V CITY OF LAKE GENEVA (RIPARIAN RIGHT TO REQUIRE REMOVAL OF PIERS).
W69-06148 06E

BRIGGSON V CITY OF VIROQUA (SEWAGE DISCHARGE ACROSS LAND).
W69-06355 05C

LE CLAIR V SWIFT (ENFORCEMENT OF CONSERVATION STATUTES).
W69-06377 06E

STATE V SENSENBRENNER (RIPARIAN RIGHTS REGARDING NATURAL DAMS).
W69-06401 04A

WRECK ACT
IN RE EASTERN TRANSPORTATION CO (ABANDONMENT OF VESSELS IN NAVIGABLE WATERS).
W69-06391 06E

ZONING
PONELEIT V DUDAS (ZONING REGULATIONS AS AFFECTING RIPARIAN RIGHTS).
W69-06320 06E

AUTHOR INDEX

ADAMS, WILLIAM M.
COASTAL EVIDENCES OF GROUND WATER CONDITIONS IN THE VICINITY OF ANAEHOOMALU AND LALAMILO, SOUTH KOHALA, HAWAII,
W69-06006 03B

AGEE, JAMES
WATER QUALITY STANDARDS THE FEDERAL PERSPECTIVE - PROGRESS TOWARD OBJECTIVES,
W69-06095 05G

ALBERT, C. D.
KANSAS RIVER, BONNER SPRINGS TO MOUTH, DEGRADATION OF CHANNEL,
W69-06256 02J

ALLEE, DAVID J.
GOALS AND PERSPECTIVES IN WATER RESOURCES PLANNING,
W69-06046 06B

AMBACH, W.
INVESTIGATIONS ON FISSION PRODUCTS IN THE ACCUMULATION AREA OF AN ALPINE GLACIER (KESSELWANDFERNER, OETZTAL ALPS),
W69-06261 02C

TRITIUM CONTENT IN THE FIRN LAYERS OF AN ALPINE GLACIER,
W69-06262 02C

ANDERSON, DAVID A.
FREEZING IN FOREST SOIL AS INFLUENCED BY SOIL PROPERTIES, LITTER, AND SNOW,
W69-06028 02C

ANDERSON, J. U.
A PORTABLE RAINFALL SIMULATOR AND RUNOFF SAMPLER,
W69-06011 07B

ANDERSON, PETER W.
LONG-TERM TREND ANALYSES OF WATER QUALITY-A MODEL STUDY OF THE PASSAIC RIVER BASIN,
W69-06235 05B

APPEL, CHARLES A.
HYDROGEOLOGIC DATA RELATED TO ESTABLISHMENT OF A PUMPING STATION IN THE EVERGLADES NATIONAL PARK, FLORIDA,
W69-06033 02F

ARAMAYO, D. L.
THE EFFECT OF LOOSE BLOCKS ON THE RATE OF SEDIMENT TRANSPORT,
W69-06083 02J

ASHDOWN, DONALD
ALTERNATE METHODS OF MOSQUITO CONTROL TO REDUCE CHEMICAL POLLUTION OF WATERS FOR RECHARGE OF THE OGALLALA FORMATION,
W69-06001 05G

ASKEW, J.
GENERAL METHOD FOR DETERMINATION OF ORGANOPHOSPHORUS RESIDUES IN RIVER WATERS AND EFFLUENTS,
W69-06023 05A

BALL, ROBERT C.
PRIMARY PRODUCTION, ENERGETICS, AND NUTRIENT UTILIZATION IN A WARM-WATER STREAM,
W69-06092 05C

BALOGH, J.
MAN'S INFLUENCE ON HYDROLOGICAL PHENOMENA,
W69-06233 04C

BARNES, P.
PLASTIC FLOW AND PRESSURE MELTING IN THE DEFORMATION OF ICE I,
W69-06270 01A

BARTFAI-SZABO, L.
QUALITY CHARACTERISTICS OF WATER RESOURCES,
W69-06225 05G

BAUER, W. J.
THE CHICAGO AREA DEEP TUNNEL PROJECT-A USE OF THE UNDERGROUND STORAGE RESOURCE,
W69-06021 05G

BECKER, STANLEY L.
RECOVERY OF ORGANICS FROM A EUTROPHIC LAKE BY THE CARBON ADSORPTION TECHNIQUE,
W69-06282 05A

BELMAN, MURRAY J.
THE ROLE OF THE STATE DEPARTMENT IN FORMULATING FEDERAL POLICY REGARDING MARINE RESOURCES,
W69-06108 06E

BENSON, M. A.
MEASUREMENT OF PEAK DISCHARGE BY INDIRECT METHODS,
W69-06251 02E

BLACK, ROBERT F.
SALTS AND ASSOCIATED PHENOMENA OF THE TERMINI OF THE HOBBS AND TAYLOR GLACIERS, VICTORIA LAND, ANTARCTICA,
W69-06266 02C

BOEGLY, W. J., JR.
THE FEASIBILITY OF DEEP-WELL INJECTION OF WASTE BRINE FROM INLAND DESALTING PLANTS,
W69-06286 05E

BOGARDI, J. L.
MATHEMATICAL STATISTICS AS A METHOD FOR HYDROLOGICAL INVESTIGATIONS,
W69-06226 06A

SEDIMENT TRANSPORTATION IN ALLUVIAL STREAMS,
W69-06232 02J

BOLT, G. H.
NON-EQUILIBRIUM THERMODYNAMICS OF THE SOIL-WATER SYSTEM,
W69-06016 02G

BOWSER, CARL J.
SALTS AND ASSOCIATED PHENOMENA OF THE TERMINI OF THE HOBBS AND TAYLOR GLACIERS, VICTORIA LAND, ANTARCTICA,
W69-06266 02C

BREZONIK, PATRICK L.
SOURCES OF ELEMENTAL NITROGEN IN FERMENTATION GASES,
W69-06285 05C

BROWN, HARRY E.
THE STATUS OF PILOT WATERSHED STUDIES IN ARIZONA,
W69-06091 03B

BRUVOLD, WILLIAM H.
MINERAL TASTE IN DOMESTIC WATER,
W69-06215 05E

BRYANT, H. C.
PRECISION MEASUREMENTS OF WATER DROPLET EVAPORATION RATES,
W69-06236 02D

BUDD, W.
THE LONGITUDINAL VELOCITY PROFILE OF LARGE ICE MASSES,
W69-06257 02C

BURD, ROBERT
WATER QUALITY STANDARDS THE FEDERAL PERSPECTIVE - PROGRESS TOWARD OBJECTIVES,
W69-06095 05G

BURFORD, J. B.
NUMERICAL EXPERIMENTS WITH THE STANFORD WATERSHED MODEL ON SMALL AGRICULTURAL WATERSHEDS IN VIRGINIA,
W69-06032 02E

BURKE, WILLIAM T.
A NEGATIVE VIEW OF A PROPOSAL FOR UNITED NATIONS OWNERSHIP OF OCEAN MINERAL RESOURCES,
W69-06106 06E

BUSCH, F. E.
GROUND-WATER LEVELS IN NEW MEXICO, 1967,
W69-06212 02F

BYBEE, H. H.
SOLUTION OF ESTUARY PROBLEMS AND NETWORK PROGRAMS,
W69-06077 02L

BYERS, GORDON L.
WATER RESOURCES PLANNING,
W69-06049 06B

CAMPBELL, JOHN F.
COASTAL EVIDENCES OF GROUND WATER CONDITIONS IN THE VICINITY OF ANAEHOOMALU AND LALAMILO, SOUTH KOHALA, HAWAII,
W69-06006 03B

CAREY, GEORGE W.
BENEFITS FROM INTEGRATED WATER MANAGEMENT IN URBAN AREAS - THE CASE OF THE NEW YORK METROPOLITAN REGION,
W69-06201 06B

CARTWRIGHT, KEROS
HYDROGEOLOGY AT SHELBYVILLE, ILLINOIS - A BASIS FOR WATER RESOURCES PLANNING,
W69-06075 02F

CARVER, ROBERT E.
THE PIEZOMETRIC SURFACE OF THE COASTAL PLAIN AQUIFER IN GEORGIA, ESTIMATES OF ORIGINAL ELEVATION AND LONG-TERM DECLINE,
W69-06043 02F

CASTLE, EMERY N.
RESERVOIRS PROBLEMS AND CONFLICTS,
W69-06207 06B

CERVIONE, MICHAEL A., JR.
WATER RESOURCES INVENTORY OF CONNECTICUT-PART 3, LOWER THAMES AND SOUTHEASTERN COASTAL RIVER BASINS,
W69-06250 02F

CHANGNON, STANLEY A., JR.
CLIMATOLOGY OF SEVERE WINTER STORMS IN ILLINOIS,
W69-06210 02C

CHRISTY, FRANCIS T., JR.
ALTERNATIVE REGIMES FOR MARINE RESOURCES UNDERLYING THE SEA,
W69-06105 06E

CLESCERI, NICHOLAS L.
HYDROLYSIS OF CONDENSED PHOSPHATES--I NON-STERILE ENVIRONMENT,
W69-06271 02K

HYDROLYSIS OF CONDENSED PHOSPHATES--II STERILE ENVIRONMENT,
W69-06284 02K

CLINE, DENZEL R.
GROUND-WATER RESOURCES AND RELATED GEOLOGY OF NORTH-CENTRAL SPOKANE AND SOUTHEASTERN STEVENS COUNTIES, WASHINGTON,
W69-06213 02F

COATS, KEITH H.
UNDERGROUND STORAGE OF FLUIDS,
W69-06055 02F

COLLINS, IAN
RIFTS AT THE FOOT OF BEARDMORE GLACIER, ANTARCTICA,
W69-06260 02C

COPPEDGE, ROBERT O.
RECREATIONAL VALUE OF WATER AT ELEPHANT BUTTE AND NAVAJO RESERVOIRS,
W69-06010 06B

CORDOVA, R. M.
SELECTED HYDROLOGIC DATA, SOUTHERN UTAH AND GOSHEN VALLEYS, UTAH,
W69-06211 02F

CORY, JOHN T.
FACTORS RESTRICTING INFILTRATION RATES ON DECOMPOSED GRANITIC SOILS,
W69-06041 02G

COX, DOAK C.
COASTAL EVIDENCES OF GROUND WATER CONDITIONS IN THE VICINITY OF ANAEHOOMALU AND LALAMILO, SOUTH KOHALA, HAWAII,
W69-06006 03B

CROSBY, N. T.
AN EVALUATION OF SOME METHODS FOR THE DETERMINATION OF FLUORIDE IN POTABLE WATERS AND OTHER AQUEOUS SOLUTIONS,
W69-06037 05F

CROSSWHITE, WILLIAM M.
USE OF WATER FOR SUPPLEMENTAL IRRIGATION IN DELAWARE,
W69-06036 03F

CROSTHWAITE, E. G.
WATER RESOURCES IN THE GOOSE CREEK-ROCK CREEK BASINS, IDAHO, NEVADA AND UTAH,
W69-06206 02F

CSERMAK, B.
HYDROLOGY OF WATER STORAGE,
W69-06231 02E

DALTON, F. E.
THE CHICAGO AREA DEEP TUNNEL PROJECT-A USE OF THE UNDERGROUND STORAGE RESOURCE,
W69-06021 05G

DAVIS, ERNST M.
LIMNOLOGICAL INVESTIGATIONS OF TEXAS IMPOUNDMENTS FOR WATER QUALITY MANAGEMENT PURPOSES - LIMNOLOGICAL AND WATER QUALITY DATA FOR THE HIGHLAND LAKES, 1968,
W69-06003 05B

LIMNOLOGICAL INVESTIGATIONS OF TEXAS IMPOUNDMENTS FOR WATER QUALITY MANAGEMENT PURPOSES - THE USE OF ALGAL CULTURES TO ASSESS THE EFFECTS OF NUTRIENT ENRICHMENT ON THE HIGHLAND LAKES OF THE COLORADO RIVER, TEXAS,
W69-06004 05C

LIMNOLOGICAL INVESTIGATIONS OF TEXAS IMPOUNDMENTS FOR WATER QUALITY MANAGEMENT PURPOSES - THE DISTRIBUTION OF COLIFORM BACTERIA IN STRATIFIED IMPOUNDMENT,
W69-06005 05D

DAVIS, G. H.
ISOTOPE HYDROLOGY OF THE ARTESIAN AQUIFERS OF THE STYRIAN BASIN, AUSTRIA,
W69-06249 02K

DENNIS, A. L.
AN EVALUATION OF SOME METHODS FOR THE DETERMINATION OF FLUORIDE IN POTABLE WATERS AND OTHER AQUEOUS SOLUTIONS,
W69-06037 05F

DOBO, M.
ESTIMATION OF SURFACE-WATER RESOURCES,
W69-06229 02E

DREGNE, H. E.
PREDICTION OF CROP YIELDS FROM QUANTITY AND SALINITY OF IRRIGATION WATER,
W69-06007 03C

IRRIGATION WATER QUALITY AND THE LEACHING REQUIREMENT,
W69-06008 03F

DWORSKY, LEONARD B.
GOALS AND PERSPECTIVES IN WATER RESOURCES PLANNING,
W69-06046 06B

EATON, E. D.
WATER RESOURCES PLANNING STRATEGY,
W69-06047 06B

EICHELBERGER, CLARK M.
A CASE FOR THE ADMINISTRATION OF MARINE RESOURCES UNDERLYING THE HIGH SEAS BY THE UNITED NATIONS,
W69-06103 06E

EISNER, H.
INVESTIGATIONS ON FISSION PRODUCTS IN THE ACCUMULATION AREA OF AN ALPINE GLACIER (KESSELWANDFERNER, OETZTAL ALPS),
W69-06261 02C

TRITIUM CONTENT IN THE FIRN LAYERS OF AN ALPINE GLACIER,
W69-06262 02C

ELLER, JAMES M.
OXYGEN PRODUCTION AND LOSS IN A MODEL RIVER,
W69-06002 05B

ELLISON, B. E., JR.
FLOODS OF THE 1965 WATER YEAR IN MISSISSIPPI,
W69-06219 02E

ELY, NORTHCUT
A CASE FOR THE ADMINISTRATION OF MINERAL RESOURCES UNDERLYING THE HIGH SEAS BY NATIONAL INTERESTS,
W69-06104 06E

EMERSON, D. W.
THE LOCATION OF DEEP AQUIFERS BY RESISTIVITY SOUNDINGS,
W69-06027 02F

ERDELYI, M.
ESTIMATION OF GROUNDWATER RESOURCES,
W69-06230 02F

EVANS, C. G. T.
THE GROWTH RATE OF MICROORGANISMS AS A FUNCTION OF SUBSTRATE CONCENTRATION,
W69-06281 05C

EVANS, NORMAN A.
HYDRAULIC OPERATING CHARACTERISTICS OF LOW GRADIENT BORDER IRRIGATION SYSTEMS,
W69-06035 03F

FAHLEN, T. S.
PRECISION MEASUREMENTS OF WATER DROPLET EVAPORATION RATES,
W69-06236 02D

FARNHAM, WILLIAM H.
IMPROVEMENT AND MODERNIZATION OF N. Y. WATER LAW WITHIN THE FRAMEWORK OF THE RIPARIAN SYSTEM,
W69-06341 06E

FAUST, SAMUEL D.
LONG-TERM TREND ANALYSES OF WATER QUALITY-A MODEL STUDY OF THE PASSAIC RIVER BASIN,
W69-06235 05B

FELFOLDY, L.
QUALITY CHARACTERISTICS OF WATER RESOURCES,
W69-06225 05G

FJERDINGSTAD, EINER
BACTERIAL CORROSION OF CONCRETE IN WATER,
W69-06029 08F

FLOYD, BERT A.
LIMNOLOGICAL INVESTIGATIONS OF TEXAS IMPOUNDMENTS FOR WATER QUALITY MANAGEMENT PURPOSES - THE USE OF ALGAL CULTURES TO ASSESS THE EFFECTS OF NUTRIENT ENRICHMENT ON THE HIGHLAND LAKES OF THE COLORADO RIVER, TEXAS,
W69-06004 05C

FORNEY, JOHN L.
AGE AND GROWTH OF WHITE BASS IN ONEIDA LAKE, NEW YORK,
W69-06275 05C

FOSS, PHILLIP O.
AN EXPLORATION OF COMPONENTS AFFECTING AND LIMITING POLICY MAKING OPTIONS IN LOCAL WATER AGENCIES,
W69-06306 06B

FOSTER, J. B.
WATER RESOURCE RECORDS OF THE ECONFINA CREEK BASIN AREA, FLORIDA,
W69-06051 02E

FRUH, E. GUS
LIMNOLOGICAL INVESTIGATIONS OF TEXAS IMPOUNDMENTS FOR WATER QUALITY MANAGEMENT PURPOSES - LIMNOLOGICAL AND WATER QUALITY DATA FOR THE HIGHLAND LAKES, 1968,
W69-06003 05B

LIMNOLOGICAL INVESTIGATIONS OF TEXAS IMPOUNDMENTS FOR WATER QUALITY MANAGEMENT PURPOSES - THE USE OF ALGAL CULTURES TO ASSESS THE EFFECTS OF NUTRIENT ENRICHMENT ON THE HIGHLAND LAKES OF THE COLORADO RIVER, TEXAS,
W69-06004 05C

LIMNOLOGICAL INVESTIGATIONS OF TEXAS IMPOUNDMENTS FOR WATER QUALITY MANAGEMENT PURPOSES - THE DISTRIBUTION OF COLIFORM BACTERIA IN STRATIFIED IMPOUNDMENT,
W69-06005 05D

FURNESS, L. W.
KANSAS RIVER, BONNER SPRINGS TO MOUTH, DEGRADATION OF CHANNEL,
W69-06256 02J

GALFI, J.
ESTIMATION OF GROUNDWATER RESOURCES,
W69-06230 02F

GANIARIS, N.

SECONDARY REFRIGERANT FREEZING DESALTING PROCESS OPERATION OF A 15,000 GPD PILOT PLANT,
W69-06288 03A

GARDINER, DEIRDRE K.
DETERMINATION OF FREE HYDROGEN CYANIDE IN RIVER WATER BY A SOLVENT-EXTRACTION METHOD,
W69-06024 05A

GARRISON, CHARLES
AN EXPLORATION OF COMPONENTS AFFECTING AND LIMITING POLICY MAKING OPTIONS IN LOCAL WATER AGENCIES,
W69-06306 06B

GEBBER, H. BRUCE
BIBLIOGRAPHY ON THERMAL POLLUTION,
W69-06081 05C

GERLOFF, GERALD C.
COBALT AS AN ESSENTIAL ELEMENT FOR BLUE-GREEN ALGAE,
W69-06277 05A

GILLEY, JAMES R.
HYDRAULIC OPERATING CHARACTERISTICS OF LOW GRADIENT BORDER IRRIGATION SYSTEMS,
W69-06035 03F

GLASSER, R.
SECONDARY REFRIGERANT FREEZING DESALTING PROCESS OPERATION OF A 15,000 GPD PILOT PLANT,
W69-06288 03A

GLENNE, G.
LONGITUDINAL ESTUARINE DIFFUSION IN SAN FRANCISCO BAY, CALIFORNIA,
W69-06030 05A

GLOYNA, E. F.
OXYGEN PRODUCTION AND LOSS IN A MODEL RIVER,
W69-06002 05B

GRAVEL, ALAN C.
LIMNOLOGICAL INVESTIGATIONS OF TEXAS IMPOUNDMENTS FOR WATER QUALITY MANAGEMENT PURPOSES - THE DISTRIBUTION OF COLIFORM BACTERIA IN STRATIFIED IMPOUNDMENT,
W69-06005 05D

GRAY, JAMES R.
RECREATIONAL VALUE OF WATER AT ELEPHANT BUTTE AND NAVAJO RESERVOIRS,
W69-06010 06B

GREENBERG, MICHAEL R.
BENEFITS FROM INTEGRATED WATER MANAGEMENT IN URBAN AREAS - THE CASE OF THE NEW YORK METROPOLITAN REGION,
W69-06201 06B

GREGORY, J. G. G.
DETERMINATION OF FREE HYDROGEN CYANIDE IN RIVER WATER BY A SOLVENT-EXTRACTION METHOD,
W69-06024 05A

GREGORY, P. C.
A PORTABLE RAINFALL SIMULATOR AND RUNOFF SAMPLER,
W69-06011 07B

GRIFFITHS, M. L.
RECORDS OF OBSERVATION WELLS AND WATER-LEVEL FLUCTUATIONS IN THE ABERDEEN-SPRINGFIELD AREA, BINGHAM AND POWER COUNTIES, IDAHO, IN 1967,
W69-06040 02F

GROENEVELT, P. H.
NON-EQUILIBRIUM THERMODYNAMICS OF THE SOIL-WATER SYSTEM,
W69-06016 02G

GROSSMAN, I. G.
WATER RESOURCES INVENTORY OF CONNECTICUT-PART 3, LOWER THAMES AND SOUTHEASTERN COASTAL RIVER BASINS,
W69-06250 02F

GRZENDA, ALFRED R.
PRIMARY PRODUCTION, ENERGETICS, AND NUTRIENT UTILIZATION IN A WARM-WATER STREAM,
W69-06092 05C

HAMMOND, WELDON W., JR.
GROUND-WATER RESOURCES OF MATAGORDA COUNTY, TEXAS,
W69-06025 02F

HANKS, EVA M.
THE LAW OF WATER IN NEW JERSEY,
W69-06301 06E

W69-06302 06E

W69-06303 06E

W69-06304 06E

HANSON, G. F.
PRELIMINARY REPORT ON THE IRRIGATION POTENTIAL OF DUNN COUNTY, WISCONSIN,
W69-06074 02G

HANYA, TAKASHISA
BEHAVIOR OF HUMIC ACID IN RECENT LAKE SEDIMENTS TOWARD SODIUM HYDROXYDE AQUEOUS SOLUTION AT THE EXTRACTION (IN JAPANESE),
W69-06278 02H

HARRIS, JOHN O.
ECOLOGICAL RELATIONSHIPS OF ORGANIC MATTER AND BACTERIA IN TUTTLE CREEK RESERVOIR,
W69-06014 02H

HARRIS, R. F.
TOWARDS STANDARDIZATION OF SOIL EXTRACTS FOR MICROBIAL MEDIA,
W69-06272 02K

HASLER, ARTHUR D.
MOVEMENT OF RADIOSODIUM IN A CHEMICALLY STRATIFIED LAKE,
W69-06283 02H

HEARN, WILFRED A.
THE ROLE OF THE UNITED STATES NAVY IN THE FORMULATION OF FEDERAL POLICY REGARDING THE SEA,
W69-06107 06E

HEERMANN, DALE F.
HYDRAULIC OPERATING CHARACTERISTICS OF LOW GRADIENT BORDER IRRIGATION SYSTEMS,
W69-06035 03F

HEIDEL, SUMNER G.
CHEMICAL AND PHYSICAL CHARACTER OF MUNICIPAL WATER SUPPLIES IN MARYLAND,
W69-06031 05F

HENDERSON, DONALD C.
CONSUMPTIVE IRRIGATION REQUIREMENTS OF SELECTED IRRIGATED AREAS IN NEW MEXICO,
W69-06013 03F

HENDERSON, R. J.
THE LOCATION OF DEEP AQUIFERS BY RESISTIVITY SOUNDINGS,
W69-06027 02F

HILL, DUANE
AN EXPLORATION OF COMPONENTS AFFECTING AND LIMITING POLICY MAKING OPTIONS IN LOCAL WATER AGENCIES,
W69-06306 06B

HIRSCH, ALLAN
WATER QUALITY STANDARDS THE FEDERAL PERSPECTIVE - PROGRESS TOWARD OBJECTIVES,
W69-06095 05G

HOINKES, HERFRIED C.
GLACIER MASS BUDGET AND MESOSCALE WEATHER IN THE AUSTRIAN ALPS 1964 TO 1966,
W69-06267 02C

HOLE, FRANCIS D.
PRELIMINARY REPORT ON THE IRRIGATION POTENTIAL OF DUNN COUNTY, WISCONSIN,
W69-06074 02G

HOLM-HANSEN, OSMUND
COBALT AS AN ESSENTIAL ELEMENT FOR BLUE-GREEN ALGAE,
W69-06277 05A

HORDON, ROBERT M.
BENEFITS FROM INTEGRATED WATER MANAGEMENT IN URBAN AREAS - THE CASE OF THE NEW YORK METROPOLITAN REGION,
W69-06201 06B

HOWE, ORLANDO W.
HYDRAULIC OPERATING CHARACTERISTICS OF LOW GRADIENT BORDER IRRIGATION SYSTEMS,
W69-06035 03F

HOWORKA, F.
GLACIER MASS BUDGET AND MESOSCALE WEATHER IN THE AUSTRIAN ALPS 1964 TO 1966,
W69-06267 02C

HUDDLESTON, ELLIS W.
ALTERNATE METHODS OF MOSQUITO CONTROL TO REDUCE CHEMICAL POLLUTION OF WATERS FOR RECHARGE OF THE OGALLALA FORMATION,
W69-06001 05G

HUDSON, J. D.
GROUND-WATER LEVELS IN NEW MEXICO, 1967,
W69-06212 02F

HUSSAIN, SYED B.
INFILTROMETER STUDIES ON NON-WETTABLE SOILS ON EAST SIERRA NEVADA,
W69-06042 02G

JACOBS, D. J.
THE FEASIBILITY OF DEEP-WELL INJECTION OF WASTE BRINE FROM INLAND DESALTING PLANTS,
W69-06286 05E

JANICKI, JOZEF
THE BIOSYNTHESIS OF VITAMINS OF THE (B-12) GROUP IN MIXED CULTURES OF BACTERIA,
W69-06274 05B

JASKE, ROBERT T.
DENSITY FLOW REGIME OF FRANKLIN D. ROOSEVELT LAKE,
W69-06076 02H

JOYNER, B. F.
TEST WELL EXPLORATION IN THE MYAKKA RIVER BASIN AREA, FLORIDA,
W69-06053 02F

KAHANA, YONA

THE ROLE OF GROUNDWATER IN THE DEVELOPMENT OF WATER RESOURCES,
W69-06054 04B

KAROLY, A.
LOSS RATES ON SELECTED CATCHMENTS IN VICTORIA,
W69-06085 02D

KATES, ROBERT C.
GEORGIA WATER LAW,
W69-06009 06E

KATZ, DONALD L.
UNDERGROUND STORAGE OF FLUIDS,
W69-06055 02F

KEENEY, D. R.
TOWARDS STANDARDIZATION OF SOIL EXTRACTS FOR MICROBIAL MEDIA,
W69-06272 02K

KEVERN, NILES R.
PRIMARY PRODUCTION, ENERGETICS, AND NUTRIENT UTILIZATION IN A WARM-WATER STREAM,
W69-06092 05C

KEZDI, A.
SOIL PHYSICS,
W69-06224 02G

KICK, W.
EXPERIENCES IN COMPARING GEOMETRIC ELEMENTS OF GLACIER VARIATIONS,
W69-06264 02C

KIENITZ, G.
THE HYDROLOGIC CYCLE AND THE WATER BALANCE IN NATURE,
W69-06227 02A

ESTIMATION OF SURFACE-WATER RESOURCES,
W69-06229 02E

HYDROLOGY OF LAND DRAINAGE,
W69-06234 04A

KLASSEN, CLARENCE W.
FITTING A STATE PROGRAM TO FEDERAL OBJECTIVES,
W69-06096 05G

KLEIN, HOWARD
HYDROGEOLOGIC DATA RELATED TO ESTABLISHMENT OF A PUMPING STATION IN THE EVERGLADES NATIONAL PARK, FLORIDA,
W69-06033 02F

KNOCHENMUS, DARWIN D.
SURFACE DRAINAGE CHARACTERISTICS IN VOLUSIA COUNTY, FLORIDA,
W69-06216 02E

KNOX, JAMES C.
THE VALLEYS OF IOWA-1 VALLEY WIDTH AND STREAM DISCHARGE RELATIONSHIPS IN THE MAJOR STREAMS,
W69-06034 02E

KOCH, NEIL C.
GROUND-WATER RESOURCES OF GREENVILLE COUNTY, SOUTH CAROLINA,
W69-06052 02F

KOELZER, V. A.
THE CHICAGO AREA DEEP TUNNEL PROJECT-A USE OF THE UNDERGROUND STORAGE RESOURCE,
W69-06021 05G

KOVACS, GY
HYDROLOGICAL ASPECTS OF WATER MANAGEMENT,
W69-06221 06B

ESTIMATION OF SURFACE-WATER RESOURCES,
W69-06229 02E

KRAATZ, PAUL
HYDROGEOLOGY AT SHELBYVILLE, ILLINOIS - A BASIS FOR WATER RESOURCES PLANNING,
W69-06075 02F

KREMPELS, T.
HYDROLOGY OF WATER STORAGE,
W69-06231 02E

KRUTCHKOFF, RICHARD G.
STOCHASTIC MODEL FOR BOD AND DO IN STREAMS,
W69-06080 05B

PROBABILITY FORECASTS OF 30-DAY PRECIPITATION,
W69-06205 02B

KUNKE, GORDON W.
RECOVERY OF ORGANICS FROM A EUTROPHIC LAKE BY THE CARBON ADSORPTION TECHNIQUE,
W69-06282 05A

LAMBIRIS, J.
SECONDARY REFRIGERANT FREEZING DESALTING PROCESS OPERATION OF A 15,000 GPD PILOT PLANT,
W69-06288 03A

LAMKE, R. D.
STAGE-DISCHARGE RELATIONS ON BIG LOST RIVER WITHIN NATIONAL REACTOR TESTING STAION, IDAHO,
W69-06204 02E

LANDON, RONALD A.
GEOLOGIC STUDIES AS AN AID TO GROUND-WATER MANAGEMENT,
W69-06082 04B

LANGBEIN, W. B.
HYDROLOGICAL BENCH MARKS,
W69-06252 07A

LANGLEBEN, M. P.
THE HEAT BUDGET OF A MELTING COVER OF SEA ICE,
W69-06263 02C

LAO, CHESTER
COASTAL EVIDENCES OF GROUND WATER CONDITIONS IN THE VICINITY OF ANAEHOOMALU AND LALAMILO, SOUTH KOHALA, HAWAII,
W69-06006 03B

LEACH, LOWELL E.
EUFAULA RESERVOIR AERATION RESEARCH-1968,
W69-06255 05G

LEEDS, J. V.
SOLUTION OF ESTUARY PROBLEMS AND NETWORK PROGRAMS,
W69-06077 02L

LEE, G. FRED
HYDROLYSIS OF CONDENSED PHOSPHATES--I NON-STERILE ENVIRONMENT,
W69-06271 02K

RECOVERY OF ORGANICS FROM A EUTROPHIC LAKE BY THE CARBON ADSORPTION TECHNIQUE,
W69-06282 05A

HYDROLYSIS OF CONDENSED PHOSPHATES--II STERILE ENVIRONMENT,
W69-06284 02K

SOURCES OF ELEMENTAL NITROGEN IN FERMENTATION GASES,
W69-06285 05C

LEONARD, R. B.
KANSAS RIVER, BONNER SPRINGS TO MOUTH, DEGRADATION OF CHANNEL,
W69-06256 02J

LERMAN, ABRAHAM
DEAD SEA BRINES DEGREE OF HALITE SATURATION BY ELECTRODE MEASUREMENTS,
W69-06038 02K

LIKENS, GENE E.
MOVEMENT OF RADIOSODIUM IN A CHEMICALLY STRATIFIED LAKE,
W69-06283 02H

LIVERMORE, DONALD F.
HARVESTING UNDERWATER WEEDS,
W69-06276 05G

LOFTING, E. M.
ECONOMIC EVALUATION OF WATER-PART IV AN INPUT-OUTPUT AND LINEAR PROGRAMMING ANALYSIS OF CALIFORNIA WATER REQUIREMENTS,
W69-06220 06B

LOKEN, O. H.
MASS BALANCE OBSERVATIONS ON THE BARNES ICE CAP, BAFFIN ISLAND, CANADA,
W69-06269 02C

LOMENICK, T. F.
THE FEASIBILITY OF DEEP-WELL INJECTION OF WASTE BRINE FROM INLAND DESALTING PLANTS,
W69-06286 05E

LONGINELLI, A.
OXYGEN ISOTOPIC COMPOSITION OF SULFATE IONS IN WATER FROM THERMAL SPRINGS,
W69-06044 02K

LOVE, S. K.
QUALITY OF SURFACE WATERS FOR IRRIGATION, WESTERN STATES-1961,
W69-06253 03F

QUALITY OF SURFACE WATERS FOR IRRIGATION, WESTERN STATES-1960,
W69-06254 03F

LOWMAN, P. D., JR.
THE MOON'S RESOURCES,
W69-06015 02E

LYNN, WALTER R.
TECHNOLOGY AND PUBLIC DECISION MAKING,
W69-06048 06B

LYON, WALTER A.
EUROPEAN PRACTICE IN WATER QUALITY CONTROL,
W69-06078 05G

MACIOLEK, JOHN A.
LIMNOLOGICAL ORGANIC ANALYSES BY QUANTITATIVE DICHROMATE OXIDATION,
W69-06093 05A

MARINO, MIGUEL A.
GROUNDWATER LEVELS AND PUMPAGE IN THE PEORIA-PEKIN AREA ILLINOIS, 1890-1966,
W69-06208 02F

MARTIN, P. C. S.

GLACIAL EROSION,
W69-06258 02C

MASCH, FRANK D.
EFFECTS OF SMALL STRUCTURES ON WATER YIELD IN TEXAS,
W69-06218 03B

MATRAI, I.
MAN'S INFLUENCE ON HYDROLOGICAL PHENOMENA,
W69-06233 04C

MAYO, RONALD I.
FLOODS AT JACKSON, OHIO,
W69-06056 02E

MCCOY, H. J.
WATER IN BROWARD COUNTY, FLORIDA,
W69-06217 02E

MCGAUHEY, P. H.
ECONOMIC EVALUATION OF WATER-PART IV AN INPUT-OUTPUT AND LINEAR PROGRAMMING ANALYSIS OF CALIFORNIA WATER REQUIREMENTS,
W69-06220 06B

MCKEAN, ROLAND N.
EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT,
W69-06290 06B

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTERS I-II INTRODUCTION THE CRITERION PROBLEM,
W69-06291 06B

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER III THE APPROPRIATE ALTERNATIVES,
W69-06292 06B

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER IV INTANGIBLES, UNCERTAINTY, AND CRITERIA,
W69-06293 06B

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER V TIME STREAMS AND CRITERIA,
W69-06294 06B

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS, ANALYSIS WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER VI WHAT CAN BE DONE A RECAPITULATION,
W69-06295 06B

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER VIII KINDS OF BENEFITS AND COSTS SPILLOVER EFFECTS,
W69-06296 06B

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER IX KINDS OF BENEFITS OVERCOUNTING, AND SECONDARY BENEFITS.
W69-06297 06B

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER X VALUATION OF BENEFITS,
W69-06298 06B

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER XI CASE STUDY I THE GREEN RIVER WATERSHED,
W69-06299 06B

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER XIII CASE STUDY II SANTA MARIA PROJECT,
W69-06300 06B

MEAD, A. R.
ENVIRONMENTAL IMPACT OF BRINE EFFLUENTS ON GULF OF CALIFORNIA,
W69-06287 05C

MEEUWIG, R. O.
INFILTROMETER STUDIES ON NON-WETTABLE SOILS ON EAST SIERRA NEVADA,
W69-06042 02G

MELLOR, MALCOLM
THE GREENLAND MASS BALANCE FLUX DIVERGENCE CONSIDERATIONS,
W69-06268 02C

MENZEL, BRUCE W.
HEATED EFFLUENTS AND EFFECTS ON AQUATIC LIFE WITH EMPHASIS ON FISHES,
W69-06022 05C

MEYER, G. L.
ISOTOPE HYDROLOGY OF THE ARTESIAN AQUIFERS OF THE STYRIAN BASIN, AUSTRIA,
W69-06249 02K

MONTGOMERY, H. A. C.
DETERMINATION OF FREE HYDROGEN CYANIDE IN RIVER WATER BY A SOLVENT-EXTRACTION METHOD,
W69-06024 05A

MONTGOMERY, R. G.
NITROGEN REMOVAL FROM NATURAL WATERS,
W69-06012 05D

MORRIS, ROBERT J.
FACTORS RESTRICTING INFILTRATION RATES ON DECOMPOSED GRANITIC SOILS,
W69-06041 02G

MULL, D. S.
THE HYDROLOGY OF THE LEXINGTON AND FAYETTE-COUNTY AREA, KENTUCKY,
W69-06084 02F

MURAVLEV, G. G.
MOUNTAIN AND DESERT LAKES IN SOUTHERN KAZAKHSTAN, THEIR RESOURCES AND METHODS OF ECONOMIC DEVELOPMENT,
W69-06073 02H

MUSGROVE, R. H.
WATER RESOURCE RECORDS OF THE ECONFINA CREEK BASIN AREA, FLORIDA,
W69-06051 02E

NAGY, I. V.
MATHEMATICAL STATISTICS AS A METHOD FOR HYDROLOGICAL INVESTIGATIONS,
W69-06226 06A

HYDROLOGY OF WATER STORAGE,
W69-06231 02E

NYE, J. F.
GLACIAL EROSION,
W69-06258 02C

OBBINK, J. GROOT
CONSTRUCTION OF PIEZOMETERS, AND METHOD OF INSTALLATION FOR GROUND WATER OBSERVATIONS IN AQUIFERS,
W69-06019 07B

OLCOTT, PERRY G.
PRELIMINARY REPORT ON THE IRRIGATION POTENTIAL OF DUNN COUNTY, WISCONSIN,
W69-06074 02G

OLLOS, G.
ESTIMATION OF GROUNDWATER RESOURCES,
W69-06230 02F

ORCUTT, RICHARD G.
AN ENGINEERING-ECONOMIC ANALYSIS OF SYSTEMS UTILIZING AQUIFER STORAGE FOR THE IRRIGATION OF PARKS AND GOLFCOURSES WITH RECLAIMED WASTEWATER,
W69-06289 03C

OTSUKI, AKIRA
BEHAVIOR OF HUMIC ACID IN RECENT LAKE SEDIMENTS TOWARD SODIUM HYDROXYDE AQUEOUS SOLUTION AT THE EXTRACTION (IN JAPANESE),
W69-06278 02H

OWENS, JOHN C.
ALTERNATE METHODS OF MOSQUITO CONTROL TO REDUCE CHEMICAL POLLUTION OF WATERS FOR RECHARGE OF THE OGALLALA FORMATION,
W69-06001 05G

PARKER, BRUCE C.
RAIN AS A SOURCE OF VITAMIN (B-12),
W69-06273 05B

PEDZIWILK, FRANCISZCK
THE BIOSYNTHESIS OF VITAMINS OF THE (B-12) GROUP IN MIXED CULTURES OF BACTERIA,
W69-06274 05B

PETERSON, FRANK L.
COASTAL EVIDENCES OF GROUND WATER CONDITIONS IN THE VICINITY OF ANAEHOOMALU AND LALAMILO, SOUTH KOHALA, HAWAII,
W69-06006 03B

PHILPOT, JOHN W.
PROBABILITY FORECASTS OF 30-DAY PRECIPITATION,
W69-06205 02B

POTASH, MILTON
A BIOLOGICAL TEST FOR DETERMINING THE POTENTIAL PRODUCTIVITY OF WATER,
W69-06279 05A

POWELL, E. O.
THE GROWTH RATE OF MICROORGANISMS AS A FUNCTION OF SUBSTRATE CONCENTRATION,
W69-06281 05C

PRANTL, F. A.
INVESTIGATIONS ON FISSION PRODUCTS IN THE ACCUMULATION AREA OF AN ALPINE GLACIER (KESSELWANDFERNER, OETZTAL ALPS),
W69-06261 02C

RAKOCZI, L.
SURFACE WATER HYDROLOGY (GENERAL OUTLINE),
W69-06222 02E

ESTIMATION OF SURFACE-WATER RESOURCES,
W69-06229 02E

RANEY, EDWARD C.
HEATED EFFLUENTS AND EFFECTS ON AQUATIC LIFE WITH EMPHASIS ON FISHES,
W69-06022 05C

REITZE, ARNOLD W., JR.

WASTES, WATER, AND WISHFUL THINKING THE BATTLE OF LAKE ERIE,
W69-06305 05G

RICHARDS, S. J.
SOIL-WATER PROPERTIES COMPUTED FROM TRANSIENT FLOW DATA,
W69-06072 02G

ROTHLISBERGER, HANS
EROSIVE PROCESSES WHICH ARE LIKELY TO ACCENTUATE OR REDUCE THE BOTTOM RELIEF OF VALLEY GLACIERS,
W69-06259 02J

RO, PYUNG SYK
PRECISION MEASUREMENTS OF WATER DROPLET EVAPORATION RATES,
W69-06236 02D

ROZICKA, J. H.
GENERAL METHOD FOR DETERMINATION OF ORGANOPHOSPHORUS RESIDUES IN RIVER WATERS AND EFFLUENTS,
W69-06023 05A

SAGAR, R. B.
MASS BALANCE OBSERVATIONS ON THE BARNES ICE CAP, BAFFIN ISLAND, CANADA,
W69-06269 02C

SALISBURY, NEIL E.
THE VALLEYS OF IOWA-1 VALLEY WIDTH AND STREAM DISCHARGE RELATIONSHIPS IN THE MAJOR STREAMS,
W69-06034 02E

SAUER, STANLEY P.
EFFECTS OF SMALL STRUCTURES ON WATER YIELD IN TEXAS,
W69-06218 03B

SCHICHT, RICHARD J.
GROUNDWATER LEVELS AND PUMPAGE IN THE PEORIA-PEKIN AREA ILLINOIS, 1890-1966,
W69-06208 02F

SCHNEIDER, W.
GLACIER MASS BUDGET AND MESOSCALE WEATHER IN THE AUSTRIAN ALPS 1964 TO 1966,
W69-06267 02C

SCHRIEBER, J. B., JR.
ENVIRONMENTAL IMPACT OF BRINE EFFLUENTS ON GULF OF CALIFORNIA,
W69-06287 05C

SCOTT, MARTHA R.
THORIUM AND URANIUM CONCENTRATIONS AND ISOTOPE RATIOS IN RIVER SEDIMENTS,
W69-06045 02J

SEALAND, O. M.
THE FEASIBILITY OF DEEP-WELL INJECTION OF WASTE BRINE FROM INLAND DESALTING PLANTS,
W69-06286 05E

SELLECK, R. E.
LONGITUDINAL ESTUARINE DIFFUSION IN SAN FRANCISCO BAY, CALIFORNIA,
W69-06030 05A

SHANHOLTZ, V. O.
NUMERICAL EXPERIMENTS WITH THE STANFORD WATERSHED MODEL ON SMALL AGRICULTURAL WATERSHEDS IN VIRGINIA,
W69-06032 02E

SHATKAY, ADAM
DEAD SEA BRINES DEGREE OF HALITE SATURATION BY ELECTRODE MEASUREMENTS,
W69-06038 02K

SHERWOOD, C. B.
WATER IN BROWARD COUNTY, FLORIDA,
W69-06217 02E

SISCO, H. G.
RECORDS OF OBSERVATION WELLS AND WATER-LEVEL FLUCTUATIONS IN THE ABERDEEN-SPRINGFIELD AREA, BINGHAM AND POWER COUNTIES, IDAHO, IN 1967,
W69-06040 02F

SKAU, C. M.
INFILTROMETER STUDIES ON NON-WETTABLE SOILS ON EAST SIERRA NEVADA,
W69-06042 02G

SKODJE, MARVIN T.
USE OF GRAVITY SHAFTS FOR GROUND WATER RECHARGE,
W69-06202 04B

SKOOG, FOLKE
COBALT AS AN ESSENTIAL ELEMENT FOR BLUE-GREEN ALGAE,
W69-06277 05A

SMITH, ROBERT G.
METROPOLITAN PROBLEMS METROPOLITAN PUBLIC AUTHORITIES,
W69-06098 06B

SORENSEN, EARL F.
CONSUMPTIVE IRRIGATION REQUIREMENTS OF SELECTED IRRIGATED AREAS IN NEW MEXICO,
W69-06013 03F

SPEECE, R. E.
NITROGEN REMOVAL FROM NATURAL WATERS,
W69-06012 05D

STABOSOLSZKY, O.
HYDROLOGICAL FORECASTING,
W69-06228 02A

ESTIMATION OF SURFACE-WATER RESOURCES,
W69-06229 02E

STEPHENSON, RICHARD A.
THE VALLEYS OF IOWA-1 VALLEY WIDTH AND STREAM DISCHARGE RELATIONSHIPS IN THE MAJOR STREAMS,
W69-06034 02E

STEVENS, J. G.
AN EVALUATION OF SOME METHODS FOR THE DETERMINATION OF FLUORIDE IN POTABLE WATERS AND OTHER AQUEOUS SOLUTIONS,
W69-06037 05F

STEWART, A. E.
A PORTABLE RAINFALL SIMULATOR AND RUNOFF SAMPLER,
W69-06011 07B

STRANGE, R. E.
THE GROWTH RATE OF MICROORGANISMS AS A FUNCTION OF SUBSTRATE CONCENTRATION,
W69-06281 05C

SULAKVELIDZE, G. K.
RAINSTORMS AND HAIL,
W69-06214 02B

SUTCLIFFE, H., JR.
TEST WELL EXPLORATION IN THE MYAKKA RIVER BASIN AREA, FLORIDA,
W69-06053 02F

SWITHINBANK, CHARLES
RIFTS AT THE FOOT OF BEARDMORE GLACIER, ANTARCTICA,
W69-06260 02C

SYNDER, GEORGE R.
DENSITY FLOW REGIME OF FRANKLIN D. ROOSEVELT LAKE,
W69-06076 02H

SZEBELLEDY, L.
QUALITY CHARACTERISTICS OF WATER RESOURCES,
W69-06225 05G

SZESZTAY, K.
SURFACE WATER HYDROLOGY (GENERAL OUTLINE),
W69-06222 02E

THE HYDROLOGIC CYCLE AND THE WATER BALANCE IN NATURE,
W69-06227 02A

HYDROLOGICAL FORECASTING,
W69-06228 02A

HYDROLOGY OF WATER STORAGE,
W69-06231 02E

SZIGYARTO, Z.
MATHEMATICAL STATISTICS AS A METHOD FOR HYDROLOGICAL INVESTIGATIONS,
W69-06226 06A

TABOR, D.
PLASTIC FLOW AND PRESSURE MELTING IN THE DEFORMATION OF ICE I,
W69-06270 01A

TAYLOR, CHARLES B.
AGE AND GROWTH OF WHITE BASS IN ONEIDA LAKE, NEW YORK,
W69-06275 05C

TAYLOR, CLYDE C.
GROWTH EQUATIONS WITH METABOLIC PARAMETERS,
W69-06280 05C

TEMPEST, D. W.
THE GROWTH RATE OF MICROORGANISMS AS A FUNCTION OF SUBSTRATE CONCENTRATION,
W69-06281 05C

TERJUNG, WERNER H.
SOME MAPS OF ISANOMALIES IN ENERGY BALANCE CLIMATOLOGY,
W69-06050 02B

THATCHER, L. L.
TRITIUM CONTENT IN THE FIRN LAYERS OF AN ALPINE GLACIER,
W69-06262 02C

THAYER, RICHARD P.
STOCHASTIC MODEL FOR BOD AND DO IN STREAMS,
W69-06080 05B

THOMAS, CHESTER E.
WATER RESOURCES INVENTORY OF CONNECTICUT-PART 3, LOWER THAMES AND SOUTHEASTERN COASTAL RIVER BASINS,
W69-06250 02F

THOMAS, JOLLY D.
CHEMICAL AND PHYSICAL CHARACTER OF MUNICIPAL WATER SUPPLIES IN MARYLAND,
W69-06031 05F

THOMSON, D. A.
ENVIRONMENTAL IMPACT OF BRINE EFFLUENTS ON GULF OF CALIFORNIA,
W69-06287 05C

THORUD, DAVID B.
FREEZING IN FOREST SOIL AS INFLUENCED BY SOIL PROPERTIES, LITTER, AND SNOW,
W69-06028 02C

TOLER, L. G.
WATER RESOURCE RECORDS OF THE ECONFINA CREEK BASIN AREA, FLORIDA,
W69-06051 02E

UBELL, K.
HYDROLOGY OF GROUNDWATER (GENERAL OUTLINE),
W69-06223 02F

THE HYDROLOGIC CYCLE AND THE WATER BALANCE IN NATURE,
W69-06227 02A

HYDROLOGICAL FORECASTING,
W69-06228 02A

ESTIMATION OF GROUNDWATER RESOURCES,
W69-06230 02F

HYDROLOGY OF WATER STORAGE,
W69-06231 02E

UNDERHILL, H. W.
CARBONATE SCALE IN ROMAN AND MODERN CANALS IN THE JORDAN VALLEY,
W69-06017 08A

UNWIN, D. J.
THE AREAL EXTENSION OF RAINFALL RECORDS AN ALTERNATIVE MODEL,
W69-06018 02B

VANNI, MANFREDO
CHANGE OF ITALIAN GLACIERS DURING THE DECADE 1957-1966 (FRENCH),
W69-06265 02C

VARROK, E.
ESTIMATION OF GROUNDWATER RESOURCES,
W69-06230 02F

VENETIS, C.
THE IUH (INSTANTANEOUS UNIT HYDROGRAPH) OF THE MUSKINGUM CHANNEL REACH,
W69-06020 02E

WALKER, WILLIAM R.
WATER RESOURCES RESEARCH IN VIRGINIA,
W69-06039 02E

WARD, CHARLES R.
ALTERNATE METHODS OF MOSQUITO CONTROL TO REDUCE CHEMICAL POLLUTION OF WATERS FOR RECHARGE OF THE OGALLALA FORMATION,
W69-06001 05G

WASTLER, T. A.
MEASURING ESTUARINE POLLUTION,
W69-06203 05A

WATSON, K. K.
THE MEASUREMENT OF THE HYDRAULIC CONDUCTIVITY OF UNSATURATED POROUS MATERIALS UTILIZING A ZONE OF ENTRAPPED AIR,
W69-06071 02G

WEBBER, EARL E.
FLOODS AT JACKSON, OHIO,
W69-06056 02E

WEEKS, L. V.
SOIL-WATER PROPERTIES COMPUTED FROM TRANSIENT FLOW DATA,
W69-06072 02G

WENK, EDWARD, JR.
UNITED STATES POLICY REGARDING MARINE RESOURCES (IMPLEMENTATION OF THE NEW MARINE POLICY),
W69-06100 06E

WHEALS, B. B.
GENERAL METHOD FOR DETERMINATION OF ORGANOPHOSPHORUS RESIDUES IN RIVER WATERS AND EFFLUENTS,
W69-06023 05A

WHITAKER, G. L.
SUMMARY OF MAXIMUM DISCHARGES IN UTAH STREAMS,
W69-06209 02E

WHITE, GILBERT F.
A FLOOD LOSS REDUCTION PROGRAM,
W69-06097 06F

WILFORD, JOHN
LEGAL ASPECTS OF NEW JERSEY POTABLE WATER PROGRAM,
W69-06331 05G

WILSON, KENNETH V.
FLOODS OF THE 1965 WATER YEAR IN MISSISSIPPI,
W69-06219 02E

WRIGHT, JAMES F.
WATER QUALITY CONTROL - THE ROLE OF THE INTERSTATE AGENCY,
W69-06094 05G

METROPOLITAN PROBLEMS THE DELAWARE RIVER BASIN COMMISSION,
W69-06099 06B

YEN, C. K.
ISOTOPE HYDROLOGY OF THE ARTESIAN AQUIFERS OF THE STYRIAN BASIN, AUSTRIA,
W69-06249 02K

ZOBLER, LEONARD
BENEFITS FROM INTEGRATED WATER MANAGEMENT IN URBAN AREAS - THE CASE OF THE NEW YORK METROPOLITAN REGION,
W69-06201 06B

ORGANIZATIONAL INDEX

AGRICULTURAL RESEARCH SERVICE, PHOENIX, ARIZ. WATER CONSERV LAB.
THE MEASUREMENT OF THE HYDRAULIC CONDUCTIVITY OF UNSATURATED POROUS MATERIALS UTILIZING A ZONE OF ENTRAPPED AIR,
W69-06071 02G

AGRICULTURAL UNIV., WAGENINGEN (NETHERLANDS). LAB. OF SOILS AND FERTILIZERS.
NON-EQUILIBRIUM THERMODYNAMICS OF THE SOIL-WATER SYSTEM,
W69-06016 02G

AMERICAN BAR ASSOCIATION, CHICAGO, ILL. SECTION OF NATURAL RESOURCES LAW.
A CASE FOR THE ADMINISTRATION OF MARINE RESOURCES UNDERLYING THE HIGH SEAS BY THE UNITED NATIONS,
W69-06103 06E

AMERICAN SOCIETY OF CIVIL ENGINEERS, NEW YORK, COMMITTEE ON THERMAL POLLUTION.
BIBLIOGRAPHY ON THERMAL POLLUTION,
W69-06081 05C

ARIZONA UNIV., TUSCON.
ENVIRONMENTAL IMPACT OF BRINE EFFLUENTS ON GULF OF CALIFORNIA,
W69-06287 05C

BATTELLE-NORTHWEST, RICHLAND, WASH. DEPT. OF ENVIRONMENTAL HEALTH AND ENGINEERING AND BUREAU OF COMMERCIAL FISHERIES, SEATTLE, WASH. FISH PASSAGE RESEARCH PROGRAM.
DENSITY FLOW REGIME OF FRANKLIN D. ROOSEVELT LAKE,
W69-06076 02H

BRISTOL UNIV. (ENGLAND), H. H. WILLS PHYSICS LAB.
GLACIAL EROSION,
W69-06258 02C

BUREAU OF COMMERCIAL FISHERIES, LA JOLLA, CALIF. BIOLOGICAL LAB.
GROWTH EQUATIONS WITH METABOLIC PARAMETERS,
W69-06280 05C

CALIFORNIA UNIV., BERKELEY. HYDRAULIC ENGINEERING LAB.
THE EFFECT OF LOOSE BLOCKS ON THE RATE OF SEDIMENT TRANSPORT,
W69-06083 02J

CALIFORNIA UNIV., BERKELEY. SANITARY ENGINEERING RESEARCH LAB. AND CALIF. UNIV., BERKELEY. SCHOOL OF PUBLIC HEALTH.
ECONOMIC EVALUATION OF WATER-PART IV AN INPUT-OUTPUT AND LINEAR PROGRAMMING ANALYSIS OF CALIFORNIA WATER REQUIREMENTS,
W69-06220 06B

CALIFORNIA UNIV., BERKELEY. SCHOOL OF PUBLIC HEALTH.
MINERAL TASTE IN DOMESTIC WATER,
W69-06215 05E

CALIFORNIA UNIV., LOS ANGELES. DEPT. OF GEOGRAPHY.
SOME MAPS OF ISANOMALIES IN ENERGY BALANCE CLIMATOLOGY,
W69-06050 02B

CALIFORNIA UNIV., RIVERSIDE. DEPT. OF SOILS AND PLANT NUTRITION.
SOIL-WATER PROPERTIES COMPUTED FROM TRANSIENT FLOW DATA,
W69-06072 02G

CAMBRIDGE UNIV, (ENGLAND). DEPT. OF APPLIED MATHEMATICS AND THEORETICAL PHYSICS AND SCOTT POLAR RESEARCH INST., CAMBRIDGE (ENGLAND).
RIFTS AT THE FOOT OF BEARDMORE GLACIER, ANTARCTICA,
W69-06260 02C

CAMBRIDGE UNIV. (ENGLAND). CAVENDISH LAB.
PLASTIC FLOW AND PRESSURE MELTING IN THE DEFORMATION OF ICE I,
W69-06270 01A

CASE WESTERN RESERVE UNIV., CLEVELAND.
WASTES, WATER, AND WISHFUL THINKING THE BATTLE OF LAKE ERIE,
W69-06305 05G

CITY UNIV., LONDON (ENGLAND). DEPT. OF CIVIL ENGINEERING.
THE IUH (INSTANTANEOUS UNIT HYDROGRAPH) OF THE MUSKINGUM CHANNEL REACH,
W69-06020 02E

COLD REGIONS RESEARCH AND ENGINEERING LAB., HANOVER, N. H.
THE GREENLAND MASS BALANCE FLUX DIVERGENCE CONSIDERATIONS,
W69-06268 02C

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF AGRICULTURAL AND IRRIGATION ENGINEERING.
HYDRAULIC OPERATING CHARACTERISTICS OF LOW GRADIENT BORDER IRRIGATION SYSTEMS,
W69-06035 03F

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF POLITICAL SCIENCE.
AN EXPLORATION OF COMPONENTS AFFECTING AND LIMITING POLICY MAKING OPTIONS IN LOCAL WATER AGENCIES,
W69-06306 06B

COLUMBIA UNIV., NEW YORK BARNARD COLL., NEW YORK. DEPT. OF GEOGRAPHY AND RUTGERS - THE STATE UNIV., NEW BRUNSWICK, N. J.
BENEFITS FROM INTEGRATED WATER MANAGEMENT IN URBAN AREAS - THE CASE OF THE NEW YORK METROPOLITAN REGION,
W69-06201 06B

COMITATO NAZIONALE PER LE RICERCHE NUCLEARI, PISA (ITALY). LABORATORIO DI GEOLOGIA NUCLEARE.
OXYGEN ISOTOPIC COMPOSITION OF SULFATE IONS IN WATER FROM THERMAL SPRINGS,
W69-06044 02K

COMMISSION ON MARINE SCIENCE, ENGINEERING AND RESOURCES, WASHINGTON, D. C.
OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION).
W69-06411 06B

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION, PART III DEVELOPMENT OF NONLIVING MARINE RESOURCES.
W69-06412 06B

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION, PART III NATURAL GAS.
W69-06413 06B

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION), PART III OTHER MARINE MINERALS.
W69-06414 06B

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION, PART III LEGAL AND REGULATORY CONSIDERATIONS.
W69-06415 06B

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION), PART III FRESH WATER RESOURCES.
W69-06416 06B

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION), PART III AN INTERNATIONAL LEGAL-POLITICAL FRAMEWORK FOR EXPLORING AND EXPLOITING THE MINERAL RESOURCES UNDERLYING THE HIGH SEAS.
W69-06417 06B

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION), PART III AN INTERNATIONAL AUTHORITY TO REGISTER NATIONAL CLAIMS BEYOND THE REDEFINED CONTINENTAL SHELF.
W69-06418 06B

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION), PART IV GOVERNMENT-INDUSTRY RELATIONSHIPS IN SUPPORT OF RESEARCH DEVELOPMENT.
W69-06419 06B

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION) ORGANIZING A NATIONAL OCEAN EFFORT.
W69-06420 06B

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, MERBEIN (VICTORIA). DIV. OF HORTICULTURAL RESEARCH.
CONSTRUCTION OF PIEZOMETERS, AND METHOD OF INSTALLATION FOR GROUND WATER OBSERVATIONS IN AQUIFERS,
W69-06019 07B

CORNELL UNIV., ITHACA, N. Y.
IMPROVEMENT AND MODERNIZATION OF N. Y. WATER LAW WITHIN THE FRAMEWORK OF THE RIPARIAN SYSTEM,
W69-06341 06E

CORNELL UNIV., ITHACA, N. Y. CENTER FOR ENVIRONMENTAL QUALITY MANAGEMENT.
TECHNOLOGY AND PUBLIC DECISION MAKING,
W69-06048 06B

CORNELL UNIV., ITHACA, N. Y. DEPT. OF CONSERVATION.
AGE AND GROWTH OF WHITE BASS IN ONEIDA LAKE, NEW YORK,
W69-06275 05C

CORNELL UNIV., ITHACA, N. Y. WATER RESOURCES AND MARINE SCIENCES CENTER.
HEATED EFFLUENTS AND EFFECTS ON AQUATIC LIFE WITH EMPHASIS ON FISHES,
W69-06022 05C

CORPS OF ENGINEERS, ALBUQUERQUE, N. MEX.
FLOOD PLAIN INFORMATION, ARROYO DE LOS CHAMISOS AND ARROYO HONDO, SANTA FE, NEW MEXICO.
W69-06247 04A

CORPS OF ENGINEERS, BALTIMORE, MD.
FLOOD PLAIN INFORMATION, BEAVERDAM CREEK, PRINCE GEORGES COUNTY, MARYLAND.
W69-06068 04A

CORPS OF ENGINEERS, CHARLESTON, S. C.
FLOOD PLAIN INFORMATION, RICHLAND COUNTY, SOUTH CAROLINA.
W69-06238 04A

FLOOD PLAIN INFORMATION, LAWSONS FORK CREEK AND FAIRFOREST CREEK, SPARTANBURG, SOUTH CAROLINA.
W69-06245 04A

CORPS OF ENGINEERS, DETROIT, MICH.
FLOOD PLAIN INFORMATION, OTTAWA RIVER, ALLEN COUNTY, OHIO.
W69-06069 04A

CORPS OF ENGINEERS, GALVESTON, TEX.
FLOOD PLAIN INFORMATION, DICKINSON BAYOU, DICKINSON, TEXAS.
W69-06065 04A

CORPS OF ENGINEERS, HUNTINGTON, W. VA.
FLOOD PLAIN INFORMATION, BIG WALNUT CREEK, VICINITY OF COLUMBUS, OHIO.
W69-06062 04A

CORPS OF ENGINEERS, LOUISVILLE, KY.
FLOOD PLAIN INFORMATION, OHIO RIVER, JEFFERSON COUNTY, KENTUCKY.
W69-06070 04A

CORPS OF ENGINEERS, MEMPHIS, TENN.
FLOOD PLAIN INFORMATION, SOUTH FORK OF FORKED DEER RIVER AND SUGAR CREEK, HENDERSON, TENNESSEE.
W69-06246 04A

CORPS OF ENGINEERS, MOBILE, ALA.
FLOOD PLAIN INFORMATION, UPPER FLINT RIVER, MUD AND JESTER CREEKS, METROPOLITAN ATLANTA, GEORGIA.
W69-06057 04A

CORPS OF ENGINEERS, NASHVILLE, TENN.
FLOOD PLAIN INFORMATION, CUMBERLAND RIVER, ROARING RIVER, AND DOE CREEK, GAINESBORO, TENNESSEE.
W69-06243 04A

CORPS OF ENGINEERS, OMAHA, NEB.
FLOOD PLAIN INFORMATION, DICKINSON, NORTH DAKOTA DRAINAGE DITCH.
W69-06241 04A

CORPS OF ENGINEERS, PITTSBURG, PA.
FLOOD PLAIN INFORMATION, PIGEON CREEK, BENTLEYVILLE, FALLOWFIELD TOWNSHIP AND SOMERSET TOWNSHIP, PENNSYLVANIA.
W69-06242 04A

CORPS OF ENGINEERS, ROCK ISLAND, ILL.
FLOOD PLAIN INFORMATION, ROCK RIVER AT JANESVILLE, WISCONSIN.
W69-06061 04A

FLOOD PLAIN INFORMATION, TURTLE CREEK, ROCK COUNTY, WISCONSIN.
W69-06067 04A

CORPS OF ENGINEERS, SAVANNAH, GA.
FLOOD PLAIN INFORMATION, CASEY CANAL NORTH, SAVANNAH AND CHATHAM COUNTY, GEORGIA.
W69-06058 04A

FLOOD PLAIN INFORMATION, COBBS CREEK-FOWLER BRANCH, DEKALB COUNTY, GEORGIA.
W69-06060 04A

FLOOD PLAIN INFORMATION, HUNNICUTT CREEK, ATHENS, CLARKE COUNTY, GEORGIA.
W69-06063 04A

CORPS OF ENGINEERS, SEATTLE, WASH.
FLOOD PLAIN INFORMATION, SKOOKUMCHUCK RIVER, BUCODA, WASHINGTON.
W69-06244 04A

FLOOD PLAIN INFORMATION, CLARK FORK, MISSOULA, MONTANA.
W69-06248 04A

CORPS OF ENGINEERS, WILMINGTON, N. C.
FLOOD PLAIN INFORMATION, TAR RIVER AND STONY CREEK, ROCKY MOUNT, NORTH CAROLINA.
W69-06059 04A

FLOOD PLAIN INFORMATION, TAR RIVER AT LOUISBURG, NORTH CAROLINA.
W69-06064 04A

FLOOD PLAIN INFORMATION, ELLERBE, GOOSE, WARREN, SANDY AND THIRD FORK CREEKS, DURHAM, NORTH CAROLINA.
W69-06066 04A

DELAWARE RIVER BASIN COMMISSION, TRENTON, N. J.
METROPOLITAN PROBLEMS THE DELAWARE RIVER BASIN COMMISSION,
W69-06099 06B

DELAWARE UNIV., NEWARK. AGRICULTURAL EXPERIMENT STATION.
USE OF WATER FOR SUPPLEMENTAL IRRIGATION IN DELAWARE,
W69-06036 03F

DEPARTMENT OF THE INTERIOR, WASHINGTON, D. C. AND DEPARTMENT OF TRANSPORTATION, WASHINGTON, D. C.
OIL POLLUTION - A REPORT TO THE PRESIDENT.
W69-06237 05B

DREW UNIV., INST. FOR RESEARCH ON GOVERNMENT.
METROPOLITAN PROBLEMS METROPOLITAN PUBLIC AUTHORITIES,
W69-06098 06B

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, WASHINGTON, D. C. ESTUARINE AND OCEANOGRAPHIC PROGRAMS BRANCH.
MEASURING ESTUARINE POLLUTION,
W69-06203 05A

FISH AND WILDLIFE SERVICE, WASHINGTON, D. C. BUREAU OF SPORT FISHERIES AND WILDLIFE.
LIMNOLOGICAL ORGANIC ANALYSES BY QUANTITATIVE DICHROMATE OXIDATION,
W69-06093 05A

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, IRAKLION (CRETE).
CARBONATE SCALE IN ROMAN AND MODERN CANALS IN THE JORDAN VALLEY,
W69-06017 08A

FOREST SERVICE (USDA), FLAGSTAFF, ARIZ. ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION.
THE STATUS OF PILOT WATERSHED STUDIES IN ARIZONA,
W69-06091 03B

GEOLOGICAL SURVEY, ALBUQUERQUE, N. MEX.
GROUND-WATER LEVELS IN NEW MEXICO, 1967,
W69-06212 02F

GEOLOGICAL SURVEY, AUSTIN, TEX. AND TEXAS UNIV., AUSTIN. DEPT. OF CIVIL ENGINEERING.
EFFECTS OF SMALL STRUCTURES ON WATER YIELD IN TEXAS,
W69-06218 03B

GEOLOGICAL SURVEY, BOISE, IDAHO.
RECORDS OF OBSERVATION WELLS AND WATER-LEVEL FLUCTUATIONS IN THE ABERDEEN-SPRINGFIELD AREA, BINGHAM AND POWER COUNTIES, IDAHO, IN 1967,
W69-06040 02F

WATER RESOURCES IN THE GOOSE CREEK-ROCK CREEK BASINS, IDAHO, NEVADA AND UTAH,
W69-06206 02F

GEOLOGICAL SURVEY, COLUMBIA, S. C., AND SOUTH CAROLINA STATE DEVELOPMENT BOARD.
GROUND-WATER RESOURCES OF GREENVILLE COUNTY, SOUTH CAROLINA,
W69-06052 02F

GEOLOGICAL SURVEY, HARTFORD, CONN.
WATER RESOURCES INVENTORY OF CONNECTICUT-PART 3, LOWER THAMES AND SOUTHEASTERN COASTAL RIVER BASINS,
W69-06250 02F

GEOLOGICAL SURVEY, IDAHO FALLS, IDAHO.
STAGE-DISCHARGE RELATIONS ON BIG LOST RIVER WITHIN NATIONAL REACTOR TESTING STAION, IDAHO,
W69-06204 02E

GEOLOGICAL SURVEY, JACKSON, MISS.
FLOODS OF THE 1965 WATER YEAR IN MISSISSIPPI,
W69-06219 02E

GEOLOGICAL SURVEY, LAWRENCE, KANS.
KANSAS RIVER, BONNER SPRINGS TO MOUTH, DEGRADATION OF CHANNEL,
W69-06256 02J

GEOLOGICAL SURVEY, LOUISVILLE, KY.
THE HYDROLOGY OF THE LEXINGTON AND FAYETTE-COUNTY AREA, KENTUCKY,
W69-06084 02F

GEOLOGICAL SURVEY, MIAMI, FLA.
WATER IN BROWARD COUNTY, FLORIDA,
W69-06217 02E

GEOLOGICAL SURVEY, OCALA, FLA.
SURFACE DRAINAGE CHARACTERISTICS IN VOLUSIA COUNTY, FLORIDA,
W69-06216 02E

GEOLOGICAL SURVEY, SALT LAKE CITY, UTAH.
SUMMARY OF MAXIMUM DISCHARGES IN UTAH STREAMS,
W69-06209 02E

SELECTED HYDROLOGIC DATA, SOUTHERN UTAH AND GOSHEN VALLEYS, UTAH,
W69-06211 02F

GEOLOGICAL SURVEY, TALLAHASSEE, FLA.
HYDROGEOLOGIC DATA RELATED TO ESTABLISHMENT OF A PUMPING STATION IN THE EVERGLADES NATIONAL PARK, FLORIDA,
W69-06033 02F

TEST WELL EXPLORATION IN THE MYAKKA RIVER BASIN AREA, FLORIDA,
W69-06053 02F

GEOLOGICAL SURVEY, TUCSON, ARIZ.
ANNUAL REPORT ON GROUND WATER IN ARIZONA, SPRING 1967 TO SPRING 1968.
W69-06026 02F

GEOLOGICAL SURVEY, WASHINGTON, D. C.
CHEMICAL AND PHYSICAL CHARACTER OF MUNICIPAL WATER SUPPLIES IN MARYLAND,
W69-06031 05F

WATER RESOURCE RECORDS OF THE ECONFINA CREEK BASIN AREA, FLORIDA,
W69-06051 02E

FLOODS AT JACKSON, OHIO,
W69-06056 02E

GROUND-WATER RESOURCES AND RELATED GEOLOGY OF NORTH-CENTRAL SPOKANE AND SOUTHEASTERN STEVENS COUNTIES, WASHINGTON,
W69-06213 02F

MEASUREMENT OF PEAK DISCHARGE BY INDIRECT METHODS,
W69-06251 02E

HYDROLOGICAL BENCH MARKS,
W69-06252 07A

QUALITY OF SURFACE WATERS FOR IRRIGATION, WESTERN STATES-1961,
W69-06253 03F

QUALITY OF SURFACE WATERS FOR IRRIGATION, WESTERN STATES-1960,
W69-06258 03F

GEORGIA UNIV., ATHENS.
THE PIEZOMETRIC SURFACE OF THE COASTAL PLAIN AQUIFER IN GEORGIA, ESTIMATES OF ORIGINAL ELEVATION AND LONG-TERM DECLINE,
W69-06043 02F

GEORGIA UNIV., ATHENS. INST. OF GOVERNMENT.
GEORGIA WATER LAW,
W69-06009 06E

GIDROMETEOROLOGICHESKII INSTITUT, LENINGRAD (USSR). HIGH-ALTITUDE GEOPHYSICS INST.
RAINSTORMS AND HAIL,
W69-06214 02B

HARZA ENGINEERING CO., CHICAGO, ILL. BAUER ENGINEERING, INC., CHICAGO, ILL. AND METROPOLITAN SANITARY DISTRICT OF GREAT CHICAGO, ILL.
THE CHICAGO AREA DEEP TUNNEL PROJECT-A USE OF THE UNDERGROUND STORAGE RESOURCE,
W69-06021 05G

HAWAII UNIV., HONOLULU. WATER RESOURCES RESEARCH CENTER.
COASTAL EVIDENCES OF GROUND WATER CONDITIONS IN THE VICINITY OF ANAEHOOMALU AND LALAMILO, SOUTH KOHALA, HAWAII,
W69-06006 03B

ILLINOIS STATE GEOLOGICAL SURVEY, URBANA.
HYDROGEOLOGY AT SHELBYVILLE, ILLINOIS - A BASIS FOR WATER RESOURCES PLANNING,
W69-06075 02F

GEOLOGIC STUDIES AS AN AID TO GROUND-WATER MANAGEMENT,
W69-06082 04B

ILLINOIS STATE WATER SURVEY, URBANA.
GROUNDWATER LEVELS AND PUMPAGE IN THE PEORIA-PEKIN AREA ILLINOIS, 1890-1966,
W69-06208 02F

CLIMATOLOGY OF SEVERE WINTER STORMS IN ILLINOIS,
W69-06210 02C

INNSBRUCK UNIV. (AUSTRIA). DEPT. OF PHYSICS AND INTERNATIONAL ATOMIC ENERGY AGENCY (VIENNA).
TRITIUM CONTENT IN THE FIRN LAYERS OF AN ALPINE GLACIER,
W69-06262 02C

INNSBRUCK UNIV. (AUSTRIA). DEPT. OF PHYSICS AND ALPINE FORSCHUNGSSTELLE DER UNIVERSITAET INNSBRUCK, OBERGURGL (AUSTRIA).
INVESTIGATIONS ON FISSION PRODUCTS IN THE ACCUMULATION AREA OF AN ALPINE GLACIER (KESSELWANDFERNER, OETZTAL ALPS),
W69-06261 02C

INNSBRUCK UNIV. (AUSTRIA). INST. OF METEOROLOGY AND GEOPHYSICS.
GLACIER MASS BUDGET AND MESOSCALE WEATHER IN THE AUSTRIAN ALPS 1964 TO 1966,
W69-06267 02C

INTERNATIONAL ATOMIC ENERGY AGENCY, VIENNA (AUSTRIA). SECTION OF HYDROLOGY.
ISOTOPE HYDROLOGY OF THE ARTESIAN AQUIFERS OF THE STYRIAN BASIN, AUSTRIA,
W69-06249 02K

IOWA UNIV., IOWA CITY. DEPT. OF GEOGRAPHY.
THE VALLEYS OF IOWA-1 VALLEY WIDTH AND STREAM DISCHARGE RELATIONSHIPS IN THE MAJOR STREAMS,
W69-06038 02E

KANSAS STATE UNIV., MANHATTAN.
ECOLOGICAL RELATIONSHIPS OF ORGANIC MATTER AND BACTERIA IN TUTTLE CREEK RESERVOIR,
W69-06014 02H

MACQUARIE UNIV., SYDNEY (AUSTRALIA). SCHOOL OF EARTH SCIENCES AND SYDNEY UNIV., (AUSTRALIA). DEPT. OF GEOLOGY AND GEOPHYSICS.
THE LOCATION OF DEEP AQUIFERS BY RESISTIVITY SOUNDINGS,
W69-06027 02F

MCGILL UNIV., MONTREAL (QUEBEC). ICE RESEARCH PROJECT.
THE HEAT BUDGET OF A MELTING COVER OF SEA ICE,
W69-06263 02C

MELBOURNE UNIV., PARKVILLE(AUSTRALIA). ANTARCTIC DIV.
THE LONGITUDINAL VELOCITY PROFILE OF LARGE ICE MASSES,
W69-06257 02C

MICHIGAN STATE UNIV., EAST LANSING. DEPT. OF FISHERIES AND WILDLIFE.
PRIMARY PRODUCTION, ENERGETICS, AND NUTRIENT UTILIZATION IN A WARM-WATER STREAM,
W69-06092 05C

MICHIGAN UNIV., ANN ARBOR. DEPT OF CHEMICAL AND METALLURGICAL ENGINEERING AND TEXAS UNIV., AUSTIN. DEPT. OF PETROLEUM ENGINEERING.
UNDERGROUND STORAGE OF FLUIDS,
W69-06055 02F

MICROBIOLOGICAL RESEARCH ESTABLISHMENT, SALISBURY (ENGLAND).
THE GROWTH RATE OF MICROORGANISMS AS A FUNCTION OF SUBSTRATE CONCENTRATION,
W69-06281 05C

MINISTRY OF TECHNOLOGY, LONDON (ENGLAND). LAB. OF GOVERNMENT CHEMIST.
GENERAL METHOD FOR DETERMINATION OF ORGANOPHOSPHORUS RESIDUES IN RIVER WATERS AND EFFLUENTS,
W69-06023 05A

AN EVALUATION OF SOME METHODS FOR THE DETERMINATION OF FLUORIDE IN POTABLE WATERS AND OTHER AQUEOUS SOLUTIONS,
W69-06037 05F

MINNESOTA UNIV., ST. PAUL. SCHOOL OF FORESTRY.
FREEZING IN FOREST SOIL AS INFLUENCED BY SOIL PROPERTIES, LITTER, AND SNOW,
W69-06028 02C

NATIONAL ACADEMY OF SCIENCES--NATIONAL RESEARCH COUNCIL, WASHINGTON, D. C. COMMITTEE ON WATER.
WATER AND CHOICE IN THE COLORADO BASIN AN EXAMPLE OF ALTERNATIVES IN WATER MANAGEMENT.
W69-06086 06B

WATER AND CHOICE IN THE COLORADO BASIN AN EXAMPLE OF ALTERNATIVES IN WATER MANAGEMENT, CH. 2, THE SETTING.
W69-06087 06B

WATER AND CHOICE IN THE COLORADO BASIN AN EXAMPLE OF ALTERNATIVES IN WATER MANAGEMENT, CH. 3, PROBLEMS OF WATER SUPPLY IN THE BASIN.
W69-06088 06B

WATER AND CHOICE IN THE COLORADO BASIN AN EXAMPLE OF ALTERNATIVES IN WATER MANAGEMENT, CH. 4, THE RANGE OF OBJECTIVES IN PLANNING FOR THE USE OF COLORADO WATER.
W69-06089 06B

WATER AND CHOICE IN THE COLORADO BASIN AN EXAMPLE OF ALTERNATIVES IN WATER MANAGEMENT, CH. 5, ALTERNATIVES FOR PROMOTING REGIONAL ECONOMIC GROWTH.
W69-06090 06B

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, GREENBELT, MD. GODDARD SPACE FLIGHT CENTER.
THE MOON'S RESOURCES,
W69-06015 02E

NEVADA UNIV., RENO. COLL. OF AGRICULTURE.
FACTORS RESTRICTING INFILTRATION RATES ON DECOMPOSED GRANITIC SOILS,
W69-06041 02G

INFILTROMETER STUDIES ON NON-WETTABLE SOILS ON EAST SIERRA NEVADA,
W69-06042 02G

NEVADE UNIV., RENO.
AN ENGINEERING-ECONOMIC ANALYSIS OF SYSTEMS UTILIZING AQUIFER STORAGE FOR THE IRRIGATION OF PARKS AND GOLFCOURSES WITH RECLAIMED WASTEWATER,
W69-06289 03C

NEW MEXICO STATE UNIV., LAS CRUCES.
PREDICTION OF CROP YIELDS FROM QUANTITY AND SALINITY OF IRRIGATION WATER,
W69-06007 03C

IRRIGATION WATER QUALITY AND THE LEACHING REQUIREMENT,
W69-06008 03F

RECREATIONAL VALUE OF WATER AT ELEPHANT BUTTE AND NAVAJO RESERVOIRS,
W69-06010 06B

A PORTABLE RAINFALL SIMULATOR AND RUNOFF SAMPLER,
W69-06011 07B

NEW MEXICO STATE UNIV., LAS CRUCES. ENGINEERING EXPERIMENT STATION.
NITROGEN REMOVAL FROM NATURAL WATERS,
W69-06012 05D

NEW MEXICO UNIV., ALBUQUERQUE. DEPT. OF PHYSICS AND ASTRONOMY.
PRECISION MEASUREMENTS OF WATER DROPLET EVAPORATION RATES,
W69-06236 02D

NEW MEXICO UNIV., LAS CRUCES.
CONSUMPTIVE IRRIGATION REQUIREMENTS OF SELECTED IRRIGATED AREAS IN NEW MEXICO,
W69-06013 03F

NORTH DAKOTA STATE UNIV., FARGO. COLL. OF CIVIL ENGINEERING.
USE OF GRAVITY SHAFTS FOR GROUND WATER RECHARGE,
W69-06202 04B

OAK RIDGE NATIONAL LABORATORY, TENN.
THE FEASIBILITY OF DEEP-WELL INJECTION OF WASTE BRINE FROM INLAND DESALTING PLANTS,
W69-06286 05E

OFFICE OF SCIENCE AND TECHNOLOGY, WASHINGTON, D. C. AND CORNELL UNIV., ITHACA, N. Y. WATER RESOURCES CENTER.
GOALS AND PERSPECTIVES IN WATER RESOURCES PLANNING,
W69-06046 06B

OFFICE OF WATER RESOURCES RESEARCH, WASHINGTON, D. C.
WATER RESOURCES PLANNING STRATEGY,
W69-06047 06B

OREGON STATE UNIV., CORVALLIS AND CALIFORNIA UNIV.,

BERKELEY.
LONGITUDINAL ESTUARINE DIFFUSION IN SAN FRANCISCO BAY, CALIFORNIA,
W69-06030 05A

PENNSYLVANIA DEPT. OF HEALTH, HARRISBURG. DIV. OF SANITARY ENGINEERING.
EUROPEAN PRACTICE IN WATER QUALITY CONTROL,
W69-06078 05G

POZNAN AGRICULTURAL ACADEMY (POLAND). DEPT. OF AGRICULTURAL TECHNOLOGY.
THE BIOSYNTHESIS OF VITAMINS OF THE (B-12) GROUP IN MIXED CULTURES OF BACTERIA,
W69-06274 05B

RAND CORP., SANTA MONICA, CALIF.
EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT,
W69-06290 06B

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTERS I-II INTRODUCTION THE CRITERION PROBLEM,
W69-06291 06B

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER III THE APPROPRIATE ALTERNATIVES,
W69-06292 06B

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER IV INTANGIBLES, UNCERTAINTY, AND CRITERIA,
W69-06293 06B

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER V TIME STREAMS AND CRITERIA,
W69-06294 06B

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS, ANALYSIS WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER VI WHAT CAN BE DONE A RECAPITULATION,
W69-06295 06B

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER VIII KINDS OF BENEFITS AND COSTS SPILLOVER EFFECTS,
W69-06296 06B

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER IX KINDS OF BENEFITS OVERCOUNTING, AND SECONDARY BENEFITS.
W69-06297 06B

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALISIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER X VALUATION OF BENEFITS,
W69-06298 06B

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER XI CASE STUDY I THE GREEN RIVER WATERSHED,
W69-06299 06B

EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH EMPHASIS ON WATER RESOURCES DEVELOPMENT, CHAPTER XII CASE STUDY II SANTA MARIA PROJECT,
W69-06300 06B

RESEARCH INST. FOR WATER RESOURCE DEVELOPMENT, BUDAPEST (HUNGARY).
HYDROLOGY OF WATER STORAGE,
W69-06231 02E

RESEARCH INST. FOR WATER RESOURCES DEVELOPMENT, BUDAPEST (HUNGARY).
HYDROLOGICAL ASPECTS OF WATER MANAGEMENT,
W69-06221 06B

SURFACE WATER HYDROLOGY (GENERAL OUTLINE),
W69-06222 02E

HYDROLOGY OF GROUNDWATER (GENERAL OUTLINE),
W69-06223 02F

SOIL PHYSICS,
W69-06224 02G

QUALITY CHARACTERISTICS OF WATER RESOURCES,
W69-06225 05G

MATHEMATICAL STATISTICS AS A METHOD FOR HYDROLOGICAL INVESTIGATIONS,
W69-06226 06A

THE HYDROLOGIC CYCLE AND THE WATER BALANCE IN NATURE,
W69-06227 02A

HYDROLOGICAL FORECASTING,
W69-06228 02A

ESTIMATION OF SURFACE-WATER RESOURCES,
W69-06229 02E

ESTIMATION OF GROUNDWATER RESOURCES,
W69-06230 02F

SEDIMENT TRANSPORTATION IN ALLUVIAL STREAMS,
W69-06232 02J

MAN'S INFLUENCE ON HYDROLOGICAL PHENOMENA,
W69-06233 04C

HYDROLOGY OF LAND DRAINAGE,
W69-06234 04A

RICE UNIV., HOUSTON. DEPT. OF ENVIRONMENTAL SCIENCE AND ENGINEERING AND TEXAS UNIV., AUSTIN. DEPT. OF CIVIL ENGINEERING.
SOLUTION OF ESTUARY PROBLEMS AND NETWORK PROGRAMS,
W69-06077 02L

ROBERT S. KERR WATER RESEARCH CENTER, ADA, OKLA.
EUFAULA RESERVOIR AERATION RESEARCH-1968,
W69-06255 05G

RUTGERS - THE STATE UNIV., NEW BRUNSWICK, N. J. SCHOOL OF LAW.
THE LAW OF WATER IN NEW JERSEY,
W69-06301 06E

W69-06302 06E

W69-06303 06E

W69-06304 06E

RUTGERS - THE STATE UNIV., NEWARK, N. J. DEPT. OF ENVIRONMENTAL SCIENCE AND GEOLOGICAL SURVEY, TRENTON, N. J.
LONG-TERM TREND ANALYSES OF WATER QUALITY-A MODEL STUDY OF THE PASSAIC RIVER BASIN,
W69-06235 05B

STRUTHERS SCIENTIFIC AND INTERNATIONAL CORP., NEW YORK.
SECONDARY REFRIGERANT FREEZING DESALTING PROCESS OPERATION OF A 15,000 GPD PILOT PLANT,
W69-06288 03A

TECHNICAL UNIV. OF DENMARK, COPENHAGEN. INST. OF HYGIENE.
BACTERIAL CORROSION OF CONCRETE IN WATER,
W69-06029 08F

TEXAS TECHNOLOGICAL COLL., LUBBOCK.
ALTERNATE METHODS OF MOSQUITO CONTROL TO REDUCE CHEMICAL POLLUTION OF WATERS FOR RECHARGE OF THE OGALLALA FORMATION,
W69-06001 05G

TEXAS UNIV., AUSTIN.
OXYGEN PRODUCTION AND LOSS IN A MODEL RIVER,
W69-06002 05B

LIMNOLOGICAL INVESTIGATIONS OF TEXAS IMPOUNDMENTS FOR WATER QUALITY MANAGEMENT PURPOSES - LIMNOLOGICAL AND WATER QUALITY DATA FOR THE HIGHLAND LAKES, 1968,
W69-06003 05B

LIMNOLOGICAL INVESTIGATIONS OF TEXAS IMPOUNDMENTS FOR WATER QUALITY MANAGEMENT PURPOSES - THE USE OF ALGAL CULTURES TO ASSESS THE EFFECTS OF NUTRIENT ENRICHMENT ON THE HIGHLAND LAKES OF THE COLORADO RIVER, TEXAS,
W69-06004 05C

LIMNOLOGICAL INVESTIGATIONS OF TEXAS IMPOUNDMENTS FOR WATER QUALITY MANAGEMENT PURPOSES - THE DISTRIBUTION OF COLIFORM BACTERIA IN STRATIFIED IMPOUNDMENT,
W69-06005 05D

TEXAS WATER DEVELOPMENT BOARD, AUSTIN.
GROUND-WATER RESOURCES OF MATAGORDA COUNTY, TEXAS,
W69-06025 02F

TURNER, COLLIE AND BRADEN, INC., HOUSTON, TEX.
FLOOD PLAIN INFORMATION, GUADALUPE RIVER, SPRING CREEK AND LONE TREE CREEK, VICTORIA, TEXAS.
W69-06239 04A

FLOOD PLAIN INFORMATION, SABINE RIVER AND ADAMS BAYOU, ORANGE, TEXAS AREA.
W69-06240 04A

UNIVERSITY COLL. OF WALES, ABERYSTWYTH. DEPT. OF GEOGRAPHY.
THE AREAL EXTENSION OF RAINFALL RECORDS AN ALTERNATIVE MODEL,
W69-06018 02B

VERMONT UNIV., BURLINGTON. DEPT. OF ZOOLOGY.
A BIOLOGICAL TEST FOR DETERMINING THE POTENTIAL PRODUCTIVITY OF WATER,
W69-06279 05A

VIRGINIA POLYTECHNIC INST., BLACKSBURG. DEPT. OF AGRICULTURAL ENGINEERING AND AGRICULTURAL RESEARCH SERVICE, BLACKSBURG, VA. SOIL AND WATER CONSERVATION RESEARCH DIV.
NUMERICAL EXPERIMENTS WITH THE STANFORD WATERSHED MODEL ON SMALL AGRICULTURAL WATERSHEDS IN VIRGINIA,
W69-06032 02E

VIRGINIA POLYTECHNIC INST., BLACKSBURG. DEPT. OF STATISTICS.
STOCHASTIC MODEL FOR BOD AND DO IN STREAMS,
W69-06080 05B

PROBABILITY FORECASTS OF 30-DAY PRECIPITATION,
W69-06205 02B

VIRGINIA POLYTECHNIC INST., BLACKSBURG. WATER RESOURCES RESEARCH CENTER.
WATER RESOURCES RESEARCH IN VIRGINIA,
W69-06039 02E

WASHINGTON UNIV., ST LOUIS, MO. DEPT. OF BOTANY.
RAIN AS A SOURCE OF VITAMIN (B-12),
W69-06273 05B

WATER PLANNING FOR ISRAEL LTD., TEL AVIV. RESEARCH DEPT.
THE ROLE OF GROUNDWATER IN THE DEVELOPMENT OF WATER RESOURCES,
W69-06054 04B

WATER POLLUTION CONTROL FEDERATION, WASHINGTON, D. C.
WATER QUALITY CONTROL - THE ROLE OF THE INTERSTATE AGENCY,
W69-06094 05G

WATER QUALITY STANDARDS THE FEDERAL PERSPECTIVE - PROGRESS TOWARD OBJECTIVES,
W69-06095 05G

FITTING A STATE PROGRAM TO FEDERAL OBJECTIVES,
W69-06096 05G

WATER POLLUTION RESEARCH LAB., STEVENAGE (ENGLAND).
DETERMINATION OF FREE HYDROGEN CYANIDE IN RIVER WATER BY A SOLVENT-EXTRACTION METHOD,
W69-06024 05A

WATER RESEARCH FOUNDATION OF AUSTRALIA, KINGSFORD.
LOSS RATES ON SELECTED CATCHMENTS IN VICTORIA,
W69-06085 02D

WEIZMANN INST. OF SCIENCE, REHOVOTH (ISRAEL).
DEAD SEA BRINES DEGREE OF HALITE SATURATION BY ELECTRODE MEASUREMENTS,
W69-06038 02K

WISCONSIN UNIV., MADISON.
SALTS AND ASSOCIATED PHENOMENA OF THE TERMINI OF THE HOBBS AND TAYLOR GLACIERS, VICTORIA LAND, ANTARCTICA,
W69-06266 02C

WISCONSIN UNIV., MADISON. DEPT. OF BOTANY.
COBALT AS AN ESSENTIAL ELEMENT FOR BLUE-GREEN ALGAE,
W69-06277 05A

WISCONSIN UNIV., MADISON. DEPT. OF MECHANICAL ENGINEERING.
HARVESTING UNDERWATER WEEDS,
W69-06276 05G

WISCONSIN UNIV., MADISON. DEPT. OF SOILS.
TOWARDS STANDARDIZATION OF SOIL EXTRACTS FOR MICROBIAL MEDIA,
W69-06272 02K

WISCONSIN UNIV., MADISON. DEPT. OF ZOOLOGY.
MOVEMENT OF RADIOSODIUM IN A CHEMICALLY STRATIFIED LAKE,
W69-06283 02H

WISCONSIN UNIV., MADISON. GEOLOGICAL AND NATURAL HISTORY SURVEY.
PRELIMINARY REPORT ON THE IRRIGATION POTENTIAL OF DUNN COUNTY, WISCONSIN,
W69-06074 02G

WISCONSIN UNIV., MADISON. HYDRAULIC LAB. AND WISCONSIN UNIV., MADISON. WATER CHEMISTRY LAB.
RECOVERY OF ORGANICS FROM A EUTROPHIC LAKE BY THE CARBON ADSORPTION TECHNIQUE,
W69-06282 05A

WISCONSIN UNIV., MADISON. WATER CHEMISTRY LAB.
HYDROLYSIS OF CONDENSED PHOSPHATES--I NON-STERILE ENVIRONMENT,
W69-06271 02K

HYDROLYSIS OF CONDENSED PHOSPHATES--II STERILE ENVIRONMENT,
W69-06284 02K

SOURCES OF ELEMENTAL NITROGEN IN FERMENTATION GASES,
W69-06285 05C

YALE UNIV., NEW HAVEN, CONN. DEPT. OF GEOLOGY.
THORIUM AND URANIUM CONCENTRATIONS AND ISOTOPE RATIOS IN RIVER SEDIMENTS,
W69-06045 02J

ACCESSION NUMBER INDEX

05G W69-06001
05B W69-06002
05B W69-06003
05C W69-06004
05D W69-06005
03B W69-06006
03C W69-06007
03F W69-06008
06E W69-06009
06B W69-06010
07B W69-06011
05D W69-06012
03F W69-06013
02H W69-06014
02E W69-06015
02G W69-06016
08A W69-06017
02B W69-06018
07B W69-06019
02E W69-06020
05G W69-06021
05C W69-06022
05A W69-06023
05A W69-06024
02F W69-06025
02F W69-06026
02F W69-06027
02C W69-06028
08F W69-06029
05A W69-06030
05F W69-06031
02E W69-06032
02F W69-06033
02E W69-06034
03F W69-06035
03F W69-06036
05F W69-06037
02K W69-06038
02E W69-06039
02F W69-06040
02G W69-06041
02G W69-06042
02F W69-06043
02K W69-06044
02J W69-06045
06B W69-06046
06B W69-06047
06B W69-06048
06B W69-06049
02B W69-06050
02E W69-06051
02F W69-06052
02F W69-06053
04B W69-06054
02F W69-06055
02E W69-06056
04A W69-06057
04A W69-06058
04A W69-06059
04A W69-06060
04A W69-06061
04A W69-06062
04A W69-06063
04A W69-06064
04A W69-06065
04A W69-06066
04A W69-06067
04A W69-06068
04A W69-06069
04A W69-06070
02G W69-06071
02G W69-06072
02H W69-06073
02G W69-06074
02F W69-06075
02H W69-06076
02L W69-06077
05G W69-06078
05B W69-06080
05C W69-06081
04B W69-06082
02J W69-06083
02F W69-06084
02D W69-06085
06B W69-06086
06B W69-06087
06B W69-06088
06B W69-06089
06B W69-06090
03B W69-06091
05C W69-06092
05A W69-06093
05G W69-06094
05G W69-06095
05G W69-06096
06F W69-06097
06B W69-06098
06B W69-06099
06E W69-06100
06E W69-06103
06E W69-06104
06E W69-06105
06E W69-06106
06E W69-06107
06E W69-06108
05G W69-06109
05C W69-06110
05C W69-06111
05G W69-06112
05G W69-06113
05G W69-06114
05G W69-06115
05G W69-06116
05G W69-06117
05G W69-06118
05G W69-06119
05G W69-06120
06E W69-06121
06E W69-06122
06E W69-06123
06E W69-06124
06E W69-06125
06E W69-06126
06E W69-06127
06E W69-06128
06E W69-06129
06E W69-06130
06E W69-06131
06E W69-06132
04C W69-06133
06E W69-06134
06E W69-06135
06E W69-06136
06E W69-06137
06E W69-06138
06E W69-06139
06E W69-06140
06E W69-06141
06E W69-06142
06E W69-06143
06E W69-06144
06E W69-06145
06E W69-06146
06E W69-06147
06E W69-06148
06E W69-06149
06E W69-06150
06E W69-06151
06E W69-06152
06E W69-06153
06E W69-06154
06E W69-06155
06E W69-06156
06E W69-06157
06E W69-06158
06E W69-06159
06E W69-06160
06E W69-06161
06E W69-06162
06E W69-06163
06E W69-06164
06E W69-06165
06E W69-06166
06E W69-06167
06E W69-06168
06E W69-06169
06E W69-06170
06E W69-06171
06E W69-06172
06E W69-06173
06E W69-06174
06E W69-06175
06E W69-06176
06E W69-06177
06E W69-06178
06E W69-06179
06E W69-06180
06E W69-06181
06E W69-06182
06E W69-06183
06E W69-06184
06E W69-06185
06E W69-06186
06E W69-06188
06E W69-06189
06E W69-06190
06E W69-06191
06E W69-06192
06E W69-06193
06E W69-06194
06E W69-06195
06E W69-06196
06E W69-06197
06E W69-06198
06E W69-06199
06E W69-06200
06B W69-06201
04B W69-06202
05A W69-06203
02E W69-06204
02B W69-06205
02F W69-06206
06B W69-06207
02F W69-06208
02E W69-06209
02C W69-06210
02F W69-06211
02F W69-06212
02F W69-06213
02B W69-06214
05E W69-06215
02E W69-06216
02E W69-06217
03B W69-06218
02E W69-06219
06B W69-06220
06B W69-06221
02E W69-06222
02F W69-06223
02G W69-06224
05G W69-06225
06A W69-06226
02A W69-06227
02A W69-06228
02E W69-06229
02F W69-06230
02E W69-06231
02J W69-06232
04C W69-06233
04A W69-06234
05B W69-06235
02D W69-06236
05B W69-06237
04A W69-06238
04A W69-06239
04A W69-06240
04A W69-06241
04A W69-06242
04A W69-06243
04A W69-06244
04A W69-06245
04A W69-06246
04A W69-06247
04A W69-06248
02K W69-06249
02F W69-06250
02E W69-06251
07A W69-06252
03F W69-06253
03F W69-06254
05G W69-06255
02J W69-06256
02C W69-06257
02C W69-06258
02J W69-06259
02C W69-06260
02C W69-06261
02C W69-06262
02C W69-06263
02C W69-06264
02C W69-06265
02C W69-06266
02C W69-06267
02C W69-06268
02C W69-06269
01A W69-06270
02K W69-06271
02K W69-06272
05B W69-06273
05B W69-06274
05C W69-06275
05G W69-06276
05A W69-06277
02H W69-06278
05A W69-06279
05C W69-06280
05C W69-06281
05A W69-06282
02H W69-06283
02K W69-06284
05C W69-06285
05E W69-06286
05C W69-06287
03A W69-06288
03C W69-06289
06B W69-06290
06B W69-06291
06B W69-06292
06B W69-06293
06B W69-06294
06B W69-06295
06B W69-06296
06B W69-06297
06B W69-06298
06B W69-06299
06B W69-06300
06E W69-06301
06E W69-06302
06E W69-06303
06E W69-06304
05G W69-06305
06B W69-06306
06E W69-06307
04C W69-06308
04A W69-06309
04A W69-06310
04A W69-06311
06E W69-06312
06E W69-06313
04C W69-06314
06E W69-06315
05G W69-06316
03D W69-06317
06E W69-06318
06E W69-06319
06E W69-06320
04A W69-06321
04A W69-06322
04A W69-06323
04A W69-06324
03F W69-06325
06E W69-06326
06E W69-06327
06E W69-06328
06E W69-06329
05G W69-06330
05G W69-06331
04A W69-06332
06E W69-06333
06E W69-06334
05G W69-06335
05G W69-06336
05G W69-06337
03F W69-06338
05G W69-06339
03F W69-06340
06E W69-06341
06E W69-06342
06E W69-06343
05G W69-06344
05G W69-06345
08C W69-06346
06E W69-06347
06E W69-06348
05G W69-06349
05G W69-06350
05G W69-06351
05G W69-06352
05G W69-06353
05G W69-06354
05C W69-06355
05C W69-06356
04A W69-06357
06E W69-06358
04A W69-06359
04A W69-06360
04A W69-06361
04A W69-06362
04A W69-06363
04A W69-06364
04A W69-06365
04A W69-06366
04A W69-06367
04A W69-06368
04A W69-06369
04A W69-06370
04A W69-06371
04A W69-06372
04A W69-06373
04A W69-06374
04A W69-06375
04A W69-06376
06E W69-06377
06E W69-06378
06E W69-06379
04A W69-06380
06E W69-06381
06E W69-06382
06E W69-06383
06E W69-06384
06E W69-06385
06E W69-06386
06E W69-06387
06E W69-06388
06E W69-06389
06E W69-06390
06E W69-06391
06E W69-06392
06E W69-06393
06E W69-06394
06E W69-06395
06E W69-06396
06E W69-06397
06E W69-06398
06E W69-06399
04A W69-06400
04A W69-06401
06E W69-06402
04A W69-06403
05G W69-06404
06C W69-06405
05G W69-06406
05G W69-06407
05G W69-06408
05G W69-06409
05G W69-06410
06B W69-06411
06B W69-06412
06B W69-06413
06B W69-06414
06B W69-06415
06B W69-06416
06B W69-06417
06B W69-06418
06B W69-06419
06B W69-06420

ABSTRACT SOURCES

	Accession Numbers	Total
A. Center of Competence		
(1) U.S. Geological Survey - Hydrology	W69-06015 -- W69-06085 W69-06201 -- W69-06270	140
(2) University of Florida - Eastern U.S. Water Law	W69-06100 -- W69-06200 W69-06301 -- W69-06420 W69-06094 -- W69-06097	222
(3) University of Wisconsin - Eutrophication	W69-06271 -- W69-06285 W69-06092 -- W69-06093	17
(4) University of Chicago - Metropolitan Water Resource Management	W69-06290 -- W69-06300 W69-06086 -- W69-06090 W69-06098 -- W69-06099	18
(5) Bureau of Reclamation - Engineering Works	W69-06091	1
B. Other		
(1) Office of Saline Water	W69-06286 -- W69-06288	3
(2) University of Nevada - Center for Water Resources Research	W69-06289	1
(3) Texas Technological College - Water Resources Center	W69-06001	1
(4) University of Texas - Center for Research in Water Resources	W69-06002 -- W69-06005	4
(5) University of Hawaii - Water Resources Center	W69-06006	1
(6) New Mexico State University - Water Resources Research Institute	W69-06007 -- W69-06008 W69-06010 -- W69-06013	6
(7) Georgia Institute of Technology - Water Resources Center	W69-06009	1
(8) Kansas State University - Water Resources Research Institute	W69-06014	1
	Grand Total	416

Reports Available from the Clearinghouse

The following publications can be purchased from the Clearinghouse for Federal Scientific and Technical Information, U.S. Department of Commerce, Springfield, Virginia 22151. Documents are priced at $3 each in paper copy or 65 cents in microfiche. Prepayment is required.

Title	Author	Organization	SWRA Abstract (Ref. to Vol. 2, 1969)
Effects of Urbanization on Unit Hydrographs for Small Watersheds, Houston, Texas, 1964-67 (2 vols)	W.H. Espey, Jr., D.E. Winslow	TRACOR, Inc.	No. 6, p. 2, W69-02354
Main I, A System of Computerized Models for Calculating and Evaluating Municipal Water Requirements (2 vols)		Hittman Assoc., Inc.	No. 9, p. 56, W69-03201
Main I, A System of Computerized Models for Calculating and Evaluating Municipal Water Requirements (two magnetic tapes $75 each: tape one, Library of Water Usage Parameters, tape two, Source Language Programs)		Hittman Assoc., Inc.	No. 9, p. 56, W69-03202
A Study to Determine the Cost of Water In Industrial Uses	H.C. Bramer D.J. Motz	Cyrus W. Rice & Co.	No. 9, p. 55, W69-03322
Northwood Gaging Installation, Baltimore - Instrumentation and Data	L.S. Tucker	American Society of Civil Engineers	No. 9, p. 7, W69-03507
Oakdale Gaging Installation, Chicago - Instrumentation and Data	L.S. Tucker	American Society of Civil Engineers	No. 9, p. 7, W69-03508
Response Characteristics of Urban Water Resources Data Systems	J.C. Schaake, Jr.	American Society of Civil Engineers	No. 9, p. 65, W69-03509
A Critical Review of Methods of Measuring Discharge Within A Sewer Pipe	H.G. Wenzel, Jr.	American Society of Civil Engineers	No. 9, p. 66, W69-03510
The Nature of Changes in Urban Watersheds and Their Importance in the Decades Ahead	M.B. McPherson	American Society of Civil Engineers	No. 9, p. 34, W69-03511
Estimation of Recreational Benefits at Some Selected Water Development Sites in California	Leonard Merewitz	Planmetrics, Inc.	No. 9, p. 51, W69-03578
Effective Water Resource Management		TRW Systems, Inc.	No. 10, p. 41, W69-03702
Velocity-Distributions in Straight Rectangular Channels	Chin-lien Yen	Hydronautics, Inc.	No. 10, p. 4, W69-03703
A Discussion of the Dispersivity Tensor for a Turbulent Uniform Channel Flow	C. Dagan	Hydronautics, Inc.	No. 10, p. 4, W69-03704
Calculation of Dispersion Coefficient in Straight Prismatic Streams	C.L. Yen C. Elata	Hydronautics, Inc.	No. 10, p. 4, W69-03705
Urban Water Resources Research; Systematic Study and Development of Long-Range Plans, First Year Report, September 1968		American Society of Civil Engineers	No. 9, p. 50, W69-03506

Subject Fields

1 NATURE OF WATER

2 WATER CYCLE

3 WATER SUPPLY AUGMENTATION AND CONSERVATION

4 WATER QUANTITY MANAGEMENT AND CONTROL

5 WATER QUALITY MANAGEMENT AND PROTECTION

6 WATER RESOURCES PLANNING

7 RESOURCES DATA

8 ENGINEERING WORKS

9 MANPOWER, GRANTS, AND FACILITIES

10 SCIENTIFIC AND TECHNICAL INFORMATION

INDEXES

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

ABSTRACT SOURCES

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF COMMERCE

LIBRARY RATE
PRINTED MATTER

U.S. DEPARTMENT OF COMMERCE
CLEARINGHOUSE FOR FEDERAL
SCIENTIFIC AND TECHNICAL INFORMATION
Springfield, Va 22151

OFFICIAL BUSINESS

16. 33391
Se 48

UNIVERSITY OF ILLINOIS
AUG 29 1969
LIBRARY

SELECTED WATER RESOURCES ABSTRACTS

VOLUME 2, NUMBER 16
AUGUST 15, 1969

W69-06421 -- W69-06840

Selected Water Resources Abstracts is published semimonthly for the Water Resources Scientific Information Center (WRSIC) by the Clearinghouse for Federal Scientific and Technical Information (CFSTI) of the Bureau of Standards, U. S. Department of Commerce. It is available to Federal agencies, contractors, or grantees in water resources upon request to: Manager, Water Resources Scientific Information Center, Office of Water Resources Research, U. S. Department of the Interior, Washington, D. C. 20240. Annual subscription is $22.00 (domestic), $27.50 (foreign), single copy price is $3.00. Certain documents abstracted in this journal can be purchased from the Clearinghouse at the prices indicated in the entry. Prepayment is required.

CLEARINGHOUSE
FOR FEDERAL SCIENTIFIC AND TECHNICAL INFORMATION
U.S. Department of Commerce, Springfield, Va., 22151

SELECTED
WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

VOLUME 2, NUMBER 16
AUGUST 15, 1969

W69-06421 -- W69-06840

Use of funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources. WRSIC is not presently prepared to furnish loan or retention copies of the publications announced.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas. Centers, and their subject coverage, now in operation are:

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

CONTENTS

FOREWORD_____iii

SUBJECT FIELDS AND GROUPS

(Use Edge Index on back cover to Locate Subject Fields and Indexes in the journal.)

01 NATURE OF WATER
Includes the following Groups: Properties; Aqueous Solutions and Suspensions

02 WATER CYCLE
Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION
Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL
Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Non-Water Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION
Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING
Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA
Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS
Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS, AND FACILITIES
Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.

10 SCIENTIFIC AND TECHNICAL INFORMATION
Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

01. NATURE OF WATER

1A. Properties

INTERMOLECULAR FORCES AND THE LIQUID STATE,
Purdue Univ., Lafayette, Ind.
C. R. Mueller.
Office of Saline Water Research and Development Progress Report No. 405. 1969. 34 p. OSW 14-01-0001-606.

Descriptors: *Liquids, *Molecular structure, *Statistical mechanics, Gases, Argon, Helium, Methane, Water, Theoretical analysis.
Identifiers: *Liquid state, *Intermolecular potentials, Molecular beams.

The intermolecular potential in the regions of interest to liquid state theory was studied by means of crossed molecular beams in order to provide data for the calculation of the statistical mechanical properties of liquids. The method involved the generation of two mechanically collimated beams of molecules which are forced to collide. By observing the angular distribution of the molecules scattered by the collisions the intermolecular forces were deduced. Differential cross section of helium-argon, argon-argon, neon-neon, methane-methane and water-water were determined. All of the systems indicated a common pattern in intermolecular potentials. The depth and position of the intermolecular potential minima were found to be similar to those obtained from the use of the Lennard-Jones 6-8 potential. The more common 6-12 potential did not even remotely fit the experiments. The potentials, however, were found to have a very broad forward bowl. This means that second and third nearest neighbors play very strong roles in the statistical mechanical theories. (Scott-Office of Saline Water)
W69-06838

02. WATER CYCLE

2A. General

DROUGHT IN THE NORTHEASTERN UNITED STATES,
New York Univ., N. Y. Dept. of Meteorology and Oceanology.
For primary bibliographic entry see Field 02B.
W69-06436

THE ABNORMALLY DRY WEATHER OF 1961-1966 IN THE NORTHEASTERN UNITED STATES,
Environmental Data Service, Silver Spring, Md.
For primary bibliographic entry see Field 02B.
W69-06437

FURTHER STUDIES OF DROUGHT OVER NORTHEASTERN UNITED STATES,
Weather Bureau, Washington, D. C. Extended Forecast Div.
For primary bibliographic entry see Field 02B.
W69-06438

SOME REMARKS ON THE PREDICTABILITY OF DROUGHT AND RELATED CLIMATIC ANOMALIES,
Environmental Science Services Administration, Silver Spring, Md.
For primary bibliographic entry see Field 02B.
W69-06439

EFFECTS OF THE DROUGHT ON WATER RESOURCES-SURFACE AND SUBSURFACE HYDROLOGY,
Geological Survey, Arlington, Va.
For primary bibliographic entry see Field 02B.
W69-06440

RELATION OF A HYDROLOGIC INDEX TO MEAN ANNUAL FLOW,
River Forecast Center, Harrisburg, Pa.
For primary bibliographic entry see Field 02B.
W69-06441

HYDROLOGIC CYCLE AS A CLOSED SYSTEM,
University Coll., Cork (Ireland).
James C. I. Dooge.
Bull Int Assoc Sci Hydrol, Vol 13, No 1, pp 58-68, Feb 1968. 11 p, 9 fig.

Descriptors: *Hydrologic cycle, *Water circulation, *Mathematical studies, *Systems analysis, Parametric Hydrology, Physics, Analytical techniques, Forecasting, Synthesis, Synthetic hydrology, Natural streams, Watersheds (Basons), Groundwater, Soil moisture, Storms.
Identifiers: *Lecture, Conceptual model.

Analytical and conceptual approach to the analysis of the hydrologic cycle, as a determinated system, is reviewed on the basis of earlier publications, and the main types of solutions for the analysis and synthesis of the combined deterministic systems are briefly summarized. The paper contains the following topic headings: the systems approach; hydrologic cycle; the problem of prediction; the problem of identification; the problem of simulation; non-linear methods; and review of present position. The article has 8 formulas. (Gabriel-USGS)
W69-06442

THE ANNUAL HEAT ENERGY TRANSFER ABOVE AND INSIDE ANTARCTICA BLUE ICE,
Melbourne Univ., Parkville (Australia). Dept. of Meteorology; and Melbourne Univ., Parkville (Australia). Antarctic Div.
For primary bibliographic entry see Field 02C.
W69-06480

RELATIONS BETWEEN GLACIER RUNOFF AND METEOROLOGICAL FACTORS OBSERVED ON AND OUTSIDE THE GLACIER,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Versuchsanstalt fuer Wasserbau und Erbau.
For primary bibliographic entry see Field 02C.
W69-06481

DYNAMIC SIMULATION MODEL OF THE TRANSPIRATION PROCESS,
Oregon State Univ., Corvallis.
For primary bibliographic entry see Field 02D.
W69-06504

A PRELIMINARY FIELD STUDY OF SURFACE TREATMENTS FOR RUNOFF INDUCEMENT IN THE NEGEV OF ISRAEL,
Hebrew Univ., Jerusalem (Israel).
D. Hillel, and E. Rawitz.
9th Int Congr Soil Sci, Trans, Vol 1, pp 303-311, Adelaide, Australia, 1968. 9 p, 2 fig, 4 tab, 3 ref.

Descriptors: Field investigations, *Runoff, Overland flow, Rainfall, Field tests, *Storm runoff, *Surface runoff, *Water harvesting, Paving, Arid climates, Rainfall-runoff relationships, Water conservation, Soils, Compaction, Water yield, *Water yield improvement, Induced benefits, Fuel oils, Salts, Cultivation, Infiltration, Foreign research.
Identifiers: Israel, *Negev (Israel), Surfacing, *Surface treatment, Aggregation.

Obtaining additional supplies of water by artificial inducement of runoff can be important in arid regions. Various surface treatments can affect the infiltration rate and stability of the soil and determine the quantity and frequency of runoff. Several treatments were compared in field runoff plots in Israel in which the rainfall pattern and runoff rates were monitored during 2 seasons. These treatments included: control, mechanical compaction, sodic dispersion, fuel oil, cultivation, and aggregation. An analysis is presented of the seasonal runoff potential and the performance of the various treatments, including: (1) total runoff yield, (2) runoff ratio, (3) average infiltration capacity, (4) relation of runoff yield to storm size, and (5) total seasonal erosion. The formation of a layer of stable aggregates reduced runoff to practically zero (especially during a drought season), whereas the formation of an artificial crust (fuel oil having the triple effect of sealing, waterproofing, and binding the soil surface) induced runoff in amounts exceeding 80% of seasonal rainfall. (USBR)
W69-06715

AN ANALYSIS OF NATIONAL BASIC INFORMATION NEEDS IN URBAN HYDROLOGY,
American Society of Civil Engineers, Cambridge, Mass. Urban Hydrology Research Council.
For primary bibliographic entry see Field 04C.
W69-06770

A RIGID PLATE MODEL OF THE BAROMETRIC EFFECT,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
For primary bibliographic entry see Field 02F.
W69-06775

EFFECTS OF TRUNCATION ON DEPENDENCE IN HYDROLOGICAL TIME SERIES,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
Rezaul K. Bhuiya, and Vujica Yevjevich.
Colo State Univ Hydrol Pap No 31, Nov 1968. 23 p, 10 fig, 5 tab, 2 ref, 2 append. Grant No GK-1661 (NSF).

Descriptors: *Time series analysis, *Synthetic hydrology, *Rainfall-runoff relationships, *Stochastic processes, *Markov processes, Correlation analysis, Frequency analysis, Statistical methods, Forecasting, Streamflow forecasting.
Identifiers: *Hydrological time series, Time-series truncation, Normal process, Lognormal process.

The effects of constant value truncation on the dependence property of idealized hydrological time series are investigated. This analysis was carried out for dependent stochastic components, for periodic component and for the sum of stochastic dependent and periodic deterministic components of hydrological time series. The random elements of the process were considered for both normal and lognormal distributions. For all cases, the truncation is considered at a constant level. Analytical equations were developed in approximate forms for correlograms which express the dependence of the truncated time series. Computations of correlograms from these equations were made on a digital computer. Two series of daily river flows were used with the truncation at the mean flow to compare their correlograms with those of the original daily flow time series. Truncation at any constant level of a dependent random process reduces the dependence in sequence of a time series. The magnitude of the reduction depends on the constant of truncation. First autocorrelation coefficients of precipitation series in an arid region should be, in general and neglecting other factors which affect the dependence, less on the average than in a wet region, if the annual evaporation is assumed to be a constant. The truncation of a periodic process at a constant level reduces the amplitude of the correlogram while the period remains the same. It can also be said that the periodic truncation of a purely stochastic process makes the correlogram periodic. (Knapp-USGS)
W69-06789

REGIONAL HYDROLOGIC AREA STUDY AS AN ANALYSIS TOOL IN WEATHER MODIFICATION,
Sierra Hydrotechnology, Placerville, Calif.; and Atmospheric Water Resources Research, Fresno, Calif.

Jack F. Hannaford, and Merlin C. Williams.
Proc 36th Annu Meeting of Western Snow Conf, Apr 16-18, 1968, Lake Tahoe, Nev, pp 67-76, 1968. 10 p, 4 fig, 1 tab, 13 ref.

Descriptors: *Weather modification, *Cloud seeding, *Hydrologic data, Hydrologic aspects, Runoff, Streamflow, Water supply, Rainfall, Snowpacks.
Identifiers: *Sierra Nevada (Calif).

A regional hydrologic analysis of the southern and central Sierra Nevada from Bakersfield, California to Reno, Nevada was made to identify trends in runoff and to identify trends associated with weather modification activity. Most target areas show apparent increases in runoff during the period of modification operations. The pattern is clear even though increases may only be in the 5 to 10 percent range. This implies that Sierra weather modification projects have been successful, well targeted, and effective. There is an apparent area of downwind effect showing increases in runoff of a magnitude similar to that in the target areas. No peripheral or downwind effects indicating decreases in runoff were found which could be associated with the period of weather modification activity. It is recognized that rigorous statistical proof with the data in this analysis is a virtual impossibility. Apparent effects are small when related to overall discharge and potential measurement errors, so that detection with a suitable degree of statistical reliability basins may not be possible. However, an overall pattern is developing which appears consistent with findings of others in this and other areas. (Knapp-USGS)
W69-06805

THE USE OF ELECTRIC ANALOG MODELS IN HYDRODYNAMICAL STUDY OF THE ALSACE AQUIFERS (FRENCH),
Institut de Physique du Globe, Strasbourg (France).
For primary bibliographic entry see Field 02F.
W69-06806

ON MULTILEVEL OPTIMIZATION IN GROUND WATER SYSTEMS,
California Univ., Los Angeles. Dept. of Engineering.
For primary bibliographic entry see Field 02F.
W69-06813

QUASILINEARIZATION APPROACH TO THE IDENTIFICATION OF HYDROLOGIC SYSTEMS,
California Univ., Los Angeles. Dept. of Engineering; and Nevada Univ., Reno. Dept. of Water Resources.
John W. Labadie, William S. Butcher, and John A. Dracup.
Calif Univ Water Resources Center Rep, 1967. 15 p, 1 fig. OWRR Proj No B-028-CAL.

Descriptors: *Mathematical models, *Systems analysis, Optimization, Linear programming, Simulation analysis, Digital computers, Input-output analysis, Synthetic hydrology.
Identifiers: *Quasilinearization.

The use of quasilinearization in systems identification for the solution of complex hydrological problems is discussed. Quasilinearization is a powerful mathematical tool to solve many complex mathematical representations of hydrologic systems in the systems analysis or mathematical modeling techniques utilizing digital computers. Realistic models use systems of high-order, nonlinear, ordinary differential equations and partial differential equations. Solution of these equations may be found by finite difference techniques in digital computers. In modeling of hydrologic systems by quasilinearization, complex, nonlinear problems can be replaced by a successive approximation scheme which utilizes linear, first-order differential equations. A complete set of initial conditions need not be supplied. An algorithm is set up which can be used to converge to the optimal values of the parameters of the original nonlinear equations. (Knapp-USGS)
W69-06822

RAINFALL-RUNOFF RELATIONS FOR SOUTHEASTERN LOUISIANA AND SOUTHWESTERN MISSISSIPPI,
Geological Survey, Baton Rouge, La.
Anthony J. Calandro.
Louisiana State Dep Public Works Tech Rep No 2a, 1967. 61 p, 2 fig, 3 tab, 11 ref, append.

Descriptors: *Rainfall-runoff relationships, *Louisiana, *Mississippi, Hydrographs, Hydrograph analysis, Data collections, Rainfall, Runoff, Statistical models, Regression analysis, Antecedent precipitation, Duration curves, Runoff forecasting, Rain gages.
Identifiers: Thiessen methods.

A method for estimating storm runoff from rainfall records is presented for southeastern Louisiana and southwestern Mississippi. A rainfall-runoff relationship generally useful in the study area relates storm runoff to storm rainfall and the week of its occurrence. Values of weekly coefficients and exponents are tabulated. The standard error of estimate of this relationship for all storm is about 40%; for storm rainfalls greater than 4 inches, the standard error decreases to about 25%. With these limitations, the rainfall-runoff relations can also be used to distribute incremental rainfall excess with time. Records for 20 stream-gaging stations and 34 rainfall stations in the area studied were used to compute antecedent rainfall parameters, rainfall duration, total storm rainfall, and total runoff for 959 storm hydrographs. Graphical analysis indicates that regressions of rainfall versus runoff for each week of the year are good as or better than regressions involving parameters of antecedent conditions and rainfall duration for estimating storm runoff. Apparently, the week-of-year factor accounts for seasonal variations in duration and antecedent conditions, and use of the seasonal factor alone will provide useful estimates of storm runoff in the area studied. (Knapp-USGS)
W69-06829

IMPROVED TECHNIQUES FOR ESTIMATING RUNOFF WITH BRIEF RECORDS,
New South Wales Univ., Manly (Australia). Water Research Lab.
For primary bibliographic entry see Field 02E.
W69-06830

2B. Precipitation

DROUGHT IN THE NORTHEASTERN UNITED STATES,
New York Univ., N. Y. Dept. of Meteorology and Oceanology.
Jerome Spar.
Proc of Conf on Drought in Northeastern US, May 15-17, 1967 at Sterling Forest, N. Y. Mar 1968. 233 p.

Descriptors: *Droughts, *Precipitation (Atmospheric), *Water shortage, *Northeast U S, Meteorology, Climatology, Synoptic analysis, Statistical methods, Time series analysis, Rainfall, Streamflow forecasting, Water supply.
Identifiers: *Northeastern U S drought (1961-67).

A conference was held to discuss the drought of 1961-67 in the northeastern U. S. Topics discussed include economic aspects, water supply problems, the statistical aspects of northeastern U. S. precipitation, definition of droughts, hydrological aspects and effects on streamflow. Forecasting of rainfall, streamflow, and runoff, particularly long-range forecasting, was stressed. Analysis of meterological data suggests that precipitation frequency is less important than intensity as a drought factor, droughts are characterized by a mean upper trough position east of the normal position rather than by a low frequency of trough passages, westnorthwesterly storm tracks are more frequent than usual, southwesterly tracks are displaced east, and relative humidity is lower than usual in the lower atmosphere. (Knapp-USGS)
W69-06436

THE ABNORMALLY DRY WEATHER OF 1961-1966 IN THE NORTHEASTERN UNITED STATES,
Environmental Data Service, Silver Spring, Md.
Wayne C. Palmer.
Proc of Conf on Drought in Northeastern U S, May 15-17, 1967, Sterling Forest, N Y, pp 32-56, Mar 1968. 25 p, 12 fig, 1 tab, 4 ref.

Descriptors: *Drought, *Northeast U S, Climatology, Synoptic analysis, Statistical methods, Rainfall, Precipitation (Atmospheric), Streamflow.
Identifiers: Northeastern U S Drought (1961-67).

The history of the drought of 1961-67 in the northeastern U. S. is discussed. Unusually dry weather first appeared in the Hudson Valley in the fall of 1961. From there the drought spread and sporadically increased in severity until the shortages of urban and municipal water supplies became acute in many places by late 1964. After mid-1965 the heart of the drought area had shifted from the Hudson Valley to the Potomac Basic region. Maximum drought severity each year is shown by maps. Another map shows the drought of 1930-31 to have been more widespread and centered some 300 miles southwest of the center of this 1960's drought. The runoff deficit accounted for nearly 3/4 of the 5-year precipitation deficiency. The evapotranspiration deficit developed primarily during 1964 and 1966 and was considerably smaller than the runoff deficiency. A detailed analysis is given for determination of the likelihood that the 5 year of dry weather has finally given way to a period of near normal or wetter than normal weather. The conclusion was that by May 1967 the weather has been wet enough to justify at least a 50% likelihood that the drought had ended in September 1966. (Knapp-USGS)
W69-06437

FURTHER STUDIES OF DROUGHT OVER NORTHEASTERN UNITED STATES,
Weather Bureau, Washington, D. C. Extended Forecast Div.
Jerome Namias.
Proc of Conf on Drought in Northeastern US, May 15-17, 1967, Sterling Forest, N Y, pp 57-94, Mar 1968. 37 p, 19 fig, 1 tab, 13 ref.

Descriptors: *Droughts, *Northeast U S, *Climatology, Synoptic analysis, Statistical methods, Rainfall, Precipitation (Atmospheric), Winds, Meteorology, Anticyclones.
Identifiers: Northeastern U S drought (1961-67).

Records from New York Central Park Observatory were used to study the small-scale manifestations of the drought of 1961-67 in the Northeastern U. S. A long-term downward precipitation trend beginning in the 1920's or 1930's was found. This appears to be related to general circulation aberrations. Nationwide precipitation patterns were calculated from 59 yrs of precipitation records, and dry years in the northeast are usually also dry in the Southern Plains and wetter than usual in the Far West. It is suggested that when a prevailing upper-level trough is off the Atlantic coast in spring, leading to dry weather in the Northeast, another trough dominates the Western Plateau, causing intense frontal activity and showers. This system appears to be caused by the dominent influence of the upper-level anticyclone in the Southern Plains. (Knapp-USGS)
W69-06438

SOME REMARKS ON THE PREDICTABILITY OF DROUGHT AND RELATED CLIMATIC ANOMALIES,
Environmental Science Services Administration, Silver Spring, Md.

J. Murray Mitchell, Jr.
Proc of Conf on Drought in Northeastern US, May 15-17, 1967, Sterling Forest, NY, pp 129-159, Mar 1968. 31 p, 11 fig, 1 tab, 2 ref.

Descriptors: *Droughts, *Forecasting, *Climatology, Synoptic analysis, Statistical methods, Time series analysis, Meteorology, Rainfall, Precipitation (Atmospheric), Temperature, Winds.
Identifiers: *Drought prediction.

The general problem of climatic prediction is defined, and various conceivable approaches to prediction, in part physical and in part statistical, are distinguished. An analysis of the pattern of mean precipitation and temperature anomalies in the United States from 1962-1966 strongly suggests that the Northeast Drought was a regional manifestation of a general climatic fluctuation, associated with large-scale aberrations of the atmospheric circulation over North America. The Northeast Drought, unlike other recent U. S. droughts, was a comparatively cool one, especially during the winter and summer seasons when temperatures averaged below normal over most sections of the nation. On the basis of a power spectrum analysis of drought indices for Central Park, there seems to be very little hope that major droughts in the Northeast can be predicted years in advance by statistical means. Our best chance for reliable long-range drought prediction lies in the possibility of our gaining further insight into the physical causes of climatic fluctuation. (Knapp-USGS)
W69-06439

EFFECTS OF THE DROUGHT ON WATER RESOURCES-SURFACE AND SUBSURFACE HYDROLOGY,
Geological Survey, Arlington, Va.
Henry C. Barksdale.
Proc of Conf on Drought in Northeastern U S, May 15-17, 1967, Sterling Forest, N Y. pp 202-217, Mar 1968. 16 p, 4 fig.

Descriptors: *Droughts, *Water shortage, *Northeast U S, Water level fluctuations, Streamflow, Runnoff, Water storage, Water supply, Water yield, Hydrologic budget.
Identifiers: Drought criteria.

The relationship of climatic drought to the water resource deficit is discussed to establish reasonable criteria for the beginning and end of droughts. Insofar as water resources and water supplies are concerned, we may safely conclude that the drought is over if, during the coming growing season, normal or above-normal precipitation results in the maintenance of groundwater levels and streamflows above critical levels and certainly if, in the subsequent non-growing season, a more nearly complete recovery to normal levels and flows occur. The fact that the carryover of groundwater deficiency from 1966 to 1967 was absent in parts of the region and was less than in the preceding 2 years in other parts suggests that insofar as water resources are concerned the end of the drought is clearly within reach. It is not necessary for future above-normal precipitation to erase entirely the large cumulative deficiencies that have developed before we may feel that the drought is over from a water-resources viewpoint. It is impossible to store up any significant part of the water resources or water-supply needs that may have gone unsatisfied. (Knapp-USGS)
W69-06440

RELATION OF A HYDROLOGIC INDEX TO MEAN ANNUAL FLOW,
River Forecast Center, Harrisburg, Pa.
O. D. White.
Proc of Conf on Drought in Northeastern U S, May 15-17, 1967, Sterling Forest, NY, pp 218-228, Mar 1968. 11 p, 5 fig.

Descriptors: *Rainfall-runoff relationships, *Streamflow forecasting, Evapotranspiration, Soil moisture, Groundwater movement, Precipitation (Atmospheric), Infiltration, Antecedent precipitation, Statistical methods, River forecasting.
Identifiers: *Susquehanna River Basin, Hydrologic index.

A hydrologic index was developed for the Susquehanna Basin by logarithmic weighting of departures from normal of precipitation and soil moisture conditions. Because of the manner of weighting the variables, hydrologic departures from normal up to a year previous were given weight. The most recent events have progressively greater weights. Soil moisture was computed by using a storm rainfall-runoff procedure tested for use in the Susquehanna Basin. The soil moisture index is a measure of dryness as empirically defined by an antecedent precipitation index and a computed antecedent potential evapotranspiration index. March values of these indices were used to develop a relation between the HI for March and the annual mean flow of the basin. The average error for the dependent data was 1,300 cfs for the Susquehanna Basin and 700 cfs for a similar procedure developed for the Delaware Basin above Trenton, New Jersey. Average long-term flow for the Susquehanna above Harrisburg is 34,400 cfs and 11,800 cfs above Trenton. In every case, the forecast values were of the proper sign when compared to the long-term average flows. (Knapp-USGS)
W69-06441

PRECIPITATION AND BASE FLOW VARIABILITY,
Agricultural Research Service, Madison, Wis. Soil and Water Conservation Research Div.
Neal E. Minshall.
Int Ass Sci Hydrol Pub No 76, Symp on Hydrol Aspects of Util of Water, Bern, Sept 25-Oct 7, 1967, pp 137-145, 1968. 9 p, 7 fig, 1 tab, 3 ref.

Descriptors: *Base flow, *Surface-groundwater relationships, *Rainfall-runoff relationships, *Wisconsin, Hydrographs, Hyetographs, Groundwater, Low flow, Springs, Computers.
Identifiers: *Precipitation-base flow relations.

The effect of rainfall variability on the base flow of streams during a period involving only minor changes in vegetation cover is shown. Data from 133.5-hectare and larger watersheds in Wisconsin are presented to illustrate the relation between precipitation and base flow. Variations from the mean base flow on selected southwestern Wisconsin streams for the period 1940-1964 were correlated with precipitation trends. Accumulated deviations from the mean base flow bear a consistent relation to the accumulated deviation of precipitation, independent of the size of drainage area or magnitude of the mean annual base flow. Knowledge of the relation between precipitation and base flow permits estimating past base flows from the precipitation pattern. Precipitation is seldom normal for any extended period, but occurs in series of above- or below-normal yr. The lag between beginning of above-normal precipitation and base flow response may be several years, depending on the magnitudes preceding droughts and the precipitation departures. Reduction in base flow is almost immediate when precipitation drops below normal. A method is presented for estimating missing base flow records from the precipitation pattern. The relationship between average annual deviation of precipitation and base flow appears to be independent of the size of the drainage area. (Knapp-USGS)
W69-06443

ESTIMATION OF RAINFALL IN SPARSELY GAUGED AREAS,
Otago Univ., Dunedin (New Zealand). Dept. of Geography.
Peter Hutchinson.
Bull Int Ass Sci Hydrol, Vol 14, No 1, pp 101-119, Mar 1969. 19 p, 10 fig, 3 tab, 11 ref.

Descriptors: *Rain gages, *Correlation analysis, *Topography, Statistical methods, Gaging stations, Elevation, Meteorology, Mountains, Rainfall disposition.
Identifiers: *New Zealand.

In areas of high relief, topography strongly affects both the rainfall distribution and the variability of rainfall as measured by the correlation between pairs of points. To determine topographic effect, 2 New Zealand areas of different topography were compared. Coastal Otago has very strong relief, and Coastal Canterbury is flat to rolling. Correlation analyses were made on rain gage data of 1955-1965 in the 2 areas. The extreme values of the station coefficients of variability in Otago were 27.30 and 11.34. In Canterbury the extremes were 22.6 and 13.27. A second method of comparing the 2 areas was standard multiple regression in which the independent variables were topographic parameters. The results are shown graphically. On the average, correlations between any 2 Canterbury stations separated by as much as 60 mi are significant at the 99% level, while in Otago, the separation for 99% significance is only 29 mi and for 95% significance, separation is 50 mi. The results can be used to estimate the area described by each rain gage, to estimate rainfall at ungaged sites, and to establish correction factors to use with gages to make their readings representative of their surrounding areas. (Knapp-USGS)
W69-06773

FREQUENCY AND AREAL DISTRIBUTIONS OF TROPICAL STORM RAINFALL, U.S. COASTAL REGION, GULF OF MEXICO,
Weather Bureau, Silver Spring, Md. Office of Hydrology.
Hugo V. Goodyear.
Environ Sci Serv Admin Tech Rep WB-7, July 1968. 33 p, 54 fig, 3 tab, 7 ref.

Descriptors: *Rainfall disposition, *Rainfall intensity, *Tropical cyclones, *Frequency analysis, *Gulf Coastal Plain, Gulf of Mexico, Spatial distribution, Storms, Probability, Areal, Flooding, Structural design.
Identifiers: *Areal rainfall, Storm track, Landfall, Public Works, Storm frequency.

Results are presented of a rainfall frequency and areal distribution study of 46 well-developed tropical storms, basic data for which were collected during the 26-year period 1940-65. The storms entered the Gulf Coast between Apalachicola, Fla. and Brownsville, Tex.; rainfall investigation was for the 48-hour period from 24-hr before landfall to 24-hr after. A series of charts shows the spacial distribution of 12-, 24-, and 48-hr rainfall up to 100 mi inland and within 150 mi of either side of storm track. Other charts show distributions of 6- and 12-hr point rainfalls for 2, 10, 25, and 50% frequency in five 25-mi zones parallel to the coast and for 125 mi on either side of the storm track. Most probable time of maximum 6-hr point rainfall (29% probability) is during 6 hr before landfall. Combining probabilities of both time and space, a 21% probability exists that the max 6-hr point value will occur in the 12-hr period from 6 hr before to 6 hr after landfall and in a 75-mi square to the right of and landward from point of landfall. An area-point relation is provided for adjusting point rainfall values to average depths for areas up to 1000 sq mi. (Lang-USGS)
W69-06797

A UNIVERSAL SURFACE PRECIPITATION GAGE,
Agricultural Research Service, Boise, Idaho. Soil and Water Conservation Research Div.
Lloyd M. Cox, and W. Russell Hamon.
Proc 36th Annu Meeting of Western Snow Conf, Apr 16-18, 1968, Lake Tahoe, Nev, pp 6-8, 1968. 3 p, 5 fig.

Descriptors: *Snowpack, *Melt water, *Precipitation gages, *Measurement, *Water equivalent, Instrumentation, Mechanical equipment, Telemetry, Snow surveys, Snowfall, Snow management, Water management (Applied), Rainfall.
Identifiers: *Snow pressure recorder.

A total precipitation gage which weighs overlying snow and collects and measures water yield from

precipitation or snowmelt is described. The hydraulic weighing platform consists of a 5-ft dia platform supported by liquid-filled flexible tubing, surrounded by a 6-inch wide ring to provide a positive boundary for the system. An opening in the center of the platform collects water, which is measured in a tripping tank. Diagrams and specifications for building the system, and instructions for its operation are included. (Knapp-USGS)
W69-06804

RADAR MEASUREMENT OF PRECIPITATION FOR HYDROLOGICAL PURPOSES,
National Severe Storms Lab., Norman, Okla.
E. Kessler, and K. E. Wilk.
World Meteorol Organ/Int Hydrol Decade Proj Rep No 5, 1968. 46 p, 16 fig, 3 tab, 63 ref.

Descriptors: *Radar, *Remote sensing, *Precipitation (Atmospheric), *Measurement, *Rainfall, Precipitation intensity, Instrumentation, Meteorology, Runoff, Thunderstorms, Weather data.
Identifiers: *Radar storm-measurement.

Radar applications for the measurement of precipitation over an area are reviewed. Radar-sets with a beamwidth of 2 deg or less and a wavelength of 10 cm should provide improved measurements of area rainfall and more timely and comprehensive rainfall reports. However, practical use of the potential of radar for hydrologic work requires further examination of the correspondence between radar and raingage data, improved use of data-processing and communicating techniques, and development of improved means for measuring precipitation echoes in the presence of terrain echoes. A system for the display, processing and communication of accurate and suitably detailed weather radar information is being operated with the WSR-57 radar at the National Severe Storms Laboratory, Norman, Okla. The radar data can be presented in the usual manner on PPI displays and can also be quantized in small-range increments. In the latter case, the signal is averaged from pulse-to-pulse and is continuously recorded as a measure of the averaged reflectivity of each associated target volume. The averaged signals are displayed as contour-maps of target intensity on PPI scopes for photographic recording and they are also registered on magnetic tape in numerical form. The tape system is presently arranged to record in 2 and a half min the echo intensity in 8 categories at 14,400 locations between 20 and 130 nautical mi away. Computer programs are available to adapt the numerical data to a variety of specialized requirements. (Knapp-USGS)
W69-06812

CLIMATOLOGY STUDIES OF BAFFIN ISLAND, NORTHWEST TERRITORIES,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
R. G. Barry, and S. Fogarasi.
Inland Waters Br, Dep Energy, Mines and Resources Tech Bull No 13, 1968. 106 p, 9 fig, 5 ref.

Descriptors: *Synoptic analysis, *Climatology, *Data collections, Climatic data, Snow, Snowpacks, Glaciers, Precipitation (Atmospheric), Meteorological data.
Identifiers: *Canada, Baffin Island, Ice caps.

Vapor content and horizontal vapor transport over the Eastern Canadian Arctic were studied in a synoptic analysis of the Baffin Island region. Low temperatures cause low atmospheric moisture availability and consequent low winter precipitation, but there is no unique relation of maximum precipitation to moisture content or moisture transport. Precipitation maxima probably result from storm frequency maxima. Depressions moving northward toward Baffin Bay are probably a major source of moisture transport for southern and eastern Baffin Island. Mean monthly moisture content, mean monthly humidity, mean monthly vector transport and eddy vector transport, zonal transport and pressure-snowfall relations are shown in summary form by contour maps. (Knapp-USGS)
W69-06814

2C. Snow, Ice, and Frost

THE MECHANICAL PROPERTIES OF SINGLE CRYSTALS OF ICE AT LOW TEMPERATURES,
Birmingham Univ. (England). Dept. of Physics.
S. J. Jones, and J. W. Glen.
Comm of Snow and Ice, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Sci Hydrol, Pub No 79, pp 326-340, 1967. 15 p, 13 fig, 12 ref.

Descriptors: *Ice, *Plastic deformation, *Flow, Physical properties, Rheology, Temperature, Pressure, Mechanical properties, Plasticity, Strain, Stress, Crystal growth.
Identifiers: Dislocation (Crystallographic).

The mechanical properties of single crystals of ice were investigated at various temperatures down to -90 deg C. Two methods were used: creep tests in tension and constant strain-rate tests in compression. Results show that the activation energy for creep varies with temperature from 0.41+ or - 0.03 eV between -50 deg C and -90 deg C to 0.68+ or - 0.04 eV between -50 deg C and - 10 deg C. The glide direction in ice is confirmed to be the (11-20) crystallographic direction. The yield point phenomenon observed in the constant strain-rate tests is discussed in terms of the theory of the multiplication of dislocations. Experimental curves compare well with computed curves. Small amounts of HF dissolved in ice cause a pronounced softening. (Knapp-USGS)
W69-06474

DEFORMATION OF POLYCRYSTALLINE ICE UNDER COMBINED UNIAXIAL AND HYDROSTATIC PRESSURE,
Federal Inst. for Snow and Avalanche Research, Weissfluhjoch-Davos (Switzerland).
R. Haefeli, C. Jaccard, and M. De Quervain.
Comm of Snow and Ice, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 79, pp 341-344, 1967. 4 p, 2 fig, 1 tab.

Descriptors: *Ice, *Plastic deformation, *Flow, *Hydrostatic pressure, Physical properties, Rheology, Temperature, Pressure, Mechanical properties, Plasticity, Strain, Stress.
Identifiers: Ice deformation, Uniaxial stress.

A cylindrical polycrystalline ice sample is deformed under an uniaxial load of 0.8 bars and a hydrostatic pressure of 295 bars at temperatures of -5.9 deg and -8.1 deg C. The creep rate is increased by the hydrostatic pressure at constant temperature, but reduced again below its original value if the temperature is dropped at the rate of the depression of the pressure melting point. (Knapp-USGS)
W69-06475

THE IMPORTANCE OF THE HYDROGEN ATOM ARRANGEMENT IN DETERMINING HOW ICE CAN DEFORM PLASTICALLY,
Birmingham Univ. (England). Dept. of Physics.
J. W. Glen.
Comm of Snow and Ice, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 79, pp 352-355, 1967. 4 p, 2 fig, 3 ref.

Descriptors: *Ice, *Plastic deformation, *Crystallography, Rheology, Physical properties, Thermodynamics, Plasticity, Strain.
Identifiers: Lattice defects, Point dislocations, Crystallographic slip.

In the structure of ice, the oxygen atoms are arranged crystallographically, but the hydrogen atoms are not. This means that if ice were deformed plastically by slip without any other process occurring, electrical point defects would have to be created, and the energy of these is such that the stress required to make them is far higher than the observed stress required to deform ice. Thus the ordinary slip process could not occur in ice unless some mechanism is available to re-orient the hydrogen atoms, such as the presence of mobile point defects. This necessity explains why creep in ice is as slow as it is, and also why hydrogen fluoride impurity in ice, which introduces such point defects, has such a large effect on the creep rate of ice, particularly at low temperatures. (Knapp-USGS)
W69-06476

THE METAMORPHISM OF WET SNOW,
Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.
Gorow Wakahama.
Comm of Snow and Ice, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 79, pp 370-379, 1967. 10 p, 9 fig, 1 tab, 1 ref.

Descriptors: *Snow, *Crystallization, *Melting, Crystals, Snowmelt, Melt water, Permeability, Porosity, Runoff, Ice.
Identifiers: Snow metamorphism, Wet snow.

In order to study the metamorphism of wet snow, a block of snow was placed in a thermally insulated box and maintained at 0 deg C for a long time. The microscopic changes occurring in the texture of snow were examined by the use of thin sections cut every other day from the block. Four series of experiments were carried out, using (1) dry snow, (2) snow wetted by adding a small amount of water, (3) snow immersed in water of 0 deg C, (4) snow immersed in water of 0 deg C and loaded with a weight. It was found that ice grains composing the snow grew rapidly in size in the case (3), while they grew slowly in the cases (1) and (2). In the case (4) snow was transformed into ice within a week. (Knapp-USGS)
W69-06477

LIQUID PERMEABILITY OF SNOW,
Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.
Daisuke Kuroiwa.
Comm of Snow and Ice, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 79, pp 380-391, 1967. 12 p, 8 fig, 2 tab, 3 ref.

Descriptors: *Permeability, *Snow, *Permeameters, Infiltration, Physical properties, Hydrologic properties, Flow, Porosity, Saturated flow, Structure.
Identifiers: Kerosene permeameters, Falling-head permeameters, Snow structure, Grain size.

In order to measure the liquid permeability of snow, 3 types of kerosene permeameters were designed for low, medium, and high density snow. The measurements were conducted on natural snow cover and artificially compressed snow, and correlation between kerosene permeability and porosity was investigated for wide range of porosity. The principle of these permeameters is analogous to the ordinary falling-head method used in soil engineering. The reproducibility of the kerosene permeability (k) was carefully investigated by repeating many tests on the same sample of snow. In the case of low density snow, less than 0.36 g/cu cm, a 10-15% difference was found between the k values for the first and second tests and those of subsequent tests. This difference is presumably caused by the compression of the low density snow specimen by the kerosene pressure. The horizontal permeability was larger than the vertical permeability. The relation between k and porosity of snow showed a wide scatter in the range of porosity 0.45 to 9.0. The values of k for fine-grained snow varied between 0.1 and 1.0 cm/sec, while k values for coarse-grained snow varied between 1.0 and 4.0 cm/sec. When porosity of snow was reduced from 0.4 to 0.05, the value of k decreased logarithmically from 0.1 to 10 minus 4 cm/sec. (Knapp-USGS)

W69-06478

THE METAMORPHISM OF DRY SNOW AT A UNIFORM TEMPERATURE,
Wash Univ., Seattle. Dept. of Atmospheric Sciences.
P. V. Hobbs.
Comm of Snow and Ice, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub no 79, pp 392-402, 1967. 11 p, 2 fig, 14 ref. Grant Nos GP-3809 (NSF), GA-780 (NSF).

Descriptors: *Snow, *Crystallization, *Physical properties, Crystallography, Diffusion, Density, Pressure, Temperature, Melting, Freezing.
Identifiers: Snow metamorphism, Recrystallization, Dry snow.

The mechanisms by which the strength and density of old dry snow at a uniform temperature increase with time are discussed. It is concluded from theoretical and experimental studies that once the snow particles have assumed spherical shapes the dominant mechanism controlling the increase in the area of the ice bonds between grains, and therefore the strength of snow, is the transfer of material by diffusion through the vapor phase. The area of the ice bonds increases to the 2/5 power of t, where t is the age of old snow. In the absence of appreciable overburden pressure or temperature gradients, the increase in the density of old snow appears to be determined by the transfer of material by volume diffusion through the ice. Under these conditions the density also increase as the 2/5 power of t. The effects of time, grain size, and temperature of the strength of old snow are predicted theoretically and the results compared with experimental measurements. (Knapp-USGS)
W69-06479

THE ANNUAL HEAT ENERGY TRANSFER ABOVE AND INSIDE ANTARCTICA BLUE ICE,
Melbourne Univ., Parkville (Australia). Dept. of Meteorology; and Melbourne Univ., Parkville (Australia). Antarctic Div.
G. Weller.
Comm of Snow and Ice, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 79, pp 417-428, 1967. 12 p, 3 fig, 6 tab, 8 ref.

Descriptors: *Climatology, *Glaciers, *Heat transfer, Heat flow, Antarctic, Heat budget, Solar radiation, Winds, Air temperature, Geothermal studies, Conduction, Convection, Storage, Density.
Identifiers: *Antarctic ice cap, Continental ice sheets, Eddy transfer (Heat).

The heat energy fluxes at an ice surface in the Antarctic coastal ablation zone were measured and a Fourier analysis was carried out on the monthly mean values of all components. The energy transfer in the ice was measured and analyzed by computing the amplitudes of the radiative and conductive heat fluxes at various depths in the ice. In the surface heat budget the eddy heat transfer to the surface is the largest component with an annual mean value of 60 cal per sq cm per day and an annual amplitude of 50 cal per sq cm per day balancing the annual mean heat energy loss of 22 cal per sq cm per day by radiation and 38 cal per sq cm per day by evaporation and melting at the ice surface. The annual amplitude of the conducted heat flux through the surface of the ice resulting from changes in the net heat storage is approximately 30 cal per sq cm per day or 1/3 of the amplitude of the radiative net short wave flux through the surface. The annual temperature wave at the surface and the absorbed radiation contribute about equally to net changes in stored heat. At 4 metres depth the amplitude of the radiative flux is 1/3 of that of the conductive flux and the contribution of absorbed radiation to net changes in stored heat is still 15%. The mean annual value of the absorbed short wave radiation of 90 cal per sq cm per day balances heat losses by conduction to give zero annual net heat storage in the ice. (Knapp-USGS)
W69-06480

RELATIONS BETWEEN GLACIER RUNOFF AND METEOROLOGICAL FACTORS OBSERVED ON AND OUTSIDE THE GLACIER,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Versuchsanstalt fuer Wasserbau und Erbau.
Herbert Lang.
Comm of Snow and Ice, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 79, pp 429-439, 1967. 11 p, 5 fig, 11 ref.

Descriptors: *Glaciers, *Meteorology, *Hydrologic budget, *Heat budget, Regimen, Runoff, Ablation, Melting, Solar radiation, Temperature, Wind, Vapor pressure, Precipitation (Atmospheric), Regression analysis, Statistical methods.
Identifiers: *Alpine glacier budget, Aletschgletscher.

A heat balance and runoff study was made on the lower part of the Aletschgletscher in July and August 1965. The data were treated by multiple regression analysis. Meltwater runoff from a small area of the glacier surface was taken to be representative of heat balance at that point, while runoff from the whole Aletschgletscher basin is used as a measure of melting of the entire glacier area. Meteorological data collected were global radiation, temperature, vapor pressure, wind, and precipitation. Regression analysis showed that for hourly means in the small area regression, radiation was the most important factor. It made no difference whether temperature and vapor pressure were taken on the glacier or nearby. Temperature taken near the glacier gives a better correlation than temperature on the glacier. For daily means in the small area regression, the on-glacier temperature is better than off-glacier temperature or global radiation. In the multiple correlation, vapor pressure has great influence, wind speed is negligible, and on-glacier measurements correlate best with runoff. For the whole glacier off-glacier temperature is the most important factor, and temperature, vapor pressure, and precipitation give as good a regression as using all the factors. (Knapp-USGS)
W69-06481

A TEMPERATURE PROFILE THROUGH THE MEIGHEN ICE CAP, ARCTIC CANADA,
Department of Energy, Mines and Resources, Ottawa (Ontario). Polar Continental Shelf Project.
W. S. B. Patterson.
Comm of Snow and Ice, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 79, pp 440-449, 1967. 10 p, 2 fig, 1 tab, 13 ref, 1 append.

Descriptors: *Temperature, *Glaciers, Boreholes, Geothermal studies, Climatology, Regimen, Ablation, Heat budget, Air temperature, Solar radiation.
Identifiers: *Meighen Ice Cap (Canada), Glacial temperature profiles, Mass balance.

Temperatures were measured in a 121 m borehole through the 35 sq km ice cap on Meighen Island, Arctic Canada. The ice cap is virtually stagnant; thus advection of ice is not a factor in determining the temperature distribution. Temperatures below 10 m depth were in the range -16 to -18 deg C. Below 100 m, temperature varied linearly with depth at a rate which corresponds to a geothermal heat flux of 0.8 millionths of a cal per sq cm per sec. The shape of the temperature - depth curve over the range 20 to 100 m can be explained by assuming that (1) the mean annual temperature at the surface has decreased by some 1.5 deg C since the year 1940 and (2) the mean annual surface temperature was increasing during the period 1880-1940, the total increase being about 3.5 deg C. (Knapp-USGS)
W69-06482

A SYSTEM FOR MAKING REMOTE AND UNDISTURBED MEASUREMENTS OF SNOW SETTLEMENT AND TEMPERATURES,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
Robert H. Swanson.
Proc 36th Annu Meeting of Western Snow Conf, Apr 16-18, 1968, Lake Tahoe, Nev, pp 1-5, 1968. 5 p, 7 fig, 6 ref.

Descriptors: *Snow management, *Snowpacks, *Snow surveys, *Instrumentation, Depth, Snowfall, Density stratification, Snow management, Remote control, Mechanical equipment, Telemetry.
Identifiers: Snow settlement, Snow temperature.

Snow settlement and temperature are measured by thermistors mounted on platters dropped onto snow by remote control. Platter height is measured by the resistance of a vertical wire down which the platters slide. Several platters are stored above the snow to be released one at a time for successive settlement measurements. The equipment and its operation are described in detail. (Knapp-USGS)
W69-06803

A UNIVERSAL SURFACE PRECIPITATION GAGE,
Agricultural Research Service, Boise, Idaho. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 02B.
W69-06804

RECENT HISTORY OF GULKANA AND COLLEGE GLACIERS, CENTRAL ALASKA RANGE, ALASKA,
Arizona State Univ., Tempe. Dept. of Geology.
Richard D. Reger.
J of Geol, Vol 76, no 1, pp 2-16, Jan 1968. 15 p, 5 fig, 2 plate, 36 ref.

Descriptors: *Glaciers, *Regimen, *Alaska, Climatology, Water sources, Precipitation (Atmospheric), Melting, Hydrologic budget.
Identifiers: Glacial history (Alaska), Central Alaska Range.

The Recent moraines of Gulkana and College Glaciers lie above tree line in the central Alaska Range and were dated by lichenometry as being deposited by advances possibly in 1580 and 1650, and in 1830 and 1875. Older moraines are also present, but could not be dated by this method. Gulkana Glacier advanced in 1580, depositing moraines which were partly buried by moraines of later advances. No correlative advance apparently occurred at College Glacier. Gulkana Glacier readvanced in 1650 and overrode the 1580 terminal moraine. In 1830 Gulkana Glacier advanced to a position 2.5 km beyond the 1962 ice terminus, overriding 1650 moraines, spilling onto the Wisconsin glacial floor, damming College Creek, and partly blocking West Gulkana Creek canyon. With the blocking of College Creek, and a small ice-dammed lake formed and was rapidly filled with outwash material from College Glacier. College Glacier also advanced in 1830 to a position 1.7 km beyond its 1962 position. After a period of thinning and retreat, Gulkana Glacier advanced in 1875; no equivalent advance is recorded for College Glacier. The 1875 advance again blocked College Creek, and another small ice-dammed lake formed. Since 1875, both glaciers have rapidly thinned and retreated, indicating they have negative economies. (Knapp-USGS)
W69-06808

2D. Evaporation and Transpiration

DYNAMIC SIMULATION MODEL OF THE TRANSPIRATION PROCESS,
Oregon State Univ., Corvallis.
K. B. Woo, L. Boersma, and L. N. Stone.
Water Resources Res, Vol 2, No 1, pp 85-97, 1st Quarter 1966. 13 p, 8 fig, 20 ref.

Descriptors: *Analog computers, *Simulation analysis, *Transpiration, Soil moisture, Soil-water-plant relationships, Mathematical models, Flow rates, Dynamics, Storage capacity.
Identifiers: System gain, Differential equations.

A simulation model of the transpiration process was presented, based on Ohm's law describing water flow into, through, and out of plants. The hypothesis was expanded to include an analogous storage factor to deal with the dynamic flow of water in the plant. A set of differential equations and transfer functions was expressed in terms of water suction variables. The dynamic description of the water status in the plant was completed by introducing the system gain, which was a function of the transpiration rate and soil-water condition. The entire system was simulated on an analog computer; its dynamic characteristics were investigated with consideration of various environmental effects. (Gysi-Cornell)
W69-06504

EVALUATION OF THE GAMMA TRANSMISSION METHOD FOR DETERMINING SOIL WATER BALANCE AND EVAPOTRANSPIRATION,
Clemson Univ., S. C.
For primary bibliographic entry see Field 02G.
W69-06514

THE HYDROLOGIC IMPORTANCE OF TRANSPIRATION CONTROL BY STOMATA,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
Richard Lee.
Water Resources Research, Vol 3, No 3, pp 737-752, 3rd Q 1967. 8 fig, 9 tab, 34 ref.

Descriptors: *Leaves, *Transpiration control, *Water yield improvement, *Stomata, *Diffusion, Water vapor, Photosynthesis, Temperature, Carbon dioxide, Hydrologic aspects, Pores, Resistance, Evapotranspiration, Plant physiology, Water loss, Winds, Conductivity, Equations.

Discussed in this report were the concept that a transpiration decrease in leaves was not caused by the extra mechanical obstruction to the passage of water vapor, and its potential significance in management of vegetation to increase water yields. Stomatal transpiration was considered as it was affected by the dimensions of the leaf and stomata, stomatal density and movements, external resistances in the diffusion path and thermodynamic considerations. Conclusions were based on results of laboratory tests of water vapor diffusion through tubes, through single pore and multipore membranes and on diffusion theory. Diffusive conductance of small pores was more sensitive to diameter changes at the larger apertures, thus permitting carbon dioxide exchange for photosynthesis without dehydration of the leaf mesophyll. Characteristic diffusion coefficients for leaf types, based on a study of leaf microstructure, physiology, and seasonal variation, were a basis for cover-type conversions or biochemical controls to reduce water loss in arid climates. (Blecker-Ariz)
W69-06520

ESTIMATING PAN EVAPORATION AND EVAPOTRANSPIRATION FROM CLIMATIC DATA,
Utah Water Research Lab., Logan.
Jerald E. Christiansen.
Irrigation and Drainage Specialty Conference, Los Vegas, Nevada, pp 193-234, Nov 2-4, 1966. 39 p, 16 tab, 33 ref.

Descriptors: *Evaporation, *Evapotranspiration, *Evaporation pans, *Climatic data, *Estimating, Utah, Estimating equations, Equations, Monthly, Correlation analysis, Elevation, Humidity, Solar radiation, Temperature, Wind velocity.
Identifiers: *Formulae, Coefficients.

Pan evaporation formulas, which have been developed at Utah State University, provide a satisfactory procedure for estimating pan evaporation when such data are not available. The tables presented make application of the revised pan evaporation formula very convenient. Where climatic data are available, pan evaporation can be estimated with a fair degree of accuracy for practically all climatic conditions. Use of tables for the coefficients and their logs makes the pan evaporation formula easy to apply. The formula is useful when all of the climatic factors included are not available. (Blecker-Ariz)
W69-06522

TRANSPIRATION OF DESERT PLANTS UNDER DIFFERENT ENVIRONMENTAL CONDITIONS,
Cairo Univ. (Egypt). Dept. of Botany.
A. A. Abd El Rahman, and K. H. Batanouny.
J of Ecology, Vol 53, No 2, pp 267-272, July 1965. 3 fig, 1 tab, 14 ref.

Descriptors: *Transpiration, *Desert plants, *Environmental effects, *Evaporation, *Microenvironment, Moisture deficit, Atmosphere, Moisture stress, Soil moisture, Soil-water-plant relationships, Weight, Water utilization, Fluctuation, Droughts, Diurnal, Humidity.
Identifiers: *Egypto-Arabian desert, United Arab Republic, Evaporimeters.

Transpiration rate of two common desert plants (Zygophyllum coccineum and Zilla spinosa of the Egypto-Arabian desert was studied in different microhabitats to see how far their environmental conditions influenced transpiration intensity. Transpiration intensity was compared in different combinations of atmospheric and soil moisture stresses. The method used for measuring rate of transpiration was that of rapid weighing of detached parts. Early reduction in transpiration rate in the plateau and the first terrace represented an economy in water use during a time of high evaporation rate, but in the shade it may be referred to general decline in evaporating factors. Highest maximum and mean transpiration rates were attained under conditions of atmospheric drought and favorable soil moisture. When atmospheric drought was associated with soil drought, maximum and mean transpiration rates in the two species were much lower. (Blecker-Ariz)
W69-06526

EVALUATION OF SOME PRACTICAL METHODS OF ESTIMATING EVAPOTRANSPIRATION IN ARID CLIMATES AT LOW LATITUDES,
Cornell Univ., Ithaca, N. Y. School of Civil Engineering.
Wilfried Brutsaert.
Water Resources Research, Vol 1, No 2, pp 187-191, 2nd q, 1965. 2 tab, 12 ref.

Descriptors: *Evapotranspiration, *Arid climates, *Estimating, *Weather data, *Latitudinal studies, Evaporation, Air temperature, Humidity, Dry seasons, Wet seasons, Evaporation pans, Equations, Measurement, Lysimeters, Consumptive use, Monthly, Diurnal.
Identifiers: Eastern Congo Republic, Blaney-Criddle formula, Blaney-Morin formula, Penman's equation, Equator, Thornthwaite formula.

A comparison was presented of monthly evapotranspiration data obtained by methods that were used at low latitudes. The valley of the Ruzizi in the Eastern Congo Republic was used for the study area. Best agreement was noted for evaporation when measured with a pan and calculated with Penman's equation. Equations for predicting evapotranspiration based on temperature only, such as those of Blaney-Criddle and of Thornthwaite, may yield good results in arid climates as long as there is a well defined wet winter-dry summer cycle. Equations such as Blaney-Morin's, which include the effect both of temperature and humidity of the air, showed great promise for equatorial climatic conditions. (Blecker-Ariz)
W69-06530

EVAPORATION REDUCTION ON LARGE RESERVOIRS,
Utah State Univ., Logan; Utah Engineering Experiment Station, Salt Lake City; and Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 03F.
W69-06531

TRANSPIRATION REDUCTION BY SURFACE FILMS,
Commonwealth Scientific and Industrial Research Organization, Aspendale (Australia). Div. of Meteorological Physics.
For primary bibliographic entry see Field 03F.
W69-06532

PHOTOSYNTHESIS AND WATER USE BY SALTCEDAR,
Geological Survey, Lubbock, Tex.
For primary bibliographic entry see Field 03B.
W69-06771

ON THE ESTIMATION OF EVAPORATION FROM A LAND SURFACE,
Liu Chen-hsing.
Acta Meteorologica Sinica, Peking, China, Vol 27, No 4, pp 337-343, 1956. 7 p, 1 fig, 1 tab, 6 ref.

Descriptors: *Evaporation, *Forecasting, Energy budget, Heat balance, Water balance, Equations.
Identifiers: Bagrov equation (Evaporation).

A modification of the evaporation equation of Bagrov is suggested for simplicity of computation and extension of the range of its applicable physical conditions. Comparison of isopleths plotted by both methods shows values below those of Bagrov for values of the ratio precipitation/evaporation potential less than 1.10, and higher than those of Bagrov for values above 1.10. (Knapp-USGS)
W69-06833

2E. Streamflow and Runoff

INFLOW TO SNAKE RIVER BETWEEN MILNER AND KING HILL, IDAHO,
Geological Survey, Washington, D. C.
C. A. Thomas.
Idaho Dep Reclam Water Inform Bull No 9, Apr 1969. 39 p, 15 fig, 8 ref.

Descriptors: *Inflow, *Discharge (Water), *Springs, *Idaho, Streams, Streamflow, Water quality, Hydrogeology, Hydrologic data, Data collections.
Identifiers: *Snake River Plain, Snake River (Idaho).

The principal source of inflow to the Snake River, Idaho is the springs along the north bank of the river. The springs discharge water from the Snake Plain aquifer, which underlies most of the Snake River Plain. The hydrologic and geographic features of the supply are shown on maps and graphs and are described briefly. Generally, inflow to the study reach fluctuates in a narrow range. Total inflow during the water years 1910-66 averaged 7,400 cfs or 5.4 million acre-ft per year; an estimated 5,900 cfs issued from springs along the north bank, and about 1,500 cfs was contributed from all south-side sources. Inflow to the reach increased from 5,500 cfs in 1910 to 8,300 cfs in 1953, as a result of increased irrigation. However, starting in 1953, pumping from the Snake Plain aquifer and a decrease in recharge reduced the inflow to about 7,000 cfs by 1962. An increase in recharge raised the inflow to about 7,800 cfs in 1965. Excellent forecasts of the spring flows and of the total inflow to the reach can be made. Chemical analyses of the spring waters showed that dissolved solids range from 382 mg/l in Blue Lakes Spring to 217 mg/l in Riley Creek. Dissolved solids in the flows in the south-side channels averaged 560 mg/l. The composite dissolved solids of the total inflow was found to be 328 mg/l. (Knapp-USGS)
W69-06427

RESPONSE OF BUBBLE-GAGE SERVOMANOMETERS TO OSCILLATIONS IN WATER LEVEL,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 07C.
W69-06434

WATER-RESOURCES APPRAISAL OF THE LOWER MOAPA-LAKE MEAD AREA, CLARK COUNTY, NEVADA,
Geological Survey, Carson City, Nev.
For primary bibliographic entry see Field 02F.
W69-06435

RELATION OF A HYDROLOGIC INDEX TO MEAN ANNUAL FLOW,
River Forecast Center, Harrisburg, Pa.
For primary bibliographic entry see Field 02B.
W69-06441

PRECIPITATION AND BASE FLOW VARIABILITY,
Agricultural Research Service, Madison, Wis. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 02B.
W69-06443

FLOOD INUNDATION AND EFFECTS OF URBANIZATION IN METROPOLITAN CHARLOTTE, NORTH CAROLINA,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 04C.
W69-06445

EXTENSIONS OF STREAMFLOW RECORDS IN UTAH,
Geological Survey, Washington, D. C.
J. K. Reid, L. E. Carroon, and G. E. Pyper.
Utah State Dep of Natur Resources Tech Publication No 20, 1968. 110 p, 6 fig, 7 reg, append.

Descriptors: *Streamflow, *Data collections, *Utah, Statistical methods, Correlation analysis, Hydrologic data, Stream gages, Hydrographs, Water management (Applied).
Identifiers: Streamflow record extension.

Long-term data on streamflow at selected short-term gaging stations in Utah are tabulated. The records of streamflow at the short-term or secondary gaging stations are extended on the basis of a graphical correlation with concurrent records at long-term or primary gaging stations. The data presented consist of records of runoff at the short-term stations summarized on a monthly and yearly basis; these data include the actual short-term records and the correlative estimates of runoff. Methods and information are included to enable the reader to make further extensions of runoff records. The standard error of estimate for correlations used is 30% or less, and the coefficient of correlation is at least 0.8. Streamflow information is thereby obtained that is believed to be more representative of the long-term runoff than is an actual short-term record. The optimum period of concurrent record needed in Utah for a reliable correlation is about 15-20 yr. Extensions of record for low-flow and flood-frequency studies usually cannot be obtained from correlations. Much of this information could be collected economically by converting short-term stream-gaging stations to partial-record stations after a satisfactory correlation with a long-term station has been obtained. (Knapp-USGS)
W69-06447

WATER AVAILABILITY, CONECUH COUNTY, ALABAMA,
Alabama Geological Survey, University; and Geological Survey, Washington, D. C.
P. C. Reed, J. C. Scott, H. G. Golden, and J. R. Avrett.
Geol Surv of Ala Basic Data Rep and Map No 75, 1968. 24 p, 3 fig, 1 map, 4 tab, 5 ref.

Descriptors: Water resources, *Surface waters, *Groundwater, *Alabama, Water wells, Streamflow, Water yield, Water quality, Water levels, Hydrologic data, Data collections, Aquifers, Hydrogeology.
Identifiers: Conecuh County (Ala).

The water availability in Conecuh County, Alabama is described by maps showing streamflow, areas of potential well yields of over 1 mgd from 2 major aquifers, depth to water, and thickness and depth of the major aquifers. A compilation of basic data includes well depths, aquifer tapped, water level, and construction data for 264 wells. Chemical analyses of well, stream, and spring waters are also compiled. In most of the county, water supplies are adequate to meet any forecast demand and are of good enough quality for most uses. (Knapp-USGS)
W69-06451

WATER AVAILABILITY, COFFEE COUNTY, ALABAMA,
Alabama Geological Survey, University; and Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02F.
W69-06452

FLOOD PLAIN INFORMATION, WILSON CREEK AND TRIBUTARIES, SPRINGFIELD, MISSOURI-PART 1.
Corps of Engineers, Little Rock, Ark.
For primary bibliographic entry see Field 04A.
W69-06467

FLOOD PLAIN INFORMATION, ROCKY RIVER IN CITIES OF ROCKY RIVER AND LAKEWOOD, CUYAHOGA COUNTY, OHIO.
Corps of Engineers, Buffalo, N. Y.
For primary bibliographic entry see Field 04A.
W69-06468

FLOOD PLAIN INFORMATION, WALLA WALLA RIVER TRIBUTARIES IN THE VICINITY OF WALLA WALLA, WASHINGTON.
Corps of Engineers, Walla Walla, Wash.
For primary bibliographic entry see Field 04A.
W69-06469

FLOOD PLAIN INFORMATION, YAKIMA RIVER, BENTON COUNTY, WASHINGTON.
Corps of Engineers, Seattle, Wash.
For primary bibliographic entry see Field 04A.
W69-06470

FLOOD PLAIN INFORMATION, OMAHA METROPOLITAN REGION, NEBRASKA - VOLUME 1.
Corps of Engineers, Omaha, Nebr.
For primary bibliographic entry see Field 04A.
W69-06471

FLOOD PLAIN INFORMATION, CEDAR RIVER, LINN COUNTY, IOWA.
Corps of Engineers, Rock Island, Ill.
For primary bibliographic entry see Field 04A.
W69-06472

FLOOD PLAIN INFORMATION, GUAYANILLA RIVER, GUAYANILLA, PUERTO RICO.
Corps of Engineers, Jacksonville, Fla.
For primary bibliographic entry see Field 04A.
W69-06473

GEOLOGY AND HYDROLOGY OF CLAY COUNTY SOUTH DAKOTA-PART 1, GEOLOGY, AND PART 2, WATER RESOURCES,
South Dakota Geological Survey, Vermillion; and Geological Survey, Vermillion, S. Dak.
For primary bibliographic entry see Field 02F.
W69-06486

A NEW TABLE OF PERCENTAGE POINTS OF THE PEARSON TYPE III DISTRIBUTION,
Aerospace Research Labs., Wright-Patterson AFB, Ohio.
H. Leon Harter.
Technometrics, Vol 11, No 1, pp 177-187, Feb 1969. 11 p, 1 tab, 14 ref.

Descriptors: *Flood forecasting, Flood hydrographs, *Flood peaks, Floodwater, Distribution, Hydrology, Probability, *Statistical methods, *Floods, Hydrologic data, Statistical analysis, Statistical models, Statistics.
Identifiers: *Pearson type III distrib, *Flood estimate, Skewness, Flood frequency, Flood hydrology, *Flood probability, Tables (Data).

The U S Water Resources Council recently proposed the standardization of peak flood discharge analysis by fitting a Pearson Type III distribution to the logarithms of the data. This action drew attention to the inadequacy of available tables of percentage points of such distribution. Tables of percentage points of the related chi-square distribution could be used to obtain percentage points of the Pearson Type III distribution, but a table giving these percentage points directly would be more convenient. A 5-decimal-place table and a description of the computation method are given. Possible applications are discussed, including estimating return periods of floods. (USBR)
W69-06680

STREAMFLOW RECORD LENGTH FOR MODELLING CATCHMENT DYNAMICS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
Walter M. Grayman, and Peter S. Eagleson.
Mass Inst of Technol Hydrodynamics Lab Rep No 114, Feb 1969. 137 p, 40 fig, 8 tab, 26 ref, 6 append. OWRR Grant No. 14-01-0001-1576.

Descriptors: *Rainfall-runoff relationships, *Mathematical models, Synthetic hydrology, Linear programming, Digital computers, Climatology, Precipitation (Atmospheric), Computer programs, Runoff forecasting, Streamflow forecasting.
Identifiers: *Precipitation patterns, Catchment dynamics.

The length of rainfall-streamflow record required for the formulation of a linear model of catchment dynamics is investigated as a function of the physical characteristics of the catchment and of the climate. Climates with more homogeneous precipitation patterns require shorter lengths of rainfall-streamflow record. For the 2 climates tested, 5 years of record allows the hydrologist to be quite confident that his linear model is truly representative of the real world. The linear model is limited in accuracy by the degree of linearity of the real system. A parameter describing the relative dynamic importance of streamflow compared to overland flow appears to be a convenient measure of linearity. Extreme values indicate either catchment or stream control, and yield a smaller irremovable error than obtained with the median values which show equal catchment-stream influence. There is a general computational trend to the irremovable error. Analysis of this trend may be used to develop an improved, quasi-linear forecasting method. Computer program listings of the model and tabulated results of computations with it are included. (Knapp-USGS)
W69-06781

HEC-2, WATER SURFACE PROFILES.
Corps of Engineers, Sacramento, Calif.
For primary bibliographic entry see Field 04A.
W69-06787

HEC-3, RESERVIOR SYSTEM ANALYSIS.
Corps of Engineers, Sacramento, Calif.
For primary bibliographic entry see Field 04A.
W69-06788

GUIDEBOOK ON NUCLEAR TECHNIQUES IN HYDROLOGY,
For primary bibliographic entry see Field 07B.
W69-06811

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF PIKE COUNTY, ALABAMA,
Alabama Geological Survey, University; and Geological Survey, University, Ala.
For primary bibliographic entry see Field 02F.
W69-06815

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF HENRY COUNTY, ALABAMA,
Alabama Geological Survey, University; and Geological Survey, University, Ala.
For primary bibliographic entry see Field 02F.
W69-06816

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF CRENSHAW COUNTY, ALABAMA,
Alabama Geological Survey, University; and Geological Survey, University, Ala.
For primary bibliographic entry see Field 02F.
W69-06817

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF DALE COUNTY, ALABAMA,
Alabama Geological Survey, University; and Geological Survey, University, Ala.
For primary bibliographic entry see Field 02F.
W69-06818

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF COVINGTON COUNTY, ALABAMA,
Alabama Geological Survey, University; and Geological Survey, University, Ala.
For primary bibliographic entry see Field 02F.
W69-06819

FLOOD PLAIN INFORMATION, BOISE RIVER AND NORTHSIDE TRIBUTARIES, BOISE, IDAHO AND VICINITY.
Corps of Engineers, Walla Walla, Wash.
For primary bibliographic entry see Field 04A.
W69-06823

FLOOD PLAIN INFORMATION OF SPRING VALLEY CREEK, SAN DIEGO COUNTY, CALIFORNIA.
Corps of Engineers, Los Angeles, Calif.
For primary bibliographic entry see Field 04A.
W69-06824

FLOOD PLAIN INFORMATION OF SENECA LAKE, NEW YORK.
Corps of Engineers, Buffalo, N. Y.
For primary bibliographic entry see Field 04A.
W69-06825

FLOOD PLAIN INFORMATION, CAYUGA LAKE, NEW YORK.
Corps of Engineers, Buffalo, N. Y.
For primary bibliographic entry see Field 04A.
W69-06826

FLOOD PLAIN INFORMATION, CANANDAIGUA LAKE, NEW YORK.
Corps of Engineers, Buffalo, N. Y.
For primary bibliographic entry see Field 04A.
W69-06827

RAINFALL-RUNOFF RELATIONS FOR SOUTHEASTERN LOUISIANA AND SOUTHWESTERN MISSISSIPPI,
Geological Survey, Baton Rouge, La.
For primary bibliographic entry see Field 02A.
W69-06829

IMPROVED TECHNIQUES FOR ESTIMATING RUNOFF WITH BRIEF RECORDS,
New South Wales Univ., Manly (Australia). Water Research Lab.
F. C. Bell.
New South Wales Univ Water Res Lab Rep No 91, June 1966. 185 p, 45 fig, 7 tab, 189 ref, 1 append.

Descriptors: *Rainfall-runoff relationships, *Runoff forecasting, *Mathematical models, Rainfall, Runoff, Streamflow, Base flow, Infiltration, Retention, Water storage, Hydrogeology, Evapotranspiration, Small watersheds, Hydrographs, Duration curves, Hydrograph analysis.
Identifiers: *Australia.

A selective literature survey and general analysis of runoff statistics are presented. From these it is concluded that single, brief records give inaccurate estimates of means and quite unreliable estimates of extremes. Improved estimates are possible if single records are supplemented with other relevant information and it is shown that spatial correlation or regional consistencies can be utilised for this purpose. The recently developed 'complete' rainfall-runoff models provide a means of extending or synthesizing records but some of the components of these models are inconsistent with current knowledge of the physical processes of hydrology. Other deficiencies in the models are caused by their attempts to integrate fragmentary hydrological concepts that have evolved without reference to the rainfall-runoff cycle as a whole. A more comprehensive approach is suggested by replacing the traditional 'infiltration theory' with a general 'retention theory' from which an improved rainfall-runoff model is developed. The improved model is demonstrated and tested with data from a 60 acre watershed. (Knapp-USGS)
W69-06830

SYSTEMS APPROACH FOR INTEGRATING GROUND WATER AND SURFACE WATER USE.
Aerojet-General Corp., El Monte, Calif. Environmental Systems Div.; and Engineering-Science, Inc., Arcadia, Calif.
For primary bibliographic entry see Field 06A.
W69-06834

DYNAMICS OF CHANNEL FLOW,
V. N. Goncharov.
Available from Clearinghouse as TT64-11003 at $3.00 in paper copy. Leningrad Gidrometeorologicheskoe Izdatel'stvo, 1962. 317 p, 55 fig, 15 tab, 16 ref.

Descriptors: *Open channel flow, *Channel flow, *Alluvial channels, *Sediment transport, *Erosion, Channel morphology, Regime, Sedimentation, Meanders, River training, Reservoirs, Flow, Civil engineering, Channel-flow dynamics.
Identifiers: *USSR, Textbook.

Open-channel flow is discussed in a comprehensive handbook intended to help solve practical problems in water resources development, hydroelectric projects, and navigation. Part 1 subdivides rigid-channel flow dynamics into plane-flow mechanism, boundary layers, tribulent flow, rectilinear flows in rectangular channels, rectilinear river flows, flow in channel bends, and flow resistance (obstacles). Part 2 discusses dynamics of deformable-bed flows, including parameters describing grandular channel-materials, sediment transport, sediment transport regimes, sediment transport effects, channel process dynamics, sedimentation in control-reservoir headraces, and channel-deformation conditions in tailraces. (Knapp-USGS)
W69-06835

2F. Groundwater

A SIMPLIFIED TECHNIQUE FOR WELL-FIELD DESIGN,
Dames and Moore, Los Angeles, Calif.
J. Russell Mount.
Ground Water, Vol 7, No 3, pp 5-8, May-June 1969. 4 p, 2 fig, 3 tab, 1 ref.

Descriptors: *Water resources development, *Groundwater, *Design criteria, *Analytical techniques, *Well spacing, Optimum development plans, Planning, Water management (Applied), Aquifers, Water costs, Water utilization, Water-level fluctuations.
Identifiers: *Well-field design.

The planned development of an individual water supply from a group of wells must take into consideration several factors, including aquifer coefficients of transmissibility and storage, aquifer boundaries, static water level, aquifer depth, recharge capabilities, competing users, the area available for well fields, locations of wells in fields, and pumping rates. Water requirements, water cost, and well-field life expectancy are related to limitations of acreage, drawdown of water level, and the investment in pumping and transmission facilities. Well-field design calculations involve the combined interference of waterlevel drawdown among the various wells in the field. Conventional calculation methods are usually time-consuming. Final design decision can be approached quickly if it is assumed that the wells have regular spacing. An example well-field problem is given, using a simple formula and table; the problem can be calculated in a few minutes with a slide rule. It is suggested that when well spacing deviates appreciably from the assumed spacing, the final design calculations be made with computer techniques. (Lang-USGS)
W69-06421

CONTROL OF SEA-WATER INTRUSION IN A GROUND-WATER AQUIFER,
Los Angeles County Flood Control District, Calif.
A. E. Bruington.
Ground Water, Vol 7, No 3, pp 9-14, May-June 1969. 6 p, 11 fig.

Descriptors: *Saline water intrusion, *Aquifers, *Ground water, *California, Recharge, Injection wells, Sea water, Groundwater barriers, Cost comparisons, Hydraulic gradient.
Identifiers: Los Angeles (Calif), Saline water intrusion control.

Sea-water intrusion into ground-water reservoirs occurs when permeable formations outcrop into a body of sea water and when there is a landward hydraulic gradient. Intrusion can be controlled by reducing pumping, by increasing supply, or by forming some type of barrier. Pressure barriers are operated in Los Angeles County, California. Special facilities are needed and costs of operation are high. One system is 7 1/2 miles long and injects 45,000 acre-feet per year through 83 injections wells. The other system is one mile long and injects 5000 acre-feet per year through 17 injection wells. There are 55 employees involved full time on operation and maintenance of the systems. The operation and maintenance cost for these two systems during fiscal year 1966-67 was $13 per acre-foot of water injected. The filtered Colorado River water used is now purchased at a price of $24 per acre-foot. The capital outlay costs for injection wells, distribution pipeline, observation wells and other similar equipment are about $10 per acre-foot. (Knapp-USGS)
W69-06422

CONCEPTUAL MODELS FOR CARBONATE AQUIFERS,
Pennsylvania State Univ., University Park.
William B. White.
Ground Water Vol 7, No 3, pp 15-21, May-June 1969. 7 p, 6 fig, 1 tab, 18 ref.

Descriptors: *Aquifers, *Karst, Limestones, Carbonate rocks, Groundwater movement, Recharge, Discharge (Water), Sinks, Subsurface drainage, Caves, Flow nets, Water table, Aquifer-stream relationships.
Identifiers: *Carbonate aquifers.

Groundwater behavior in carbonate terrains can be classified by relating the flow type to a particular hydrogeologic environment distinguished by characteristic cave morphology. The groundwater may move by diffuse flow, by retarded flow, or by free flow. Diffuse flow occurs in less soluble rocks such as extremely shaley limestones or crystalline dolomites. Integrated conduits are rare. Caves tend to be small, irregular, and often little more than solutionally widened joints. Retarded flows occur in artesian environments where unfavorable stratigraphy forces groundwater to be confined to relatively thin beds. Network cave patterns are characteristic; solution occurs along many available joints. Free flowing aquifers are those in which solution has developed a subsurface drainage system as an underground extension of surface streams. Characteristic cave patterns are integrated conduit systems often truncated into linear, angulate, and branchwork caves. Other geologic factors such as structure, detailed lithology, relief, and locations of major streams, control the details of cave morphology and orientation of the drainage network. (Knapp-USGS)
W69-06423

MICROBIAL PROBLEMS IN GROUNDWATER,
National Water Supply Research Lab., Washington, D. C.
For primary bibliographic entry see Field 05C.
W69-06426

INFLOW TO SNAKE RIVER BETWEEN MILNER AND KING HILL, IDAHO,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02E.
W69-06427

A DESIGN METHOD FOR DEEP WELL DEWATERING INSTALLATIONS,
Birmingham Univ. (England). Dept. of Civil Engineering.
R. Herbert.
Ground Water, Vol 7, No 2, pp 24-33, Mar-Apr 1969. 10 p, 13 fig, 9 ref, 1 append.

Descriptors: *Dewatering, *Drainage engineering, *Drainage wells, *Water wells, Discharge (Water), Pumping, Drawdown, Water-level fluctuations, Water levels, Unsteady flow, Saturated flow, Design.
Identifiers: *Dewatering system design, Deep wells.

A new method for deep well dewatering systems is given. The method analyzes 3 dimensional flow to multiwell systems by considering the 2 end points to the initial fast phase of water table fall. Optimum distributions of dewatering wells, radius of influence of individual wells and well arrays, water discharge, time-drawdown relations, and predicted water levels may be calculated. Calculated results were checked against an analog model and a case history and found to be in good agreement with both. (Knapp-USGS)
W69-06430

GROUND WATER, GRAVITY AND RIFT VALLEYS IN MALAWI,
Southern Illinois Univ., Carbondale. Dept. of Geology.
Richard W. Davis.
Ground Water, Vol 7, No 2, pp 34-37, Mar-Apr 1969. 4 p, 5 fig, 3 ref.

Descriptors: *Surveys, *Gravity studies, *Hydrogeology, Geohydrologic units, Aquifers, Groundwater basins, Saline water systems, Alluvium, Water sources, Water resources development, Faults (Geology), Irrigation.
Identifiers: *Africa, Rift Valley, Malawi.

A preliminary geohydrologic survey was carried out in the Lower Shire Valley, Malawi, Africa in the summer of 1967. The valley is part of the East African Rift System. In order to develop more adequate knowledge of subsurface conditions, a reconnaissance gravity survey was performed. The survey showed that potential aquifer material over much of the valley was too thin to support high yield irrigation wells. In addition when combined with hydrochemical data the survey disclosed a high probability of water contamination by brines circulating upward along fault systems. In a few areas, irrigation wells may be developed. These areas were more sharply defined. (Knapp-USGS)
W69-06431

WATER-RESOURCES APPRAISAL OF THE LOWER MOAPA-LAKE MEAD AREA, CLARK COUNTY, NEVADA,
Geological Survey, Carson City, Nev.
F. Eugene Rush.
Nevada State Div of Water Resources Reconnaissance Ser Rep 50, Dec 1968. 66 p, 3 fig, 1 plate, 20 tab, 46 ref.

Descriptors: *Water resources, *Groundwater, *Surface waters, *Nevada, Irrigation water, Hydrologic budget, Water yield, Water quality, Water utilization, Streamflow, Water levels, Groundwater basins, Water sources.
Identifiers: Lower Moapa-Lake Mead Area (Nev).

A hydrologic budget was calculated for the lower Moapa-Lake Mead area in arid southeastern Nevada. Except for Lake Mead the region has very limited water resources. The study area is drained by the Muddy River, which has an average annual inflow of about 33,000 acre-ft and an outflow of about 34,000 acre-ft. Groundwater occurs in carbonate bedrock and alluvial valley fill aquifers. The total potential annual water yield area is about 48,000 acre-ft of which 22,000 acre-ft was consumed for irrigation and rural domestic uses in 1967. The high salinity hazard of the water limits development of irrigation to the full perennial yield. (Knapp-USGS)
W69-06435

EFFECTS OF THE DROUGHT ON WATER RESOURCES-SURFACE AND SUBSURFACE HYDROLOGY,
Geological Survey, Arlington, Va.
For primary bibliographic entry see Field 02B.
W69-06440

SUMMARY OF GROUND-WATER RESOURCES OF ATLANTIC COUNTY, NEW JERSEY,
Geological Survey, Washington, D. C.
Glenn A. Clark, Harold Meisler, Edward C. Rhodehamel, and Harold E. Gill.
N J State Div of Water Policy and Supply, Water Resources Circ No 18, 1968. 53 p, 5 fig, 7 tab, 11 ref.

Descriptors: *Water resources, *Groundwater, *New Jersey, *Water yield, Water wells, Water quality, Aquifers, Hydrologic data, Water levels, Hydrogeology.
Identifiers: *Atlantic County (NJ), Public water supplies.

Atlantic County is located in southeastern New Jersey in the Coastal Plain physiographic province. The principal fresh-water aquifers are in the Kirkwood Formation of Miocene age and the Cohansey Sand of probable Miocene and Pliocene age. The Kirkwood Formation is tapped primarily by industrial and public-supply wells. Reported yields of such wells range from 250 to 1,200 gpm. The median yield is 700 gpm. Specific capacities of these wells range from 2.5 to 34 gpm per ft of drawdown and the median is 15 gpm per ft drawdown. The Cohansey Sand is tapped widely by wells for domestic and poultry-farm use as well as for industrial use, public supply, air conditioning, and irrigation. Reported yields of industrial, public-supply, and air-conditioning wells range from 30 to 1,400 gpm and the median yield is 720 gpm. Specific capacities of these wells range from 2.4 to 43 gpm per ft drawdown and the median is 22 gpm per ft drawdown. Water from both formations is generally low in dissolved solids and in total hardness. Water from some Cohansey wells along the coast is very high in dissolved solids, chlorides, and other constituents, indicating salt-water encroachment. Ten public water-supply systems in Atlantic County pumped an average of 16.2 mgd of groundwater in 1964. Because of a summer influx of tourists, water use is considerably higher during the summer months. In 1964, pumpage during July, the peak month, was more than twice that during February, the lowest month. (Knapp-USGS)
W69-06448

GEOLOGY AND GROUND-WATER RESOURCES OF BURLINGTON COUNTY, NEW JERSEY,
Geological Survey, Trenton, N. J.
Eugene F. Rush.
N J State Div of Water Policy and Supply, Spec Rep No 26, 1968. 65 p, 25 fig, 7 tab, 38 ref.

Descriptors: *Water resources, *Groundwater, *New Jersey, Water yield, Water sources, Aquifers, Water quality, Water wells, Water levels, Hydrologic data, Observation wells.
Identifiers: Burlington County (NJ).

Burlington County, New Jersey, which lies between Trenton, Atlantic City and Camden, has an area of 827 sq mi. The county is in the Atlantic Coastal Plain physiographic province, has moderate temperatures and a dependable rainfall of 44 inches per year. The area is attracting new industries and additional population. Water usage is increasing with this economic growth; 26 mgd of groundwater were used in 1960. The Raritan and Magothy Formations are the most prolific producers, but the Cohansey Sand and Kirkwood Formation have a great and, as yet, untapped potential. Small to moderately large supplies have been obtained from other aquifers. The maximum average potential recharge to the groundwater reservoirs is estimated to be about 790 mgd. Presently, most of it is rejected because the aquifers are essentially full. On this basis, it is believed that groundwater supplies in Burlington County are sufficient for the foreseeable future. However, well spacing must be planned to avoid local overdevelopment. (Knapp-USGS)
W69-06449

GEOLOGY AND GROUND-WATER RESOURCES OF THE RAHWAY AREA, NEW JERSEY,
Geological Survey, Trenton, N. J.
Henry R. Anderson.
N J State Div of Water Policy and Supply, Spec Rep No 27, 1968. 72 p, 10 fig, 6 tab, 54 ref.

Descriptors: *Water resources, *Groundwater, *New Jersey, *Water yield, Water quality, Aquifers, Sands, Shales, Water levels, Specific capacity, Water sources.
Identifiers: Rahway area (NJ).

Groundwater in the Rahway area in New Jersey is pumped from the Triassic Brunswick Shale, the Cretaceous Raritan Formation, and Pleistocene stratified glacial drift. The Brunswick Shale yields about 6 mgd from fracture openings and from permeable interbedded sandstones. The aquifer is recharged through the hydraulically continuous overlying glacial drift. The average yield of 150 industrial, public supply, and domestic wells is 75 gpm, the specific capacity is 2.2 gpm per ft, and average well depth is 218 ft. The water is locally high in sulfate, dissolved solids, and hardness. The Farrington Sand Member of the Raritan Formation yields about 1 mgd. The average yield of 12 industrial wells is 96 gpm, the specific capacity averages 9.5 gpm per ft, and average well depth is 60 ft. The stratified drift is 30 ft thick under Rahway and yields over 1 mgd from 4 wells tapping both the drift and the underlying shale. The average yield per well is 370 gpm, and the average specific capacity is 15.3 gpm per ft. (Knapp-USGS)
W69-06450

WATER AVAILABILITY, CONECUH COUNTY, ALABAMA,
Alabama Geological Survey, University; and Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02E.
W69-06451

WATER AVAILABILITY, COFFEE COUNTY, ALABAMA,
Alabama Geological Survey, University; and Geological Survey, Washington, D. C.
J. D. Turner, J. C. Scott, J. G. Newton, H. G. Golden, and J. R. Avrett.
Geol Surv of Ala Basic Data Rep and Map No 76, 1968. 12 p, 6 fig, 1 map, 4 tab.

Descriptors: *Water resources, *Surface waters, *Groundwater, *Alabama, Water wells, Streamflow, Water yield, Water quality, Water levels, Hydrologic data, Data collections, Aquifers, Hydrogeology.
Identifiers: Coffee County (Ala).

The water availability in Coffee County, Alabama is described by maps showing streamflow, areas of potential well yields of over 0.5 mgd from 1 major aquifer, depth to water, and thickness and depth of the major aquifer. A compilation of basic data includes well depths, aquifer tapped, water level, and construction data for 101 wells. Chemical analyses of well, stream, and spring waters are also compiled. In most of the county water supplies are adequate to meet any forecast demand and are of good enough quality for most uses. (Knapp-USGS)
W69-06452

GROUND WATER FAVORABILITY MAP OF THE OTTAUQUECHEE-SAXTONS RIVER BASIN, VERMONT,
Geological Survey, Montpelier, Vt.; and Vermont Dept. of Natural Resources.
Arthur L. Hodges, Jr., and David Butterfield.
Vermont Dep Water Resources Groundwater Favorability Map, 1968. 1 sheet, 1 map, 2 tab.

Descriptors: *Water resources, *Water yield, *Groundwater, *Vermont, Permeability, Alluvium, Glacial drift, Groundwater basins, Water wells, Water sources.
Identifiers: Connecticut River (Vt), Ottauquechee River, Saxtons River.

The potential for groundwater development in the Ottauquechee-Saxtons River basin, Vermont is shown by a groundwater favorability map. Groundwater favorability areas are determined by lithology. Areas underlain by thick coarse-grained stratified glacial drift should have excellent potential for municipal and industrial water supply. Areas underlain by thin coarse-grained drift yield low to moderate amounts of water for domestic, commercial, and light industrial use. Areas underlain by fine-grained drift and swamp deposits have low potential, suitable for domestic wells only. Unstratified drift and bedrock yield only enough water for domestic or light commercial uses. The areas of best groundwater potential are along the smaller rivers of the basin. The Connecticut River Valley contains too much silt and clay for good yields in most locations. (Knapp-USGS)
W69-06463

GROUND WATER FAVORABILITY MAP OF THE WEST-DEERFIELD RIVER BASIN, VERMONT,
Geological Survey, Montpelier, Vt.; and Vermont Dept. of Water Resources.
Arthur L. Hodges, Jr., and David Butterfield.
Vermont Dep Water Resources Groundwater Favorability Map, 1968. 1 sheet, text, 1 map, 2 tab.

Descriptors: *Water resources, *Water yield, *Groundwater, *Vermont, Permeability, Alluvium, Glacial drift, Groundwater basins, Water wells, Water sources.
Identifiers: Connecticut River (Vt), West River, Deerfield River, Groundwater availability.

The potential for groundwater development in the West and Deerfield Rivers drainage basin in southeastern Vermont is shown by a groundwater favorability map. Groundwater favorability areas are determined by lithology. Areas underlain by thick coarse-grained stratified glacial drift should have excellent potential for municipal and industrial water supply. Areas underlain by thin coarse-grained drift have low to moderate potential, suitable for domestic, commercial, and light industrial use. Areas underlain by fine-grained drift and swamp deposits have low potential, suitable for domestic wells only. Areas underlain by unstratified drift and bedrock will yield only enough water for domestic or light commercial use. The areas of best groundwater availability are along the Winhall River and the West River. The main stem of the Connecticut River has too much silt and clay for good yields. (Knapp-USGS)
W69-06464

GROUND WATER FAVORABILITY MAP OF THE WELLS-OMPOMPANOOSUC RIVER BASIN, VERMONT,
Geological Survey, Montpelier, Vt.; and Vermont Dept. of Water Resources.
Arthur L. Hodges, Jr., and David Butterfield.
Vermont Dep Water Resources Groundwater Favorability Map, 1968. 1 sheet, text, 1 map, 2 text.

Descriptors: *Water resources, *Water yield, *Groundwater, *Vermont, Permeability, Alluvium, Glacial drift, Groundwater basins, Water wells, Water sources.
Identifiers: Connecticut River (Vt), Ompompanoosuc River, Wells River.

The potential for groundwater development in the Wells-Ompompanoosuc River basin, Vermont, is shown by a groundwater favorability map. Groundwater favorability areas are determined by lithology. Areas underlain by thick coarse-grained stratified glacial drift should have excellent potential for municipal and industrial water supply. Areas underlain by thin coarse-grained drift yield low to moderate amounts of water for domestic, commercial, and light industrial use. Areas underlain by fine-grained drift and swamp deposits have low potential, suitable for domestic wells only. Unstratified drift and bedrock yield only enough water for domestic or light commercial use. The areas of best groundwater potential are along the river valleys. Some parts of the Connecticut Valley are filled by silt and clay deposits with low yields. (Knapp-USGS)
W69-06465

GROUND WATER FAVORABILITY MAP OF THE WHITE RIVER BASIN, VERMONT,
Geological Survey, Montpelier, Vt.; and Vermont Dept. of Water Resources.
Arthur L. Hodges, Jr., and David Butterfield.
Vermont Dep Water Resources Groundwater Favorability Map, 1968. 1 sheet, text, 1 map, 2 tab.

Descriptors: *Water resources, *Water yield, *Groundwater, *Vermont, Permeability, Alluvium, Glacial drift, Groundwater basins, Water wells, Water sources.
Identifiers: White River (Vt), Connecticut River.

The potential for groundwater development in the White River basin, Vermont is shown by a groundwater favorability map. Groundwater favorability areas are determined by lithology. Areas underlain by thick coarse-grained stratified glacial drift should have excellent potential for municipal and industrial water supply. Areas underlain by thin coarse-grained drift yield low to moderate amounts of water for domestic, commercial, and light industrial use. Areas underlain by fine-grained drift and swamp deposits have low potential, suitable for domestic wells only. Unstratified drift and bedrock yield only enough water for domestic or light commercial use. The areas of best groundwater potential are along valleys except in a few locations where silt and clay deposits have low yield. (Knapp-USGS)
W69-06466

A CONTRIBUTION TO THE STUDY OF GROUNDWATER INTAKE RECHARGE IN KARST,
Institute for Geological and Geophysical Research, Belgrade (Yugoslavia).
J. Vilimonovic.
Hydrol of fractured rocks Vol 2, Proc Dubrovnik Symp (Oct 1965), Int Ass Sci Hydrol, Pub 74, pp 482-488, 1967. 7 p, 3 fig, 2 tab.

Descriptors: *Infiltration, *Groundwater recharge, *Karst, *Hydrologic properties, Porosity, Permeability, Climate, Hydrogeology, Geophysics, Water storage, Water wells, Limestones, Drainage, Channel flow, Fissures (Geology), Water level fluctuations, Vegetation, Rainfall.
Identifiers: *Yugoslavia, Dinaric coastal area, Zadar area, Dalmatia.

Because groundwater recharges in karstic areas depend mainly on the absorption properties of the catchment areas and the degree of influence of atmospheric precipitation on the karstic groundwater regime, the coefficient of infiltration in relation to the hydrological properties was investigated by using the broader area of Zadar in Dalmatia, as an example. The geological, hydrogeological, and geophysical data recorded in the Zadar area show the presence of considerable reserves of fresh groundwater in the carbonate rocks of this catchment area. The study shows that the groundwater reserves in karstic areas depend on the infiltration properties of carbonate rocks, and that reliable evaluation of groundwater discharge at some particular point depends on proper evaluation of the infiltration coefficient. Some discussion on the effect of rainfall on the karstic groundwater regime is given. Variations of groundwater level are described and related to rainfall patterns. (Gabriel-USGS)
W69-06484

SOME DETAILS ON THE CIRCULATION OF GROUNDWATER IN NON-KARSTIFIED FISSURED FORMATIONS IN CZECHOSLOVAKIA (FRENCH),
K. Zima.
Hydrol of fractured rocks Vol 2, Proc Dubrovnik Symp (Oct 1965), Int Ass Sci Hydrol, Pub 74, pp 489-495, 1967. 7 p, 3 fig.

Descriptors: *Groundwater movement, *Water circulation, *Crystalline rocks, *Sedimentary rocks, *Basalts, Fissures (Geology), Springs, Faults, Aquifers, Water types, Permeability, Geochemistry, Structural geology, Artesian wells, Sandstones, Conglomerate rocks, Igneous rocks.
Identifiers: *Czechoslovakia, Southern Bohemia.

Groundwater circulation in fissured crystalline and sedimentary rocks of Czechoslovakia was investigated on the basis of geological, and hydrological data. The study shows that open faults found in the fissured formations drain the small systems of joints and fissures and may capture the water of areas of several hundred square kilometers. Where there is a tectonic contact with permeable horizons, the water from the fissures augments the supplies in the porous strata (so called secondary aquifers). This tectonic juxtaposition produces high yielding and often artesian aquifers. The primary origin of the springs in the area is sufficiently demonstrated by their low mineralization character (total dry residue, 100-150 mg/l) and relatively high radioactivity. Discharges from the springs range from a few liters per second to several hundred l/s. Several aquifers were discovered in igneous and sedimentary rocks as a result of the application of hydrogeological research in Czechoslovakia. (Gabriel-USGS)
W69-06485

GEOLOGY AND HYDROLOGY OF CLAY COUNTY SOUTH DAKOTA-PART 1, GEOLOGY, AND PART 2, WATER RESOURCES,
South Dakota Geological Survey, Vermillion; and Geological Survey, Vermillion, S. Dak.
Cleo M. Christensen, and Jerry C. Stephens.
S Dak State Geol Surv Bull No 19, 1967. Part 1, 86 p, 16 fig, 4 plate, 5 tab, 41 ref, 1 append. Part 2, 62 p, 11 fig, 4 plate, 5 tab, 35 ref.

Descriptors: *Water resources, *Groundwater, *South Dakota, Surface waters, Aquifers, Water quality, Water yield, Water sources, Water wells, Hydrogeology, Water levels, Permeability.
Identifiers: Clay County (S Dak).

Clay County, South Dakota obtains most of its water supplies from wells. Surface waters are little used because the discharge of the Vermillion River is supplied largely from runoff and is very erratic. Groundwater supplies over 70% of the County's water. The Lower Vermillion-Missouri aquifer is composed mainly of outwash, averages 100 ft thick, and underlies 75% of the county. Its permeability ranges from 1,000 to 2,500 gpd/sq ft. Water levels are 10-15 ft below the land surface under floodplains and 75-100 ft under uplands. The Dakota Sandstone underlies all of the county and contains water under artesian pressure. The piezometric surface ranges from 1,280 to 1,120 ft altitude. Most of the water available in the county is fresh or slightly saline, hard with calcium sulfate, and undesirable amounts of iron, manganese, sulfate, and total dissolved solids. All aquifers yield water good enough for stock and some domestic uses, and good to permissible for irrigation, with low sodium hazard and high salinity hazard. (Knapp-USGS)
W69-06486

ARTIFICIAL RECHARGE OF A FISSURED SANDSTONE AQUIFER, TANGIERS, MOROCCO (FRENCH),
For primary bibliographic entry see Field 04B.
W69-06487

ITERATIVE ANALYSIS: BOUNDED LEAKY ARTESIAN AQUIFER,
Manitoba Univ., Winnipeg. Dept. of Actuarial Mathematics and Statistics; and Research Council of Alberta, Edmonton. Groundwater Div.
S. A. Bukhari, A. Vanden Berg, and D. H. Lennox.
J Irrig and Drain Div, ASCE, Vol 95, No IR1, Proc Paper 6431, pp 1-14, March 1969. 4 fig, 4 tab, 7 ref.

Descriptors: *Confined water, *Aquifers, *Drawdown, *Leakage, *Boundaries (Surfaces), Groundwater, Wells, Hydraulics, Computers, Data collections, Analytical techniques, Transmissivity, Storage coefficient, Estimating, Numerical analysis, Bedrock, Equations, Digital computers.
Identifiers: *Iterative analysis, *Algorithms.

Application of the leaky artesian well function to analysis of aquifer test data may be difficult if there are boundaries close enough for their effects to obscure those of leakage. If available information is adequate to establish boundary locations with reasonable accuracy, and if transmissibility and storage coefficient can be determined from early draw-down data, leakage factor B may be determined by iterative adjustment of an initial rough estimate until observed and calculated drawdowns match within some specified range of accuracy. An algorithm for iterative adjustment was developed and a method of improving its efficiency discussed. Formulas were presented for generalized image-well positions for a strip aquifer and all results combined and applied to digital computer analysis of drawdown data for a buried preglacial bedrock-valley aquifer. (Affleck-Ariz)
W69-06508

ANALOG OF GROUND WATER IN EAST-CENTRAL NEW MEXICO,
Bureau of Reclamation, Denver, Colo. Experimental Design Analysis Section; and Bureau of Reclamation, Denver, Colo. Water Utilization Branch.
H. Boyd Phillips, and Harris R. McDonald.
J Irrig and Drain Div, ASCE, Vol 95, No IR1, Proc Paper 6435, pp 27-42, March 1969. 11 fig, 9 ref.

Descriptors: *Analog models, *Groundwater mining, *Water supply, *Withdrawal, Model studies, Aquifers, New Mexico, Wells, Water table, Computer models, Water distribution (Applied), Recharge, Water storage, *Irrigation water.
Identifiers: *Portales Valley (New Mexico).

A study utilizing an electric resistor-capacitor analog model, has been made to determine the adequacy of the ground water supply for the approximate 60,000 acres now irrigated in Portales Valley, New Mexico. Results indicated that over 60% of the irrigated area will be without sufficient water by the year 2010 unless an additional supply is found. A proposed plan to import water from a well field outside the project area was investigated. The aquifer underlying the project area would be utilized as a distribution system. Although some small areas would become deficient, the supply of water from the well field would be sufficient to sustain irrigation in nearly all the area now under irrigation until at least the year 2010. (Affleck-Ariz)
W69-06509

A COMPARATIVE STUDY OF HYDRAULIC CONDUCTIVITY IN THE ALLUVIAL SOILS OF EGYPT,
Ain Shams Univ., Cairo (Egypt). Dept. of Soils.
H. Hamdi, Salah Eldin Mitwally, and Bishay Guindi.
Geoderma, Vol 2, No 1, pp 27-32, Sept 1968. 1 fig, 3 tab, 3 ref.

Descriptors: *Hydraulic conductivity, *Alluvium, *Subsoil, *Sampling, *Measurement, Soil profiles, Soil texture, Permeability, Particle size, Aggregates, Cores, Core drilling, Boreholes, Clays, Water table.
Identifiers: *Auger holes, *United Arab Republic, Nile River Valley, Formulae.

Hydraulic conductivity determinations of subsoil strata were conducted using the auger hole method at 26 locations distributed throughout the Nile Valley and Delta. The different methods of calculating hydraulic conductivity values from the rate of water rise in the auger holes were Ernst nomographs, Ernst and Kirkham formulae, and Ernst formulae. Hydraulic conductivity values were also obtained from undisturbed soil cores for purposes of comparison. There was no significant difference between the three methods of calculating hydraulic conductivity. All hydraulic conductivity values measured by the auger method were higher than those of undisturbed soil core samples. The values confirmed suitability of auger hole values for designing depths and spacings of drains in the heavy, clayey and compact alluvial soils of Egypt. (Affleck-Ariz)
W69-06517

GEOCHEMICAL TRACING OF MINERAL WATER SOURCES IN THE SOUTH WESTERN DEAD SEA BASIN, ISRAEL,
Weizmann Inst. of Science, Rehovoth (Israel); Israel Atomic Energy Commission, Rehovoth; and Geological Survey of Israel, Jerusalem. Hydrogeological Div.
E. Mazor, E. Rosenthal, and J. Ekstein.
Journal of Hydrology, Vol 7, No 3, pp 246-275, Mar 1969. 30 p, 8 fig, 3 tab, 21 ref, 2 append.

Descriptors: *Geochemistry, *Chemical analysis, *Water chemistry, *Mineral water, *Hydrogeology, Sampling, Water quality, Dissolved solids, Aquifer characteristics, Water temperature, Wells, Springs, Thermal water, Fresh water, Saline water, Salts, Lake basins, Trace elements, Radioactivity.
Identifiers: *Israel, Dead Sea Basin.

Chemical composition of thermal and mineral waters along the southwestern shores of the Dead Sea was investigated. Data included 108 chemical analyses of different water samples, taken from 36 wells and springs. Chemical composition of the waters was used as a tracing tool for the determination of various groups of waters in the investigated area. Three distinct water groups were found in the area. The Kikar-Noit group waters had temperatures ranging up to 42 deg C and contained up to 17g/l dissolved solids. The Zohar-Yesha group waters had temperatures of 33 deg C to 39 deg C, 50-190g/l dissolved solids, and up to 40mg/l H sub 2 S. The third group consisted of fresh waters. This report deals with the geographical extension of the established water groups and the mutual relations between them. (Affleck-Ariz)
W69-06747

GEOCHEMICAL TRACING OF MINERAL AND FRESH WATER SOURCES IN THE LAKE TIBERIAS BASIN, ISRAEL,
Weizmann Inst. of Science, Rehovoth (Israel); Israel Atomic Energy Commission, Rehovoth; and Water Planning for Israel Ltd., Haifa.
Emanuel Mazor, and Felix Mero.
Journal of Hydrology, Vol 7, No 3, pp 276-317, Mar 1969. 42 p, 12 fig, 10 ref, 2 append.

Descriptors: *Water chemistry, *Mineral water, *Lake basins, *Fresh water, *Chemical analysis, Geochemistry, Water quality, Springs, Wells, Sampling, Data processing, Magnesium, Calcium, Ion exchange, Water properties.
Identifiers: *Israel, *Lake Tiberias Basin, Water associations.

Two hundred sixty analyses of different water samples from seventy wells and springs around the Lake Tiberias basin were studied. The data were processed by simple graphical methods in order to find out the general geochemical regularities and to define large water associations of uniform composition. Four compositional-geographical water subgroups were found. In spite of minor differences between these subgroups, all these waters belong to one compositional association known as the Tiberias-Noit water association. Composition and maximum concentrations of the water association were quite close to the oceanic values. The Tiberias basin waters were also compared with other mineral waters in the Rift Valley and waters all over the world. (Affleck-Ariz)
W69-06748

THE ORIGIN OF THE TIBERIAS-NOIT MINERAL WATER ASSOCIATION IN THE TIBERIAS-DEAD SEA RIFT VALLEY, ISRAEL,
Weizmann Inst. of Science, Rehovoth (Israel); Israel Atomic Energy Commission, Rehovoth; and Water Planning for Israel Ltd., Haifa.
Emanuel Mazor, and Felix Mero.
Journal of Hydrology, Vol 7, No 3, pp 318-333, Mar 1969. 16 p, 2 fig, 1 tab, 15 ref.

Descriptors: *Connate water, *Mineral water, *Brines, *Infiltration, *Sea water, Geochemistry, Lake basins, Saline water, Springs, Wells, Water chemistry, Evaporation, Groundwater basins, Paleohydrology, Salts, Thermal water, Chemical analysis, Porous media, Rocks, Reservoirs.
Identifiers: *Lake Tiberias Basin, *Israel, Rift Valley, Water associations, Dead Sea, Tectonics.

The genesis of mineral waters of the Tiberias-Noit water association was discussed. This water association consists of 150 wells and springs around Lake Tiberias, tens of springs in the Beit Shean Valley and 22 sources on the shores of the Dead Sea. It was suggested that the ocean had a temporary connection to the Rift Valley in the past. Enormous amounts of sea water were trapped in separate reservoirs when the waters infiltrated porous rocks in various fissured and faulted blocks that were under tectonic tension. The permeated blocks were brought under compression by later

tectonic movements and the brines were squeezed out and pushed upwards. These brines were mixed in various degrees with local fresh waters. (Affleck-Ariz)
W69-06749

THE STABLE ISOTOPE COMPOSITION OF MINERAL WATERS IN THE JORDON RIFT VALLEY, ISRAEL,
Weizmann Inst of Science, Rehovoth (Israel). Dept. of Isotopes.
Joel R. Gat, E. Mazor, and Y. Tzur.
Journal of Hydrology, Vol 7, No 3, pp 334-352, Mar 1969. 18 p, 5 fig, 1 tab, 20 ref.

Descriptors: *Stable isotopes, *Mineral water, *Groundwater, *Brines, *Mixing, Evaporation, Lakes, Deuterium, Sampling, Wells, Saline water, Sea water.
Identifiers: *Jordon Rift Valley, Israel, Fossil groundwater, Dead sea, Lake Tiberias.

The stable isotopic composition (super 18 O and super 2 H) of mineral water sources in the Jordon Rift Valley were examined to determine the origin of their fluid component. It appeared that these sources evolved through a two stage mixing process. It was suggested that some time in the past waters of a slightly evaporated seawater lake mixed with the prevailing groundwaters, to form various fossil brine pockets along the Rift Valley's floor. Today these brines mix with local groundwaters and sometimes with the waters of Lake Tiberias and the Dead Sea. There was no evidence of changes in the isotopic content of the water by exchange with rocks or by other fractionating processes. (Affleck-Ariz)
W69-06750

THE HYDROLOGIC AND GEOLOGIC ASPECTS OF A PERCHING LAYER - SAN JOAQUIN VALLEY, WESTERN FRESNO COUNTY, CALIFORNIA,
Fresno Ground-Water Recharge Field Station, Calif. Southwest Branch.
E. E. Haskell, Jr., and W. C. Bianchi.
Ground Water, Vol 5, No 4, pp 12-17, March 1968. 7 fig, 4 tab, 10 ref.

Descriptors: *Hydrogeology, *Perched water, *Water table, *Irrigation wells, *Impervious soils, Hydrologic aspects, Geologic investigations, Groundwater barriers, California, Permeability, Core drilling, Water quality, Logging (Recording), Electrical well logging, Irrigation effects, Head loss, Soil profiles, Particle size, Clays.
Identifiers: *San Joaquin Valley, California.

Shallow, fine-textured layers are impeding vertical flow of ground water in unconsolidated alluvial sediments of the San Joaquin Valley. The area is intensely irrigated with water from deep wells, and excess irrigation is believed to be the source of the perched water. The quality of water is poor. Drilling and cores showed a dense clay layer at about 100 ft depth, about 10 feet thick, with low permeability. It is continuous within the area and slopes west. If more land is irrigated with less efficient practices, the area will have a drainage problem, which this study may help to solve. (Affleck-Ariz)
W69-06758

GEOLOGY, DESIGN, AND CONSTRUCTION OF DEEP WELLS IN SEDIMENTARY FOUNDATIONS,
Eugene B. Waggoner, and Willard G. Owens.
Am Water Works Assoc Jour, Vol 59, No 3, pp 379-382, Feb 1968.

Descriptors: *Wells, *Groundwater basins, *Aquifer characteristics, *Water wells, *Design criteria, Groundwater mining, Drilling, Testing, Drill holes, Oil wells, Water yield, Legal aspects, Economic feasibility, Geologic formations, Water quality, Pumping, Water pollution control, Hydrologic properties, Geophysics.

A study of general geologic and ground water conditions within an area should be made to justify ground-water development, using available records of test holes, seismic shot holes, oil wells, gas wells, or completed water wells, and actual results from development of nearby aquifers. Legal and economic aspects should be considered also; then test-hole drilling apparent hydrologic properties of the aquifers, thickness and estimated yields, stability of formations and required open area for transmission of water. Unexpected conditions might require modification of well design; zones of development remove drilling muds and cuttings, and fines, and provide for prevention of pollution. (Affleck-Ariz)
W69-06759

EFFECT OF SUBSIDENCE ON WELL FIELDS,
Santa Clara Valley Water Conservation District, San Jose, Calif.
For primary bibliographic entry see Field 04B.
W69-06763

A COMPUTER-ORIENTED GROUND-WATER INFORMATION STORAGE AND RETRIEVAL SYSTEM,
Research Council of Alberta, Edmonton.
For primary bibliographic entry see Field 07C.
W69-06764

THE GROUNDWATER PROVINCES OF IRAN,
Hebrew Univ., Jerusalem (Israel); Geological Survey of Israel, Jerusalem; and Center for Groundwater Research, Jerusalem (Israel).
For primary bibliographic entry see Field 04B.
W69-06772

TRACER METHOD FOR DETERMINING THE VELOCITY OF FLOW IN A CONFINED KARSTIC AQUIFER,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 07B.
W69-06774

A RIGID PLATE MODEL OF THE BAROMETRIC EFFECT,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
J. A. Gilliland.
J Hydrol, Vol 7, No 3, pp 233-245, Mar 1969. 13 p, 6 fig, 7 ref.

Descriptors: *Barometric efficiency, *Water wells, Aquifers, Compressibility, Mathematical models, Elasticity (Mechanical), Water levels, Water table, Potentiometric level.
Identifiers: Jacobs equation, Rigid plate model.

The proposed 'rigid plate model' envisages a plate lying between the atmosphere and the water table which prevents the complete transfer of increased pressure loads to the groundwater mass. The barometric efficiency of a well is dependent not only on the properties of the aquifer, but also on the properties of the rigid plate. Jacob's equation is a special case of the general model. The soil moisture zone is one possible rigid plate. Measurements of barometric efficiency, air temperature and precipitation at Delta, Manitoba confirm the validity of the model. In the model it is assumed that response to pressure occurs instantaneously, the modulus of compressibility of the aquifer structure is substantially less than that of the aquifer grains, and that the discontinuities between the rigid layer and the capillary fringe as well as between the upper impermeable layer and the water level in the confining bed are negligible in effect. (Knapp-USGS)
W69-06775

CONSERVATION OF SOIL WATER BY GRAVEL MULCHES,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Irrigation Engineering, and Agricultural Research Service, Fort Collins, Colo. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 03F.
W69-06796

THE USE OF ELECTRIC ANALOG MODELS IN HYDRODYNAMICAL STUDY OF THE ALSACE AQUIFERS (FRENCH),
Institut de Physique du Globe, Strasbourg (France).
P. Ungemach.
Grad Thesis, Strasburg Inst of Earth Phys, Mar 1968. 91 p, 14 fig, 11 plate, 95 ref.

Descriptors: *Aquifers, *Model studies, *Dynamics, Hydrologic properties, Hydrogeology, Geophysics, Mathematical studies, Permeability, Darcys law, Transmissivity, Porosity, Pumping, Water circulation, Viscosity, Velocity, Alluvium, Dupuit-Forchheimer theory, Flow, Pressure, River basins.
Identifiers: *Alsace (France), Electric analog model, Rhine River.

This investigation represents a mathematical analysis of pertinent parameters characterizing the hydrologic conditions usually found in large scale aquifers and a detailed study of similarity which exists between these developed analytical expressions and electrical current flows used as electric analog models. The analytical study is based on the use of Bernoulli's theorem, Darcy's law, continuity equation, and the Dupuit-Forchheimer hypothesis. Results of the electric analog models were applied to the hydrogeological data of the Rhine River alluvial aquifer recorded in 1966. The analysis shows that use of electrical analog models is a considerable contribution as a method for evaluation of aquifers. (Gabriel-USGS)
W69-06806

RANDOM PROCESSES AND LITHOLOGIC TRANSITIONS,
Indiana Univ., Bloomington. Dept. of Geology; and Indiana Geological Survey, Bloomington.
For primary bibliographic entry see Field 02J.
W69-06807

GUIDEBOOK ON NUCLEAR TECHNIQUES IN HYDROLOGY,
For primary bibliographic entry see Field 07B.
W69-06811

ON MULTILEVEL OPTIMIZATION IN GROUND WATER SYSTEMS,
California Univ., Los Angeles. Dept. of Engineering.
John A. Dracup, and Yacov Y. Haimes.
Calif Univ Water Resources Center Rep, 1968. 7 p, 14 ref.

Descriptors: *Mathematical models, *Systems analysis, *Optimization, Linear programming, Simulation analysis, Digital computers, Input-output analysis, Synthetic hydrology, Dynamic programming.
Identifiers: *Multilevel optimization.

Groundwater aquifers can be analyzed as lumped or as distributed systems. In the lumped models the aquifer parameters of the system are considered as aggregated for the entire basin. In the distributed models the aquifer parameters are distributed into nodes throughout the basin. Lumped models have been analyzed using optimization techniques, however, simulation analysis has mainly been used for distributed models. It is proposed that distributed models of groundwater systems can be analyzed using multilevel optimization techniques. The concept of multilevel optimization technique is based on the decomposition of large scale and composed

systems followed by the reconstruction of the system into independent subsystems. The multilevel and the multigoals of the procedure are then defined. This procedure is accomplished by introducing new variables, called psuedo variables, into the system. Each subsystem is then separately and independently optimized. This is called a first level optimization. The subsystems are tied together into a 2nd level optimization through coordinator parameters (such as Lagrangian Multipliers), which are responsible for the optimization of the whole system. The characteristics of groundwater basins may be determined by organizing producing water wells into a multilevel structure. Such determinations can greatly aid water resource planning agents who are attempting to coordinate surface water and groundwater resources in an optimal manner. (Knapp-USGS)
W69-06813

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF PIKE COUNTY, ALABAMA,
Alabama Geological Survey, University; and Geological Survey, University, Ala.
Victor M. Shamburger, Jr., J. C. Scott, H. G. Golden, and J. R. Avrett.
Ala State Geol Surv Maps 72 and 73, 1968. Map 72, text 1 sheet, 9 ref; map 73, text, 5 fig, 5 tab, 7 ref.

Descriptors: *Water resources, *Surface waters, *Groundwater, *Alabama, Water wells, Streamflow, Water yield, Water quality, Water levels, Hydrologic data, Data collections, Aquifers, Hydrogeology.
Identifiers: Pike County (Ala).

The water availability and geology of Pike County, Alabama are described by maps showing geology, streamflow, areas of potential well yields of over 1 mgd from 2 major aquifers, depth to water, and thickness and depth of the major aquifers. A compilation of basic data includes well depth, aquifer tapped, water level, and construction data for 200 wells. Chemical analyses of well, stream, and spring waters are also compiled. In most of the county water supplies are adequate to meet any forecast demand and are of good enough quality for most uses. (Knapp-USGS)
W69-06815

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF HENRY COUNTY, ALABAMA,
Alabama Geological Survey, University; and Geological Survey, University, Ala.
J. G. Newton, J. F. McCain, and J. R. Avrett.
Ala State Geol Surv Maps 70 and 71, 1968. Map 70, 1 sheet, 1 fig, 10 ref, map 71, text, 2 fig, 4 tab, 6 ref.

Descriptors: *Water resources, *Surface waters, *Groundwater, *Alabama, Water wells, Streamflow, Water yield, Water quality, Water levels, Hydrologic data, Data collections, Aquifers, Hydrogeology.
Identifiers: Henry County (Ala).

The water availability and geology of Henry County, Alabama are described by maps showing geology, streamflow, areas of potential well yields of over 1-2 mgd from 2 major aquifers, depth to water, and thickness and depth of the major aquifers. A compilation of basic data includes well depth, aquifer tapped, water level, and construction data for 103 wells. Chemical analyses of well, stream, and spring waters are also compiled. In most of the county water supplies are adequate to meet any forecast demand and are of good enough quality for most uses. (Knapp-USGS)
W69-06816

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF CRENSHAW COUNTY, ALABAMA,
Alabama Geological Survey, University; and Geological Survey, University, Ala.
R. D. McWilliams, J. C. Scott, H. G. Golden, J. G. Newton, and J. R. Avrett.
Ala State Geol Surv Maps 68 and 69, 1968. Map 68, 1 sheet, 7 ref, map 69, text, 4 fig, 6 tab.

Descriptors: *Water resources, *Surface waters, *Groundwater, *Alabama, Water wells, Streamflow, Water yield, Water quality, Water levels, Hydrologic data, Data collections, Aquifers, Hydrogeology.
Identifiers: Crenshaw County (Ala).

The water availability and geology of Crenshaw County, Alabama are described by maps showing geology, streamflow, areas of potential well yields of over 1-3 mgd from the 3 major aquifers, depth to water, and thickness and depth of the major aquifers. A compilation of basic data includes well depth, aquifer tapped, water level, and construction data for 98 wells. Chemical analyses of well, stream, and spring waters are also compiled. In most of the County water supplies are adequate to meet any forecast demand and are of good enough quality for most uses. (Knapp-USGS)
W69-06817

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF DALE COUNTY, ALABAMA,
Alabama Geological Survey, University; and Geological Survey, University, Ala.
J. G. Newton, H. G. Golden, J. R. Avrett, and J. C. Scott.
Ala State Geol Surv Maps 63 and 64, 1968. Map 63, 1 sheet, text, 2 fig, 6 ref; map 64, text, 2 fig, 7 tab.

Descriptors: *Water resources, *Surface waters, *Groundwater, *Alabama, Water wells, Streamflow, Water yield, Water quality, Water levels, Hydrologic data, Data collections, Aquifers, Hydrogeology.
Identifiers: Dale County (Ala).

The water availability and geology of Dale County, Alabama are described by maps showing geology, streamflow, areas of potential well yields of 2 mgd or greater depth to water, and thickness of the major aquifers. A compilation of basic data includes well depth, aquifer tapped, water level, and construction data for 169 drilled wells. Chemical analyses of well, stream, and spring waters are also compiled. In most of the county water supplies are adequate to meet any forecast demand and of good enough quality for most uses. (Knapp-USGS)
W69-06818

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF COVINGTON COUNTY, ALABAMA,
Alabama Geological Survey, University; and Geological Survey, University, Ala.
J. D. Turner, J. C. Scott, J. F. McCain, and J. R. Avrett.
Ala State Geol Surv Maps 66 and 67, 1968. Map 66, 1 sheet, 6 ref; map 67, text, 2 fig, 4 tab.

Descriptors: *Water resources, *Surface waters, *Groundwater, *Alabama, Water wells, Streamflow, Water yield, Water quality, Water levels, Hydrologic data, Data collections, Aquifers, Hydrogeology.
Identifiers: Covington County (Ala).

The water availability and geology of Covington County, Alabama are described by maps showing geology, streamflow, areas of potential well yields of over 0.5 mgd from the 3 major aquifers, depth to water, and thickness and depth of the major aquifers. A compilation of basic data includes well depth, aquifer tapped, water level, and construction data for 93 drilled wells. Chemical analyses of well, stream, and spring waters are also compiled. In most of the County water supplies are adequate to meet any forecast demand and are of good enough quality for most uses. (Knapp-USGS)
W69-06819

RECORDS OF WELLS AND TEST HOLES IN THE NEVADA TEST SITE AND VICINITY,
Geological Survey, Washington, D. C.
William Thordarson, R. A. Young, and I. J. Winograd.
Geol Surv -At Energy Comm Open-file rep TEI-872, Dec 1967. 26 p, 2 fig, 1 tab, 18 ref.

Descriptors: *Data collections, *Wells, *Boreholes, *Nevada, Logging (Recording), Borehole geophysics, Water yield, Water quality, Water supply, Hydraulics, Hydrogeology, Geohydrologic units, Aquifers, Water temperature.
Identifiers: *Test holes, Well data, Cuttings logs, Pumping tests, Aquifer testing.

Hydrogeologic and construction data obtained from 119 test holes, wells, and emplacement holes at the Nevada Test Site and vicinity (through December 1966) are tabulated. The availability of cuttings, cores, lithologic logs, geophysical logs, formation-water analyses, hydraulic test data, and detailed construction data for each hole, as well as references to published reports for selected holes, are noted. (Knapp-USGS)
W69-06820

GROUNDWATER IN FRACTURED VOLCANIC ROCKS IN SOUTHERN ARIZONA,
Geological Survey, Arlington, Va.
L. A. Heindl.
Hydrol of fractured rocks Vol 2, Proc Dubrovnik Symp (Oct 1965), Int Ass Sci Hydrol, Pub 74, pp 503-513, 1967. 11 p, 3 fig, 9 ref.

Descriptors: *Groundwater, *Igneous rocks, *Fissures (Geology), *Arizona, Alluvium, Permeability, Groundwater movement, Groundwater barriers, Water supply, Water yield, Hydrologic properties, Geologic investigations, Tertiary period, Basins, Transmissivity, Groundwater recharge.
Identifiers: Southern Arizona, Volcanic rocks.

This article summarizes the general conditions under which water occurs in fractured volcanic rocks in southern Arizona and suggests certain guidelines for further investigation of the potential productivity of these rocks on the basis of geological, hydrological, and topographical data given in earlier publications. The study shows that locally wells in andesitic flows yield as much as 60 liters/s; the yields are highly variable and cannot be reliably predicted even within short distances. Yields from volcanic rocks are obtained from interflow breccias and primary voids and fractures. Fractured volcanic rocks in the basin-and-range country of southern Arizona also underlie areas of recharge in the mountains and act as conduits in transmitting water to reservoirs in the alluvium or in the permeable volcanic rocks buried by or interbedded with the alluvium. Some criteria for the projection of water-bearing fractures to below the surface are suggested. (Gabriel-USGS)
W69-06831

SYSTEMS APPROACH FOR INTEGRATING GROUND WATER AND SURFACE WATER USE.
Aerojet-General Corp., El Monte, Calif. Environmental Systems Div.; and Engineering-Science, Inc., Arcadia, Calif.
For primary bibliographic entry see Field 06A.
W69-06834

2G. Water in Soils

THEORY OF SOIL MOISTURE - VOL 1, MOISTURE PROPERTIES OF SOILS AND MOVEMENT OF SOIL MOISTURE,
Akademiya Nauk SSSR, Moscow. Pochvennyi Institut.
A. A. Rode.
Order from the Clearinghouse as TT-68-50441. Papercopy $3.00; Microfiche $0.65. Transl from Gidrometeorologicheskoe Izdatel'stvo, Leningrad, 1965. 560 p, 188 fig, 122 tab, 630 ref.

Descriptors: *Soil moisture, *Soil water movement, Soilewater-plant relationships, Soil science, Soil physics, Soil chemistry, Soil properties, Soil investigations, Soil water, Unsaturated flow, Diffusion, Evapotranspiration, Infiltration, Lysimeters, Moisture tension.
Identifiers: *USSR, Book.

Soil moisure, soil moisture movement, and soil properties are described in a comprehensive monograph of the present state of soil moisture science in the USSR. The approach to soil hydrologic studies in the USSR involves experiments and observations under field conditions, in which the soil layer is studied as a whole in its native state. The discussion of the water properties of soils is subdivided into porosity, water properties, sorption of water vapor, sorption of liquid water, suspended water, and free gravitational water. The discussion of soil water movement and soil-water-plant relationships is subdivided into thermodynamics, water motion, soil moisture and plants, and forms of soil moisture. The approaches to soil moisture studies in the US, Europe, and the USSR are described and compared. (Knapp-USGS)
W69-06489

DISPLACEMENT FRONT UNDER PONDED LEACHING,
California Univ., El Centro. El Centro Field Station.
James N. Luthin, Pedro Fernandez, Boris Masloc, Jack Woerner, and Frank Robinson.
J Irrig and Drain Div, ASCE, Vol 95, No IR1, Proc Paper 6446, pp 117-125, March 1969. 4 fig, 7 ref.

Descriptors: *Leaching, *Saline soils, *Drains, *Ponding, *Salts, Drainage, Irrigation water, Dispersion, Soil chemistry, Soil surfaces, Equations, Theoretical analysis, Analytical techniques.
Identifiers: *Displacement, Kirkham's equation.

Leaching of tile-drained soils by ponding water on the soil surface was examined both experimentally and theoretically. A method of analyzing movement of the displacement front was presented. The method was based on piston-type displacement of saline soil water by the added leaching water. In this initial analysis presence of precipitated salts, hydrostatic dispersion, and soil-chemical reactions were ignored. Experimental results obtained on a 15 by 6 by 3 foot tank showed satisfactory agreement to theoretical results obtained by solving Kirkham's equation for the ponded water case. Results indicated that ponded leaching was inefficient in removing salts midway between drains. Intermittant leaching by applying excessive amounts of irrigation water should be more efficient in controlling soil salinity. (Affleck-Ariz)
W69-06510

DRAINING AREA UNDERLAIN BY HIGHLY PERMEABLE SHALLOW SAND AQUIFER,
Agricultural Research Service, Washington, D. C. Soil and Water Research Div.; and South Dakota State Univ., Brookings. Remote Sensing Inst.
R. R. Allen, and V. I. Myers.
Trans ASAE, Vol 12, No 1, pp 29-31, Jan 1969. 6 fig, 5 ref.

Descriptors: *Aquifers, *Drainage systems, *Drains, *Tiles, *Subsurface drainage, Permeability, Sands, Texas, Electrical resistance, Electrical conductance, Analog models, Model studies, Water table, Flow measurement, On-site data collections, Effluents, Soil water movements.

This paper reports a field and electrical resistance analog study of subsurface tile drainage of an area near Raymondville, Texas, where the top of the sand aquifer was 10 ft. below ground surface. A subsurface tile drain, placed 8 ft. deep, yielded considerable effluent yet had a limited effect on the water table. Field and electrical analog data indicated that the underlying aquifer supplied 70 to 75% of the total tile flow. It was suggested that successful water-table control might be achieved through subsurface drains planned as an area unit rather than isolated individual systems. Such a system would be costly and involved. Single 8 ft drains appeared to be the most feasible for individual field areas. (Affleck-Ariz)
W69-06512

EVALUATION OF THE GAMMA TRANSMISSION METHOD FOR DETERMINING SOIL WATER BALANCE AND EVAPOTRANSPIRATION,
Clemson Univ., S. C.
James T. Ligon.
Trans ASAE, Vol 12, No 1, pp 121-126, 129, Jan 1969. 7 fig, 2 tab, 16 ref.

Descriptors: *Soil moisture, *Soil moisture meters, *Measurement, *Gamma rays, *Evapotranspiration, Instrumentation, Variability, Soil temperature, Air temperature, Sampling, Moisture content, Soil profiles, Interfaces, Equations, On-site date collections, Soil density, Field capacity.

This study reports on use of the gamma transmission system in a practical field situation. The theory, some of the problems encountered, techniques employed, and results obtained were presented in this paper. Some of the conclusions were that unexplained variations in count rates which occurred in the field were probably due to sensitivity of the detector system to temperature differences between air and soil and between different soil levels. The system was capable of measuring moisture changes with 1/2 inch of the soil surface and near interfaces within the soil profile. Major soil moisture changes owing to infiltration, drainage, or evapotranspiration over a period of several days could be detected and the distribution pattern of the accretion of depletion observed. The system at present does not appear to be sufficiently sensitive to accurately detect small moisture changes spread over a large part of the profile, such as evapotranspiration for a 24 hour period. (Affleck-Ariz)
W69-06514

FIELD OBSERVATIONS OF SOME PHYSICAL PROPERTIES IN ALLUVIAL SOILS OF ARID AND SEMI-ARID REGIONS,
Food and Agriculture Organization of the United Nations, Rome (Italy).
S. A. Radwanski.
Soil Science, Vol 106, No 4, pp 314-316, October 1968. 6 ref.

Descriptors: *Soil physical properties, *Surface sealing, *Salts, *Soil surfaces, *Surface waters, Arid climates, Semiarid climates, Rain water, Alluvium, Soil water movement, Irrigation water, Drainage effects, Winds, Cultivation, Soil profiles, Runoff, Silts, Penetration, Velocity, Flow, Evaporation.
Identifiers: *Microlamination, Lamination.

Physical properties of soils in arid and semi-arid regions were discussed with respect to microlamination and self-sealing, distorted drainage, salts and wind effect. Microlamination was often produced when silt or other soil particles were desposited from water flowing with a variable velocity. Thin laminae interfered with conventional movement of water in the soil profile. This sealing was virtually watertight and it may happen that most seasonal rainwater does not penetrate the soil but stands on the surface or runs off. In the intense desert heat surface water evaporates, salts precipitate and a cumulative effect over a number of seasons produced a salt deposit resting on the soil surface. Self-sealing caused by wind-affected surface layers was generally less serious from the agricultural point of view than that caused by microlamination. Tillage could be used to break the seal caused by microlamination and self-sealing resulting from a salt deposit on the soil surface and wind affecting surface layers of arid soils. (Blecker-Ariz)
W69-06515

TENSION OF THE SOIL WATER WHEN PERMANENT WILTING OCCURS, AS MEASURED BY THE GRAY HYDROCAL HYGROMETER METHOD,
Michigan State Univ., East Lansing.
George J. Bouyoucos, and Ray L. Cook.
Soil Science, Vol 106, No 4, pp 317-322, October 1968. 3 fig, 2 tab, 14 ref.

Descriptors: *Hygrometry, *Moisture content, *Wilting point, *Moisture tension, *Soil water, Wheat, Plant physiology, Osmotic pressure, Electrical resistance, Root systems, Absorption, Atmosphere, Humidity, Loam, Measurement, Moisture uptake.
Identifiers: *Gray hydrocal hygrometer, Non-saline soils.

The gray hydrocal hygrometer was used to measure soil moisture tensions or matrix suctions of non-saline soils when soils were at or near the permanent wilting point. Results revealed that magnitude of the tension of soil water when ultimate wilting occurred varied from 23.4 - 25.0 atmospheres. Osmotic pressure of unwilted vigorous growing young plants was 0.5 atmospheres as compared to 57.1 and 64.9 atmospheres of wilted plants. Osmotic pressure of roots in the wilted plants was 25.4 and 26.0 atmospheres. Data showed that when wheat plants reached the ultimate wilting point in non-saline soils, soil moisture tension was about 24.0 atmospheres. The root system was the main factor in determining true tension of soil water when ultimate wilting occurred. Soil moisture tensions are important in arid soils where plants can be under a moisture stress for long periods of time. (Blecker-Ariz)
W69-06516

THE PERFORMANCE OF SOIL MOISTURE ESTIMATES AS COMPARED WITH THE DIRECT USE OF CLIMATOLOGICAL DATA FOR ESTIMATING CROP YIELDS,
Department of Agriculture, Ottawa (Ontario). Plant Research Inst.
W. Baier, and George W. Robertson.
Agricultural Meteorology, Vol 5, pp 17-31, 1968. 1 fig, 32 ref, 6 tab.

Descriptors: *Soil moisture, *Climatic data, *Regression analysis, *Crop production, *Estimating, Rainfall, Temperature, Correlation analysis, Field capacity, Meteorological data, Model studies, Moisture content, Plant growth, Wheat, Environmental effects.
Identifiers: *Soil moisture budget, *Canada.

This study attempts to appraise the value of soil moisture estimates made with soil moisture budget using only standard climatic data as compared with direct use of climatological data in regression analysis for explaining variations in crop yields. Wheat yields from 39 plantings across Canada during five seasons were more closely related to estimated soil moisture than observations of rainfall, maximum and minimum temperatures. The versatile soil moisture budget has the advantage that soil moisture from different soil zones with diverse fertility levels can be weighted according to their contribution to yield. Results of the study demonstrate that significant crop-weather relations can be obtained if the meteorological factors are expressed in terms of environmental factors on which crops are directly dependent. (Blecker-Ariz)
W69-06519

PRINCIPLES OF CHOOSING EXPERIMENTAL PLOTS FOR WATER BALANCE STUDIES IN IRRIGATION REGIONS OF THE ARID ZONE,
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
D. M. Katz.
Bulletin of the International Association of Scientific Hydrology, Col 10, No 4, pp 42-47, December 1965. 4 tab, 4 ref.

Descriptors: *Regional analysis, *Hydrologic data, *Hydrogeology, *Water balance, *Groundwater,

Climatic data, Arid climates, Mapping, Salt balance, Salts, Irrigation water, Terraces (Geological), On-site investigations, Drainage water, Inflow, Discharge (Outflow).
Identifiers: Experimental plots.

In the complex of regional water balance investigations, which must be carried out in major hydrogeological regions of arid climates, studies at experimental plots are of great importance and should meet objectives as outlined in this article. In order that results of studies in key plots be representative of the territory under investigation, choosing of plots should be based on analysis of detailed hydrogeological maps. On alluvial terraces studies at experimental plots must show peculiarities of the water-salt balance of terraces of different age which are usually distinguished in various degrees of natural drainage. The study of water balance and unconfined ground water balance on plots can be done by experimental observations and by using hydrodynamic analysis of the unconfined ground water regime. (Blecker-Ariz)
W69-06523

SOME CHARACTERISTICS AND FREQUENCIES OF OCCURRENCE OF DROUGHTS IN THE DRY CLIMATIC ZONES OF INDIA,
Andhra Univ., Waltair (India). Dept. of Meteorology and Oceanography.
V. P. Subrahmanyam, and A. R. Subramaniam.
Bulletin of the International Assoc of Scientific Hydrology, Vol 10, No 3, pp 31-37, September 1965. 5 fig, 8 ref.

Descriptors: *Climatic zones, *Subhumid climates, *Arid climate, *Semiarid climate, *Droughts, Dry seasons, Wet seasons, Climatology, Frequency, Moisture deficit, Moisture availability, Rainfall disposition, Hydrologic budget, Fluctuation, Stations.
Identifiers: *India, Aridity index.

De-cribed here were results of a climatic study of characteristics and decennial frequencies of droughts in three dry climatic zones of India. The zones were arid, semi-arid and dry subhumid. Climates were classified according to the water balance scheme of Thornthwaite. The aridity index was computed for each year of a 65-year period of record for all selected stations. From yearly trends of the index, it could be ascertained whether a station was becoming drier, less dry or remaining steady. The standard deviation was adopted for classification of droughts into four different degrees of severity: moderate, large, severe and disasterous. During the early part of this century North India experienced serious droughts while in South India mentionable droughts occurred in the latter decades. One aspect of drought climatology was occurance of climatic shifts resulting from wide year-to year fluctuations in water balance. Under such circumstances, it was not uncommon for the normal climatic regime to be thrown into one of more arid or more humid category. (Blecker-Ariz)
W69-06524

SOIL-WATER DIFFUSIVITY BY THE ONE-STEP METHOD,
Agricultural Research Service, Riverside, Calif. Salinity Lab.
E. J. Doering.
Soil Science, Vol 99, No 5, pp 322-326, May 1965. 2 fig, 1 tab, 10 ref.

Descriptors: *Soil water, *Soil texture, *Diffusivity, *Capillary conductivity, *Moisture content, Discharge (Water), Soil properties, Flow measurement, Fluctuation, Equilibrium, Sampling.
Identifiers: *One-step method, Equilibration, Fluxes, Gradients.

The one-step method was applied to a group of five soils of different textures in order to test its reliability for determining diffusivity and capillary conductivity of soils. The method produced reasonable diffusivity values and smooth functional relationships between diffusivity, capillary conductivity and water content. General agreement between diffusivity values obtained by the outflow methods and those obtained independently by the constant flux method supports the conclusion that the values are reasonably accurate. Tests have also shown that the method is practical for determining diffusivity because only one equilibration is required for a given range of water content instead of the several equilibrations required by other methods. The one-step method measures soil properties that describe the flow of water in arid soils. (Blecker-Ariz)
W69-06528

DROUGHT AND SOIL MOISTURE,
Hydrometeorological Service of the USSR (Moscow).
M. S. Kulik.
Agricultural Meteorology, Vol 2, No 2, pp 79-83, April 1965. 2 tab, 6 ref.

Descriptors: *Cultivation, *Soil moisture, *Droughts, *Moisture availability, *Crop production, Moisture deficit, Soil-water-plant relationships, Air temperature, Precipitation (Atmosphere), Plant growth, Winds, Drought resistance, Field capacity, Wheat, Water requirements.
Identifiers: *U.S.S.R.

A considerable proportion of cultivated areas in the Soviet Union is concentrated in zones supplied only inadequately and irregularly with moisture. Analysis of data indicated that plants subjected to the same amount of precipitation may or may not undergo growth depression using high temperatures and dry winds. Methods and procedures are given on how effective moisture may be accumulated and retained in the soil so as to reduce the effect of a drought. Effectiveness of measures to increase soil moisture varies according to district, weather and combination of agronomic techniques applied. Introduction of modern drought-resistant varieties, high levels of cultural measures and curtailment of unproductive water expenditure by wasteful evaporation and drainage, can significantly reduce harmful effects of drought conditions on crop yields in arid climates. (Blecker-Ariz)
W69-06529

SOILS STUDIES USING COLOR PHOTOS,
McGill Univ., Montreal (Quebec).
For primary bibliographic entry see Field 07B.
W69-06696

EXTENDED TECHNIQUES OF CALCULATION OF SOIL-WATER MOVEMENT, WITH SOME PHYSICAL CONSEQUENCES,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia).
J. R. Philip.
9th Int Congr Soil Sci, Trans, Vol 1, pp 1-9, Adelaide, Australia, 1968. 9 p, 1 fig, 1 tab, 20 ref.

Descriptors: *Soil water movement, *Soil water, *Soil moisture, Subsurface flow, Subsurface runoff, Infiltration, Unsaturated flow, *Analytical techniques, Porous media, Heterogeneity, Bibliographies, Homogeneity, Two-dimensional, Three-dimensional, Surface irrigation, Absorption, Moisture content, Wetting, Irrigation.
Identifiers: Analytical method, Quasi techniques, *Porous media flow, *Infiltraton rate, Wetting front.

Recently developed quasi-analytical and analytical methods are discussed for solving the nonlinear Fokker-Planck equation describing water movement in unsaturated soils and porous media. Techniques described are (1) the extension of existing quasi-analytical methods to 2- and 3-dimensional transient systems, (2) an analytically based method of analyzing 2- and 3-dimensional steady systems, (3) an analytically based method of establishing the envelope of possible integral behavior of 1-, 2-, and 3-dimensional transient systems, and (4) the extension of various quasi-analytical methods to a subclass of heterogeneous systems. Techniques (1), (2), and (3) lead to several important physical conclusions concerning the interaction of capillarity, gravity, and geometry in the absorption and infiltration processes. Special attention is given to large-time behavior: the finiteness, or otherwise, of the ultimately wetted region; the completeness, or otherwise, of the wetting process; and the existence, or otherwise, of a final steady state. The results have important consequences in connection with techniques of surface irrigation and of measuring final infiltration rates in the field. (USBR)
W69-06714

GUIDEBOOK ON NUCLEAR TECHNIQUES IN HYDROLOGY,
For primary bibliographic entry see Field 07B.
W69-06811

2H. Lakes

THE AGING OF LAKES,
Wisconsin Univ., Madison. Water Chemistry Lab.
G. Fred Lee, and E. Gus Fruh.
Ind Water Eng, Vol 3, No 2, pp 26-30, Feb 1966. 2 fig, 12 ref.

Descriptors: *Eutrophication, *Lakes, Algae, Aquatic weeds, Cyanophyta, Fishkill, Fertilization, Limiting factors, Nitrogen compounds, Nutrients, Odor, Oligotrophy, Oxygen, Oxygen demand, Phosphorus compounds, Plant growth, Primary productivity, Rivers, Taste, Thermal stratification, Waste treatment, Water quality, Water pollution control, Water pollution effects, Water pollution sources.
Identifiers: *Cultural eutrophication, Recreational use, Waste effluents.

A lake's fertilization is determined to a large extent by the rate of nutrient influx. This situation is analogous to soils; more fertilizer, more crops. When lakes have excessive algae and/or rooted aquatic vegetation along the shoreline, it is a sign that this fertilization process is in motion. Frequently, the influence of man in the lake's watershed results in increased rates of nutrient influx which bring about an accelerated rate of standing crop production in the lake. This results in a deterioration of the water quality. Domestic and industrial water treatment costs are increased because of added cost to remove resultant taste and odors and increased numbers of organics from the eutrophic water. Such recreational pursuits as boating, fishing, and swimming can also be seriously impaired. Odor arising from decaying mats of algae can also seriously decrease the economic value of shoreline property. The large productivity of eutrophic lakes can lead to the absence of dissolved oxygen in certain parts of the hypolimnion, eliminating such cold-water sport fishes as trout and cisco. Thus, the cultural eutrophication of natural waters has become one of the major water management problems of today. (Lee-Wis)
W69-06535

SIMULATION OF AN AQUATIC ECOSYSTEM,
Washington State Univ., Pullman. Dept. of Zoology; and Washington State Univ., Pullman. Dept. of Information Science.
Richard A. Parker.
Biometrics, Vol 24, No 4, pp 803-822, Dec 1968. 9 fig, 3 tab, 18 ref.

Descriptors: *Systems analysis, *Ecosystems, *Simulation analysis, Water pollution effects, Lakes, Phosphorus, Trophic level, Productivity, Model studies, Salmon, Aquatic environment, Phosphates, Algae, Daphnia, Growth rates, Predation.
Identifiers: Kootenay Lake, British Columbia, Canada, Aquatic ecosystem model, Simulation model, Phosphorus effect, Cladecera.

A deterministic model simulating aquatic ecosystem of Kootenay Lake, British Columbia, was developed considering only conditions in upper 10 meters of south arm, which receives high phosphate load from tributary river. Solar radiation was expressed as weekly photoperiod changes; seasonal temperature curve derived from means of measurements at three depths. Four differential equations simulating change rates in phosphorus concentration, algae abundance, cladoceran density, and kokanee salmon biomass were simultaneously applied. Several appropriate constants were used. Change in phosphate concentration was assumed to be linear function of phosphate input to south arm, output from arm, and change rates in algal and cladoceran populations. Changes in biological components were derived essentially from difference between growth and death rates, which were assumed to be linearly dependent on combination of factors such as photoperiod, phosphate level, temperature, and predation. Model simulated algal and cladoceran cycles reasonably well but not phosphate cycle. 80% phosphate level reduction delayed algal peak 9 weeks and decreased other components more. 30% algal growth rate reduction delayed algal and cladoceran peaks by 1-2 weeks and decreased kokanee abundance. 30% algal death rate decrease produced no significant changes. Increasing cladoceran's algal predatory rates hardly displaced various peaks but depressed all populations. (Teraguchi-Wis)
W69-06536

ARSENIC ACCUMULATION BY FISH IN LAKES TREATED WITH SODIUM ARSENITE,
New York State Dept. of Health, Albany. Div. of Laboratories and Research.
For primary bibliographic entry see Field 05B.
W69-06541

SPECIES DIVERSITY AND COMMUNITY STRUCTURE IN LACUSTRINE PHYTOPLANKTON,
Wisconsin Univ., Madison. Dept. of Zoology.
Paul Edwin Sager.
PhD Thesis, Univ Wis, 1967. 201 p, 24 fig, 4 tab, 107 ref, 3 append. Available from University Microfilms, Ann Arbor, Mich. Cite their identification number 67-6827.

Descriptors: *Lakes, *Phytoplankton, Biomass, Ecology, Ecosystems, Eutrophication, Limnology, Oligotrophy, Wisconsin.
Identifiers: *Community structure, *Information theory, *Species diversity, Diversity indices, Gardner Pond B (Wis), Lake Mendota (Wis), Madison (Wis), Shannon's index of diversity, Trout Lake (Wis), Univ Wis Arboretum.

Author utilizes equations from information theory to estimate uncertainty or diversity of phytoplanktonic communities from Lake Mendota (Madison, Wisconsin), Trout Lake (northern Wisconsin), and Gardner Pond B (University of Wisconsin Arboretum). Of two components measurable by index of diversity, relative abundance and floristic richness, the former seems more important in characterizing these lacustrine communities. Floristic richness was less important because species in excess of the ten most abundant--having low density--had less significance for the index. Detailed treatment in this report includes, by chapter: discussion of the community concept, community structure, and the problem and its analysis; description of methodology; temporal aspects of three phytoplanktonic communities; structural characteristics of the communities; and a generalized discussion of the significance of the studies. Three appendices document an extensive data bank for the three communities including: volumetric estimates for species encountered (Mendota--79 species, Trout--87 species, and Gardner Pond--68 species); summary of seasonal abundance by numbers-density and volume-density; and summary of structural aspects, tabulating parameters of Shannon's diversity index. (Eichhorn-Wis)
W69-06542

WATER-QUALITY RECORDS FOR THE HUBBARD CREEK WATERSHED, TEXAS, OCTOBER 1966-SEPTEMBER 1967,
Geological Survey, Austin, Tex.
Helen J. Davidson.
Geol Surv Open-file Rep No 115, Dec 1968. 34 p, 2 fig, 7 tab, 3 ref.

Descriptors: *Water quality, Small watersheds, *Reservoirs, *Texas, *Data collections, Salinity, Surface waters, Gaging stations, Density stratification.
Identifiers: Periodic observations, Hubbard Creek Reservoir (Tex).

Water quality data are compiled for the Hubbard Creek Watershed, Texas. A Network of daily chemical-quality and streamflow stations has been operated since 1962. In addition to daily data, several low-flow partial-record stations were observed periodically. In April 1964 a multiple-cell conductivity recorder was installed at the outlet of Hubbard Creek Reservoir. The cells are positioned at 2 ft from the bottom 30 ft from the bottom, and at the lake surface. The reservoir was sampled to study salinity stratification. (Knapp-USGS)
W69-06786

2I. Water in Plants

EFFICIENT WHEAT IRRIGATION WITH LIMITED WATER,
Southwestern Great Plains Research Center, Bushland, Tex.
For primary bibliographic entry see Field 03F.
W69-06511

A METHOD OF DETERMINING THE WATER POTENTIAL OF INTACT PLANTS,
North Carolina Agricultural Experiment Station, Raleigh.
Jerry R. Lambert, and Jan Van Schilfgaarde.
Soil Science, Vol 100, No 1, pp 1-9, July 1965. 9 fig, 15 ref.

Descriptors: *Soil-water-plant relationships, *Moisture content, *Instrumentation, *Measurement, *Leaves, Soil moisture, Stomata, Transpiration, Moisture stress, Plant physiology, Equations, Calibrations, Equilibrium, Thermocline, Drying, Energy budget.
Identifiers: *Water potential, *Intact plants, Equilibration, Gradients.

This investigation's objective was to develop a method of measuring water potential of leaves remaining intact on a plant. The term water potential was used to describe energy status of moisture in any part of a soil-plant-atmosphere system. Rapid change in probe output following either watering or initiation of accelerated drying substantiated the fact that system response was sufficiently fast to indicate dynamic changes reasonably well. In order to separate response lag of the plant to changes in soil moisture potential from measuring system lab, a considerably shorter equilibration period was desirable. The possibility was suggested of using the technique to study gradients and resistances in plants by simultaneous determination of water transpiration rates. The method described could be used to determine moisture stresses of plants placed in different arid environments. (Blecker-Ariz)
W69-06527

WATER USE BY IRRIGATED COTTON IN SUDAN. II. NET RADIATION AND SOIL HEAT FLUX,
Ministry of Agriculture, Wad Medani (Sudan). Research Div.
For primary bibliographic entry see Field 03F.
W69-06756

THE EFFECT OF CROP AND CLIMATIC FACTORS ON THE RADIATION BALANCE OF AN IRRIGATED MAIZE CROP,
Volcani Inst. of Agricultural Research, Bet-Dagan (Israel). Div. of Agricultural Meteorology.
For primary bibliographic entry see Field 03F.
W69-06757

2J. Erosion and Sedimentation

A GEOMORPHIC APPROACH TO EROSION CONTROL IN SEMIARID REGIONS,
Colorado State Univ., Fort Collins.
S. A. Schumm.
Trans ASAE, Vol 12, No 1, pp 60-68, Jan 1969. 21 fig, 3 tab, 34 ref.

Descriptors: *Geomorphology, *Land forming, *Erosion control, *Semiarid climates, *Deposition (Sediments), Erosion, Drainage systems, Sediment transport, Sediment yield, Channels, Hydrologic aspects, Hydrologic data, Slopes, Gully erosion, Soil conservation, Runoff, Watershed (Basins).

A review of roughly ten years of research concerning semiarid land forms was given in this paper. An attempt was made to view erosional and depositional phenomena from a geomorphic perspective. The paper's objective was to suggest how geomorphic research into rates and mechanics of erosion processes and into interrelations that exist among geomorphic and hydrologic characteristics of drainage systems may assist both hydrologists and engineers in their practical goals of control and prediction. Emphasis on processes of landscape modification and a quantitative description of landforms has provided information on origin of certain features, and a means of delineating critical areas of the landscape where conservation techniques should be most effective. (Affleck-Ariz)
W69-06513

GRADED FURROWS FOR WATER EROSION CONTROL,
Blacklands Experiment Watershed, Riesel, Tex.; and Texas A and M Univ., College Station. Big Spring Field Station.
C. W. Richardson, R. W. Baird, and D. W. Fryrear.
J Soil and Water Cons, Vol 24, No 2, pp 60-63, Mar-Apr 1969. 5 fig, 2 tab, 4 ref.

Descriptors: *Furrow systems, *Erosion control, *Grading, *Runoff, *Slopes, Terracing, Irrigation efficiency, Texas, Crop production, Demonstration watersheds, Cultivated lands, Peak discharge.

At the Blackland Research Center, Temple, Texas, and the Blacklands Experimental Watershed, Riesel, Texas, research is underway to evaluate the effectiveness of a system of graded furrows as an erosion control measure. A system of furrows with a 1 percent grade successfully controlled erosion on areas with slopes up to 3 percent. Operating farm equipment on the furrow ridges was not appreciably more difficult than on flat-tilled areas, and crop yields were comparable to yields obtained on nearby conventionally-tilled areas. Runoff and soil-loss data from graded furrows up to 930 feet long indicated that both unit runoff and soil loss increased as furrow length increased. Graded furrows appeared to be a method of increasing the efficiency of field operations while protecting the soil from erosion. (Afflect-Ariz)
W69-06746

PREDICTION OF RAINSPLASH EROSION IN THE SEASONALLY WET TROPICS,
Australian National Univ., Canberra. Research School of Pacific Studies.
M. A. J. Williams.
Nature, Vol 222, No 5195, pp 763-765, May 24, 1969. 3 p, 4 fig, 41 ref.

Descriptors: *Raindrops, *Impact (Rainfall), *Erosion, *Tropical regions, Sheet erosion, Soil Surfaces, Sediment yield, Runoff, Rainfall-runoff relationships.

Identifiers: *Australia, Raindrop-impact erosion.

Raindrop-splash erosion was measured in a seasonally wet tropical area of northern Australia and methods of predicting raindrop erosion were established. Total cumulative rainfall momentum was found to be significantly related to cumulative weekly soil loss. Rain of a given momentum caused about 20 times less erosion late in the wet season than at the start when soil moisture was deficient. Both the proportion of runoff and the absolute amount increased during the wet season, so that soil erosion by runoff increased through the season. (Knapp-USGS)
W69-06768

DISTRIBUTION OF RADIONUCLIDES IN BOTTOM SEDIMENT OF THE CLINCH RIVER, EASTERN TENNESSEE,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 05B.
W69-06785

COASTAL EROSION AND TRANSGRESSIVE STRATIGRAPHY,
Duke Univ., Durham, N. C.
For primary bibliographic entry see Field 02L.
W69-06798

LABORATORY EXPERIMENTS ON THE PRODUCTION OF GRAIN ORIENTATION IN SHEARING SAND,
Birmingham Univ. (England). Dept. of Geology.
N. Hamilton, W. H. Owens, and A. I. Rees.
J of Geol, Vol 76, No 4, pp 465-472, July 1968. 8 p, 6 fig, 1 tab, 2 ref.

Descriptors: *Sediments, *Distribution patterns, *Model studies, Petrofabrics, Shear stress, Flumes, Dunes, Deltas, Flow around objects, Sands.
Identifiers: *Sand grain orientation, *Shearing sand.

Five experiments are described in which a bed of sand was subjected to shear and the resulting grain orientation estimated from measurements of anisotropy of magnetic susceptibility. Two experiments involved dry sand on angle-of-repose slopes, two involved the immersion of the inclined bed in still water, and in one the bed formed the foresets of a delta produced in a horizontal flume. It was found that the longest and shortest axes of the sand grains were always preferentially aligned in the plane perpendicular to the strike, longest axes being at a small 25-37 deg angle to the surface of accumulation. High magnetic q-values were characteristic of all the deposits. The results are consistent with theoretical prediction. (Lang-USGS)
W69-06799

RANDOM PROCESSES AND LITHOLOGIC TRANSITIONS,
Indiana Univ., Bloomington. Dept. of Geology; and Indiana Geological Survey, Bloomington.
Paul E. Potter, and Robert F. Blakely.
J of Geol, Vol 76, No 2, pp 154-170, Mar 1968. 17 p, 9 fig, 4 tab, 41 ref.

Descriptors: *Aquifers, *Stratigraphy, *Statistical methods, *Markov processes, Geologic formations, Hydrogeology, Synthetic hydrology, Sedimentation, Sedimentary petrology.
Identifiers: Synthetic stratigraphy, Statistical straitigraphy.

Bedding sequences and stratigraphic sections can be profitably considered from the standpoint of their lithologic transitions, that is, the probability of any particular unit being followed by the other units in the sedimentation system. Dependent Markov processes appear to be most appropriate for the study of lithologic transitions. This paper contains an elementary expository account of Markov processes and their relation to sedimentation. A Devonian limestone-dolomite-anhydrite sequence, an Ordovician limestone-shale sequence, and Pennsylvanian cyclothems show statistical evidence of at least a one-step dependence, or memory. Other geologic evidence also points to the existence of dependent lithologic transitions, especially in transgressive sequences. Markov processes can also be used to synthesize stratigraphic sections. (Knapp-USGS)
W69-06807

TREND SURFACE ANALYSIS OF SAND TRACER DISTRIBUTIONS ON A CARBONATE BEACH, BIMINI, BWI,
Land-Sea Interaction Lab., Norfolk, Va.
For primary bibliographic entry see Field 02L.
W69-06809

A CLASSIFICATION OF PALEOCURRENT MODELS,
Imperial Coll. of Science and Technology, London (England). Dept. of Geology.
Richard C. Selley.
J of Geol, Vol 76, no 1, pp 99-110, Jan 1968. 11 p, 7 fig, 65 ref.

Descriptors: *Sedimentology, *Sedimentation, *Shores, Mathematical models, Sedimentary petrology, Sediment transport, Paleohydrology, Paleoclimatology, Sands, Sediments.
Identifiers: Paleocurrents.

A series of models is proposed to clarify the relationships between a number of regional paleocurrent patterns occurring repeatedly in time and space. Each model is defined by three parameters: environment (i.e., depositional process), azimuthal paleocurrent pattern at outcrop (i.e., unimodal, bimodal, or polymodal), and the relationship between paleocurrent pattern at outcrop (i. e., unimodal, bimodal, or polymodal), and the relationship between paleocurrents and paleoslope. One fanglomerate model is proposed, 2 fluviatile, 1 eolian, 6 shore-line, and 2 turbidite models. Fanglomerates are characterized by unimodal downslope-directed radiating paleocurrents. Both fluviatile models have unimodal downslope paleocurrents. In one case these are arranged radially, in the second, centripetally. Eolian paleocurrents may be unimodal, bimodal, or polymodal, and are unrelated to paleslope. One eolian model is definable by relating wind direction to high-pressure air cells. Shore lines are characterized by bimodal paleocurrents attributable to tidal currents, though unimodal and polymodal patterns are also known. These are all unrelated to paleoslope. Six shore-line models are proposed based on the presence or absence of fluviatile currents and on whether marine currents are dominantly onshore, offshore, or alongshore. The 2 turbidite models both have unimodal paleocurrents. These may be arranged in small-scale downslope radiating fans. On a larger scale, lateral and axial infilling is common in many marine troughs, though the role of turbidity currents has been questioned. All the models proposed are illustrated by reference to examples from ancient and recent sediments. The problems of deducing current directions from sedimentary structures are discussed. (Knapp-USGS)
W69-06810

DYNAMICS OF CHANNEL FLOW,
For primary bibliographic entry see Field 02E.
W69-06835

2K. Chemical Processes

POTASSIUM, ILLITE AND THE OCEAN,
Georgia Inst. of Tech., Atlanta.
Charles E. Weaver.
Water Resources Center, Ga. Tech., WRC-0169, Reprint from Geochimica et Cosmochimica Acta, Vol 31, 1967, pp 2181-2196, 1969. 16 p, 3 fig, 54 ref. OWRR Project A-008-GA.

Descriptors: *Potassium, *Illite, *Montmorillonite, *Clay minerals, *Geochemistry, *Oceans, Adsorption, Cations, Cation adsorption, Ion-exchange, Sodium, Hydrogen ion concentration, Connate water, Calsium, Water chemistry, Saline water, Marine geology.

The effects that ocean waters have on clays and the effects the clays have on the ocean are investigated. Some consider the extraction of potassium by the formation of illite to be one of the more important processes operative in the sea. Assumptions on which this idea is based are critically evaluated. Clay minerals are presently adsorbing from the ocean more Na+ than K+. Younger sediments have relatively more Na+ and montmorillonite and less K and illite than older sediments. This change, which occurred near the end of the Paleozoic era and appears to be world wide, is believed due to an increase in the Na, and perhaps Mg, content of the oceans, caused by the rapid development of plant life and an increase in soil acidity. Primitive biota may have aided in concentrating K in the early terrestial environment. Less than 10% of the K+ carried to the ocean today is in solution. This value may have been even smaller in the past. Considerably less K, in solution, has been cycled through the ocean than has been assumed. (Conway-Georgia Tech)
W69-06506

THE WORK OF THE FRESHWATER BIOLOGICAL ASSOCIATION OF GREAT BRITAIN IN REGARD TO WATER SUPPLIES. (a) THE NITROGEN BALANCE OF LARGE QUANTITIES OF WATER,
C. H. Mortimer.
Brit Waterworks Assoc, Official Circ, Vol 21, pp 853-866, 1939. 2 fig, 3 tab, disc.

Descriptors: *Nitrogen cycle, *Nitrogen, Nitrogen fixation, Nitrates, Nutrients, Ammonia, Inflow, Outflow, Lakes, Productivity, Eutrophication, Cycling nutrients.
Identifiers: Lake Windermere, England, Inflow waters, Outflow waters.

Author reviews the nitrogen cycle in soils and a lake system. The average nitrogen content of inflow and outflow waters of various English lakes in the summer of 1938 was determined. There was less total nitrogen in the outflow than in the inflow water of the productive lake types. This amount is probably in excess of the amount stored in the mud and represents nitrogen loss. In the less productive lake types there is either an approximate balance or there is a higher concentration of total nitrogen in the outflow. It is hypothesized that as a certain production level in a lake has been reached sources of nitrogen loss appear which gradually balance and eventually exceed nitrogen fixation. (Bortleson-Wis)
W69-06538

GEOCHEMICAL TRACING OF MINERAL WATER SOURCES IN THE SOUTH WESTERN DEAD SEA BASIN, ISRAEL,
Weizmann Inst. of Science, Rehovoth (Israel); Israel Atomic Energy Commission, Rehovoth; and Geological Survey of Israel, Jerusalem. Hydrogeological Div.
For primary bibliographic entry see Field 02F.
W69-06747

GEOCHEMICAL TRACING OF MINERAL AND FRESH WATER SOURCES IN THE LAKE TIBERIAS BASIN, ISRAEL,
Weizmann Inst. of Science, Rehovoth (Israel); Israel Atomic Energy Commission, Rehovoth; and Water Planning for Israel Ltd., Haifa.
For primary bibliographic entry see Field 02F.
W69-06748

THE STABLE ISOTOPE COMPOSITION OF MINERAL WATERS IN THE JORDON RIFT VALLEY, ISRAEL,
Weizmann Inst of Science, Rehovoth (Israel). Dept. of Isotopes.
For primary bibliographic entry see Field 02F.
W69-06750

WATER-QUALITY RECORDS FOR THE HUBBARD CREEK WATERSHED, TEXAS, OCTOBER 1966-SEPTEMBER 1967,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 02H.
W69-06786

RECOVERY OF METAL SALTS FROM CONCENTRATED BRINES BY CHELATION,
Aerojet-General Corp., El Monte, Calif.
For primary bibliographic entry see Field 03A.
W69-06837

RECOVERY OF SALTS FROM SALINE WATER VIA SOLVENT EXTRACTION (FINAL REPORT),
Dow Chemical Co., Walnut Creek, Calif.
For primary bibliographic entry see Field 03A.
W69-06839

2L. Estuaries

REPORT OF THE BUREAU OF COMMERCIAL FISHERIES BIOLOGICAL LABORATORY, ST. PETERSBURG BEACH, FLORIDA, FISCAL YEAR 1968,
Fish and Wildlife Service, Washington D. C.; and Bureau of Commercial Fisheries, Washington, D. C.
For primary bibliographic entry see Field 09C.
W69-06767

PROGRESS REPORT OF THE BUREAU OF COMMERCIAL FISHERIES RADIOBIOLOGICAL LABORATORY, BEAUFORT, N. C., FISCAL YEAR 1968,
Bureau of Commercial Fisheries, Beaufort, N. C. Radiobiological Lab.
For primary bibliographic entry see Field 09C.
W69-06769

PRELIMINARY REMOTE SENSING OF THE DELAWARE ESTUARY,
Geological Survey, Philadelphia, Pa.
Richard W. Paulson.
Nat Aeron and Space Admin Tech Lett 128, Oct 1968. 22 p, 9 fig, 12 ref. NASA Contract No R-146-09-020-011. Task 160-75-01-63-10.

Descriptors: *Remote sensing, *Infrared radiation, *Photography, Surveys, Reaeration, Diffusion, Dispersion, Path of pullutants, Thermal pollution, Currents (Water), Water temperature, Waves (Water).
Identifiers: *Delaware Estuary, Infrared imagery.

Potential applications of remote sensing techniques for estuarine hydrology are discussed in a review of infrared imagery and aerial photography of the Delaware estuary. It is clear that infrared imagery can be an important estuarine reconnaissance tool. In addition, the analysis indicates that estuarine circulation, reaeration, and dispersion might be effectively studied with remote sensors. (USGS)
W69-06793

CHESAPEAKE BAY CASE STUDY.
Trident Engineering Associates, Inc., Annapolis, Md.
For primary bibliographic entry see Field 06B.
W69-06794

COASTAL EROSION AND TRANSGRESSIVE STRATIGRAPHY,
Duke Univ., Durham, N. C.
Donald J. Swift.
J of Geol, Vol 76, No 4, pp 444-456, July 1968. 13 p, 12 fig, 2 plate, 43 ref.

Descriptors: *Sedimentation, *Erosion, *Stratification, *Stratigraphy, *Beaches, Barriers, Aquifers, Anisotropy, Aquicludes, Permeability, Hydrogeology, Sedimentology, Sands, Silts, Shores.
Identifiers: *Beach stratigraphy, Uncomformities, Ravinements.

Unconformities of transgressive sequences commonly occur within the basal beds of the sequences, not below them. Such unconformities, called ravinements, separate basal marsh, lagoon, estuarine, and beach deposits from overlying marine sands. Study of the ravinements in the Bay of Fundy shows that they are cut mainly by surf action along a narrow zone at the foot of the shore face. Spits in the Bay of Fundy advance shoreward before the ravinement, leaving no trace of their passage, except where the supply of shingle is so great that the spits are stabilized. Sea level shifts then result in the abandonment of an old barrier and the formation of a new. The Cretaceous Peedee and the Black Creek Formations of the Carolina Coastal Plain are separated by a well-developed ravinement when operating over a considerable period of time. Sporadic lenses of littoral sand at the Black Creek-Peedee interface indicate that the shoreline advanced in the stepwise manner characteristic of many transgressive shorelines. It is suggested that the ravinement process may contribute to stepwise migration. Shore face erosion may feed a barrier until the shore face is mantled in its own lag; the barrier is then overstepped and a new shoreline is formed. It has recently been shown that erosion by inlet migration is an important coastal process. If the barriers are retreating landward, an especially severe form of ravinement results. (Knapp-USGS)
W69-06798

TREND SURFACE ANALYSIS OF SAND TRACER DISTRIBUTIONS ON A CARBONATE BEACH, BIMINI, BWI,
Land-Sea Interaction Lab., Norfolk, Va.
John D. Boon, III
J of Geol, Vol 76, no 1, pp 71-87, Jan 1968. 17 p, 16 fig, 3 tab, 16 ref.

Descriptors: *Beach erosion, *Sedimentation, *Beaches, *Sands, Tracers, Tracking techniques, Statistical methods, Bed load, Waves (Water), Currents (Water), Stochastic processes, Littoral drift, Surf.
Identifiers: *Trend surface analysis, *Bimini (BWI).

Two-dimensional trend surface analyses were performed on areally distributed tracer-concentration data for 3 different fluorescent sand tracers recovered from 4 depth, intervals of the foreshore of Bimini, BWI. The tracers had been affected by the swash, breakers, and logshore currents of 1 tidal cycle. Analysis of the statistical significance of trend surfaces for each depth interval showed that only the upper 2.5 cm of the sand column evidenced definite trend components. Differential sorting of tracers of different shapes and mean grain sizes was probably negligible, as deduced from the similarity in direction of orthogonals to the trend surface contours for the various tracer data. The advantage of the trend surface method of describing sand movement patterns on beaches lies in its ability to represent, in an objective manner, the average movement of sand grains by means of a single representative equation. Furthermore, for time scales of the order of minutes to several hours, the motion of sand is seldom parallel to the shore line. Studies attempting to define over-all particle drift at such time scales will be more meaningful where areal concentration data are objectively analyzed, as opposed to the subjective analysis of linear concentration data from samples collected parallel to the shore line. (Knapp-USGS)
W69-06809

A CLASSIFICATION OF PALEOCURRENT MODELS,
Imperial Coll. of Science and Technology, London (England). Dept. of Geology.
For primary bibliographic entry see Field 02J.
W69-06810

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

THE ROLE OF THE INTERNATIONAL ATOMIC ENERGY AGENCY IN THE DEVELOPMENT, USE AND CONTROL OF WATER RESOURCES.
International Atomic Energy Agency, Vienna (Austria).

Int Conf on Water for Peace, Wash, D C, Vol 5, pp 51-61, 1968. 11 p. For the 8 Volume Proc, see Vol 2, No 9, Field 06B and W69-03305.

Descriptors: *Water resources development, *Nuclear energy, *United Nations, Organizations, Governments, Nuclear powerplants, Desalination, Tracers, Irrigation.
Identifiers: *International Atomic Energy Agency.

IAEA's Statute authorizes it 'to encourage and assist research on, and development and practical application of, atomic energy for peaceful uses throughout the world'. The IAEA has international responsibility for the application of nuclear techniques for water resources. At present IAEA's principal interests in water resources are: applying isotope techniques to hydrological problems; using nuclear energy for water desalination; establishing international safety standards to control radioactive pollution of water; technical assistance to its Member States in these fields. Isotope techniques include measurements of discharge of rivers; sediment measurements; snow hydrology and glaciology; groundwater movement; measurement of soil moisture; seepage from reservoirs and canals; geochronology; and the study of isotopic composition of water bodies to identify possible areas of recharge. A joint project with WMO measures concentrations of tritium, carbon-14, deuterium, and oxygen-18 in water. Desalination of water by the application of nuclear energy promises to meet a part of the municipal, industrial, and eventually, irrigation requirements for fresh water. In the future, nuclear energy is also likely to be involved in interbasin transfer of water and in the construction of civil works for water projects. Investigations are being made as to the practicability of a dual-purpose desalination plant for arid regions. The IAEA has specific responsibility for setting international standards of safety for any radioactive contamination of the environment that may originate from the peaceful uses of atomic energy, and studies radiation effects in oceanography. (Knapp-USGS)
W69-06456

OPTIMIZATION THEORY APPLIED TO PRELIMINARY DESIGN OF A SINGLE EFFECT MULTISTAGE FLASH DESALINATION PLANT,
Stanford Univ., Calif.; and Mobil Oil Co., Paulboro, N. J.
J. H. Beamer, D. J. Wilde, B. A. Williams, and M. Arriel.
Proc, Nat Symp Anal Water-Resource Syst, pp 19-36, July 1968. 18 p, 5 fig, 5 ref.

Descriptors: *Desalination plants, *Optimization, *Flash distillation, *Design, Linear programming, Simulation analysis, Cost analysis, Economic efficiency, Mathematical models, Distillation, Water supply, Water treatment.
Identifiers: Los Angeles, Single effect, Multistage flash desalination.

The process of developing a model for a single effect multistage flash desalination plant, similar to the one planned for Los Angeles, was described to illustrate simulation techniques and considerations. Both an accurate nonlinear and an approximate linear model were constructed. The optimization of the models was described. The linearized approximation to the original model was constructed for computation speed and so that sufficient conditions could be determined at the optimum. The objective of the model was minimization of construction and operating costs subject to required capacity constraints. Some theoretical problems arising from the model application were discussed. (Gysi-Cornell)
W69-06495

ECONOMIC EFFECTS OF MINERAL CONTENT IN MUNICIPAL WATER SUPPLIES.
Black and Veatch, Kansas City, Mo.

Research and Development Report No 260, Office of Saline Water, U S Dept of Interior, 9 fig, 13 tab, append. May 1967. 159 p. OSW-14-01-001-537.

Descriptors: *Water properties, *Costs, *Corrosion, *Durability, Water quality, Mineralogy, Chemical properties, Capital costs, Operating costs, Annual costs, Investment, Economics, Damages, Water resource development, Water supply.
Identifiers: Mineralized water.

The purpose of this report is to evaluate the economic effect of mineral content of water supplies upon the facilities of water and sewage utilities and upon the customer. The adverse effects of mineralized waters result principally from corrosion, encrustation and related problems of both the water utility and customer facilities. The economic effects of using a water supply of a particular mineral content as compared to an alternate content could have a marked effect upon the economics of selection of the source to be developed. Emphasis has been placed on estimating the cost effects resulting from those minerals not readily and economically removed or neutralized in conventional water treatment processes. (Winn-Rutgers)
W69-06555

A FEASIBILITY STUDY ON THE UTILIZATION OF WASTE BRINE FROM SALINATION PLANTS: PART 1,
Brigham Young Univ., Provo, Utah; and Dow Chemical Co., Midland, Mich.
For primary bibliographic entry see Field 03C.
W69-06556

THE POTENTIAL CONTRIBUTION OF DESALTING TO FUTURE WATER SUPPLY IN TEXAS.
Southwest Research Inst., Houston, Tex.; and Texas Water Development Board, Austin.

Research and Development Progress Report No 250, Office of Saline Water, United States Dept of the Interior, 26 fig, 19 tab, append. Nov 1966. 197 p. OSW-14-01-0001-603.

Descriptors: *Desalination, *Texas, Water supply, Water quality, Water sources, Costs, Capital costs, Operating costs, Brine disposal, Electrodialysis, Flash distillation, Feasibility.
Identifiers: Conventional water, Texas Water Plan.

On the basis of a unit cost comparison, expressed in terms of cents per thousand gallons, eleven Texas cities have been identified as representative of those which could benefit from future use of a desalting plant. In each, the unit cost for desalting water has been found to be less than or about the same as the unit cost for water from conventional sources. In favor of desalting is the lower initial capital investment required for desalting as compared to the development of conventional water supplies. Although unit costs of both may be relatively close due to higher operating and maintenance costs for desalting, the lower initial capital costs should be of interest to all cities, and especially to those with limited borrowing power. (Winn-Rutgers)
W69-06558

MANUAL OF PROCEDURES AND METHODS FOR CALCULATING COMPARATIVE COSTS OF MUNICIPAL WATER SUPPLY FROM SALINE AND CONVENTIONAL WATER SOURCES IN TEXAS,
Southwest Research Inst., Houston, Tex.; and Texas Water Development Board, Austin.
Ralph E. Childers, W. Lawrence Prehn, Harold D. Holloway, and Thomas R. Weaver.
Research and Development Progress Report No 257, Office of Saline Water, U S Dept of Interior, 22 fig, 4 tab, append. Nov 1966. 111 p. OSW-14-01-0001-603.

Descriptors: *Desalination, *Texas, *Costs, Water supply, Water quality, Capital costs, Operating costs, Brine disposal, Electrodialysis, Flash distillation.
Identifiers: Conventional water.

This manual describes the procedures developed for calculating total costs for electrodialysis and multistage flash distillation desalting systems and for conventional water supply systems. Information provided on the methodology of all cost calculating procedures used will enable costs to be calculated for any desalting situation. The cost estimating procedure developed for a conventional water supply system includes the cost of a well field or an intake and pumping station at a reservoir or river. The costs of a pipeline with necessary pumping stations and the cost of a conventional water treatment plant. Raw water costs are also considered. In developing a cost estimating procedure for a desalting plant, cost elements include the costs of drilling and completing a water well field, the cost of pumping facilities and a pipeline to the desalting plant, the cost of pretreating salt water, the cost of the desalting plant and the cost of brine disposal. (Winn-Rutgers)
W69-06559

NUCLEAR REACTORS,
California Univ., Berkeley.
Thomas Pigford.
For main entry see Field 06B, W69-06572.
Proceedings of Conference at University of California at Davis, pp 154-155, Jan 11-13, 1961. 2 p.

Descriptors: *Nuclear energy, Nuclear reactor, Energy, Costs, Water resources, Development.

Nuclear power offers promise of lower fuel cost than conventional fossil fuels. The most likely role of nuclear plants in the water resources program would be as energy sources for seawater conversion and power sources for water pumping stations. It is likely that on economic grounds nuclear plants will be the best selection for these applications in the not too distant future. It is unlikely that the selection of a nuclear power plant over a conventional plant for any of these applications will have any great economic or logistical effect upon the development of water resources in the near future. (Winn-Rutgers)
W69-06582

THE STATUS OF SEA WATER CONVERSION,
California Univ., Berkeley.
Everett D. Howe.
For main entry see Field 06B, W69-06572.
Proceedings of Conference at University of California at Davis, pp 156-160, Jan 11-13, 1961. 5 p, 1 ref.

Descriptors: *Demineralization, *Water cost, Costs, Desalination, Desalination processes, Water properties, Distillation, Electrodialysis, Reverse osmosis.
Identifiers: Thermal distillation, Cold distillation.

The possible use of desalted water or demineralized brackish water in place of natural waters derived from precipitation in the mountains and transported to the points of use is dependent on the relative costs. Demineralized water can now compete in cost with natural water supplies in a few cases. By continued research and development it may be able to compete favorably with the future costs of imported water and thereby save water users many times the cost of the research program. Some thirty possible processes for demineralizing water have been considered at various times, but only a few have been regarded as potentially economical processes. (Winn-Rutgers)
W69-06583

DESALTED SEAWATER FOR AGRICULTURE: IS IT ECONOMIC,
Resources for the Future, Inc., Washington, D. C.
For primary bibliographic entry see Field 03F.
W69-06765

SUL-biSUL (T) ION EXCHANGE PROCESS: FIELD EVALUATION ON BRACKISH WATERS,
Elgin International, Inc.
K. Schmidt, D. Senger, D. Schwark, and H. Dalaly.
Office of Saline Water, Research and Development Progress Report No. 466. May 1969. 139 p. OSW 14-01-0001-1487.

Descriptors: *Desalination processes, *Ion exchange, Pilot Plant, Cation exchange, Anion exchange, Resins.
Identifiers: *SUL-biSUL (T).

The results of a field evaluation of the Sul-biSul ion exchange process as a mobile pilot plant, transported to different sites, are discussed. Sul-biSul is a two-bed ion exchange resin process which employs a cation exchanger in the regenerated hydrogen ion form, and an anion exchanger in the regenerated sulfate salt form. Waters suitable for treatment by Sul-biSul should not exceed a total dissolved solids content of 2000 ppm as CaCO3; the sulfate-to-chloride ratio should be approximately 9.0; the alkalinity of the water should represent at least 10% of the total anions present; and a gypsum type water containing a high bicarbonate alkalinity is most suitable for optimum performance. For a 1 MGPD 2-bed Sul-biSul plant using 1082 ppm influent as CaCO3, the cost per 1000 gallons of product water of 400 ppm salinity is $0.33. For a 1.5 MGPD plant the cost per 1000 gals. is $0.27. (Rinne-Office of Saline Water)
W69-06836

RECOVERY OF METAL SALTS FROM CONCENTRATED BRINES BY CHELATION,
Aerojet-General Corp., El Monte, Calif.
D. O. DePree, and Herman Weyland.
Office of Saline Water Research and Development Progress Report No. 435. 1969. 54 p. OSW 14-01-0001-1692.

Descriptors: *Brine disposal, *Desalination processes, *Chelation, *By-products, Ion exchange, Sodium compounds, Magnesium compounds, Potassium compounds, Calcium compounds, Brines, Sea water, Ultimate disposal.
Identifiers: Salt recovery, Chelating agents.

A process was investigated and evaluated for the removal of salt from brine effluents. The specific process under investigation was (1) the passage of brine through anion and cation exchange resins to remove all salts; (2) thermal regeneration of anion exchange resins; (3) regeneration of cation exchange resins with chelating agents to preferentially remove certain cations; and (4) acidification of the chelating agents to recover the cation salts. The investigation was concerned with steps (3) and (4) of the process and was limited to determination of the optimum methods and conditions for recovery of sodium, magnesium, potassium and calcium. Amberlite CG-50 resin, loaded with sodium, potassium, magnesium and calcium

ions in the ratio in which they occur in sea water, was eluted with methanol solutions of selected ligands. Extraction with 2-acetylcyclohexanone produced a mixture of potassium and sodium chelates in which the potassium content had been enriched approximately seven fold over the ratio in the resin. Sodium ion free of potassium, magnesium and calcium was then removed from the resin with a methanol solution of acetylacetone. Separation of magnesium and calcium was achieved with a methanol solution of citric acid. Recovery of metal salts by acidification of the chelate solutions was found to be dependent on the concentration of metal chelate. An estimate of the economics of the process is included. (Scott-Office of Saline Water)
W69-06837

INTERMOLECULAR FORCES AND THE LIQUID STATE,
Purdue Univ., Lafayette, Ind.
For primary bibliographic entry see Field 01A.
W69-06838

RECOVERY OF SALTS FROM SALINE WATER VIA SOLVENT EXTRACTION (FINAL REPORT),
Dow Chemical Co., Walnut Creek, Calif.
R. R. Grinstead, J. C. Davis, and S. W. Snider.
Office of Saline Water Research and Development Progress Report No. 406. 1969. 132 p. OSW 14-01-0001-1134.

Descriptors: *Solvent extraction, *By-products, *Magnesium compounds, Sea water, Separation techniques, Organic acid, Brine disposal, Ultimate disposal.
Identifiers: Liquid extraction, Amines, Salt recovery.

The goal of this project was to examine the 'mixed ionic' or 'organic salt' system as a possible means of treating waste brine systems for by-product recovery. The initial phase of this study consisting of the work done during the first year of this contract was reported in a summary report in September 1967. (Office of Saline Water Research and Development Progress Report No. 320). Additional work carried out on the selectivity of simple non-quarternary amine systems gives the usual order of extraction (nitrate greater than bromide greater than chloride) with tertiary amines being most selective and primaries least. Variations in the acid component of the mixed ionic system show the extraction ability in the order carboxylic greater than alkylphosphoric greater than arylsulfonic. Increasing the temperature had little effect on magnesium chloride extraction, but caused a decrease in the distribution of sodium chloride into the organic phase. Preliminary economic estimates are given for the extraction and recovery of magnesium chloride as the solid 6-hydrate from 3X (threefold evaporated) and 10X seawater, and bittern (about 40X). Assuming no feed cost, the process costs vary from $84/ton MgCl2 for the 3X seawater to $35/ton MgCl2 for either 10X or bittern. A number of uncertainities, including the actual cost of a solar distillation step and the size of a magnesium chloride market, make the realization of a credit an unlikely proposition; however, in perhaps a very limited number of cases, a credit can be realized. (Scott-Office of Saline Water)
W69-06839

BEHAVIOR OF LIQUID SURFACES DURING EVAPORATION AND CONDENSATION,
Rochester Inst. of Tech., N. Y.
Kenneth Hickman, Jer Ru Maa, Peter J. Harris, and Andrew Davidhazy.
Office of Saline Water Research and Development Progress Report No. 392. 1969. 80 p. OSW 14-01-0001-736.

Descriptors: *Evaporation, *Liquids, *Condensation, *Boule flotation, Heat transfer, Films, Surfaces, Air-water interfaces.
Identifiers: Transport coefficient, Liquid-vapor interface, Dissolved gases.

The purpose of the research was twofold: to demonstrate that transport across the clean liquid vapor interface is dependent only on the gas laws and is independent of chemistry--the transport coefficient is unity or nearly so; and to demonstrate that the same liquids (notably water) when stagnant acquire artifacts at the free surface that modify vapor transport and other surface properties. The tools employed were the jet tensimeter for examining new clean surfaces, and the floating liquid boule for probing resting, superheated liquids. It was demonstrated that the condensation (or evaporation) coefficient is unity; and there is little or no resistance to molecules crossing the vapor-liquid interface in addition to that imposed by the gas laws. Experimental results and thermal gradient calculations both showed that in most cases heat transfer in the liquid region is the rate-controlling factor for condensation and evaporation. The floating drop, or 'boule,' was found to be extremely sensitive to trace quantities of impurities, which contaminate and structure the water surface, and impede or prevent boule formation. By adding chemicals to carefully purified water, it was found that a combination of impurities was particularly effective: (1) a film forming substance such as a silicate, and (2) a film stabilizing substance, such as an aluminum, copper or nickel salt. The films which are formed on the water surface constitute a barrier to water evaporation. This work thus offers an explanation of some factors responsible for inhibiting evaporation in distillation processes, and possibilities for control of evaporation from lakes and rivers. (Scott-Office of Saline Water)
W69-06840

3B. Water Yield Improvement

MODERN IRRIGATION FOR INCREASED AGRICULTURAL PRODUCTION,
Hebrew Univ., Jerusalem (Israel). Dept. of Irrigation.
For primary bibliographic entry see Field 03F.
W69-06454

IRRIGATION WATER SYSTEM--ISRAEL'S NATIONAL WATER GRID,
Water Planning for Israel Ltd., Haifa.
For primary bibliographic entry see Field 03F.
W69-06459

ON THE DISTRIBUTION OF STATISTICS SUITABLE FOR EVALUATING RAINFALL STIMULATION EXPERIMENTS,
Princeton Univ., N. J.; Stanford Univ., Calif.
K. R. Gabriel, and Paul Feder.
Technometrics, Vol 11, No 1, pp 149-160, Feb 1969. 12 p, 3 tab, 10 ref, append.

Descriptors: *Weather modification, *Cloud seeding, Statistics, Monte Carlo Method, Foreign research, Rainfall, Statistical models, Sampling, *Artificial precipitation, *Statistical analysis, Mathematical models, Meteorology, Statistical methods, Atmospheric precipitation.
Identifiers: Israel, Atmospheric research.

Two randomization tests of the null hypothesis in cloud seeding experiments are compared--the Wilcoxon-Mann-Whitney test and a test based on an average ratio of seeded to nonseeded amounts of precipitation. Data from an Israeli experiment suggest that the latter test is relatively more sensitive to apparent effects of seeding. The significance level of this test may be estimated by the Monte Carlo method, or approximated by using the asymptotic normal distribution of the average ratio. Sampling trials show that this approximation is adequate only when the experiment extends over several years. (USBR)
W69-06679

PHOTOSYNTHESIS AND WATER USE BY SALTCEDAR,
Geological Survey, Lubbock, Tex.
T. E. A. Van Hylckama.
Bull Int Ass Sci Hydrol, Vol 14, No 1, pp 71-83, Mar 1969. 13 p, 7 fig, 15 ref.

Descriptors: *Phreatophytes, *Photosynthesis, *Consumptive use, Evapotranspiration, Evaporation, Carbon dioxide, Tamarisk, Water loss.
Identifiers: Evapotranspirometers.

Near Buckeye, Arizona, saltcedar (Tamarix pentandra) was grown on a battery of evapotranspirometers under various conditions of plant density, soil salinity, and access to water. Growth and development of these plants declined sharply at the beginning of each July, although before that time rates of growth and development had been very high. It was initially postulated that carbon dioxide might have become the limiting factor. Measurements of carbon dioxide content of the air made at different heights inside and outside the evapotranspirometers, however, showed that this was not the case. Analysis of the data shows a close correlation between carbon dioxide and water vapor fluxes (computed by means of mass transfer equations) above the saltcedar thickets. A reduction in fluxes during hot afternoons appears to be due to ambient temperatures over 40 deg C. Water use is similarly affected. (Knapp-USGS)
W69-06771

REGIONAL HYDROLOGIC AREA STUDY AS AN ANALYSIS TOOL IN WEATHER MODIFICATION,
Sierra Hydrotechnology, Placerville, Calif.; and Atmospheric Water Resources Research, Fresno, Calif.
For primary bibliographic entry see Field 02A.
W69-06805

BEHAVIOR OF LIQUID SURFACES DURING EVAPORATION AND CONDENSATION,
Rochester Inst. of Tech., N. Y.
For primary bibliographic entry see Field 03A.
W69-06840

3C. Use of Water of Impaired Quality

ECONOMIC FRAMEWORK FOR SALINITY CONTROL PROJECTS,
Harvard Univ., Cambridge, Mass.; and Colorado River Basin Project, Denver.
For primary bibliographic entry see Field 05D.
W69-06490

A FEASIBILITY STUDY ON THE UTILIZATION OF WASTE BRINE FROM SALINATION PLANTS: PART I,
Brigham Young Univ., Provo, Utah; and Dow Chemical Co., Midland, Mich.
J. J. Christensen, W. F. McIlhenney, P. E. Muehlberg, and H. G. Smith.
Research and Development Progress Report No 245, Office of Saline Water, U S Dept of Interior, 55 tab, 24 fig, 405 ref, append. April 1967. 359 p. OSW-14-01-0001-392.

Descriptors: *Brines, *Economic feasibility, Saline water, Brine disposal, Desalination, Feasibility, Economics, Value.
Identifiers: *Mineral recovery, Brine classification.

It is technically feasible to recover most of the various dissolved minerals likely to be encountered in the effluent brines of desalination plants by proven, commercial methods. It is economically feasible to do so only if both the physical conditions and the price of the brines are competitive with other sources of the same mineral. In general, common salt, magnesium hydroxide and bromine are the only materials whose economic recovery looks promising from the effluent brine of a large scale seawater desalination plant. The recovery of potassium compounds from this source may be economically feasible if the concentration factor of the

brine is considerably greater than five. Generally, the disposal costs of the effluent brine from a desalination plant will be decreased if dissolved minerals are recovered. However, this reduction will be modest. (Winn-Rutgers)
W69-06556

3F. Conservation in Agriculture

MODERN IRRIGATION FOR INCREASED AGRICULTURAL PRODUCTION,
Hebrew Univ., Jerusalem (Israel). Dept. of Irrigation.
Dan Goldberg.
Int Conf on Water for Peace, Wash, D C, Vol 3, pp 395-406, 1968. 12 p. For the 8 Volume Proc, see Vol 2, No 9, Field 06B and W69-03305.

Descriptors: *Water management (Applied), *Irrigation efficiency, *Irrigation practices, *Sprinkler irrigation, *Arid lands, Economic efficiency, Irrigation operation and maintenance, Drainage, Land management, Water demand, Water distribution (Applied), Water resources, Water utilization.
Identifiers: *Israel, Irrigation planning.

In arid and semi-arid regions (where most of the developing countries are located) irrigation is about the only means to ensure crop production. Irrigation safeguards crops against drought. Conventional or gravity methods of irrigation in intensive use the world over contain inherent serious limitations, which become particularly apparent when comparing the traditional methods with the more advanced modern irrigation methods. In gravity irrigation, more water is needed per unit area and water accumulates in the subsoil, causing waterlogging and salinity. Preparation of land for proper gravity irrigation is time-consuming, difficult to perform for lack of proper equipment and skilled operators, and very costly. In general, gravity irrigation methods are cumbersome to design, to construct, and to apply. Sprinkler irrigation has been tested in Israel and offers the following advantages: it is easy and quick to install on large areas, unlimited by topography; if properly designed, it offers highly efficient irrigation; the yearly cost of irrigation per unit area compares very favorably with the cost of gravity irrigation; it yields high irrigation efficiencies, or 80% and above, as compared with 20% in gravity irrigation. Practically all irrigation in Israel is done by sprinkling which has proved extremely sucessful. In advocating its adoption, it is suggested that the following measures be taken: standardization of sprinkler irrigation equipment; reduction of the cost of sprinkler equipment by breaking monopolies, encouraging competition, buying in bulk; initiation and support of courses for engineers, technicians and farmers dealing with the proper use and care of the equipment. (Knapp-USGS)
W69-06454

IRRIGATION WATER SYSTEM--ISRAEL'S NATIONAL WATER GRID,
Water Planning for Israel Ltd., Haifa.
A. Wiener.
Int Conf on Water for Peace, Wash, D C, Vol 7, pp 195-205, 1968. 11 p. For the 8 Volume Proc, see Vol 2, No 9, Field 06B and W69-03305.

Descriptors: *Water management (Applied), *Water conservation, *Irrigation operation and maintenance, Arid lands, Water quality, Artificial recharge, Conjunctive use, Drainage, Land management, Non-structural alternatives, Water demand, Watershed management, Desalination, Water utilization.
Identifiers: *Israel, Groundwater management, Comprehensive water plans.

Distribution and availability of water has always had a decisive influence on the economic and cultural development of Israel. Ancient responses to the problems of water scarcity cannot be used to solve present problems because of the deterioration through neglect of large areas of land and the different claims we now make on productivity and dependability of agriculture. In Israel's long-term plans an attempt was made to define a development policy for water quantity, quality, and distribution. Between 1948 and 1966, water utilization rose from 17% to almost 90% of the country's proven potential resources, the extent of irrigated land from 70,000 to over 400,000 acres, and agricultural production seven-fold, to US $450 million. More than half of Israel's farmers started farming in the past 15 yr, mostly with no previous farming experience, but agricultural productivity is high, and water utilization is nearly at its limit. The physical system that has evolved is a fully integrated national water grid. Practically all potential water sources (including reclaimed wastes) will be in use by the early 1970's. Further economic development will then depend on the introduction of man-made water, improving the quality of natural waters, or on the shift of water resources from lower-value to higher-value use, or on a combination of these approaches. (Knapp-USGS)
W69-06459

AGRICULTURE USE OF WATER IN TAIWAN, REPUBLIC OF CHINA,
Taiwan Provincial Government, Taipei. Water Conservancy Bureau.
Liu Fong-yih.
Int Conf on Water for Peace, Wash, D C, Vol 7, pp 220-230, 1968. 11 p, 1 fig, 4 tab. For the 8 Volume Proceedings, see Vol 2, No 9, Field 06B and W69-03305.

Descriptors: *Water resources development, *Irrigation, Conservation, Governments, Institutions, Legislation, Optimum development plans, Political aspects, Economies, Water allocation (Policy), Water requirements, Water utilization.
Identifiers: Taiwan, Rotational cropping, Rotational irrigation.

Taiwan is a densely populated island of 35,800 sq km whose people depend largely on agriculture for a livelihood. Rainfall is abundant but very uneven in distribution. Mountains are numerous and steep; rivers are short and rapid. Under such conditions flood and drought are the essential problems of water resources development. About 889,000 ha of the island are in cultivation and 60% of this is irrigated. Soils of cultivable areas are mostly in the Cenozoic alluvium belt with laterites below. Alluvial deposits are mixed with gravels, sand and clay, and are generally high in fertility. In the early stage of water development, direct diversion of natural stream-flow was the common type of irrigation. As the irrigation area had to be increased with time and population, utilization of the natural flow gradually reached a limit. In order to store water for irrigation to even out the fluctuations in rainfall, farm ponds and reservoirs have been built. Reservoir storage requires large capital investment and as an alternative, a groundwater development plan has been implemented to serve as a source of irrigation water supply. In order to save water so as to extend the irrigated area, cooperative farmer irrigation associations, rotational cropping, rotational irrigation, and low cost canal lining have been adopted. In addition, the study of irrigated upland farming crops, which respond favorably to water and contribute high economic value, has been promoted by the Government in order to advance economic development. (Knapp-USGS)
W69-06460

ANALOG OF GROUND WATER IN EAST-CENTRAL NEW MEXICO,
Bureau of Reclamation, Denver, Colo. Experimental Design Analysis Section; and Bureau of Reclamation, Denver, Colo. Water Utilization Branch.
For primary bibliographic entry see Field 02F.
W69-06509

DISPLACEMENT FRONT UNDER PONDED LEACHING,
California Univ., El Centro. El Centro Field Station.
For primary bibliographic entry see Field 02G.
W69-06510

EFFICIENT WHEAT IRRIGATION WITH LIMITED WATER,
Southwestern Great Plains Research Center, Bushland, Tex.
A. D. Schneider, J. T. Musick, and D. A. Dusek.
Transactions of the ASAE, Vol 12, No 1, pp 23-26, Jan 1969. 5 fig, 4 tab, 7 ref.

Descriptors: *Irrigation efficiency, *Wheat, *Crop production, *Water utilization, *Growth stages, Timing, Soil moisture, Irrigation water, Texas, Plant physiology, Moisture stress, Moisture deficit, Soil-water-plant relationships, Winter, Rates of application, Moisture availability, Precipitation (Atmospheric).

A study was conducted at Bushland, Texas during 3 wheat seasons to determine the combinations of spring irrigations at 4 selected stages of plant development that produced the best water-use efficiencies and to determine some effects on yields and plant development caused by delaying or deleting irrigations. The study showed that irrigation timing was critical when less than an optimum amount of water was applied to winter wheat. Every number and timing of the 4 irrigations was used so that the effect of any combinations of irrigations could be evaluated. The most critical period for adequate soil moisture was from booting through early grain filling. Moderate soil-moisture stress during early spring did not reduce yields appreciably if soil moisture was adequate during this critical period. (Affleck-Ariz)
W69-06511

DROUGHT AND SOIL MOISTURE,
Hydrometeorological Service of the USSR (Moscow).
For primary bibliographic entry see Field 02G.
W69-06529

EVAPORATION REDUCTION ON LARGE RESERVOIRS,
Utah State Univ., Logan; Utah Engineering Experiment Station, Salt Lake City; and Utah Water Research Lab., Logan.
C. Earl Israelsen, and Vaughn E. Hansen.
Proc American Soc Civil Engineers, Vol 91, No IR1, paper 4262, pp 93-98, March 1965. 5 ref.

Descriptors: *Reservoir evaporation, *Evaporation control, *Monomolecular films, *Aircraft, *Application equipment, Equipment, Spraying, Rates of application, Retardants, Lakes, Chemcontrol, Particle size, Films, Alcohols, Heating, Liquids.
Identifiers: *Powder, *Dispensers.

Descriptions were given of equipment developed by Utah State University for dispensing evaporation retardants in liquid and powder form from aircraft. Monolayer film covers could be obtained by applying material at rates between 0.05 and 0.30 lb per acre. Applications using the newly developed equipment to spread monolayer-forming chemicals on several large lakes in Utah, Idaho, Wyoming and New Mexico were summarized. Observations and recommendations concerning equipment, procedures and continuing research were also presented. (Blecker-Ariz)
W69-06531

TRANSPIRATION REDUCTION BY SURFACE FILMS,
Commonwealth Scientific and Industrial Research Organization, Aspendale (Australia). Div. of Meteorological Physics.
D. E. Angus, and H. Bielorai.
Aust J Ag Research, Vol 16, No 2, pp 107-113, March 1965. 1 fig, 1 tab, 1 photo, 9 ref.

Descriptors: *Transpiration control, *Monomolecular films, *Plant growth, *Surfactants, *Foliar application, Transpiration, Damages,

Sprays, Leaves, Alcohols, Films, Chemcontrol, Wetting.
Identifiers: *Oils, *Silicones, Sunflowers.

Exploratory tests on the possibility of reducing plant transpiration by means of surface films were described. When cetyl alcohol was sprayed on sunflower plants, it reduced transpiration significantly but caused considerable damage to plants. Low viscosity silicone oils reduced transpiration by about 50% and caused only marginal growth abnormalities on sunflower plants. Application of wetting agents combined with silicones caused less reduction in transpiration and in the transpiration ratio and had no visible effect on the leaves. Comparison of data with other work where film-forming material were added to the root medium of plants suggested that foliar application was preferable to root application. Runoff from arid watersheds might be increased by application of transpiration suppression agents on vegetation of these areas. (Blecker-Ariz)
W69-06532

SOILS STUDIES USING COLOR PHOTOS,
McGill Univ., Montreal (Quebec).
For primary bibliographic entry see Field 07B.
W69-06696

EXPERIENCE IN ACCELERATED IRREVERSIBLE DESALINIZATION OF SOILS IN GOLODNAYA STEPPE,
Vsesoyuznyi Nauchno-Issledovatelskii Institut Gidrotekhniki i Melioratsii, Moscow (USSR).
V. E. Bobchenko, and A. A. Sydko.
9th Int Congr Soil Sci, Trans, Vol 1, pp 443-453, Adelaide, Australia, 1968. 11 p, 3 fig, 2 tab.

Descriptors: *Saline soils, Salinity, Salts, *Leaching, Soils, Rice, Foreign research, *Land reclamation, *Alkaline soils, Arid lands, Soil chemical properties, Drainage, Irrigable land, Cotton.
Identifiers: *Golodnaia Steppe (USSR), *Soil reclamation, Drain spacing, USSR.

Soil research was performed in the Golodnaya Steppe, USSR, to determine effective measures for accelerated irreversible desalinization of the virgin lands now being developed. Soils containing up to 1% toxic salts and having a seepage factor of 2-4 m/day were desalted by drainage and leaching at the rate of 8,200-71,000 cu m/ha (gross). The soils were desalinized to a depth of 0.7-9.5 m during 1-5 mo; the amount of unleached toxic salts within this depth was below the damaging limit. Increasing the leaching rate results in an increase in the amount of water that must be delivered for each consequent unit of salt removal and delays the progress of land reclamation, making capital investments less profitable. Application of very high leaching rates is economically unfeasible. Very low leaching rates are economically unfeasible because they do not provide for sufficient soil desalinization nor for beneficial crop yields. Measures are recommended for preventing secondary salinization of the leached soils and further desalinization in the lower horizons. At high rates, leaching during rice cultivation provides for deep desalinization of soil and quick repayment of capital investments. (USBR)
W69-06716

SALT BALANCE AND SALT TRANSPORT PROCESSES IN IRRIGATED SOILS,
National Inst. for Agricultural Quality Testing Budapest (Hungary).
I. Szabolcs, and K. Darab.
9th Int Congr Soil Sci, Trans, Vol 1, pp 491-502, Adelaide, Australia, 1968. 12 p, 4 tab, 14 ref.

Descriptors: *Salts, *Salt balance, *Irrigated land, Soils, *Leaching, Irrigation water, Saline water, Salinity, Water quality, Soil profiles, *Soil science, Soil physical properties, Soil chemical properties, Alkali soils, Alkalinity, Saline soils.

Exact knowledge of the salt dynamics of soils, regardless of whether they are irrigated or not, is important. The nature of changes in soils following various methods of amelioration, irrigation, and crop production, may be revealed when the salt balance is studied. An understanding of these changes is necessary for prevention of secondary salinization. If the salt dynamics of soils is expressed in the salt balance, changes in salt content of soils expected in one or more years may be calculated approximately. The permissible maximum salt concentration of the irrigation water may be determined for any soil from a study of the salt balance. If the salt balance is negative, leaching of the soil is effective and the salt concentration in irrigation water is lower than that required for maintaining equilibrium. If the salt balance is positive, the amount of salt retained in the soil is higher than that leached out by irrigation water. If the salt balance is positive and salts accumulate in the surface layer, the primary source of these salts is saline ground water and not irrigation water. A formula is given for calculating the salt regime constant. The amount and salt concentration of the irrigation water necessary for maintaining the existing salt content or for inducing a predetermined change may then be computed. (USBR)
W69-06717

WATER USE BY IRRIGATED COTTON IN SUDAN. II. NET RADIATION AND SOIL HEAT FLUX,
Ministry of Agriculture, Wad Medani (Sudan). Research Div.
D. A. Rijks.
Journ of Applied Ecology, Vol 5, No 3, pp 685-706, Dec 1968. 22 p, 14 fig, 2 tab, 30 ref, 1 append.

Descriptors: *Water utilization, *Radiation, *Cotton, *Crop response, *Solar radiation, Measurement, Heating, Fluctuation, Diurnal, Meteorrological data, Soil temperature, Seasonal, Soil-water-plant relationships, Thermal properties, Energy budget, Irrigation, Air masses, Surfaces, Cover crops.
Identifiers: *Sudan, Soil heat, Net radiation, Long-wave radiation.

Investigations into use of water by cotton crops in the Sudan Gezira were made during the 1965-66 season. This paper deals mainly with seasonal and diurnal patterns of incoming and outgoing long-wave radiation, net-radiation and soil heat-flux. Net long-wave loss was affected equally by the radiating surface and overlying airmass. It decreased as crop cover increased and when irrigations were given early in the season. Net radiation was approximately proportional to incoming short-wave radiation because effects of a developing crop cover, decrease in solar altitude and change in the overlying airmass on reflected short-wave radiation and on net long-wave loss were approximately self-cancelling. The seasonal pattern of soil heat-flux was dominated by the increase in crop cover. (Affleck-Ariz)
W69-06756

THE EFFECT OF CROP AND CLIMATIC FACTORS ON THE RADIATION BALANCE OF AN IRRIGATED MAIZE CROP,
Volcani Inst. of Agricultural Research, Bet-Dagan (Israel). Div. of Agricultural Meteorology.
G. Stanhill, J. T. H. Cox, and S. Moreshet.
Journ of Applied Ecology, Vol 5, No 3, pp 707-720, Dec 1968. 4 fig, 6 tab, 28 ref.

Descriptors: *Climatology, *Crop response, *Irrigation effects, *Radiation, *Albedo, Corn (Field), Seasonal, Diurnal, Variability, Air temperature, Vapor pressure, Soil water, Soil-water-plant relationships, Heating, Solar radiation, Cloud cover, Leaves, Plant growth.
Identifiers: *Israel, *Short-wave radiation, *Long-wave radiation.

This paper presents results of an investigation of seasonal and diurnal variation in the radiative characteristics of irrigated maize in Israel. Loss of short-wave radiation by reflection from the maize crop averaged 0.18 of the incident total short-wave radiation received during the growing season. Net long-wave radiation loss from the crop averaged 0.35 of the incident total short-wave radiation received during the growing season. Seasonal variation in this component was small, but diurnal variation averaged 20%. Variation in sky radiation showed little correlation with air temperature and even less with air vapour pressure, but closely followed the diurnal pattern of cloud cover. Both short and long wave components of the radiation balance were unaffected by soil water content and irrigation treatment within the range examined by the study. (Affleck-Ariz)
W69-06757

DESALTED SEAWATER FOR AGRICULTURE: IS IT ECONOMIC,
Resources for the Future, Inc., Washington, D. C.
Marion Clawson, Hans H. Landsberg, and Lyle T. Alexander.
Science, Vol 164, No 3884, pp 1141-1148, June 6, 1969. 8 p, 23 ref.

Descriptors: *Desalination, *Economics, *Water costs, Nuclear powerplants, Irrigation programs, Costs, Multiple-purpose projects, Industrial plants, Water supply, Irrigation water, Water distribution (Applied), Water rates, Direct costs, Economics of scale, Government finance, Interest, Power marketing, Social aspects.
Identifiers: *Agro-industrial complexes.

The economics of desalting sea water on a very large scale for commercial agriculture in arid lands is reviewed. Proposals for integrated nuclear agro-industrial complexes treat water cost as residual after the profitable use of electricity, but project feasibility must be based on profitability of the whole operation, not on a heavily subsidized price of one product. Even in Southern California today, where water is scarce and imported at high cost, and there is a ready market for electricity, a proposed desalting-power plant had to be shelved because construction cost, interest, and production costs made the project uneconomic. The lowest cost plant now operating (Key West, Fla), produces water for 83 cents per 1,000 gal with a subsidized interest-rate construction loan. In a proposed agro-industry plant in Israel, an interest rate of 1.9% yields a water cost of 40 cents per 1,000 gal, and use of a 10% rate (lower than Israel's current rate) results in water cost of $.90-$1.00 per 1,000 gal. Combined plants operate efficiently only at a constant output, and agricultural use is the most highly seasonal of uses, so inefficency cost, transportation cost, storage cost, and evaporative loss must be added to water production cost. These costs, conservatively estimated, will add over $34 per ac-ft to the cost of raw water. In Central Arizona, an already highly developed area, irrigation water value is less than $21 per ac-ft; why expect it to be higher in underdeveloped areas. A reasonable guess is that in an underdeveloped area, water is worth only $10-$30 per ac-ft (3-10 cents per 1,000 gal). This is a whole order of magnitude lower than the cost of desalted water. Research may solve this problem, and should be done, but no present or near-future solution is at hand. (Knapp-USGS)
W69-06765

PROCEEDINGS OF TILE DRAINAGE RESEARCH CONFERENCE,
Cooperative State Research Service, Washington, D. C.
For primary bibliographic entry see Field 04A.
W69-06795

CONSERVATION OF SOIL WATER BY GRAVEL MULCHES,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Irrigation Engineering; and Agricultural Research Service, Fort Collins, Colo. Soil and Water Conservation Research Div.

Arthur Thomas Corey, and William D. Kemper.
Colo State Univ Hydrol Pap No 30, Sept 1968. 23 p, 9 fig, 6 tab, 7 ref. Projects W-32 and W-73 (Exp Sta).

Descriptors: *Infiltration, *Surface-groundwater relationships, *Recharge, *Mulching, Evaporation, Infiltrometers, Soil water movement, Water management (Applied), Hydrologic budget.
Identifiers: *Gravel mulches.

Results of studies to discover methods of reducing evaporation from soils, conducted at Colorado State U since 1956, show that a gravel mulch on a fallow soil surface is the most promising method for increasing infiltration. The use of a gravel mulch 5 cm thick resulted in an additional infiltration of 14 inches of water in a year compared to infiltration under bare soil. Interactions between soils, gravel sizes, radiation and winds are shown graphically. (Knapp-USGS)
W69-06796

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

SAFETY CONTROL OF PRIVATE DAMS,
New England River Basins Commission, Boston, Mass.
Robert Restall.
New Engl River Basins Comm Tech Rep No 1, Jan 1969. 32 p, 3 tab, 3 append.

Descriptors: *Reservoir operation, *Regulation, *New England, *Safety, *Operation and maintenance, Legislation, Governments, State governments, Water law, Legal aspects, Dams, Dam failure, Dam design, Dam construction.
Identifiers: *Dam safety.

Hazards caused by unsafe privately-owned dams are reviewed and recommendations for regulation to promote safe construction, operation, and maintenance are made. Applicable state laws are discussed. All designs should be prepared, and construction of dams performed, under the direction of a professional engineer. The permit should specify certain stages in the construction when the control agency must be notified. The professional engineer must certify upon completion of the dam that a safe dam was constructed to accepted standards. The responsibility for proper maintenance and repair would be recorded as a condition of the permit. The dam owner could be responsible for recording the permit in the registry of deeds within a limited time. Permits would be issued for definite periods of time with inspections and other investigations occurring near the end of the period. (Knapp-USGS)
W69-06433

RURAL WATER DEVELOPMENT IN KENYA,
Department of Water Development (Kenya).
R. Barrett, and G. Classen.
Int Conf on Water for Peace, Wash, D C, Vol 1, pp 476-487, 1968. 12 p, 1 tab. For the 8 volume Proc, see Vol 2, No 9, Field 06B and W69-03305.

Descriptors: *Water resources development, *Rural areas, Water resources, Surface waters, Groundwater, Rainfall, Streamflow, Dams, Reservoirs, Water storage, Water wells, Climates, Weather, Evaporation.
Identifiers: Kenya, Rural water development.

Kenya lies astride the Equator, and stretches inland from the Indian Ocean to Lake Victoria. Differences in climatic conditions are caused mainly by variations in altitude. Along the coastline is a narrow tropical belt behind which is desert. Inland the influence of mountains changes the climate to subtropical and temperate. Rainfall varies from 10 in. in the desert to over 100 in. in the major hills. Above the 30 in. isohyet the country is generally hilly and often precipitous, and numerous springs and perennial streams occur. In the East, such streams tend to taper as they reach the lower and drier zone where they disappear in alluvial cones or in the large seasonal sand rivers. The Great Rift Valley has an internal drainage system. Below the 30 in. isohyet, the country is flatter, drier and much hotter, and evaporation is about 100 in. per yr. Extensive groundwater resources are largely underdeveloped. Sub-surface dams have wide application in dry areas. By constructing concrete barriers across such sand beds at favorable sites, the underflow in the sand is retarded and brought near the surface for easier development. Small earth dams and stock tanks are built by hand and by mechanical means. Some 2,000 dams and tanks have been built to date; but very many more are required to serve the pastoral areas. Spring protection and well construction are used in groundwater development. (Knapp-USGS)
W69-06453

THE POSSIBILITY OF USING A MOVABLE DAM: THE 'FABRIDAM' AND ITS APPLICATION IN ARID REGIONS,
Plan Organization (Iran). Water Planning Group.
M. Vahidi.
Int Conf on Water for Peace, Wash, D C, Vol 3, pp 423-430, 1968. 8 p, 2 tab. For the 8 Volume Proceedings, see Vol 2, No 9, Field 06B and W69-03305.

Descriptors: *Dams, *Dam design, *Movable dams, Arid lands, Water supply, Water control, Water storage, Recharge, Flood control, Irrigation.
Identifiers: *Iran, Fabridam, Fabric dams, Inflatable dams.

Iran is an arid region, with 25-30 centimeters mean annual rainfall which may be compared with a figure of 86 cm for the entire globe. Consequently most rivers of the country are intermittent, with high variability of their small amount of streamflow. The flow is high in late winter and early spring and very low in summer, and during the low flow and flood periods the full capacity of the rivers cannot be utilized directly. One of the common techniques used for diverting streams in low flow is use of temporary dams such as brush dams or flash boards which are washed off by the first flood. In the last few decades many types of movable dams and crests such as stop logs, vertical lift gates, radial gates, rolling gates, bear trap gates and drum gates have been employed for the purpose and operate as diversion dams or crest control devices. All of these movable control devices require lifting power, a bridge or overhead cableway, hoisting cable, and piers. As a result they create some obstruction for flood flows and are very expensive for small and medium size movable dams. The Fabridam is an inflatable dam adapted for installation on any stream, river or waterway, and consists of neoprene coated fabric; when deflated there will be no resistance to flood flow. A 4-ply sheet of fabric has a tensile strength of 400 kg per linear cm, and weight of the material is 7 kg per sq m. Fabridam is most practical in arid regions, because of diversion of water in low flow periods and recharging the groundwater in flood periods. Costs of materials used for installations are generally less than 1/2 to 1/3 of concrete and steel. (Knapp-USGS)
W69-06455

CONSTRUCTION AND MANAGEMENT OF RIVER VALLEY PROJECTS IN INDIA,
Ministry of Irrigation and Power (India).
K. P. Mathrani.
Int Conf on Water for Peace, Wash, D C, Vol 5, pp 321-333, 1968. 13 p, 1 tab. For the 8 Volume Proc, see Vol 2, No 9, Field 06B and W69-03305.

Descriptors: *Irrigation programs, *River basin development, *Government supports, History, Long-term planning, Future planning (Projected), Irrigation, Arable land, Irrigable land.
Identifiers: *India.

Although the irrigation function is assigned to the states of India, the Indian Government has been taking much interest in the scientific aspects of irrigation development since independence. The Ministry of Irrigation and Power reviews progress on projects and assists in removing bottlenecks as they develop. The Government emphasizes scientific management of water resources by organizing meetings, seminars, and study groups. At the time of partition in 1947, the irrigation potential was 47 million acres, but 36 million acres were added in the next 18 yr. Plans on hand envisage an addition of 40 million acres during the next 10 yr, and 200 million acres should be exploited within 20 or 25 yr. (Vorhis-USGS)
W69-06457

A CENTURY OF DESIGN AND CONSTRUCTION OF IRRIGATION WORKS IN INDIA,
Central Water and Power Commission (India).
D. B. Anand, and S. Balasubramaniam.
Int Conf on Water for Peace, Wash, D C, Vol 7, pp 403-411, 1968. 9 p, 9 ref, 1 append. For the 8 Volume Proc, see Vol 2, No 9, Field 06B and W69-03305.

Descriptors: *History, *Irrigation, *Dams, *Canals, Foundations, Pozzolans, Dam design, Earth dams, Irrigation engineering, Construction.
Identifiers: *India, Grand Anicut.

Among Indian irrigation works several thousand yr old, a large number of tanks are still functioning. The Grand Anicut across the Cauvery was built in the second century A.D. Large irrigation projects, including the Western and Eastern Jumna Canals and the Cauvery Delta System were begun in the early 19th century. Late in the 19th century the Godaveri Diversion Scheme, the 100-ft high Khadakwasla Dam, and the 176-ft high Periyar Dam were built. The early storage structures were in the central and southern parts of the country where foundations are nearly ideal and the streamflows need regulation. Present-day canal design draws heavily from early studies by Kennedy, Lacey, and Khosla on structures in alluvial terrain. Canals are now designed and constructed for discharges over 20,000 cusecs with linings to minimize transit losses and eliminate water-logging. After the Second World War came construction of medium to large storage structures planned for multiple uses. In the design of earlier masonry dams, the foundation conditions, together with the traditionally available building skill (stone masonry), dictated gravity dams. Advances being made in foundation treatment and construction of cutoff and the availability of suitable construction machinery have led to a greater use of earth and rockfill dams. Modern Portland cement brought about use of mortar. Pozzolans were in use in the country from very early times. Mention has been made of calcined clay, shale and fly ash. (Vorhis-USGS)
W69-06461

FLOOD PLAIN INFORMATION, WILSON CREEK AND TRIBUTARIES, SPRINGFIELD, MISSOURI-PART I.
Corps of Engineers, Little Rock, Ark.

Corps Eng Flood Plain Rep, Nov 1968. 40 p, 22 fig, 26 plate, 11 tab.

Descriptors: *Floods, *Flood damage, *Missouri, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Wilson Creek (Missouri), Springfield, Intermediate regional flood, Standard project flood.

Flooding of Wilson Creek and tributaries, Springfield, Missouri is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may

be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-06467

FLOOD PLAIN INFORMATION, ROCKY RIVER IN CITIES OF ROCKY RIVER AND LAKEWOOD, CUYAHOGA COUNTY, OHIO.
Corps of Engineers, Buffalo, N. Y.

Corps Eng Flood Plain Rep, July 1968. 54 p, 44 fig, 8 plate, 10 tab.

Descriptors: *Floods, *Flood damage, *Ohio, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: Rocky River (Ohio), Lakewood, Cuyahoga County, Standard project flood, Intermediate regional flood.

Flooding of Rocky River in the cities of Rocky River and Lakewood, Cuyahoga County, Ohio is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-06468

FLOOD PLAIN INFORMATION, WALLA WALLA RIVER TRIBUTARIES IN THE VICINITY OF WALLA WALLA, WASHINGTON.
Corps of Engineers, Walla Walla, Wash.

Corps Eng Flood Plain Rep, June 1968. 35 p, 9 fig, 23 plate, 4 tab.

Descriptors: *Floods, *Flood damage, *Washington, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: Walla Walla (Wash), Walla Walla River, Standard project flood, Intermediate regional flood.

Flooding in the vicinity of Walla Walla, Washington is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-06469

FLOOD PLAIN INFORMATION, YAKIMA RIVER, BENTON COUNTY, WASHINGTON.
Corps of Engineers, Seattle, Wash.

Corps Eng Flood Plain Rep, Mar 1968. 37 p, 8 fig, 17 plate, 8 tab.

Descriptors: *Floods, *Flood damage, *Washington, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Benton County (Wash), Yakima River, Standard project flood, Intermediate regional flood.

Flooding of the Yakima River, Benton County, Washington is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-06470

FLOOD PLAIN INFORMATION, OMAHA METROPOLITAN REGION, NEBRASKA - VOLUME 1.
Corps of Engineers, Omaha, Nebr.

Corps Eng Flood Plain Rep, Nov 1967. 48 p, 3 exhibits, 20 plate, 9 tab.

Descriptors: *Floods, *Flood damage, *Nebraska, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Omaha (Nebr), Papillion Creek, Standard project flood, Intermediate regional flood.

Flooding of Papillion Creek, Omaha, Nebraska is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-06471

FLOOD PLAIN INFORMATION, CEDAR RIVER, LINN COUNTY, IOWA.
Corps of Engineers, Rock Island, Ill.

Corps Eng Flood Plain Rep, Oct 1967. 62 p, 19 fig, 22 plate, 7 tab.

Descriptors: *Floods, *Flood damage, *Iowa, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: Linn County (Iowa), Cedar Rapids (Iowa), Cedar River, Standard project flood, Intermediate regional flood.

Flooding of the Cedar River, Linn County, Iowa is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-06472

FLOOD PLAIN INFORMATION, GUAYANILLA RIVER, GUAYANILLA, PUERTO RICO.
Corps of Engineers, Jacksonville, Fla.

Corps Eng Flood Plain Rep, Oct 1967. 29 p, 4 fig, 8 plate, 6 tab.

Descriptors: *Floods, *Flood damage, *Puerto Rico, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Hurricanes, Historic flood.
Identifiers: Guayanilla River (Puerto Rico), Standard project flood, Intermediate regional flood.

Flooding of the Guayanilla River in Guayanilla, Puerto Rico, is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-06473

SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE.
Texas Water Development Board, Austin; and Water Resources Engineers, Inc., Lafayette, Calif.

Interim Progress Report, Dec 23, 1968. 42 p, 14 fig, 2 tab, 2 ref, 1 append.

Descriptors: *Simulation analysis, *Water management (Applied), *Water resources development, *Systems analysis, Future planning (Projected), Mathematical models, Optimization, Constraints, Water conveyance, Water allocation (Policy), Reservoir operation, Timing, Networks, Digital computers.
Identifiers: *Out-of-kilter algorithm, Link-node networks, Texas.

An interim report was made on the state of development of a systems study of the future Texas reservoir-river-canal water distribution problem. Four models were described, the first three progressively acting as screening models for the increasingly constrained following models. The models were link-node network models which solved for the allocation of water throughout the system, subject to known inputs and demands, using an 'out-of-kilter' algorithm to obtain fast digital computer solutions. The objective of the study was to determine the optimal timing of reservoir and canal construction with future water imports from the Mississippi River. Seasonal water demands, evaporation rates and reservoir capacities were assumed known. Several response surface searching methods used in the final allocation model were described. (Gysi-Cornell)
W69-06494

RESERVOIR MANAGEMENT: THE TRADEOFF BETWEEN LOW-FLOW REGULATION AND FLOOD CONTROL,
Federal Water Pollution Control Administration, Washington, D. C.
G. K. Young.
Water Resources Res, Vol 4, No 3, pp 507-511, June 1968. 5 p, 2 fig, 6 ref.

Descriptors: *Linear programming, *Reservoir operation, *Low-flow augmentation, *Flood control, Water management (Applied), Probability, Water quality control, Water policy, Flow control, Optimization.
Identifiers: Rule curves.

The results of a linear programming study which found optimal operating policies for a hypothetical low-flow augmentation-flood control reservoir, were given. The objective of the study was to find operation schemes that minimized expected losses, which were specified so that low-flow penalities were considered along with flood losses. Discrete inflow probabilities, and low-flow and flood penalty functions were assumed known. Solutions for the example were given that indicated the degree to which flood and water quality control were complementary. It was concluded that even if the low-flow penalty is known only within a range, the optimal policy (rule curve) can often be determined. (Gysi-Cornell)
W69-06496

SBARRA V ERIE RR (DRAINAGE OF SURFACE WATERS AND PRESCRIPTIVE RIGHTS).
For primary bibliographic entry see Field 06E.
W69-06591

NASSAU COUNTY V CHERRY VALLEY ESTATES, INC (OBSTRUCTION OF ALLEGED WATER COURSE).
For primary bibliographic entry see Field 06E.
W69-06592

SAMYN V TACEY (ARTIFICIAL DRAINAGE OF SURFACE WATERS).
For primary bibliographic entry see Field 06E.
W69-06593

CANNON V CITY OF MACON (NATURAL DRAINAGE FLOW AND THE LOWER LAND PROPRIETOR).
For primary bibliographic entry see Field 06E.
W69-06595

COX V MARTIN (DISCHARGE OF SURFACE WATER THROUGH A DOWNSPOUT).
For primary bibliographic entry see Field 06E.
W69-06596

DRAPER V MOSHIER (INTERFERENCE WITH DRAINAGE DITCH).
For primary bibliographic entry see Field 06E.
W69-06600

CITY OF PORTSMOUTH V CULPEPPER (SUIT FOR DAMAGES RESULTING FROM OVERFLOW OF OBSTRUCTED CANAL).
For primary bibliographic entry see Field 06E.
W69-06602

ZOMBKOWSKI V WISCONSIN RIVER POWER CO (FLOODING DAMAGES CAUSED BY DAM CONSTRUCTION).
For primary bibliographic entry see Field 06E.
W69-06603

LEONARD V STATE HIGHWAY DEPT (ACQUISITION OF TITLE BY STATE THROUGH PERMANENT FLOODING OF LAND).
For primary bibliographic entry see Field 06E.
W69-06611

BALL CREEK COAL CO V NAPIER (MEANDERS AS A BOUNDARY).
For primary bibliographic entry see Field 06E.
W69-06614

FRODERMAN V DIETZ (PRIVATE DAMS FOR FLOOD CONTROL).
For primary bibliographic entry see Field 06E.
W69-06617

KANSAS CITY LIFE INS CO V UNITED STATES (IMPAIRMENT OF LAND VALUE DUE TO DAM CONSTRUCTION).
For primary bibliographic entry see Field 06E.
W69-06623

CLEMENTS V TOWN OF CARROLLTON (DAM ACROSS DRAINAGE DITCH).
For primary bibliographic entry see Field 06E.
W69-06627

FLOOD WALL BOARD.
For primary bibliographic entry see Field 06E.
W69-06647

HANCOCK V STULL (INTERFERENCE WITH NATURAL DRAINAGE OF SURFACE WATER).
For primary bibliographic entry see Field 06E.
W69-06652

RINZLER V FOLSOM (ARTIFICIAL INCREASE OF SURFACE RUNOFF).
For primary bibliographic entry see Field 06E.
W69-06657

HEC-2, WATER SURFACE PROFILES.
Corps of Engineers, Sacramento, Calif.

Corps Eng Hydrol Eng Center Computer Program 22-32, Dec 1968. Total 141 p, 1 tab, 5 ref, 13 exhibit.

Descriptors: *Mathematical models, *Flow profiles, *Channel flow, *Computer programs, Digital computers, Mannings equation, Roughness (Hydraulic), Discharge measurement, Regime.
Identifiers: *Water surface profiles.

A digital computer program computes and plots the water surface profile for river channels of any cross section for flows greater or less than critical. The effects of various hydraulic structures such as bridges, culverts, weirs, embankments, and dams may be considered in the computation. River conditions such as variable channel roughness, islands, bends, levee overflow, river confluences, and waterfalls may also be included. Investigating channel roughness from known high water marks is one of several special program applications. Input may be in either English or Metric units. The method applies Bernoulli's theorem for the total energy at each cross section and Manning's formula for the friction head loss between cross sections. (Knapp-USGS)
W69-06787

HEC-3, RESERVIOR SYSTEM ANALYSIS.
Corps of Engineers, Sacramento, Calif.

Corps Eng Hydrol Eng Center Computer Program 23-53, Dec 1968. Total 96 p, 6 exhibit.

Descriptors: *Mathematical models, *Systems analysis, *Routing, *Reservoir operation, Economics, Water costs, Water values, Water utilization, Flood control, Multiple-purpose reservoirs, Computer programs.
Identifiers: *Reservoir system analysis, Reservoir management.

A program written in Fortran IV performs a multipurpose, multireservoir routing of a reservoir system by any number of periods of uniform or varying length per year based on flow requirements at reservoirs, diversions, and downstream control points and power requirements at reservoirs. It can accept any configuration of reservoirs, diversions, power plants and control points, and will accept system power demands that over-ride individual power plant requirements, but does not provide for channel routings, percolation losses or time translations. It can assign economic values to all outputs and summarize and allocate these in various ways. All requirements are supplied from reservoirs so as to maintain a specified balance of storage in all reservoirs. At reservoir stages below specified levels, releases from storage at each reservoir are reduced to a secondary specified flow at each control point until all active storage is withdrawn. Provision is included for shortage declaration which will reduce desired flows and diversions covering a period less than 1 year. A listing of the source program is included in exhibit 4. (Knapp-USGS)
W69-06788

PROCEEDINGS OF TILE DRAINAGE RESEARCH CONFERENCE,
Cooperative State Research Service, Washington, D. C.
Arthur F. Pillsbury.
Calif Univ Water Resources Center Rep No 15, Proc of Tile Drainage Conf, Nov 18-20, 1968, El Centro, Calif, 1968. 59 p, 3 fig, 7 tab, 20 ref.

Descriptors: *Drainage, *Drainage systems, *Tile drainage, Subsurface drainage, Surface-groundwater relationships, Drainage effects, Drainage engineering, Water management (Applied), Land reclamation, Leaching, Saline soils, Salinity.
Identifiers: *Soil salinity control, Tile drainage systems.

Tile drainage is a strong effective means of managing river-basin irrigation salt balance, probably the most critical long-term management problem of the arid southwest US. Research on tile drainage conducted by USDA, Water districts, Universities, and State agencies is summarized in a conference at El Centro, Cal. Topics discussed include progress in reducing laying costs, collapse or deformation of pipes, problems of grade control, problems of sedimentation, problems of Mn and Fe oxide deposition, problems of reclamation of slowly permeable soils, enveloping techniques and materials, and cleaning of tile lines. (Knapp-USGS)
W69-06795

FLOOD PLAIN INFORMATION, BOISE RIVER AND NORTHSIDE TRIBUTARIES, BOISE, IDAHO AND VICINITY.
Corps of Engineers, Walla Walla, Wash.

Corps Eng Flood Plain Rep, Oct 1967. 53 p, 24 fig, 22 plate, 3 tab.

Descriptors: *Floods, *Flood damage, *Idaho, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Boise (Idaho), Boise River, Standard project flood, Intermediate regional flood.

Flooding of the Boise River and tributaries, Boise, Idaho is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-06823

FLOOD PLAIN INFORMATION OF SPRING VALLEY CREEK, SAN DIEGO COUNTY, CALIFORNIA.
Corps of Engineers, Los Angeles, Calif.

Corps Eng Flood Plain Rep, Sept 1967. 29 p, 7 fig, 19 plate, 6 tab.

Descriptors: *Floods, *Flood damage, *California, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: San Diego County (Cal), Spring Valley Creek (Cal), Standard project flood, Intermediate regional flood.

Flooding of Spring Valley Creek, San Diego County, California is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-06824

FLOOD PLAIN INFORMATION OF SENECA LAKE, NEW YORK.
Corps of Engineers, Buffalo, N. Y.

Corps Eng Flood Plain Rep, June 1967. 29 p, 6 fig, 3 plate, 3 tab.

Descriptors: *Floods, *Flood damage, *New York, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: Seneca Lake (NY), Standard project flood, Intermediate regional flood.

Flooding of the Seneca Lake area, New York is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-06825

FLOOD PLAIN INFORMATION, CAYUGA LAKE, NEW YORK.
Corps of Engineers, Buffalo, N. Y.

Corps Eng Flood Plain Rep, June 1967. 29 p, 8 fig, 6 plate, 3 tab.

Descriptors: *Floods, *Flood damage, *New York, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: Cayuga Lake (NY), Standard project flood, Intermediate regional flood.

Flooding of Cayuga Lake area, New York is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-06826

FLOOD PLAIN INFORMATION, CANANDAIGUA LAKE, NEW YORK.
Corps of Engineers, Buffalo, N. Y.

Corps Eng Flood Plain Rep, May 1967. 22 p, 7 fig, 2 tab.

Descriptors: *Floods, *Flood damage, *New York, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: Canandaigua Lake (NY), Standard project flood, Intermediate regional flood.

Flooding of the Canandaigua Lake area, New York is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-06827

4B. Groundwater Management

SIGNIFICANCE OF GROUNDWATER MANAGEMENT STRATEGY-A SYSTEMS APPROACH,
San Bernardino Valley Municipal Water District, Calif.; and TRW Systems Group, Redondo Beach, Calif.
For primary bibliographic entry see Field 06A.
W69-06424

GROUND WATER, GRAVITY AND RIFT VALLEYS IN MALAWI,
Southern Illinois Univ., Carbondale. Dept. of Geology.
For primary bibliographic entry see Field 02F.
W69-06431

RURAL WATER DEVELOPMENT IN KENYA,
Department of Water Development (Kenya).
For primary bibliographic entry see Field 04A.
W69-06453

CONSTRUCTION AND MANAGEMENT OF RIVER VALLEY PROJECTS IN INDIA,
Ministry of Irrigation and Power (India).
For primary bibliographic entry see Field 04A.
W69-06457

IRRIGATION WATER SYSTEM--ISRAEL'S NATIONAL WATER GRID,
Water Planning for Israel Ltd., Haifa.
For primary bibliographic entry see Field 03F.
W69-06459

ARTIFICIAL RECHARGE TO THE EDWARDS LIMESTONE AQUIFER IN SOUTH TEXAS,
Corps of Engineers, Fort Worth, Tex.
Melvin G. Green.
Hydrol of fractured rocks, Vol 2, Proc Dubrovnik Symp (Oct 1965), Int Ass Sci Hydrol, Pub 74, pp 465-481, 1967. 18 p, 5 fig, 13 ref.

Descriptors: *Artificial recharge, *Aquifer, *Limestones, *Texas, Water storage, Underground storage, Water supply, Faults, Water wells, Springs, Hydrologic properties, Floods, Rivers, Geology, Dams, Groundwater recharge, Water loss, Water balance, Water requirement, Water level fluctuations.
Identifiers: *Balcones fault zone, Edwards Limestone.

Because of critical water conditions in South Texas, the Fort Worth District of USCE, in cooperation with State agencies, investigated the feasibility of providing recharge to the Edwards Limestone aquifer as a flood control and water conservation measure. A proposed plan is presented. The study consisted of (1) a survey of available water for recharge and the problem of open-water evaporation; (2) the determination of maximum infiltration rates along the streams, (3) a further development of the hydrology and geology of the Edwards Limestone; (4) utilization of radioactive tracers; (5) fluctuation of the 'bad-water' line; (6) methods to control springflows; (7) feasibility of reducing leakage from an existing reservoir located in the Balcones fault zone; and (8) geologic investigation of ten damsites. The study shows that the construction of five dams (three dams to be considered primarily for recharge, flood control, and recreation) should be considered as highly desirable. Two other water-conservation dams would provide an additional 89,000 acre-feet annually. It is estimated that the proposed plan of improvement will meet all the water demands in the area to about the year 2000, beyond which better use of return flows and development of additional water supplies outside the Edwards Reservoir area will be needed. (Gabriel-USGS)
W69-06483

ARTIFICIAL RECHARGE OF A FISSURED SANDSTONE AQUIFER, TANGIERS, MOROCCO (FRENCH),
Robert Ambroggi, and Raymond Hazan.
Hydrol of fractured rocks Vol 2, Proc Dubrovnik Symp (Oct 1965), Int Ass Sci Hydrol, Pub 74, pp 496-499, 1967. 4 p.

Descriptors: *Artificial recharge, *Hydrologic properties, *Sandstones, *Fissures, Karst, Permeability, Geology, Water sources, Water quality, Water levels, Basins, Water yield, Water wells, Pumping, Tertiary, Economics.
Identifiers: *Morocco, City of Tangiers.

The article describes the history of water-supply development of the City of Tangiers, Morocco, and tells about a method of artificial rechrge. Geologic and hydrologic characteristics of the aquifers supplying the city are also described. The recharge of water consisted of taking it from the 'merias' in the center of the basin and secondly by diverting water in winter from a neighboring 'oued'. The method of recharge was by feeding the water into eight 10x5x2.5 m absorption basins in isotropic sandstones and into two pits excavated along a natural fault. The city in this way obtained a water supply of 720 cu m/hr by utilizing the fissures and karstification of sandstone and limestone aquifers. (Gabriel-USGS)
W69-06487

DRAINING AREA UNDERLAIN BY HIGHLY PERMEABLE SHALLOW SAND AQUIFER,
Agricultural Research Service, Washington, D. C. Soil and Water Research Div.; and South Dakota State Univ., Brookings. Remote Sensing Inst.
For primary bibliographic entry see Field 02G.
W69-06512

GEORGE V STATE (OBSTRUCTION OF SUBSURFACE FLOW).
For primary bibliographic entry see Field 06E.
W69-06590

ROLE OF GROUND WATER CONTAMINATION IN WATER MANAGMENT,
Geological Survey, Raleigh, N. C.
For primary bibliographic entry see Field 05G.
W69-06762

EFFECT OF SUBSIDENCE ON WELL FIELDS,
Santa Clara Valley Water Conservation District, San Jose, Calif.
J. Robert Roll.
Am Water Works Assoc Jour, Vol 59, No 1, pp 80-88, Jan 1967. 4 fig, 1 ref.

Descriptors: *Subsidence, *Wells, *Damages, *Pumping, *Overdraft, California, Groundwater basins, Faults (Geology), Valleys, Bedrock, Aquifers, Dams, Water demand, Water conservation, Water delivery, Drainage systems, Percolation, Groundwater recharge.
Identifiers: *Santa Clara Valley, California.

In the Santa Clara Valley, California, subsidence has resulted from overpumping of the groundwater basin, causing serious damage to wells. Bounded by the Hayward Calaveras, and San Andreas faults, the long valley floor is underlain by consolidated bedrock beneath the semiconsolidated Santa Clara formation, which may yield a little water to penetrating wells. Recent alluvium up to 1,000 feet thick is the principal aquifer. Conservation programs included dams for storing flood waters to percolate more slowly into the basin; canals, pipelines, and percolation basins; and imported water. Maximum subsidence is 9 feet at San Jose, in a trough corresponding with the area of confined ground water, affected the gradient of drainage structures crossing it, stream transport, and deposition and flooding. The only permanent solution to the problem is to raise the ground-water level. (Affleck-Ariz)
W69-06763

THE GROUNDWATER PROVINCES OF IRAN,
Hebrew Univ., Jerusalem (Israel); Geological Survey of Israel, Jerusalem; and Center for Groundwater Research, Jerusalem (Israel).
A. Issar.
Bull Int Ass Sci Hydrol, Vol 14, No 1, pp 87-99, Mar 1969. 13 p, 5 fig, 2 tab, 12 ref.

Descriptors: *Hydrogeology, *Groundwater, Aquifers, Geohydrologic units, Geologic control, Climates, Groundwater basins, Structural geology, Alluvium, Springs.

dentifiers: *Iran, Caspian Coastal Plain, Alborz Mountains, Zagros Mountains, Central Plateau.

The hydrogeology of Iran is outlined. The influences of climate, lithology, and geological structure on the occurrence, flow, and quality of groundwater in the Central Plateau, the Zagros Mountains, the Caspian Coastal Plain, and the Alborz Mountains are described. The main aquifer in the Central Plateau is thick Pleistocene alluvium, recharged mainly by floods of mountain streams. In the Zagros Mountains, permeable limestones folded into hundreds of anticlines and synclines form many artesian systems. Basin-fill alluvium aquifers are an important secondary water source. The Caspian Coastal Plain is humid and underlain by seaward sloping alternating pervious and impervious beds, forming a productive artesian system. The Alborz Mountains are complexly folded and faulted. The northern end of the range is humid, and the southern end is arid. Faulting and the impermeability of most of the rocks at the central and eastern parts of the range are reasons for the lack of important aquifer systems. In the eastern part of the range limestones of Jurassic and Cretaceous age are important regional aquifers. (Knapp-USGS)
W69-06772

CONSERVATION OF SOIL WATER BY GRAVEL MULCHES,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Irrigation Engineering; and Agricultural Research Service, Fort Collins, Colo. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 03F.
W69-06796

3C. Effects on Water of Man's Non-Water Activities

WATER RESOURCES AND THE URBAN ENVIRONMENT,
Virginia Polytechnic Inst., Blacksburg.
James E. Hackett.
Ground Water, Vol 7, No 2, pp 11-14, Mar-Apr 1969. 4 p, 5 ref.

Descriptors: *Water management (Applied), *Urbanization, *Water resources development, Administration, Water reuse, Water sources, Waste disposal, Water pollution control, Multiple-purpose projects, Recreation, Planning, Political aspects.
Identifiers: *Urban water use.

Approximately 2/3 of the present population live in the urban environment; by the year 2000, it is anticipated that 5/6 of the population will be urban. The trend of metropolitan growth is the expansion in population and size of the smaller suburban communities. In some areas of intense urban development the problems of water quality control, recreational use of water, and water for cooling and waste transport have become more significant than problems of adequate supplies for withdrawal. The use of surface-water sources far removed from the urban center has contributed to the development of the 'commodity concept' of water use. By this attitude the water resource is viewed only in terms of its adequacy as a water supply; waste discharge and recreation uses are ignored or considered a 'downstream' problem. This concept is particularly inappropriate when applied in the multicommunity complexes of the metropolitan areas where there is little in the way of a 'downstream'. Water problems must be dealt with at the metropolitan level rather than at the individual community level, and not by the proliferation of smaller units of government. The nature of the metropolitan complex requires thinking in terms of closed systems involving reclamation and reuse rather than in terms of the open system of withdrawal, use and discharge. (Knapp-USGS)
W69-06428

FLOOD INUNDATION AND EFFECTS OF URBANIZATION IN METROPOLITAN CHARLOTTE, NORTH CAROLINA,
Geological Survey, Washington, D.C.
Lawrence A. Martens.
Geol Surv Water-Supply Pap 1591-C, 1968. 60 p, 24 fig, 2 plate, 12 tab, 6 ref.

Descriptors: *Floods, *Urbanization, *Stage-discharge relations, *North Carolina, Drainage systems, Land use, Storm runoff, Runoff, Rainfall-runoff relationships, Hydrographs, Hydrologic data, Discharge (Water).
Identifiers: Charlotte (NC), Flood profiles.

Investigation of floods on 7 streams in metropolitan Charlotte, N. C., indicates that significant increases in flood potential accompany urban development of the basins. Rainfall excess increases with the development of urban areas which are more impervious than rural areas. The magnitude of the mean annual flow increases with an increase in the degree in imperviousness. The effect of impervious area diminished with increased flood recurrence intervals becoming negligible for floods exceeding 50 yr. Basin lag time for fully developed basins was found to be about one-fourth the lag time before development. The increase in impervious area and decrease in lag time associated with the urbanization of a basin will about double the discharge of a 20-yr flood. Computed flood elevations of the 20-yr flood along 60 mi of stream channels reflect increases in elevation of as much as 6 ft for some areas as a direct result of extensive watershed development. In other areas, where channel and flood-plain improvements have been made, the increase in elevation of the 20-yr flood is as small as 1 ft. Seventy-five % of the channels in metropolitan Charlotte will reflect an increase of about 3 1/2 ft in the elevations of the 20-yr flood as a result of the change in the basins from undeveloped to urbanized conditions. Studies to determine the feasibility of selecting cross-section properties directly from detailed topographic maps, when computing flood profiles, indicate that about a 0.3 ft error can be expected in profile elevations of floods at about bankful stage; a lesser error can be expected in profile elevations of floods above bankful stage. (Knapp-USGS)
W69-06445

BARBER PURE MILK CO V GOLDIN (SURFACE DRAINAGE).
For primary bibliographic entry see Field 06E.
W69-06588

IOWA-WISCONSIN BRIDGE CO V UNITED STATES (LIABILITY FOR RESERVOIR OPERATION).
For primary bibliographic entry see Field 06E.
W69-06604

GIBSON V STATE (CONSTRUCTION AND MAINTENANCE OF SEWERS).
For primary bibliographic entry see Field 06E.
W69-06607

AN ANALYSIS OF NATIONAL BASIC INFORMATION NEEDS IN URBAN HYDROLOGY,
American Society of Civil Engineers, Cambridge, Mass. Urban Hydrology Research Council.
M. B. McPherson, D. C. Taylor, and L. S. Tucker.
Amer Soc Civil Eng Basic Inform Rep, Apr 1969. 112 p, 14 fig, 4 tab, 73 ref.

Descriptors: *Rainfall-runoff relationships, *Urbanization, Drainage Systems, Instrumentation, Hydrologyic data, Measurement, Networks, Meteorological data, Surveys, Data processing.
Identifiers: *Data needs, *Urban Hydrology.

An Analysis of National Basic Information Needs in Urban Hydrology is focused on data needs, data devices and data networks. Primarily aimed at improvement in design of storm drainage, intensive study was made of the data requirements for analyzing rainfall-runoff-quality relationships and of suitable data collection instrumentation, with consideration of the types of networks required for the collection of adequate data. Suitable data collected with properly coordinated instrumentation in networks representing a variety of climatic, topographic and land-use conditions, are virtually non-existent. There are very meager amounts of performance data with which existing or proposed storm drainage facilities can be checked or designed. Transfer of data findings between metropolitan regions is a central and primary objective. Recommendations centered on hydrologic information needs are related to storm sewers. The replacement value of existing storm sewerage systems in the United States is at least $22 billion, and it is estimated that an average of about $3.5 billion per year will be spent on construction of new storm sewerage systems over the next several years. The plan recommended for a minimum national program of urban storm drainage research would cost on the order of 1/3% of this average annual construction cost. (Knapp-USGS)
W69-06770

4D. Watershed Protection

USE OF TRACER TECHNIQUE IN SOIL EROSION RESEARCH,
Agricultural Research Service, Oxford, Miss.
J. Roger, McHenry.
Trans Amer Soc Agr Eng, Vol 11, No 5, pp 619-625, Sept-Oct 1968. 7 p, 2 fig, 2 tab, 31 ref.

Descriptors: *Tracers, *Radioisotopes, *Soil erosion, Tagging, Alpha rays, Tritium, Beta rays, Gamma rays, Bibliographies, Sampling, Half life, Radioactivity, Research equipment, Radiation measurement, Soil science, *Erosion.
Identifiers: Scintillation counters.

A review is given for those considering the use of radioactive tracers in soil erosion research. The selection and characteristics of a tracer, including half life, specific activity, type of emission, and chemical and physical form are discussed. The method for calculating the required amount of the tracer is described; the general theory of using tagged particles as tracers and of isotopic dilution is given. Selecting and preparing a radioisotope, and tagging and seeding particles in the experimental area are described. Methods are outlined for detection, sample counting, and data reduction. Advantages and disadvantages are presented for using radioisotopes as tracers. In erosion research, the measurement of volume movement of a soil mass is difficult to evaluate. If the entire soil mass can be traced or if the tracer can be mixed uniformly in the system samples, quantitative results can be calculated. These conditions do not usually occur and the result is that tracer data are more qualitative than quantitative. (USBR)
W69-06704

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

FACTORS INFLUENCING THE CONDENSATION OF 4-AMINOANTIPYRINE WITH DERIVATIVES OF HYDROXYBENZENE-III. A STUDY OF PHENOL CONTENT IN SURFACE WATERS,
Rutgers - The State Univ., New Brunswick, N. J. Dept. of Environmental Sciences; and Geological Survey, Washington, D.C.
Samuel D. Faust, and Peter W. Anderson.
Water Res, Vol 2, pp 515-525, 1968. 11 p, 2 fig, 3 tab, 10 ref. OWRR Proj No A-012-NJ.

Descriptors: *Water chemistry, *Analysical techniques, *Phenols, *Colorimetry, *Surface

waters, Water pollution sources, Pollutant identification, Indicators, Water pollution.
Identifiers: Phenol detection.

Surface waters may contain phenolic compounds. One of the more serious water-quality problems is the lack of specific and sensitive analytical techniques for the detection of these compounds. In order to test the applicability of an improved and modified 4-aminoantipyrine colorimetric procedure to natural waters, a program was undertaken to systematically sample 17 sites in 5 river systems of northeastern New Jersey, and to examine these samples for phenol. This reconnaissance survey revealed concentrations in excess of 1.0 micrograms/l which is the 'recommended potable water-quality standard' established by the New Jersey State Department of Health. All samples were split in order to compare results obtained by the Standard Methods procedure (Method I) to those obtained by the modified procedure (Method II). In 84 of 153 split samples, Method II yielded higher results than Method I. In addition, 44 of these 84 samples were cases in which Method II obtained higher results than the analytical sensitivity of Method I. This increased sensitivity is viewed as an advantage for Method II and an improvement over the Standard Methods. The phenol concentrations found in the 153 samples ranged from less than the analytical sensitivities of Methods I and II to the highest observed concentration of 210 micrograms/l. (Knapp-USGS)
W69-06444

NICKEL-63 IN MARINE AND TERRESTRIAL BIOTA, SOIL, AND SEDIMENT,
Washington Univ., Seattle. Lab. of Radiation Ecology.
T. M. Beasley, and E. E. Held.
Science, Vol 164, No 3884, pp 1161-1163, June 6, 1969. 3 p, 2 tab, 1 fig, 14 ref.

Descriptors: *Radioecology, *Radioactivity techniques, *Biota, *Pacific Ocean, Marine animals, Environmental effects, Sediments, Lichens, Clams, Lagoons, Atolls, Radiation.
Identifiers: *Radionuclides, *Nickel-63, Terrestrial biota, Marine currents.

A previously unreported radionuclide, nickel-63 (half-life, 92 yr), produced in the testing of nuclear devices, was measured in biological and environmental samples from areas of the Pacific Ocean and the eastern seaboard of the United States. Data are presented showing concentration of nickel-63 in several environmental samples in 8 areas and specific activities of the radionuclide in clams from 4 areas. Nickel-63 concentrations are low (maximum of 163 disintegrations per minute per gram of dry weight), but this radionuclide may be a useful tracer of oceanic processes because of its long half-life and long residence time in lagoons, atolls, and the ocean. (Land-USGS)
W69-06766

5B. Sources of Pollution

MICROBIAL PROBLEMS IN GROUNDWATER,
National Water Supply Research Lab., Washington, D. C.
For primary bibliographic entry see Field 05C.
W69-06426

WATER QUALITY MANAGEMENT IN IRRIGATION SYSTEMS,
Water Resources Engineers, Inc., Lafayette, Calif.; and California Univ., Berkeley.
For primary bibliographic entry see Field 05G.
W69-06499

STOCHASTIC MODEL FOR BOD AND DO IN STREAMS,
Virginia Polytechnic Inst., Blacksburg, Va.
Richard P. Thayer, and Richard G. Krutchkoff.
Proc, Amer Soc Civil Eng, Vol 93, No SA3, pp 59-72, June 1967. 14 p, 5 fig, 2 tab, 4 ref, 1 append.

Descriptors: *Mathematical models, *Water quality control, *Oxygen sag, Time of concentration, Streamflow, Hydrologic data, River systems, Water pollution effects, Dissolved oxygen, Standards.
Identifiers: Sacramento River.

A stochastic model for pollution and dissolved oxygen in steams was presented. Given the steam parameters and the initial conditions, the model predicted the mean amounts of pollution and dissolved oxygen at any point downstream, and also their variability with time. The proportion of time that pollution was above, or DO was below, any given concentration, could be determined. The theoretical results were tested by comparing them with controlled laboratory experiments and with data from the Sacramento River. It was observed that the means of both pollution and dissolved oxygen followed equations obtained by Dobbins in an earlier paper. It was concluded that the greatest variability in DO occurred at the sag, where it was most critical. (Gysi-Cornell)
W69-06500

ARSENIC ACCUMULATION BY FISH IN LAKES TREATED WITH SODIUM ARSENITE,
New York State Dept. of Health, Albany. Div. of Laboratories and Research.
William W. Ullmann, Robert W. Schaefer, and Wallace W. Sanderson.
J Water Pollution Control Fed, Vol 33, No 4, pp 416-418, April 1961. 1 tab, 5 ref.

Descriptors: *Aquatic weed control, *Arsenic compounds, *Fish, *Herbicides, *Lakes, *Sodium arsenite, Aquatic plants, Chemical analysis, Drainage effects, Neutron activation analysis, New York, Sediments, Water chemistry, Alkalinity.
Identifiers: Calico bass, Cassadaga Lake (NY), Chautauqua Lake (NY), Findley Lake (NY).

Authors investigated concentrations of arsenic in water and fishes (calico bass) in three New York State lakes, two of which had been subjected to sodium arsenite treatment for submerged plants. Analytical methods for lake water were not described, but residues in fish were determined by neutron activation analysis. Findley Lake (alkalinity: 56 milligram/liter) contained arsenic concentration of 0.06 milligrams/liter before spraying, 7.0 milligrams/liter immediately after spraying in May 1958, and 1.5 milligrams/liter one week later. By spring 1959, concentration had returned to pretreatment level. Chautaugua Lake (alkalinity: 256 milligrams/liter) contained 0.01 milligrams/liter before treatment in June 1959. After application of arsenical (4.5 hours), concentration of 0.45 milligrams/liter was found, which diminished to 0.04 milligrams/liter after 11 days. Untreated Cassadaga Lake (alkalinity: 64 milligrams/liter) contained arsenic concentrations from 0.04 to 0.10 milligrams/liter during year preceding study. In Cassadaga and Chatauqua Lakes mean arsenic residue was lower than detectable limit (0.10 micrograms/gram net weight). Authors attribute higher residues in Findley Lake fish (means: 0.28-056; maxima: 0.31-1.0) to persistence of residual arsenic here. In all fish examined, arsenic was less than that reported by others for edible marine fish. (Eichhorn-Wis)
W69-06541

NICKEL-63 IN MARINE AND TERRESTRIAL BIOTA, SOIL, AND SEDIMENT,
Washington Univ., Seattle. Lab. of Radiation Ecology.
For primary bibliographic entry see Field 05A.
W69-06766

DISTRIBUTION OF RADIONUCLIDES IN BOTTOM SEDIMENT OF THE CLINCH RIVER, EASTERN TENNESSEE,
Geological Survey, Washington, D. C.
R. J. Pickering.
Geol Surv Prof Pap No 433-H, pp H1-H25, 1969. 25 p, 7 fig, 10 tab, 46 ref.

Descriptors: *Sediment transport, *Path of pollutants, *Radioisotopes, *Radioactive waste disposal, *Tennessee, Radioactive wastes, Bed load, Cobalt radioisotopes, Water pollution sources, Clays, Ion exchange, Sediments, Suspended load, Alluvium.
Identifiers: *Radioactive sediment transport, Clinch River (Tenn), Cesium radioisotopes.

Radioactive bottom sediment in the Clinch River in eastern Tennessee was investigated through a study of the distribution of radioactivity in sediment cores taken from a 21-mile-long reach of river downstream from Oak Ridge National Laboratory. Low-level-radioactive liquid wastes are released from the Laboratory to the Clinch River via Whiteoak Creek. In the upper 8 mi of the reach radioactive sediment is found only along the sides of the stream channel, but in the lower 13 mi of the river, it extends out into the main part of the channel as well and attains its greatest thicknesses. Several sediment cores from the lower part of the river showed the same general pattern of variation of gross gamma radioactivity with depth. This pattern resembled the pattern of annual releases of cesium-137 from the Oak Ridge National Laboratory. Statistical comparison of the patterns confirmed the similarity. It is concluded that cesium-137 and cobalt-60 were incorporated in Clinch River bottom sediment by deposition of suspended radioactive solids which entered the river from Whiteoak Creek. Cation-exchange properties of the sediment are controlled largely by its content of mica and clay minerals. The effects of chemical and physical properties of the sediment on its radionuclide content are obscured as a result of variations in annual releases of the radionuclides and as a result of dilution of radioactive sediment by nonradioactive sediment in the river. Compositional effects were descernible only after corrections were made for variations in annual releases of radionuclides. (Knapp-USGS)
W69-06785

OIL AND HAZARDOUS MATERIALS-EMERGENCY PROCEDURES IN THE WATER ENVIRONMENT.
Federal Water Pollution Control Administration, Edison, N. J. North Atlantic Water Quality Management Center.
For primary bibliographic entry see Field 05G.
W69-06791

POLLUTION OF THE INTERSTATE WATERS OF THE BLACKSTONE AND TEN MILE RIVERS AND THEIR TRIBUTARIES,
Federal Water Pollution Control Administration, Washington, D. C.
Murray Stein.
Proc 2nd Sess of Conf on Pollut of Interstate Waters, Mass and Rhode Island, May 28, 1968, Providence, 1968. 166 p, 1 fig, 4 tab.

Descriptors: *Water pollution, *Water pollution control, *Water pollution treatment, *Pollution abatement, *Massachusetts, *Rhode Island, Water quality act, Water quality control, Water quality.
Identifiers: FWPCA Water-pollution conference.

Proceedings of a water pollution conference on the waters of the Blackstone and Ten Mile Rivers and their tributaries, Mass and R.I., are compiled. The purpose of the conference was to bring together State and interstate water pollution control agencies, representatives of the U. S. Department of the Interior and other interested parties to review the existing situation and the progress which has been made, to lay a basis of future action by all parties concerned and to give the States, localities, and industries an opportunity to take any indicated remedial action under State and local law. (Knapp-USGS)
W69-06802

5C. Effects of Pollution

EFFECTS OF MINE DRAINAGE ON GROUND WATER,
Pennsylvania Dept. of Health, Harrisburg; and West Virginia Univ., Morgantown.
Grover H. Emrich, and Gary L. Merritt.
Ground Water, Vol 7, No 3, pp 27-32, May-June 1969. 6 p, 8 fig, 2 tab.

Descriptors: *Water pollution, *Groundwater, *Acid mine water, *Pennsylvania, Groundwater movement, Recharge, Surface-groundwater relationships, Sulfates, Hydrogen ion concentration, Appalachian Mountain Region, Path of pollutants, Iron.
Identifiers: *Ground-water pollution, Toms Run (Pa).

Results of a study are presented which show that coal mining in Appalachia has degraded both the surface and groundwater. During mining, the pyrite associated with the coal beds is exposed to air. Oxidation and leaching of the phrite produces high iron and sulfate concentration and low pH in groundwater and surface waters. Iron concentration can increase up to several hundred mg/l and the sulfates to over one thousand mg/l. Unfortunately, in most cases the cessation of mining does not stop the groundwater pollution, and it can take many decades before the groundwater again becomes usable. In the Toms Run drainage basin, northwestern Pennsylvania, coal mining and oil and gas well drilling have gone on for almost 100 years. The rocks of Mississippian and Pennsylvanian Age contain a multiaquifer system. Three major aquifers are separated by siltstone and shale aquitards. The oil and gas wells and the natural joints and fractures in the rocks act as conduit systems permitting acid mine drainage to move downward from the strip mines and into underlying aquifers. The mine drainage adversely affects the groundwater quality by increasing the iron and sulfate content of the water especially in the vicinity of the strip mines. (Knapp-USGS)
W69-06425

MICROBIAL PROBLEMS IN GROUNDWATER,
National Water Supply Research Lab., Washington, D. C.
Gordon G. Robeck.
Ground Water, Vol 7, No 3, pp 33-35, May-June 1969. 3 p, 8 ref.

Descriptors: *Water pollution, *Groundwater, Diseases, Water pollution effects, Coliforms, Salmonella, Viruses, Public health, Epidemiology.
Identifiers: *Groundwater contamination.

Disease outbreaks caused by contaminated groundwater and problems of controlling and monitoring groundwater quality are discussed. Recharge of large groundwater basins with reclaimed sewage can cause microbial contamination. Coliforms, the usual indicators of contamination, are not always useful. Salmonella outbreaks have occurred without any detectible coliforms, and coliforms are filtered out of water by many media that will pass virus particles. Nitrates in waste water are difficult to remove and dangerous to health. Chlorination of all groundwater for domestic use is recommended as good insurance for microbial control. (Knapp-USGS)
W69-06426

STOCHASTIC MODEL FOR BOD AND DO IN STREAMS,
Virginia Polytechnic Inst., Blacksburg, Va.
For primary bibliographic entry see Field 05B.
W69-06500

A REVIEW OF THE LIFESPANS AND MORTALITY RATES OF FISH IN NATURE, AND THEIR RELATION TO GROWTH AND OTHER PHYSIOLOGICAL CHARACTERISTICS,
Ministry of Agriculture, Fisheries and Food, Lowestoft (England). Fisheries Lab; and Food and Agriculture Organization of the United Nations, Rome (Italy). Fisheries Biology Branch.
R. J. H. Beverton, and S. J. Holt.
Ciba Found Symp, Lifespan of Animals, Vol 5, pp 142-177, 1959. 1 tab, 8 fig, 106 ref.

Descriptors: *Fish, *Growth rates, *Mortality, Fisheries, Fish physiology.
Identifiers: *Lifespans, *Mortality rates, *von Bertalanffy curves, Asymptotic length, Metabolic rate.

Effective strategies for management of fish populations require information on longevity and force of mortality. Data on 69 species of fish are compared in terms of von Bertalanffy parameters, natural mortality coefficients, maximum age, and length at maturity. Comparisons are made of maximum age, mortality rate, asymptotic length, and growth rate, indicating direct relationships between growth rate and mortality rate. Maximum age and asymptotic length are closely correlated, and inverse correlations occur for maximum age-mortality rate and asymptotic length-growth rate comparisons. Comparisons with environmental data indicate that growth rate is affected by temperature and that asymptotic length is affected by food and temperature. Growth rate varies with log temperature and is closely related to metabolic rate and activity. Comparisons of the ratio (length at maturity:asymptotic length) with maximum age suggest that high ratios are related to short lifespans. 'Reproductive drain' appears to occur in species showing high growth rates, early maturity, and high length at maturity:asymptotic length ratios. (Voigtlander-Wis)
W69-06533

THE AGING OF LAKES,
Wisconsin Univ., Madison. Water Chemistry Lab.
For primary bibliographic entry see Field 02H.
W69-06535

SIMULATION OF AN AQUATIC ECOSYSTEM,
Washington State Univ., Pullman. Dept. of Zoology; and Washington State Univ., Pullman. Dept. of Information Science.
For primary bibliographic entry see Field 02H.
W69-06536

THE DESIRABILITY AND APPLICABILITY OF SIMULATING ECOSYSTEMS,
Battelle Memorial Inst., Columbus, Ohio.
For primary bibliographic entry see Field 06A.
W69-06537

THE WORK OF THE FRESHWATER BIOLOGICAL ASSOCIATION OF GREAT BRITAIN IN REGARD TO WATER SUPPLIES. (a) THE NITROGEN BALANCE OF LARGE QUANTITIES OF WATER,
For primary bibliographic entry see Field 02K.
W69-06538

APPLICATION OF AN ELECTRONIC PARTICLE COUNTER IN ANALYZING NATURAL POPULATIONS OF PHYTOPLANKTON,
Cornell Univ., Ithaca, N. Y. Dept. of Botany.
For primary bibliographic entry see Field 07B.
W69-06540

SPECIES DIVERSITY AND COMMUNITY STRUCTURE IN LACUSTRINE PHYTOPLANKTON,
Wisconsin Univ., Madison. Dept. of Zoology.
For primary bibliographic entry see Field 02H.
W69-06542

POLLUTION OF THE INTERSTATE WATERS OF THE BLACKSTONE AND TEN MILE RIVERS AND THEIR TRIBUTARIES,
Federal Water Pollution Control Administration, Washington, D. C.
For primary bibliographic entry see Field 05B.
W69-06802

5D. Waste Treatment Processes

STREAM POLLUTION CONTROL IN THE UPPER CUMBERLAND RIVER BASIN-1965.
Tennessee Dept. of Public Health, Nashville. Stream Pollution Control Div.
For primary bibliographic entry see Field 05G.
W69-06488

ECONOMIC FRAMEWORK FOR SALINITY CONTROL PROJECTS,
Harvard Univ., Cambridge, Mass.; and Colorado River Basin Project, Denver.
Philip J. Coffey, and Leonard Ortolano.
J Amer Water Works Ass, Vol 61, No 5, pp 237-241, May 1969. 5 p, 2 fig, 2 tab, 16 ref.

Descriptors: *Salinity, *Water pollution control, *Economic justification, Cost-benefit analysis, Mathematical models, Marginal benefits, Marginal costs, Dissolved solids, Water users, River flow, Optimum development plans, Water management (Applied).
Identifiers: Differential equations, Graphical methods.

A systematic approach for finding the optimal level and type of salinity control on a river was presented, and a hypothetical example demonstrated its use. The objective was to determine the minimum total pollution cost, which was the sum of upstream control costs (a decreasing function of downstream residual salinity), and downstream users costs, (an increasing function of salinity). Differential equations of cost as a function of total dissolved solids were derived and solved. The necessary first and second order conditions for cost minimization or benefit maximization were obtained. A graphical method was presented which extrapolated between four possible treatment levels. The method can be applied in situations where the level of water use is static. (Gysi-Cornell)
W69-06490

SLUDGE DISPOSAL ALTERNATIVES -- SOCIO-ECONOMIC CONSIDERATIONS,
Washington Univ., Seattle.
For primary bibliographic entry see Field 05E.
W69-06492

WATER QUALITY MANAGEMENT: ENGINEERING-ECONOMIC FACTORS IN MUNICIPAL WASTE DISPOSAL,
California Univ., Berkeley.
Richard J. Frankel.
Water Resources Res, Vol 1, No 2, pp 173-186, 2nd Quarter, 1965. 14 p, 5 fig, 8 tab, 8 ref.

Descriptors: *Water management (Applied), *Water quality control, *Computor models, Waste water treatment, Municipal water, Stream improvement, Alternative costs, Water treatment, Hydrologic data, Oxygen sag.
Identifiers: Eel River (Calif).

The results of a river basin computer study, which determined the savings of downstream treatment cost resulting from incremental upstream waste treatment, were presented. Hydrologic data from the Eel River in California were incorporated in the dynamic oxygen sag model developed. Principle variables of the model were original streamflow quantity and quality, hydraulic and physiographic characteristics of the stream, degree of stream self-purification, treatment level, distance and required use between communities, and water treatment

level at the downstream community. It was concluded that maximal return per additional investment dollar is from primary to secondary sewage treatment (cost-savings ratios from negligible to 0.10). The quantity of withdrawal of municipal water supply required to justify upstream treatment varies from 16 to 250:1 for small sewage plants to 10 to 30:1 for large plants, if in-place stream quality is unimportant. (Gysi-Cornell)
W69-06505

WATER SUPPLY AND WASTEWATER TREATMENT PROBLEMS OF INDUSTRIAL AND TRADE ENTERPRISES,
W. Husmann.
For 8 volume Proceedings see Vol 2, No 9, Field 06B, W69-03305. International Conference on Water for Peace, Vol 6, Washington, D C, U S Government Printing Office, pp 29-34, 1968. 6 p.

Descriptors: *Waste treatment, *Pollution abatement, *Water supply, Water management, Public health, Industrial wastes, Chemical wastes, Sewage, Recirculated water, Detergents, Sludge, Biological treatment.
Identifiers: *Federal Republic of Germany, *Emscher Association, Economic development, Rhine River.

A look at the present-day position of industrial wastewater treatment will reveal that for all branches of industry and also the chemical industry, efficient treatment plants have been, and still are being developed in growing number which will serve their purpose and ensure adequate biological and mechanical treatment. In the Federal Republic of Germany the Emscher (Basin) Association, in order to protect the population from damage and nuisance caused by domestic and industrial wastes, sees to it that surface depressions due to coal mining operations are promptly made up for and wastes quickly run off and treated in association-owned treatment plants. Apart from wastewater treatment within the Emscher Basin itself all essential treatment measures must aim at keeping clean, and reducing the load imposed on the Rhine. The Emscher Association demands of all polluters of the Emscher or its tributaries to cool down, treat, and neutralize all wastes prior to their discharge to such a degree that they do not constitute a threat to sound hygenic conditions, do not cause offensive smells or odors, and do not damage or endanger the operation of treatment plant components. (Sokoloff-Rutgers)
W69-06723

22 ND INDUSTRIAL WASTE CONFERENCE, 1967, PART ONE,
Purdue Univ., Lafayette, Ind. School of Engineering; and Purdue Univ., Lafayette, Ind. Div. of Conferences and Continuation Services.
Don E. Bloodgood.
Purdue Univ Eng. Ext Ser no 129, Proc 22nd Ind Waste Conf, May 2-4, 1967, Lafayette, Indiana, 1967. 552 p, 257 fig, 111 tab, 454 ref.

Descriptors: *Industrial wastes, *Water reuse, *Waste treatment, Waste indentification, Water pollution treatment, Reaeration, Waste disposal, Wastewater disposal, Injection wells, Water chemistry, Dissolved oxygen.
Identifiers: *Industrial Waste Conference.

The 22nd annual Industrial waste Conference, Purdue University, 1967 discussed means of treating industrial wastes, industrial reuse of municipal and industrial waste water, and water pollution treatment in streams. Recovery of materials from wastes and indentification of waste materials were also discussed. Contains 85 papers. (Knapp-USGS)
W69-06821

RECLAIMED WASTE WATER IN LAS VEGAS VALLEY,
Nevada Univ., Reno. Dept. of Civil Engineering; and Nevada Univ., Reno. Desert Research Inst.
R. G. Orcutt.
Desert Res Inst, Nev Univ Coll Eng Rep No 2, Aug 1965. 122 p, 10 fig, 22 tab, 75 ref, 4 append.

Descriptors: *Water reuse, *Tertiary treatment, *Nevada, Sewage treatment, Artificial recharge, Aquifers, Irrigation water, Water demand, Reclaimed water, Salvage value, Water utilization, Water yield, Water supply, Arid lands, Nevada.
Identifiers: *Las Vegas Valley (Nev).

Sewage collection, treatment, disposal, and the reuse of treated effluents in Las Vegas Valley, Nevada, were studied. The demand for effluent in the vicinity of the existing sewage treatment plant sites is expected to be substantially less than the planned capacities of the plants at these sites. Large amounts of storage will be required to utilize the excess effluent which would result from the seasonal variations in the existing and expected future reuse of reclaimed water. It will be necessary to recharge productive aquifers with reclaimed water if the water is to be reclaimed at minimum unit cost. There were insufficient data available to permit the evaluation of the feasibility of groundwater recharge. Waste water reclamation plants located higher in the sewage collection system appear to offer the best opportunity for economical utilization of reclaimed water. These plants should be located in areas which would permit maximum direct reuse of reclaimed water and which would allow a maximum credit, for the relief of downstream sewerage facilities, to be applied to the cost of the reclamation plan. Ideally, these plants would use trunk sewers as a source of raw water supply and for the disposal of solid wastes. More information relative to sewage flows and the use of water for irrigation in Las Vegas Valley is needed in order that the optimum waste water reclamation plan can be developed. (Knapp-USGS)
W69-06832

5E. Ultimate Disposal of Wastes

SLUDGE DISPOSAL ALTERNATIVES -- SOCIO-ECONOMIC CONSIDERATIONS,
Washington Univ., Seattle.
Brian W. Mar.
J Water Pollut Contr Fed, Vol 41, No 4, pp 547-552, Apr 1969. 6 p, 2 fig, 11 ref.

Descriptors: *Sludge disposal, *Alternative costs, *Social values, *Economics, Social needs, Systems analysis, Environmental engineering, Environmental sanitation, Constraints, Waste treatment.
Identifiers: *Socio-economic considerations, Muddling, Feedback.

The 'socio-economic' problem of sludge disposal was presented and discussed. It was established that no technical barrier to the problem exists, with almost any form of removal being obtainable for under $50 per ton, but that the 'muddling' technique now used in large urban systems for incrementally solving piecemeal environmental problems, hampered by poor information feedback within the system, is hampering overall system optimization solutions. Systems analysis techniques could be used to solve the overall problems but as yet quantified values have not been established for many of the social benefits and costs of environmental controls. However, it was concluded that social benefits of environment quality maintenance are likely of such a magnitude that the maximum degree of treatment should be used. A possible environmental damage charge compensation payment fund was alternatively suggested as a method of welfare optimization. (Gysi-Cornell)
W69-06492

A HEURISTIC AID FOR THE DESIGN OF SEWER NETWORKS,
Cornell Univ., Ithaca, N. Y.
Jon C. Liebman.
Proc, Amer Soc Civil Eng, Vol 93, No SA4, pp 81-90, Aug 1967. 10 p, 8 fig, 2 ref.

Descriptors: *Network design, *Optimization, *Costs, *Digital computers, *Sewers cost comparisons, Cost analysis, Excavation.
Identifiers: Iterative search method.

An iterative search method, programmed for use on a digital computer, which sought improved layouts in gravity flow sewage collection networks, was presented. The method required an original node-link layout, selected by engineering judgement, and an iterative search for cost reducing adjustments. At each node an unused link was checked to see if costs could be reduced by replacing an existing link with a new one. If replacement reduced costs, the search began at the first node again. The program ended when no improvements could be found. No guarantee of an optimal solution was obtained, as illustrated by different original network selections for a hypothetical example. However, the same least cost solution was found for most original networks chosen. (Gysi-Cornell)
W69-06498

WATER QUALITY MANAGEMENT: ENGINEERING-ECONOMIC FACTORS IN MUNICIPAL WASTE DISPOSAL,
California Univ., Berkeley.
For primary bibliographic entry see Field 05D.
W69-06505

5F. Water Treatment and Quality Alteration

ECONOMIC FRAMEWORK FOR SALINITY CONTROL PROJECTS,
Harvard Univ., Cambridge, Mass.; and Colorado River Basin Project, Denver.
For primary bibliographic entry see Field 05D.
W69-06490

WATER QUALITY MANAGEMENT: ENGINEERING-ECONOMIC FACTORS IN MUNICIPAL WASTE DISPOSAL,
California Univ., Berkeley.
For primary bibliographic entry see Field 05D.
W69-06505

THE IMPROVEMENT OF WATER QUALITY UNDER A FINANCIAL CONSTRAINT: A COMMENTARY ON 'LINEAR PROGRAMMING APPLIED TO WATER QUALITY MANAGEMENT',
Cornell Univ., Ithaca, N. Y.
Charles Revelle, Gary Dietrich, and David Stensel.
Water Resources Research, Vol 5, No 2, pp 507-513, April 1969. 7p, 1 fig, 4 tab, 3 ref.

Descriptors: *Water quality, *Linear programming, Constraints, Financial analysis, Dissolved oxygen, River basins, Efficiencies, River basin development, Biochemical oxygen demand, Oxygen sag.
Identifiers: *Financial constraint, *Water quality management, Dual variable.

Limited funds for building treatment facilities on a river basin are allocated to secure the largest possible value of the minimum level of dissolved oxygen. Linear programming is utilized to determine the configuration of efficiencies that achieve this goal. At optimality, the dual variable associated with the financial constraint indicates the instantaneous rate of change of the minimum dissolved oxygen concentration with respect to the funds available. Several alternative formulations of the problem are discussed and numerical example is solved to illustrate the methodology. (Loeb-Rutgers)
W69-06547

ECONOMIC EFFECTS OF MINERAL CONTENT IN MUNICIPAL WATER SUPPLIES.
Black and Veatch, Kansas City, Mo.
For primary bibliographic entry see Field 03A.
W69-06555

MANUAL OF PROCEDURES AND METHODS FOR CALCULATING COMPARATIVE COSTS OF MUNICIPAL WATER SUPPLY FROM SALINE AND CONVENTIONAL WATER SOURCES IN TEXAS,
Southwest Research Inst., Houston, Tex.; and Texas Water Development Board, Austin.
For primary bibliographic entry see Field 03A.
W69-06559

WATER POLLUTION CONTROL,
For primary bibliographic entry see Field 05G.
W69-06731

5G. Water Quality Control

STREAM POLLUTION CONTROL IN THE UPPER CUMBERLAND RIVER BASIN-1965.
Tennessee Dept. of Public Health, Nashville. Stream Pollution Control Div.

Tenn Stream Pollut Contr Board Publication, 1965. 37 p, 1 fig, 1 map, 9 tab.

Descriptors: *Water pollution control, *Tennessee, *Water pollution treatment, Waste treatment, Sewage treatment, Municipal wastes, Industrial wastes, Sewage disposal, Waste disposal.
Identifiers: Upper Cumberland River Basin.

The stream pollution abatement progress in the Upper Cumberland River Basin in the past 20 yr is outlined. Also included is a summarization of existing conditions and progress achieved in the Green River Basin. Since 1944, 13 new sewage treatment plants were built in the Upper Cumberland River Basin, and the sewered population increased 232% to a total 57,280, or 23% of the total population of the basin. In 1944, only 7% of the total population was sewered. In 1944, the organic wastes discharged from cities and industries in the Upper Cumberland River Basin had, before treatment, a population equivalent of 27,880. Due to expanding industrial operations and growing municipalities, this has increased 213% to 87,385 in 1965. The organic wastes being discharged, after treatment, into the Upper Cumberland River and its tributaries have increased only 20%. In 1944, a reduction of only 24% in the organic strength of the wastewater was achieved by all of the sewage treatment facilities. At present, a reduction of 71% is being achieved. Additional treatment now proposed will reduce the strength of the effluent still more, and where stream pollution problems exist, recommendations have been made to rectify the situations. (Knapp-USGS)
W69-06488

RESERVOIR MANAGEMENT: THE TRADEOFF BETWEEN LOW-FLOW REGULATION AND FLOOD CONTROL,
Federal Water Pollution Control Administration, Washington, D. C.
For primary bibliographic entry see Field 04A.
W69-06496

WATER QUALITY MANAGEMENT IN IRRIGATION SYSTEMS,
Water Resources Engineers, Inc., Lafayette, Calif.; and California Univ., Berkeley.
Gerald T. Orlob, and Philip C. Woods.
Proc, Amer Soc Civil Eng, Vol 93, No IR2, pp 49-66, June 1967. 18 p, 9 fig, 1 tab, 4 ref, 1 append.

Descriptors: *Simulation analysis, *Water quality control, *Digital computers, *River systems, *Irrigation effects, Irrigation systems, Hydrologic data, Dissolved solids.
Identifiers: Sacramento River, Conservative mineral constituents.

A water-quality model compatible with a dynamic hydrologic model and suitable for simulation on the digital computer was presented. The characteristics of a general hydrologic model and two specific models for simulating the operation of irrigation systems were described. By means of the models it was possible to determine at any desired point within the river system, the proportion of water which had been in prior contact with the surface of an irrigation plot. The 'use factor' thus developed could be related to changes in certain conservative quality constituents. The results obtained by simulation of the Sacramento River System were compared to the quality response of the prototype. It was concluded that changes in conservative mineral constituents were closely related to reuse, while constituents involved in biological decomposition processes showed little correlation with reuse. (Gysi-Cornell)
W69-06499

MANPOWER REQUIREMENTS FOR POLLUTION CONTROL AND WATER RESOURCES IN INDIANA AND A RELATED POLLUTION CONTROL TECHNOLOGY CURRICULUM,
Purdue Univ., Lafayette, Ind.
J. P. Lisack.
Purdue University Water Resources Research Center Technical Report 6, March 1969. 64 p, 10 tab, 10 appendix, 22 ref. OWRR Project A-008-IND.

Descriptors: *Manpower, *Education, Employment opportunities, *Occupations, Professional personnel, Water pollution, Air pollution, Water resources, *Professional personnel, Pollution control, Technology.
Identifiers: Technology curriculum, Indiana, Technicians.

The report covers an interdisciplinary study by 4 University departments and representatives from professional organizations in Indiana. In the survey which was conducted it was found that 600 industrial and utility firms, government agencies and educational institutions in Indiana alone have existing job vacancies for 139 engineers, 112 professionals in the physical and life sciences and 175 technicians in the pollution control and water resources development fields. Each year, the same 600 respondents will have job openings for 116 engineers, 87 life and physical scientists and 159 technicians. The report recommends recruitment of students into the disciplines of engineering and life and physical sciences related to environmental and pollution control, and the development of a completely new two-year pollution control technology program in Purdue's School of Technology to meet the critical shortage of trained technicians. This proposed curriculum is unique in that it will provide the training for technicians in water resources, waste water treatment, solid waste treatment, water supply, and air pollution. (Wiersma-Purdue)
W69-06507

SEWERAGE DISTRICTS AND BOARDS.

N J Stat Ann secs 58:12-1 to 58:12-7 (1966).

Descriptors: *New Jersey, *Water pollution control, *Administrative agencies, *Sewage disposal, Sewage effluents, Sewage treatment, Sewage districts, Cities, Municipal wastes, Pollution abatement, Water law, Water pollution sources, Bodies of water, Local governments, Regulation, Investigations, Legislation, Legal aspects, Planning.
Identifiers: Injunctions (Prohibitory), Injunctions (Mandatory).

The phrase 'waters of this state' is expressly defined. The State Department of Health has the power to investigate methods of sewage disposal in order to be better able to make intelligent recommendations for improving such methods and for altering existing sewage treatment works. If the department finds that any of the waters of the state are being polluted, it shall issue notice to the person responsible for such pollution, informing him that he has five years to abate the pollution. He must begin immediately to dispose of the polluting effluent in a manner approved by the department. The department's mandate may be filed in the superior court if such polluting activity is not thereafter discontinued. No sewage may be drained into waters of the state except under such conditions as the department shall approve. Before constructing any sewage plant, plans therefore shall be submitted to the department. The department may seek injunctive relief against violators of the act. Municipalities are required to inform the department of the disposition made of their sewage. Procedures are outlined for the establishment of sewerage districts to include two or more municipalities. (Holt-Fla)
W69-06632

DESIGN AND CONSTRUCTION OF DAMS FOR RETENTION OF SOLID WASTES,
Bechtel Corp., San Francisco, Calif.
Harris H. Burke.
Pap, Amer Soc Civ Eng Nat Meet Water Resour Eng, New Orleans, La, Feb 1969. 31 p, 13 fig.

Descriptors: Dams, *Dam construction, *Dam design, Dam failure, *Solid wastes, *Retention dams, *Earth dams, Mining, Embankments, Construction, Drainage systems, Compaction, Drainage, Pollutants, Slope stability, Safety, Liquefaction.
Identifiers: Dam stability, *Tailings, Drain filters, Construction methods, Pollution control.

Dams for retaining solid wastes are used primarily in the mining industry for disposal of tailings; other uses include storage of (1) fly-ash wastes from large coal-fired steam-electric powerplants, (2) solid wastes from chemical processing, and (3) mineral wastes from oil-recovery operations. If tailings are a serious threat to downstream life and property, they should be retained by a positive wall or dam designed to resist the possible applied loads, rather than relying on the usual upstream building method utilizing tailings alone. Rational design of tailings dams was made possible by the same developments in soil mechanics that proved to be so effective in designing water-retention structures. Introduction of these techniques is helping to improve the hit-or-miss empirical rules previously developed and used in mining and other industries, reducing the possibility of failures while still keeping the cost of waste disposal to an acceptable minimum. Techniques used to build these types of dams are illustrated. (USBR)
W69-06675

WATER POLLUTION CONTROL,
R. Pavanello.
For 8 volume Proceedings see Vol 2, No 9, Field 06B, W69-03305. International Conference on Water for Peace, Vol 7, Washington, D C, U S Government Printing Office, pp 991-999, 1968. 9 p, 5 ref.

Descriptors: *Urbanization, *Water pollution control, *Industrial production, Domestic water, Municipal water, Treatment facilities, Training, Research facilities, Waste water, Legislation.
Identifiers: *World Health Organization, Synthetic organic chemicals, International action.

The pollution of surface and ground waters presents a challenge to the health and prosperity of most countries. Although the need for research is prominent in some cases, much is known and technology is available to remedy most of the growing problems of water pollution, provided that there is sound legislation, a good administrative structure, adequate funds and most important, a determination to control water pollution. The World Health Organization has been especially active in the field of water pollution control, and is assisting Member Countries in the evaluation of their problems by conducting surveys of a regional or a national character, and in promoting and advising on the establishment of suitable water pollution control agencies. The Organization makes available to its Member Countries a variety of

technical services to assist in the study of practically every kind of water pollution problem and devotes a sizable portion of its resources in grouping training courses, to the establishment of permanent academic post-graduate facilities, and to individual fellowships, with a view to increasing everywhere the number of persons engaged in combating water pollution. (Sokoloff-Rutgers)
W69-06731

ROLE OF GROUND WATER CONTAMINATION IN WATER MANAGMENT,
Geological Survey, Raleigh, N. C.
Harry E. LeGrand.
Am Water Works Assoc Jour, Vol 59, No 5, pp 557-565, May 1967. 8 p, 1 tab, 6 ref.

Descriptors: *Groundwater, *Water pollution, *Water supply, *Waste disposal, *Water policy, Water managment (Applied), Water resources development, Water quality, Water wells, Aquifers, Hydrogeology, Pollution abatement, Planning, Administration, Costs, Economic feasibility, Municipal water, Streams.

Ground-water contamination aspects should not be excluded in long-range integrated community plans, especially in urban areas and suburbs. They include any deterioration of quality of waste disposal practices, artificial recharge of aquifers, accident, or salt water at shallow or underlying depths. These problems will increase under current practices while minimizing costs calls for coordinated efforts from several disciplines. Technically trained personnel, capable of determining best use of land for water supply and waste disposal, are rarely a part of water-resources administrative machinery. Specific problems are more often dealt with than long-range planning. Complex hydrogeologic conditions must be evaluated before decisions are made and policies established. (Affleck-Ariz)
W69-06762

TRACER METHOD FOR DETERMINING THE VELOCITY OF FLOW IN A CONFINED KARSTIC AQUIFER,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 07B.
W69-06774

OIL AND HAZARDOUS MATERIALS-EMERGENCY PROCEDURES IN THE WATER ENVIRONMENT.
Federal Water Pollution Control Administration, Edison, N. J. North Atlantic Water Quality Management Center.

Dept of Interior, Fed Water Pollut Contr Admin Rep CWR 10-1, Oct 1968. 137 p, 8 ref, 1 append.

Descriptors: *Pollutants, *Pollutant identification, *Water pollution treatment, Oily water, Toxicity, Chemical wastes, Hazards, Poisons, Public health, Cleaning.
Identifiers: *Industrial chemical spills, *Oil spills, Spill handling, Technical manuals.

Procedures for handling oil and chemical spills are given in a technical manual primarily intended for regional FWPCA use. Basic information is provided on the charateristics and effects of pollutants, and procedures to be followed in the event of significant releases to water of oil or other hazardous materials. General information is given on the effects of spills on aquatic life and important water uses including fishing, agriculture, industrial, and domestic. Pollution control measures, health hazard data, and first aid procedures are listed for each pollutant. (Knapp-USGS)
W69-06791

CHESAPEAKE BAY CASE STUDY.
Trident Engineering Associates, Inc., Annapolis, Md.
For primary bibliographic entry see Field 06B.
W69-06794

POLLUTION OF THE INTERSTATE WATERS OF THE BLACKSTONE AND TEN MILE RIVERS AND THEIR TRIBUTARIES,
Federal Water Pollution Control Administration, Washington, D. C.
For primary bibliographic entry see Field 05B.
W69-06802

22 ND INDUSTRIAL WASTE CONFERENCE, 1967, PART ONE,
Purdue Univ., Lafayette, Ind. School of Engineering; and Purdue Univ., Lafayette, Ind. Div. of Conferences and Continuation Services.
For primary bibliographic entry see Field 05D.
W69-06821

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

SIGNIFICANCE OF GROUNDWATER MANAGEMENT STRATEGY-A SYSTEMS APPROACH,
San Bernardino Valley Municipal Water District, Calif.; and TRW Systems Group, Redondo Beach, Calif.
J. A. Beaver, and M. L. Frankel.
Ground Water, Vol 7, No 3, pp 22-26, May-June 1969. 5 p.

Descriptors: *Water management (Applied), *Systems analysis, *Groundwater, *Long-term planning, *California, Methodology, Water policy, Inter-agency cooperation, Decision making, Pricing, Taxes, Data collections.
Identifiers: *Groundwater management, San Bernardino Valley.

A simplified outline is presented as a favorable study environment for the development of analytic tools and long-range planning needs of effective groundwater management strategies. Situations with real problems and stated objectives are described. A water district in Southern California's San Bernardino Valley is cooperating with private industry and the State in performing an experiment in systems analysis technology as applied to water management. The San Bernardino Valley is similar to other areas in the world where water management reduces to the allocation of locally available groundwater and potential imported water. (Lang-USGS)
W69-06424

CIVIL ENGINEERING AND URBAN SYSTEMS,
Northwestern Univ., Evanston, Ill.
George L. Peterson, Robert S. Gemmell, Richard D. Worrall, and Donald S. Berry.
Proc Amer Soc Civil Eng, Vol 95, No UP1, pp 1-14, Apr 1969. 14 p, 2 fig, 5 ref.

Descriptors: *Civil Engineering, *Systems analysis, *Urbanization, Social needs, Water supply, Waste disposal, Transportation, Economics, Mathematics, Environmental engineering, Analytical techniques, Decision making, Planning, Design.
Identifiers: Urban Systems Engineering.

A new engineering activity, Urban Systems Engineering, using the tools of mathematics, economics, and the social, behavioral and institutional sciences, all founded on an engineering base, was described. The analytic methodology, theories and descriptions of the behavior of urban systems and institutions, and the use of inductive and deductive quantitative methods which are particularly important were outlined. Included in urban services which should be engineered as systems were water supply, waste disposal, transportation, health services, power supply, education, recreation, communication, protection (fire, police) and others. The responsibility of the civil engineering profession in meeting the challenge and opportunity of Urban Systems Engineering was stressed. (Gysi-Cornell)
W69-06491

PIPELINE PLANNING BY DYNAMIC COMPUTER PROGRAMMING,
Tahal Construction Engineers Ltd., Tel Aviv (Israel).
Elisha Kally.
J Amer Water Works Ass, Vol 61, No 3, pp 114-118, Mar 1969. 5 p, 6 fig, 2 ref.

Descriptors: *Dynamic programming, *Pipelines, *Design, *Planning, *Computer programs, Hydraulic gradient, Pressure head, Pressure conduits, Cost comparisons, Optimization, Probability, Timing, Discharge (Water), Digital computers.
Identifiers: Variable discharge.

A dynamic programming approach was described which made possible the minimum cost design of a pipeline with the aid of a digital computer. The first method assumed a given set of flow data for which the optimal design was determined. Accuracy and speed of the program was dependent on the pipeline segmentation and interval spacing chosen for pressure heads at segment ends. A second method considered possible flow variations with known probability distributions for which the design with lowest expected cost was found. Finally, the possibility of increasing discharge requirements with time was handled by treating time increments as the stages (rather than pipe segments as in method 1), and treating capacity expension increments as decision variables at each stage. For the latter method the minimum cost of supplying a required capacity at any given point in time could be found. (Gysi-Cornell)
W69-06493

SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE.
Texas Water Development Board, Austin; and Water Resources Engineers, Inc., Lafayette, Calif.
For primary bibliographic entry see Field 04A.
W69-06494

THE DESIRABILITY AND APPLICABILITY OF SIMULATING ECOSYSTEMS,
Battelle Memorial Inst., Columbus, Ohio.
R. S. Davidson, and A. B. Clymer.
Ann NY Acad Sci, Vol 128, Art 3, pp 790-794, Jan 31, 1966. 1 fig, 17 ref.

Descriptors: *Ecosystems, *Model studies, *Simulation analysis, Eutrophication, Computer models, Computers, Nutrients, Trophic level, Productivity, Aquatic environment, Phytoplankton, Zooplankton, Analog models, Systems analysis.
Identifiers: Aquatic ecosystem model, Simulation model, Mid-Atlantic seaboard, Algal bloom.

A mathematical model simulating aquatic ecosystems was developed by assuming uniform distribution of all variables in a column of water, where: all variables were adequately represented by averages over 24 hours; phytoplankton and zooplankton were the only biological components; illumination and water temperature had sinusoidal yearly curve; only one critical nutrient was present; no difference between growth and reproduction was indicated; and the location was the mid-Atlantic seaboard. Twelve appropriate constants were used in the model. The simulation of aquatic ecosystems was reasonably approached. The spring bloom of phytoplankton was 1000 times greater than the winter bloom. Regular summer and fall blooms of small magnitude also appeared. Peak of spring bloom occurred when the nutrient approached zero, and peak of zooplankton occurred slightly after the algal bloom as expected. (Teraguchi-Wis)
W69-06537

THE IMPROVEMENT OF WATER QUALITY UNDER A FINANCIAL CONSTRAINT: A COMMENTARY ON 'LINEAR PROGRAMMING APPLIED TO WATER QUALITY MANAGEMENT',
Cornell Univ., Ithaca, N. Y.
For primary bibliographic entry see Field 05F.
W69-06547

FIRST ORDER AUTO REGRESSION: INFERENCE, ESTIMATION, AND PREDICTION,
International Bank for Reconstruction and Development, New York; and Office of the Secretary of Defense, Washington, D. C.
Guy H. Orcutt, and Herbert S. Winokur, Jr.
Econometrica, Vol 37, No 1, pp 1-14, January 1969. 14 p, 8 tab, 24 ref.

Descriptors: *Forecasting, *Monte Carlo study, Estimating, Time series analysis, Regression analysis, Least squares method.
Identifiers: *First order autoregression, *Inference, Estimation, Level, Slope, Error variance, T-distribution, Chi-square distribution, Bias, Chained prediction.

Monte Carlo techniques are used to study the first order autoregressive time series model with unknown level, slope, and error variance. The effect of lagged variables on inference, estimation, and prediction is described using results from the classical normal linear regression model as a standard. In particular, use of the t and Chi-square distributions are approximate sampling distributions is verified for inference concerning the level and residual error variance. Bias in the least squares estimate of the slope is measured and two bias corrections are evaluated. Least squares chained prediction is studied, and attempts to measure the success of prediction and to improve on the least squares technique are discussed. This article would be of interest to the water researcher concerned with econometric analyses of water demand conditions. (Loeb-Rutgers)
W69-06550

LEAST SQUARES, CONDITIONAL PREDICTIONS, AND ESTIMATOR PROPERTIES,
Institute for Defense Analyses, Arlington, Va.
Wade P. Sewell.
Econometrica, Vol 37, No 1, pp 39-43, January 1969. 5 p, 10 ref.

Descriptors: *Least squares method, Forecasting, Regression analysis.
Identifiers: *Conditional prediction, *Estimated properties, Normal disturbances, Bias, Consistency, Asymptotic unbiasedness, Two-stage least-squares.

The problem of prediction of a subset of the endogenous variables conditioned on the balance of the endogenous variables, as well as the predetermined variables, is discussed in the context of a general linear model with normal disturbances. It is shown that the conditional least-squares predictor is unbiased correcting Srinivasan's treatment of a paper by Waugh. In the course of the argument, a simple derivation of the multivariate t density is presented. Srinivasan's remark that the consistency of an estimator does not imply its asymptotic unbiasedness (in one of the common senses of that term) is illustrated by two examples, one with a discrete and one with a continuous distribution. These examples show that neither asymptotic unbiasedness nor zero asymptotic variance is necessary for consistency. The example with a continuous distribution is the two-stage least-squares estimator. This article is of particular interest to the water researchers using conventional least squares analysis with respect to the predictive and simulation accuracy of their results and the classical properties of the estimators. (Loeb-Rutgers)
W69-06551

THE USE OF ERROR COMPONENTS MODELS IN COMBINING CROSS SECTION WITH TIME SERIES DATA,
North Carolina State Univ., Raleigh; and Islamabad Univ., Rawalpindi (Pakistan).
T. D. Wallace, and Ashig Hussain.
Econometrica, Vol 37, No 1, pp 55-72, January 1969. 18 p, 15 ref, 5 append.

Descriptors: Time series analysis, Regression analysis, Least squares method.
Identifiers: *Error component, *Cross section data, *Time series data, Aitken estimator, Covariance estimator, Iterative estimator.

A mixed model of regression with error components is proposed as one of possible interest for combining cross section and time series data. For known variances, it is shown that Aitken estimators and covariance estimators are in one sense asymptotically equivalent, even though the Aitken estimators are more efficient in small samples. Turning to unknown variance components, Zellner-type iterative estimators are compared with covariance estimators. Here few small sample properties are obtained. However, it is shown that covariance and Zellner-type estimators have equivalent asymptotic distributions and equivalent limits of sequences of first and second order moments for weakly nonstochastic regressors. For the model analyzed, the theoretical results obtained, as well as ease of computation, tend to support traditional covariance estimators of the regression parameters. This article improves the pooling technique for cross-section and time series data and can be used in empirical water demand research to avoid problems of least squares bias and multicolinearity that are inherent in the use of only time series data. (Loeb-Rutgers)
W69-06552

AN HARMONIC ANALYSIS OF NONSTATIONARY MULTIVARIATE ECONOMIC PROCESSES,
London School of Economics and Political Science (England); and Osaka Univ. (Japan). Inst. of Social and Economic Research.
David R. Brillinger, and Michio Hatanaka.
Econometrica, Vol 37, No 1, pp 131-141, January 1969. 11 p, 22 ref.

Descriptors: *Fourier analysis, Regression analysis.
Identifiers: *Nonstationary process, Power spectrum, Cross-spectrum, Partial cross-spectrum, Estimation, Simultaneous equations, Stationary process.

This paper presents an heuristic introduction to the harmonic analysis of a class of nonstationary processes and develops the estimation techniques required for such processes. The introduction is carried out via the notion of a frequency component for both a stationary and a nonstationary process. This form of presentation has the advantage of leading directly to the definitions of power spectrum, cross-spectrum and partial cross-spectrum for stationary processes, and their moving analogues for nonstationary processes. The problem of the formulation and estimation through harmonic analysis, of a system of simultaneous equations is also considered. Harmonic and spectral analysis may be of potential use to water flow and simulation studies. (Loeb-Rutgers)
W69-06553

LONG-RUN COEFFICIENTS AND DISTRIBUTED LAG ANALYSIS: A REFORMULATION,
Hebrew Univ., Jerusalem (Israel).
Yair Mundlak.
Econometrica, Vol 35, No 2, pp 278-293, April 1967. 16 p, 9 ref, 1 append.

Descriptors:
Identifiers: *Long-run coefficients, *Distributed lag analysis, Comparative statics, Short-run variable, Dynamic formulations, Adjustment equations, Recursiveness.

The difficulty of obtaining empirical coefficients of long-run economic relations stems from the fact that long-run equilibrium values of economic variables are unobservable. To overcome this difficulty, assumptions are usually made about the relationships between observed and the unobserved long-run variables. Such assumptions have led to distributed lag analysis. In an earlier paper the author has shown that such an approach is likely to give erroneous results, for the adjustment process may not be consistent with the comparative statics solutions for the short-run variables. In the present paper, the earlier analysis is supplemented and it is also shown how the problem can be overcome and how the long-run coefficients can be estimated even though the long-run equilibrium values are unobserved. The basic deviation from other formulations of this subject is that adjustment equations are used to describe only those movements of variables about which comparative statics has nothing to say. In this way, contradictions between comparative statics and ad hoc dynamic formulations are avoided. This article may be relevant to studies dealing with long run water demand and use via stochastic estimating techniques. (Loeb-Rutgers)
W69-06557

SPECIFICATION AND ESTIMATION OF COBB-DOUGLAS PRODUCTION FUNCTION MODELS,
Chicago Univ., Ill.; Michigan State Univ., East Lansing; and Louvain Univ. (Belgium).
A. Zellner, J. Kmenta, and J. Dreze.
Econometrica, Vol 34, No 4, pp 784-795, October 1966. 12 p, 14 ref.

Descriptors: *Specifications, Sampling, Estimating, Profits, Regression analysis.
Identifiers: *Estimation, *Cobb-Douglas production function, Profit maximization, Sampling theory, Bayesian estimation techniques, Classical least squares.

This paper considers the specification and estimation of the Cobb-Douglas production function model. After reviewing the 'traditional' specifying assumptions for the model which are based on deterministic profit maximization, a model is developed in which profits are stochastic and in which maximization of the mathematical expectation of profits is posited. 'Sampling theory' and Bayesian estimation techniques for this model are presented. This paper is relevant for water studies concerned with developing empirical production functions of water supply and the effects of uncertain profit conditions on the production function. (Loeb-Rutgers)
W69-06560

THE ESTIMATION OF NONLINEAR ECONOMETRIC SYSTEMS,
International Business Machines Corp., New York.
Harry Eisenpress, and John Greenstadt.
Econometrica, Vol 34, No 4, pp 851-861, October 1966. 11 p, 1 tab, 5 ref.

Descriptors: Regression analysis.
Identifiers: *Nonlinear econometric systems, Newton method, Parameter, Ordinary least-squares, FIML, Two-stage least-squares, LIML, Identification, Gradient method.

The estimation of parameters of linear econometric systems, for single-equation methods as well as system methods, is now feasible. In a previous paper a computer program for the calculation of estimates by most of these methods was described. The present paper presents an extension of this work to the nonlinear area, i.e., to systems that are nonlinear in the parameters and/or endogenous variables. In particular, an experimental program permits computation of nonlinear ordinary least-squares and full-information maximum likelihood estimates. As regards other methods that are currently used with linear systems, viz., two-and-three-stage least-squares and limited-information maximum likelihood, it appears at present that the extension to nonlinear systems is not feasible. The

problem of identification in nonlinear systems is not treated since it has not been fully solved. The extension of econometric investigations into nonlinear problems gives water researchers important additional flexibility in their empirical investigations. This article, therefore, has relevance to improving the general econometric methodology that is available to water analyses. (Loeb-Rutgers)
W69-06562

LINEAR PROBABILITY FUNCTIONS AND DISCRIMINANT FUNCTIONS,
Iowa State Univ. of Science and Technology, Ames.
George W. Ladd.
Econometrica, Vol 34, No 4, pp 873-885, October 1966. 13 p, 1 fig, 10 ref.

Descriptors: Regression analysis, Probability.
Identifiers: *Linear probability function, *Discriminant function.

Linear probability functions are briefly discussed and the theory of linear discriminant functions in the two-class case is then presented. Such a function, which is a linear combination of observed variables, is used to classify each observed item into one of two classes. Certain identities between the two types of functions are obtained. Whereas the results from the two different models are the same, their distributional assumptions and derivations are quite different. Several water recreation demand studies have used least squares regression techniques to estimate a binary dependent variable function. This article has relevance to these and similar studies since it presents the properties of other estimating techniques for qualitative dependent variable equations. (Loeb-Rutgers)
W69-06563

MAXIMIZATION BY QUADRATIC HILL-CLIMBING,
Princeton Univ., N. J.
Stephen M. Goldfeld, Richard E. Quandt, and Hale F. Trotter.
Econometrica, Vol 34, No 3, pp 541-551, July 1966. 11 p, 4 tab, 9 ref, 1 append.

Descriptors:
Identifiers: *Maximization, *Quadratic hill-climbing, *Gradient method, Algorithm, Concavity, Quadratic approximation, FIML, Eigenvalue, Newton's method.

The purpose of this paper is to describe a new gradient method for maximizing general functions. After a brief discussion of various known gradient methods the mathematical foundation is laid for the new algorithm which rests on maximizing a quadratic approximation to the function on a suitably chosen spherical region. The method requires no assumptions about the concavity of the function to be maximized and automatically modifies the step size in the light of the success of the quadratic approximation to the function. The paper further discusses some practical problems of implementing the algorithm and presents recent computational experience with it. This type of procedure may be helpful to the researcher in the field of water problems using econometric iterative procedures. (Loeb-Rutgers)
W69-06564

TESTING SINGLE-EQUATION LEAST SQUARES REGRESSION MODELS FOR AUTOCORRELATED DISTURBANCES,
Michigan State Univ., East Lansing.
Richard C. Henshaw, Jr.
Econometrica, Vol 34, No 3, pp 646-660, July 1966. 15 p, 3 tab, 9 ref.

Descriptors: *Regression analysis, Statistical models, Markov processes.
Identifiers: *Autocorrelated disturbances, *Regression models, von Neumann ratio, Durbin-Watson test, Theil-Nagar test, Maximum likelihood estimates.

The basic theory upon which several well-known tests of the independence of least squares regression disturbances are based is reviewed and then applied to formulate a testing procedure which is inexpensive when a large-capacity, high speed electronic computer is employed. Investigations to date indicate that the significance points of the von Neumann ratio, which can be obtained by this procedure, are accurate to the order required in practical work even when the number of degrees of freedom is small, and the test is always conclusive. This is encouraging since the results from attempts to apply the Durbin-Watson or the Theil-Nagar tests frequently may be inconclusive or of doubtful accuracy. Consideration is also given to the question of what to do when the null hypothesis of residual independence is rejected. Water demand and flow simulation equations using small sample time series data can refer to the conclusions of this article when treating the validity of random residual behavior in the particular estimated equations. (Loeb-Rutgers)
W69-06565

SPECIFICATION ANALYSIS IN THE ESTIMATION OF PARAMETERS OF A SIMULTANEOUS EQUATION MODEL WITH AUTOREGRESSIVE RESIDUALS,
Stanford Univ., Palo Alto, Calif.
Takeshi Amemiya.
Econometrica, Vol 34, No 2, pp 283-306, April 1966. 24 p, 4 tab, 10 ref.

Descriptors: *Estimating, Stochastic processes.
Identifiers: *Specification analysis, *Estimation, *Modified two-stage least squares, *Two-stage least squares, *Simultaneous equation model, *Autoregressive residuals, Bias.

Several related estimators of the parameters of a single equation of a simultaneous equation model are proposed. They are shown to be consistent and asymptotically efficient when the residual of the equation follows the first-order autoregressive process. One of the estimators, called MS2SLS, is designed to be consistent under a more general assumption about the stochastic process of the residual. A numerical analysis shows that the efficiency of MS2SLS is much higher than that of 2SLS under a general assumption about the stochastic process of the residual. As such, this might be of aid to researchers analyzing water problems via econometric methods. (Loeb-Rutgers)
W69-06567

A PARAMETRIC SIMPLICAL FORMULATION OF HOUTHAKKER'S CAPACITY METHOD,
Groningen Rijksuniversiteit (Netherlands); and Virginia Univ., Charlottesville, Va.
C. Van De Panne, and Andrew Whinston.
Econometrica, Vol 34, No 2, pp 354-380, April 1966. 27 p, 2 fig, 7 tab, 7 ref.

Descriptors: Constraints, Linear programming.
Identifiers: *Houthakker's capacity method, *Quadratic programming, Simplex method, Dual method, Parametric simplical formulation, Quadratic simplex tableaux.

The paper reformulates Houthakker's capacity method for quadratic programming in the framework of the simplex and dual methods for quadratic programming, thereby greatly reducing the conceptual and computational complexities of the method. It is shown that the method is applicable for all convex quadratic programming problems, including the case of a semi-definite matrix of the quadratic form and that of constraints in equality form. In the linear programming case the method reduces to a parametric version of the dual method. In view of the increasing use of computers and computer problem solving by water researchers, this paper may prove to be relevant to certain water area problems. (Loeb-Rutgers)
W69-06568

SIMULTANEOUS TESTS FOR TREND AND SERIAL CORRELATIONS FOR GAUSSIAN MARKOV RESIDUALS,
Aerospace Research Labs., Wright-Patterson AFB, Ohio; and Douglas Aircraft Co., Inc., Santa Monica, Calif.
P. R. Krishnaiah, and V. K. Murthy.
Econometrica, Vol 34, No 2, pp 472-480, April 1966. 9 p, 9 ref.

Descriptors: *Markov processes.
Identifiers: *Simultaneous tests, *Trend, *Serial correlation, *Gaussian Markov residuals, Autocorrelation, Confidence interval, First order Markov process.

By extending a result of Ogawara, the problem of estimating the trend parameters when the residuals are serially correlated according to an hth order stationary Gaussian Markov process is reduced to the classical case where the residuals are uncorrelated and hence independent in view of normality. In this paper the problems of testing for the trend and other simultaneous hypotheses on the parameters are considered when the residuals are respectively a first and a general hth order Markov process of normal variates. Exact tests are obtained for testing the trend in the presence of autocorrelation and also for testing the trend and autocorrelation simultaneously in a first order Markov process. The simultaneous confidence bounds associated with these tests are also derived. These results are extended to the hth order Markov process. For a general stationary Markov process, exact tests are proposed for testing the hypothesis of (i) no trend in the presence of serial correlation, (ii) independence among error, and (iii) independence and no trend among errors. Water flow simulation studies employing Markov schemes will find this paper applicable to the issues and problems of such models. (Loeb-Rutgers)
W69-06569

NONRECURSIVE MODELS AS DISCRETE APPROXIMATIONS TO SYSTEMS OF STOCHASTIC DIFFERENTIAL EQUATIONS,
London School of Economics and Political Science (England).
A. R. Bergstrom.
Econometrica, Vol 34, No 1, pp 173-182, January 1966. 10 p, 1 tab, 9 ref.

Descriptors: Estimating, Approximation method.
Identifiers: *Nonrecursive models, *Discrete approximation, *Differential equations, Specification error, Restrictions, Reduced form parameters, Variance.

This article is concerned with the specification error implied by the use of a non-recursive model as a discrete approximation to a system of stochastic differential equations. One of these questions considered is whether, in view of this specification error, it is better, for the purpose of prediction, to ignore the overidentifying restrictions and estimate the reduced form parameters directly. Another is the question of how to make the best use of the estimates of the parameters of the approximate model in order to obtain estimates of the parameters of the exact model. These questions are relevant to water research investigations using a non recursive model as a framework for portraying the water market. (Loeb-Rutgers)
W69-06571

SUBSTATION EXPANSION, RELIABILITY, AND TRANSFORMER LOADING POLICY ANALYSIS,
Cleveland Electric Illuminating Co., Ohio; and Westinghouse Electric Corp., Pittsburgh, Pa.
W. R. Ossman, R. C. Craft, and N. H. Woodley.
Pap 69 TP 35-PWR, Inst Elec Electron Eng Winter Power Meet, New York, N Y, Jan 1969. 10 p, 10 fig, 1 tab, 4 ref.

Descriptors: *Probability, *Reliability, Power transformers, Risks, *Substations (Electrical),

oading rate, *Policy matters, *Expansion, Veather data, Growth rates, Temperature, Electrial equipment, Losses, Economics, Operating osts, Investment, Capital costs, Replacement osts, Computer programming.
dentifiers: Analytical method, *Service life, Ouges.

he first known attempt to apply probability ethods to the evaluation of substation expansion lans and transformer loading policies is discussed. he method (using local historical substation load nd ambient temperature environmental condions) develops the probabilities of exceeding maxnum transformer temperatures and the expected ss of transformer life. Alternate substation expanon plans to meet the forecast area load are comared on the basis of cost versus reliability. The acptable risk value can be used as the threshold risk vel for triggering the installation of new substaon capacity in the system area represented. The ethod will produce uniform risk values roughout the simulated expansion pattern. If the xpansion pattern is followed in loading throughout power system, a substation operation policy ased on uniform risk will result. (USBR)
/69-06685

NTERREGIONAL PRODUCTION AND WATER ESOURCE DEPENDENCIES AMONG THE VESTERN STATES,
ritish Columbia Univ., Vancouver.
or primary bibliographic entry see Field 06B.
/69-06721

PTIMALITY OF IMPERFECTLY COMPETIIVE RESOURCE ALLOCATION,
ase Western Reserve Univ., Cleveland, Ohio.
or primary bibliographic entry see Field 06C.
/69-06722

UASILINEARIZATION APPROACH TO THE DENTIFICATION OF HYDROLOGIC YSTEMS,
alifornia Univ., Los Angeles. Dept. of Engineerng; and Nevada Univ., Reno. Dept. of Water esources.
or primary bibliographic entry see Field 02A.
/69-06822

YSTEMS APPROACH FOR INTEGRATING ROUND WATER AND SURFACE WATER SE.
erojet-General Corp., El Monte, Calif. Environental Systems Div.; and Engineering-Science, nc., Arcadia, Calif.

vailable from Clearinghouse as PB 184 236 at 3.00 in paper copy and $0.65 in microfiche. erojet-Gen Corp Rep no 1175 F to Office Water esources Res, Dept of Interior, Nov 1968. 100 p, 4 fig, 5 tab, 37 ref. OWRR Contract no 14-01-001-1521.

escriptors: *Water resources, *Water supply, Water utilization, *Systems analysis, *California, Mathematical models, Computers, Decision makng, Water policy, Water management (Applied), Surface waters, Groundwater, Irrigation water, Municipal water, Water reuse.
dentifiers: Fresno (Cal).

A systems approach to conjunctive groundwaterurface water use integrates many relevant factors uch as water needs, projected needs, water availaility, water chemistry, water quality, legal aspects, inancial aspects, costs, benefits, and sociological spects. Historical data for the Fresno area, California, were analyzed as a basis for projections o the year 2000. Agricultural demand is predicted o decrease from 93 to 86% of total demand in the rojection period 1967-2000, while municipal and ndustrial demand will increase from 7 to 14%. Total demand is expected to increase from about 3 o about 5 million acre-ft per year. Water sources are surface water from the Kings River System (80%), San Joaquin System (18%), and foothill runoff (2%), groundwater, and direct precipitation. Surface sources can supply about 37% of total demand, direct precipitation 4.5%, and groundwater, 63.5%. All the projected increase must come from groundwater, and water levels are already declining at an average annual rate of 2 ft, and projected rates will lower levels from 60 ft in 1967 to 275 ft in 2000. With heavy pumping, salt concentration will reach 320 mg/liter by 2000. Agricultural water costs are $2.40/ac-ft for surface water and $11.60/ac-ft for groundwater, while municipal users are charged $34.40/ac-ft. Water law and proposals for water reclamation are outlined. (Knapp-USGS)
W69-06834

6B. Evaluation Process

WATER RESOURCES AND THE URBAN ENVIRONMENT,
Virginia Polytechnic Inst., Blacksburg.
For primary bibliographic entry see Field 04C.
W69-06428

INTERGOVERNMENTAL PLANNING OF WATER RESOURCES,
Water Resources Council, Washington, D. C.
Harold G. Wilm.
Ground Water, Vol 7, No 2, pp 15-17, Mar-Apr 1969. 3 p.

Descriptors: *Water resources development, *Planning, Water Resources Planning Act, Water Resources Research Act, Interstate commissions, Optimum development plans, River basin development.
Identifiers: *Water Resources Council.

The 20th century has seen dramatic increase of activity in the water resources development field, with a concomitant increase in Federal participation. A Senate Select Committee's report was the basis for the Water Resources Research Act of 1964 and the Water Resources Planning Act of 1965. The objective of the Water Resources Planning Act is to provide for optimum development of water resources through the Water Resources Council and several River Basin Commissions, and by providing financial assistance to the States in order to increase State participation in water resources planning. River basin studies include population, economic development, and water supply and water use data projected as far as the year 2020. The Water Resources Council also prepares a biennial assessment of the adequacy of water supplies in each water resource region in the United States. For this purpose a river basin model is being prepared for 300 basins, incorporating economic concepts for determination of optimum water use alternatives. Under Title I of the Water Resources Planning Act is the preparation of guidelines for all Federal participants in comprehensive regional water planning, and for the formulation and evaluation of Federal water resources projects of all types. The Council also is working on specific proposals for improved floodplain management. Title II of the Act authorizes the President to establish river basin commissions at the request of one or more States and with concurrence by the Council. Title III provides a basis for increased participation by the States by granting of matching funds. All but two States are now taking part in the State Grant program. (Knapp-USGS)
W69-06429

THE INFLUENCE OF OWNERSHIP AND CONTROL ON PROFIT RATES,
Missouri Univ., Columbia.
David R. Kamerschen.
American Economic Review, Vol LVIII, No 3, pp 432-447, June 1969, 15p, 2 tab, 20 ref.

Descriptors: *Profit, Return, Management, Industries, Growth rates.
Identifiers: Management control, Barriers to entry, Ownership, Industry growth, Rates, Assets.

This study extends Larner's analysis to determine whether the extent of management control exerts an important influence on the rate of return in firms. The author submits that it does not. The main conclusions of the study where average profit rates on equity were the dependent variable are these: (1) Two of the management-related variables with which Larner was concerned do not appear to explain much of the variation in profit rates. However, a dummy variable measuring a change in the ultimate control from non-management to management had a significant positive coefficient. This is apparently at variance with most of the non profit maximization theories of the firm that stress the importance of nonpecuniary motives of managers. (2) Other variables which seem to be the proximate determinants of rates of return and for which theoretical support can be given are total assets, barriers to entry and industry growth rate. This article may be relevant in helping to evaluate questions concerning whether water resources and supplies should be developed in a private market or public good framework. (Winn-Rutgers)
W69-06545

IMPLICATIONS OF PROPERTY RIGHTS FOR GOVERNMENT INVESTMENT CHOICES,
George Washington Univ., Washington, D. C.
Louis De Alessi.
American Economic Review, Vol LIX, No 1, pp 13-24, March 1969, 11 p, 41 ref.

Descriptors: *Cost-benefit analysis, *Decision making, Costs, Benefits, Discount rate, Governments, Investments.

The government has been making increased use of cost-benefit analysis as a device for discriminating among alternative governmental investment options. One limitation of this analysis which has not been fully recognized is the bias inherent in decisions made in an environment marked by the absence of private property rights. Section I of this paper suggests that in a wider variety of cases than may be generally recognized, cost-benefit analysis cannot yield an unambiguous ranking of projects under consideration. Moreover, present value benefit-cost data frequently mask information relevant to the choice. Section II briefly presents a utility maximization model and shows some of its implications for decision making within the government. Section III considers some aspects of the current debate on what discount rate should be used in evaluating government investments. This article is relevant for the selection of projects in a water resource development program via cost-benefit criteria. (Winn-Rutgers)
W69-06548

ECONOMIC ANALYSIS OF THE DEVELOPMENT POTENTIAL OF THE COMMERCIAL FISHERIES INDUSTRY OF THE COASTAL PLAINS REGION,
Clemson Univ., S. C.
J. C. Hite, and J. M. Stepp.
Economics of Marine Resources, No 1, Clemson, Clemson University, 1969. 78 p, 7 fig, 13 tab, 18 ref.

Descriptors: *Fisheries, *Coastal Plains, Marine fisheries, Commercial fishing, Industries, Regions, Georgia, North Carolina, South Carolina, Income, Employment opportunities, Marketing, Export, Agriculture, Supply, Economics, Regional analysis, Shrimp, Oysters.
Identifiers: *Export base concept, Processing facilities, Regional development.

The principal purpose of this report is to examine the development potential of the commercial fisheries of the Coastal Plains in terms of its ability to generate income and improve the economic well-being of the people in the Region. The export base concept is used as a framework for this examina-

tion. It is noted that increases in regional income are directly related to increases in the level of exports from the Coastal Plains Region to other regions, and consequently, the development potential of the commercial fisheries industry is dependent upon its current position in the economic base of the Region and its ability to successfully engage in interregional competition. It is concluded that the potential growth in regional income which can be stimulated by increasing the exports of the commercial fisheries' products from the Region is somewhat limited. (Winn-Rutgers)
W69-06554

ECONOMIC EFFECTS OF MINERAL CONTENT IN MUNICIPAL WATER SUPPLIES.
Black and Veatch, Kansas City, Mo.
For primary bibliographic entry see Field 03A.
W69-06555

A FEASIBILITY STUDY ON THE UTILIZATION OF WASTE BRINE FROM SALINATION PLANTS: PART 1,
Brigham Young Univ., Provo, Utah; and Dow Chemical Co., Midland, Mich.
For primary bibliographic entry see Field 03C.
W69-06556

THE POTENTIAL CONTRIBUTION OF DESALTING TO FUTURE WATER SUPPLY IN TEXAS.
Southwest Research Inst., Houston, Tex.; and Texas Water Development Board, Austin.
For primary bibliographic entry see Field 03A.
W69-06558

MANUAL OF PROCEDURES AND METHODS FOR CALCULATING COMPARATIVE COSTS OF MUNICIPAL WATER SUPPLY FROM SALINE AND CONVENTIONAL WATER SOURCES IN TEXAS,
Southwest Research Inst., Houston, Tex.; and Texas Water Development Board, Austin.
For primary bibliographic entry see Field 03A.
W69-06559

AGGREGATE KOYCK FUNCTIONS,
Oregon Univ., Eugene.
G. O. Bierwag, and M. A. Grove.
Econometrica, Vol 34, No 4, pp 828-832, October 1966. 5 p, 10 ref.

Descriptors: Income, Regression analysis.
Identifiers: *Aggregate Koyck function, Random variable, Adaptive expectation, Pascal distributed lag, Expectations, Nerlove's model of supply, Permanent income.

The specification of dynamic relations in economic theory often requires knowledge of the expectations of economic units. Since direct evidence of the way in which expectations are formed is rarely available, it is often assumed that expectations of the future value of a given variable depends on part observed values of the variable. The distributed lag function of Koyck is a convenient representation of this functional dependence and has been widely employed in the literature. An interesting problem arises, however, when the expectations relevant to a model represent an aggregation of the expectations of individual transactors. In a variety of models, some of which are explored in this paper, the aggregate expectation in the market may be regarded as a weighted average of the expectations of individual transactors. Given this form of aggregation, it is demonstrated that if each individual transactor's expectation function is a Koyck function, the aggregate expectation function is not a Koyck function unless the expectation of individual transactors are identical. The role of expectations in water demand and supply functions is of importance due to the uncertainty of water supply conditions and therefore this article has relevance to attempts to introduce aggregate expectations in water analysis. (Loeb-Rutgers)
W69-06561

CONFERENCE ON WATER DECISIONS IN THE CRITICAL 1960's,
California University, Davis. Water Resources Center.
Robert Hagan, and Vincent Lawton.
Water Resources Center Rept. No. 3. See also W69-06573 thru W69-06583. Proceedings of Conference at University of California at Davis, Jan 11-13, 1961.

Descriptors: *Water policy, *Water allocation (Policy), Water quality, Water demand, Legal aspects, Agriculture, Industries, Domestic water, Recreation, Economics, Nuclear energy, Desalination, California.

This book contains the proceedings of a water policy conference held at the University of California at Davis. The purpose of the conference was to help provide the background for water decisions to be made. The book contains five major subdivisions. The first section outlines the challenges ahead. The next section describes the competition for water quality, while the third part describes the competition for water quantity. Some of the choices which have to be made in a water resource development program are presented in the following section. The last section discusses the status of atomic energy and sea water conversion. (Winn-Rutgers)
W69-06572

NUCLEAR REACTORS,
California Univ., Berkeley.
For primary bibliographic entry see Field 03A.
W69-06582

ALLOCATION AND REALLOCATION OF WATER RESOURCES,
Department of the Interior, Washington, D. C.; and Corps of Engineers, Washington, D. C.
Elmo R. Morgan, F. P. Koisch, and Floyd E. Dominy.
J Amer Water Works Ass, Vol 61, No 1, pp 17-30, Jan 1969. 14 p.

Descriptors: *Water resources, *Policy matters, Planning, *Investment, Project planning, *Fish and wildlife, *Groundwater, Legal aspects, Water law, *Water allocation (Policy), Cost allocation, Water quality, *Water resources development, Northeast U.S., Resource development, *Resource allocation.
Identifiers: North Atlantic Basin, Bureau of Reclamation, Corps of Engineers.

National policy, project planning approaches, public investment, fish and wildlife, and groundwater aspects of water resources allocation were presented in a joint discussion at the Annual Conference of the American Water Works Association. The conference was held in Cleveland, Ohio, in June 1968. Among the points discussed were : (1) responsibilities, interpretation, analysis, legal powers, and flexibility of a National policy; (2) the North Atlantic and Northeastern Regional Water Resources Studies of the Corps of Engineers; (3) economic policy of the Bureau of Reclamation regarding water resources projects; (4) values and benefits of fish and wildlife on water resource projects; and (5) the role ground-water management plays in allocation of water resource development. (USBR)
W69-06691

THE CES PRODUCTION FUNCTION: A DERIVATION,
Rutgers - The State Univ., New Brunswick, N. J.
V. Kerry Smith.
The American Economist, Vol 13, No 1, pp 72-76, Spring 1969. 5 p, 4 fig, 4 ref.

Descriptors: Leontief models, Input-output analysis.
Identifiers: *CES production function, *Elasticity of substitution, Marginal rate of substitution, Cobb-Douglas production function.

The Constant Elasticity of Substitution production function provides a whole new dimension to productive relationships. By permitting the elasticity to take on values different from zero or one, it enables a more explicit treatment of the technological structure 'in back of' production. This paper suggests a two stage derivation procedure which first examines the economic implications of the constancy of the elasticity of substitution, and then builds upon this foundation a simplified derivation of the CES function. A graphical illustration is provided indicating that the greater the value of the elasticity of substitution, the flatter the constant product curve or isoquant, and correspondingly the more slowly does the marginal rate of substitution of capital for labor increase as one factor is substituted for the other. This article would be relevant to the water researcher concerned with both theoretical and empirical water supply and production analysis. (Loeb-Rutgers)
W69-06720

INTERREGIONAL PRODUCTION AND WATER RESOURCE DEPENDENCIES AMONG THE WESTERN STATES,
British Columbia Univ., Vancouver.
H. Craig Davis.
Western Economic Journal, Vol 7, No 1, pp 27-40, March 1969. 14 p, 5 tab, 17 ref.

Descriptors: *Input-output analysis, Regions, Arizona, California, Idaho, New Mexico, Oregon, Utah, Washington, Nevada, Montana, Water resource development, Water transfer.
Identifiers: *Interregional production, *Water resource dependencies, *Western states, Western Pacific states, Montain states.

In the last five years a considerable portion of the research in the area of regional economics has been directed towards the construction of input-output models. Of the eleven continental western Pacific and Mountain states, no fewer than seven--Arizona, California, Idaho, New Mexico, Oregon, Utah, and Washington--have completed input--output studies of their respective state economies. In addition, plans have been formulated for the construction of input-output tables for at least two more western states, Nevada and Montana. The purpose of the present paper is to set forth some of the methods by which these state input-output models can be utilized for the analysis of interregional interdependencies, partifularly in the area of water resource development which is a subject of increasing concern in the western United States. The methods discussed are illustrated wherever possible with the results of empirical research pertaining to the eleven western states. (Loeb-Rutgers)
W69-06721

THE GENERAL WATER SCHEME - AN ESSENTIAL BASIS FOR THE MOST RATIONAL USE OF WATER RESOURCES,
Heinz Muhleck.
For 8 volume Proceedings see Vol 2, No 9, Field 06B, W69-03305. International Conference on Water for Peace, Vol 6, Washington, D C, U S Government Printing Office, pp 192-199, 1968. 8 p.

Descriptors: *Water management, *Water resources, *Water balance, Legal aspects, Water quality, Future planning, Flood protection, Water pollution control.
Identifiers: *General Water Schemes, Federal Republic of Germany, Comprehensive survey.

In every river basin, there are many possibilities to make use of the water resources for meeting the demands. To ascertain such possibilities, to compare these with each other and to appraise them by having regard to the supraregional viewpoints and tak-

ing into consideration the water economy is the actual work of the planning expert. The general water schemes are established under the direction of an engineer, but are the joint work of quite a number of technical disciplines, ranging from meteorologists, hydrologists, geologists, limnologists and many other technical faculties of natural science, to socioeconomists. In the Federal Republic of Germany, general water schemes were already established prior to the coming into force of the Directives, and which, in principle, correspond to the Directives. In particular, in Land Hessen, various general water schemes have been elaborated and others are under consideration in connection with a comprehensive regional planning scheme, the 'Grobe Hessenplan.' (Sokoloff-Rutgers)
W69-06724

SOME POSSIBLE ROLES FOR INSTITUTIONS AND ECONOMICS IN WATER RESOURCE MANAGEMENT,
Adam A. Sokoloski.
For 8 volume Proceedings see Vol 2, No 9, Field 06B, W69-03305. International Conference on Water for Peace, Vol 6, Washington, D C, U S Government Printing Office, pp 226-242, 1968. 17 p, 2 fig, 1 tab.

Descriptors: *Water quality, *Water management, *Institutions, *Pacific Northwest U S, Resource allocation, Effluents, Estuarine environment, Decision-making, Benefits, Legal aspects.
Identifiers: *Resource use planning, *Inter-industry sectors, *Yaquina River, External effects, Common ownership, Economic development.

This is a discussion of both a procedure for estimating economic values associated with alternative resource use patterns as well as the process of incorporating these alternatives into the existing resource management institutions. With appropriate modifications the adoption of this procedure is possible in any region of the world. The specific steps are as follows: (1) at the outset-identification and specification of all alternatives; (2) the inclusion of technical measures associated with every related discipline, (3) an appreciation of the degree of common ownership and external effects, and therefore the need for public participation; (4) the derivation of local secondary effects to fully appreciate the magnitude of the economic results of each alternative; (5) the establishment of a continuing data collection and utilization scheme; (6) the characterization of the existing water laws as related to the alternatives considered; (7) the evaluation of existing public water management units to determine the appropriate location and form of the derived management process; (8) the resolution of economic solutions and institutional receptivity to these solutions to determine either the economic alternative acceptable within the present institutional framework, or the institutional modification required to enact a given resource use plan. (Sokoloff-Rutgers)
W69-06725

REGIONAL PLANNING FOR WATER DEVELOPMENT IN THE WESTERN UNITED STATES - THE RELEVANCE OF AMERICAN EXPERIENCE FOR OTHER NATIONS,
Ernest A. Engelbert.
For 8 volume Proceedings see Vol 2, No 9, Field 06B, W69-03305. International Conference on Water for Peace, Vol 6, Washington, D C, U S Government Printing Office, pp 256-268, 1968. 13 p, 2 fig.

Descriptors: *Water supply, *Long-term planning, *Multiple purpose projects, Irrigated land, Hydroelectric power, Municipal water, Federal government, Water distribution, Inter-basin transfers, Urbanization, Pricing.
Identifiers: *Western United States, *Water resources planning, Basin account.

Many other nations of the world are faced with some of the same conditions of water development that confront the Western United States. With the aid of hindsight, some conclusions may be drawn from American experience which may have relevance for countries which are moving forward with major water resources programs. The implication, however, should not be drawn from this that the United States does not likewise benefit from the accomplishments of other lands. Indeed, from the beginnings of irrigation to modern-day pollution control, the United States has drawn much from the experiences and practices of foreign cultures. Looking to the future, much exchange of information and knowledge will have to take place continuously among all nations, if the water resources needs of the world's populations are to be met. However, not until most Western water developments had taken shape could meaningful conclusions concerning desirable and undersirable trends be reached. (Sokoloff-Rutgers)
W69-06726

PLANNING AND DEVELOPMENT OF WATER RESOURCES IN INDIA,
K. L. Rao.
For 8 volume Proceedings see Vol 2, No 9, Field 06B, W69-03305. International Conference on Water for Peace, Vol 7, Washington, D C, U S Government Printing Office, pp 390-402, 1968. 13 p.

Descriptors: *River systems, *Water resources development, Storage capacity, Hydroelectric power, Groundwater, Irrigation, Flood control.
Identifiers: *Rainfall pattern, *Surface flows, Tubewells.

In India, the supply of water to land is not adequate. Out of a cultivated area of 158 million hectare, only about 23 percent is irrigated. With such low density of water supply, a tropical country cannot raise sufficient food-grains to feed a vast and thickly populated country like India. An adequate number of irrigation projects to supply water to at least 50 percent of the cultivated area have to be executed. Another reason for water supply is that rice, the main staple grain grown and used in India, is a plant which needs irrigation. Hence India's first and foremost need is the maximum possible extension of water supply. Hydroelectric power generation in India has a great future. Only 10 percent out of the total potential of 41 million kw, has been developed up to the end of the third plan. There is, therefore, ample scope for future development. (Sokoloff-Rutgers)
W69-06728

KANSAS RIVER BASIN FLOOD CONTROL,
Willia L. Northrop, and Clifford J. Phillips.
For 8 volume Proceedings see Vol 2, No 9, Field 06B, W69-03305. International Conference on Water for Peace, Vol 7, Washington D C, U S Government Printing Office, pp 814-834, 1968. 21 p, 8 fig, 3 tab, 7 ref.

Descriptors: *Flood control, *Flood protection, *Water resources development, Irrigation, Water Resources Planning Act.
Identifiers: *Kansas River Basin, *Bureau of Reclamation, *Corps of Engineers, *Electric Flood Model, *Digital computer, Reservoir regulation techniques.

While no one would expect to use a water management plan tailor-made for the Kansas Basin in another area, the principles and experiences can be used in many areas. The fact that planning began prior to full development and has been adjusted to fit basin needs makes it relevant in many ways to problems that will be encountered in undeveloped areas. Hydrologic engineering techniques, project formulation procedures, financing, construction methods, and adjustments necessitated by the projects are all significant factors. Adoption of a complete and practicable master plan for reservoir regulation coincident with the formulation of reservoir projects would be advantageous both to planning and to subsequent regulation of the completed facilities. The digital computer programs and the Electric Flood Model described in the paper could be adopted to flood regulation in many basins with problems quite at variance with the Kansas River Basin. (Sokoloff-Rutgers)
W69-06729

WATER TRANSPORTATION-IMPACT ON ECONOMIC DEVELOPMENT,
Walter J. Willis, and David L. Armstrong.
For 8 volume Proceedings see Vol 2, No 9, Field 06B, W69-03305. International Conference on Water for Peace, Vol 7, Washington, D C, U S Government Printing Office, pp 905-915, 1968. 12 p, 18 ref.

Descriptors: *Industrial production, Transportation, Resource allocation, Political aspects.
Identifiers: *Water transportation, *Economic development, Non-destructive use, Market economy, Market structure, Ports, Social attitudes.

The thesis of this paper is that throughout the world the urge of governments, researchers, and the people is economic development. Economic development in itself is extremely slow, often impersonal and very complex. However, the direction given by those involved in economic development provides the conscience of all planning. Economic planning implies growth. It is argued that for this growth to occur there is a need for greater production specialization which can be possible only if there is interregional trade. For such trade to develop, there must be an efficient transportation system. In either a developed or an emerging country, a fully developed water transport system is a valuable asset. Recognizing that an integrated transportation system is important, the relative advantage of water transportation in moving many goods and material of the extractive industries and as an impetus to industrial growth is empirically unquestioned. It is recognized, however, that a developed transportation system is a necessary but not a sufficient factor to assure this economic development goal. (Sokoloff-Rutgers)
W69-06730

ESTIMATION OF RETURNS TO SCALE AND THE ELASTICITY OF SUBSTITUTION,
Stanford Univ., Calif.
G. S. Maddala, and J. B. Kadane.
Econometrica, Vol 35, No 3-4, pp 419-423, July-October 1967. 5 p, 3 tab, 3 ref.

Descriptors: *Returns to scale, Monte Carlo method.
Identifiers: *Elasticity of substitution, *CES production function, production function, Cobb-Douglas production function, Bias, Kmenta's procedure.

This paper concerns itself with the following problem: Suppose the true production function is of the CES type with constant returns to scale. If we fit an unrestricted Cobb-Douglas production function instead, what is the nature of the bias in the estimate of the returns to scale parameter. The authors conclude that under some circumstances a misspecification of the elasticity of substitution, sigma can result in a substantial bias in the estimates of returns to scale. The authors feel that it is preferable to use the Kmenta approximation to the CES function rather than use the Cobb-Douglas production function. Applying Theil's formula for specification errors to the Kmenta approximation helps investigate the direction of the bias. The authors' findings suggest that in the case they investigated where L and K are independently and uniformally distributed, and where the Cobb-Douglas approximation gives a biased estimate of returns to scale, the bias in the estimates of returns to scale obtained by the Kmenta procedure is negligible while the Kmenta estimates of sigma are not reliable. Water supply analysis implicitly is based on economic production theory and thus, this article extends the area of econometric investigations into production function analysis and

may be of relevancy to empirical water research in water supply problems. (Loeb-Rutgers)
W69-06732

COST, PRECISION, AND VALUE RELATIONSHIPS OF DATA COLLECTION AND DESIGN ACTIVITIES IN WATER DEVELOPMENT PLANNING,
California Univ., Berkeley, Calif.
Stephen V. Allison.
Water Resources Center, Contribution No 120, Technical Report 6-27, May 1967. 142 p. OWRR Project A-003-CAL.

Descriptors: *Data collections, *Value, *Mathematical models, Cost allocation, Costs, Statistics, Measurement, California, Planning, Model studies, Computer models, Decision making, Hydrologic data, Ground water basin.
Identifiers: Kern County, Precision, Mathematical decision techniques.

The problem of allocating available resources among the many diverse activities required in water development planning is presented. A method of solution based on mathematical decision techniques is proposed. The conceptual framework on which the proposed method is based depends on the relationship between the cost of the activity and the precision. The degree to which this precision affects the attainment of the overall objectives of the planning program is taken as a measure of the value of precision in each activity. The expression of these cost-precision and values of precision relationships in quantitative terms provides the basis for the application of mathematical decision techniques. The problem may be formulated either in terms of maximizing overall precision subject to a fixed budget constraint, or minimizing the cost of attaining a specified degree of overall precision. (Winn-Rutgers)
W69-06733

ON THE RELATIVE SMALL-SAMPLE PROPERTIES OF SEVERAL STRUCTURAL-EQUATION ESTIMATORS,
British Columbia Univ., Vancouver.
J. G. Cragg.
Econometrica, Vol 35, No 1, pp 89-110, January 1967. 22 p, 10 tab, 19 ref.

Descriptors: Estimating, Estimating equations, Least squares method, Regression analysis, Monte Carlo method.
Identifiers: *Small-sampling properties, Structural-equation estimators, *Estimators, Direct least squares, Two-stage least squares, LIML, FIML, Bias.

This paper reports on the results of some sampling experiments on six structural-equation estimators: direct least squares, two-stage least squares, Nagar's unbiased K-class estimator, limited-information maximum likelihood, three-stage least squares and full-information maximum likelihood. Sensitivity of the relative performances of the estimators to the parameter values chosen in the models and to the values of the exogenous variables is studied. It is found that differences among the estimators are not great and that they are sensitive to the parameters used. In light of the extensive use of stochastic econometric estimating techniques in problems dealing with water research, this article presents some interesting comparisons between estimation methods that will be of relevancy to empirical water research studies. (Loeb-Rutgers)
W69-06734

CANONICAL CORRELATION AND MULTIPLE EQUATION SYSTEMS IN ECONOMICS,
Australian National Univ., Canberra.
E. J. Hannan.
Econometrica, Vol 35, No 1, pp 123-138, January 1967. 16 p, 5 ref.

Descriptors: Economics, Regression analysis.
Identifiers: *Canonical correlation, *Multiple equation systems, LISE, Estimation, Two-stage least squares, Three-stage least squares, Identification.

The LISE technique is extended to deal with certain subsystems of a full system which are of a special type. It is shown that any completely identified system can be uniquely decomposed into maximal subsystems of this type. The relation of the estimation procedure to certain classical statistical estimation procedures is discussed. The use of limited information simultaneous equation methodology may be of relevance to the researcher dealing in water problems when complete or simultaneous econometric models are used to represent the water market or system. (Loeb-Rutgers)
W69-06735

THE ROLE OF ALTERNATIVE COST IN PROJECT DESIGN AND SELECTION,
Wisconsin Univ., Madison.
Peter O. Steiner.
Quarterly Jour of Economics, Vol 79, No 3, pp 417-430, August 1965. 14 p.

Descriptors: *Alternative costs, Benefits, Costs.
Identifiers: *Project design, *Project selection, Public expenditures, Benefit measurement, Public project, Private project, Choice, Government action.

In this article the author addresses the problem of under what conditions can we avoid, limit, or make more manageable the difficult problem of benefit estimation. It is assumed throughout the paper that it is easier to evaluate the cost of anything than to estimate the benefits that accrue therefrom. As such, the central question here addressed is when and to what extent can the cost of an alternative project substitute for or provide limits to benefit measurement. The author finds that in some cases alternative costs substitute for benefits, in others they provide upper limits to benefits, and in still others they provide minimum target levels that benefits must reach for choices that have to be made. The problem is complicated because a specific proposed public project may have differing alternatives. The basic strategy of this paper is to set up what appears to be a limited model which considers only two public projects and two private projects. By varying assumptions about: (1) what is alternative to what; (2) what combinations of projects are compatible; (3) what institutional rules govern the selection of projects; (4) what quantities and qualities of services are provided by individual projects, we can capture the flavor of many possibilities of the general problem, and define the extent to which alternative costs substitute for benefit measurement. (Loeb-Rutgers)
W69-06738

THE OPPORTUNITY COSTS OF PUBLIC INVESTMENT,
Harvard Univ., Cambridge, Mass.
Stephen A. Marglin.
Quarterly Jour of Economics, Vol 77, No 2, pp 274-289, May 1963. 16 p, 2 fig.

Descriptors: Discount rate, Pricing, Marginal productivity, Investment, Planning, Return.
Identifiers: *Opportunity cost, *Public investment, Shadow pricing, Marginal rate of time discount, Marginal social rate of discount, Private investment, Consumption.

This essay builds on the results of a previous article in exploring the implications for public investment planning of departures of the marginal productivity of private investment from the marginal rate of time discount appropriate for evaluating investment from the social point of view. The world assumed is one in which the marginal social rate of discount is less than the marginal productivity of private investment. In addition it is assumed that the government is unable to drive the marginal productivity of investment all the way down to the marginal social rate of discount by direct means or by indirect means. Public investment nevertheless competes with private investment as well as with private consumption for resources. In such a world the market undervalues resources earmarked for investment, and the interdependence of the levels of public and private investment obliges us to take this undervaluation into account in the planning of public investment. In this essay three methods--each appropriate under particular assumptions about reinvestment of returns--are proposed for evaluating a 'shadow price' of public investment funds that reflects the value at the marginal social rate of discount of the alternative use of funds in the private sector. This article has important ramifications for water projects involving the questions of social discount rates and public investment decisions. (Loeb-Rutgers)
W69-06739

CHOOSING AMONG ALTERNATIVE PUBLIC INVESTMENTS IN THE WATER RESOURCE FIELD,
Wisconsin Univ., Madison.
Peter O. Steiner.
AER, Vol 49, No 5, pp 893-916, December 1959. 24 p, 4 tab, 8 ref, 1 append.

Descriptors: *Water resources, Investment, Water resources development, Benefits, Costs, Marginal benefits, Marginal costs, Performance, Welfare.
Identifiers: *Public investment, Restraint, Opportunity costs, Objective function.

The problem of choosing among alternative public expenditures with particular reference to water resource development is discussed. As a classical problem in efficient resource allocation, there is a solution that is simple and well known. In a determined model the appropriate policy is to build every project for which benefits exceed costs and to develop every project to the point where marginal benefits equal marginal costs. There are several reasons why this solution is not satisfactory and which together make the choice of the best possible program a complex one which no simple marginal equivalence can handle. An operational framework is presented for choosing efficient programs subject to appropriate budget restraints, incompatibility restraints, and discreteness restraints while recognizing the full range of opportunity costs of any action. A model is developed which suggests how to assign a numerical value to every potential project so that it may be directly compared with every other project. Thus, the program may be chosen that will maximize the appropriate welfare criterion subject to all appropriate restraints. (Loeb-Rutgers)
W69-06740

DESALTED SEAWATER FOR AGRICULTURE: IS IT ECONOMIC,
Resources for the Future, Inc., Washington, D. C.
For primary bibliographic entry see Field 03F.
W69-06765

WATER FOR TEXAS,
Texas A and M Univ., College Station. Water Resources Inst.
J. R. Runkles.
Proc 13th Annu Conf on Water for Texas, Nov 25-26, 1968, Texas A and M Univ, 1968. 72 p, 22 fig, 6 tab, 39 ref.

Descriptors: *Planning, *Water resources development, *Texas, Systems analysis, Operations research, Water reuse, Data storage and retrieval, Water conservation, Desalination, Electrophoresis.
Identifiers: Texas water planning, Texas Water Development Board.

The 13th Annual Water for Texas Conference, 1968, was held to focus attention on the water needs of Texas, methods of determining and projecting needs, and methods of planning solutions for water problems. Topics of the papers in the

conference include operations research, systems analysis, water treatment by electrophoresis, and conservation of water. Plans of the Texas Water Development Board, the Corps of Engineers, and the Bureau of Reclamation are outlined. Information storage and retrieval services provided by the Department of Interior Water Resources Scientific Information Center are included. (Knapp-USGS)
W69-06790

CHESAPEAKE BAY CASE STUDY.
Trident Engineering Associates, Inc., Annapolis, Md.

Trident Eng Ass Inc, Sept 1968. 131 p, 56 ref. Available from Clearinghouse as PB 179 844 at $3.00 in paper copy and $0.65 in microfiche.

Descriptors: *Water quality, *Water utilization, *Water policy, *Maryland, *Virginia, Estuaries, Administration, Governments, Water law, Planning, Recreation, Regulation, Fishing, Navigation, Water pollution control.
Identifiers: *Chesapeake Bay.

The policies of the Maryland, Virginia, and U.S. Governments on the use, development, and pollution control of the Chesapeake estuary, and the effects of present use and policies on water quality are surveyed. There is no State control of water development and pollution abatement, but both states leave control to individual counties, which have no integrated, uniform, or consistent policies. State and Federal matching funds and grants encourage long-range planning, but do not have provision for certification by state or regional planning agencies. Some Federal statutes, particularly urban renewal statutes, even encourage local, municipal, or neighborhood control. Coordination of local plans is needed, as well as the establishment at a regional planning agency, if the quality of the area is to be maintained. A combined Federal-State-local agency for planning, enforcement, construction, and regional regulation of development of Chesapeake Bay in water quality, marine life, erosion control, commerce, zoning, parks, recreation, and fishing is recommended. (Knapp-USGS)
W69-06794

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

THE IMPACT OF PRICE ON RESIDENTIAL WATER DEMAND AND ITS RELATION TO SYSTEM DESIGN AND PRICE STRUCTURE,
Resources for the Future, Inc., Washington, D. C.; and Johns Hopkins Univ., Baltimore, Md.
For primary bibliographic entry see Field 06D.
W69-06502

PUBLIC UTILITY PRICING AND OUTPUT UNDER RISK,
Washington Univ., Seattle; and California Univ., Santa Barbara.
Gardner Brown, and Bruce Johnson.
American Economic Review, Vol LIX, No 1, pp 119-128, March 1969, 6 fig, 8 ref.

Descriptors: *Pricing, *Welfare (Economics), Risks, Public utilities, Demand.
Identifiers: Output, Riskless demand, Stochastic demand.

Most contributors to the theory of publicly produced private goods contend that any public authority that produces and sells a private good will discharge its responsibility in an optimal manner when it acts as if it were a competitive industry and prices at marginal cost. The purpose of this paper is to introduce elements of risk into the analysis. The authority is assumed to be confronted by a product demand function subject to a stochastic disturbance term. The social welfare function that the authority maximizes is the algebraic difference between expected willingness to pay and expected costs. It is concluded that the optimal price will always be lower and, with linear demand, the optimal output will generally be higher than their counterpart in the riskless model of traditional theory, regardless of the manner in which the disturbance term enters the analysis. The implication is that the authority will fail to recover its capital or capacity costs unless the environment includes perfect risk markets. This article has relevancy to important pricing decisions in the marketing of water by public agencies. (Winn-Rutgers)
W69-06549

HOUSEHOLD PRODUCTION AND CONSUMER DEMAND FUNCTIONS,
Chicago Univ., Ill.; and Institute for Defense Analyses, Arlington, Va.
For primary bibliographic entry see Field 06D.
W69-06566

CONSUMER ASPECTS OF PRICE INSTABILITY,
Department of Agriculture, Washington, D. C.
Frederick V. Waugh.
Econometrica, Vol 34, No 2, pp 504-508, April 1966. 5 p, 2 fig, 7 ref.

Descriptors: Prices, Pricing, Stability, Average.
Identifiers: *Price instability, *Price stability, Producers, Consumers, Index number.

Recent papers in Econometrica discussed price instability vs. price stability from the standpoint of producers. Oi demonstrated that the producer of any good could make more profits when the price of that good varied than he could if prices were stabilized at their arithmetic mean of the varying price. Tisdell showed that if output could not be adjusted, but must be rigidly preplanned, the producer could make greater profits with a fixed price than with a varying price with the same average. Zucher concluded that if the elasticity of supply is constant, and if revenue, rather than price, is stabilized, producers lose nothing, and may well gain, since fluctuating prices may require additional costs to manage output efficiently. The present author has previously shown that a consumer is better off with varying prices than with prices stabilized at or above their simple unweighted arithmetic mean. Howell and Lovasy demonstrated that a consumer is worse off with varying prices than with prices stabilized at or below their unweighted mean. This paper presents simple graphic proofs of these conclusions. This article is relevant to the pricing policy decisions of water suppliers with significant implications for both water consumers and producers. (Loeb-Rutgers)
W69-06570

OPTIMALITY OF IMPERFECTLY COMPETITIVE RESOURCE ALLOCATION,
Case Western Reserve Univ., Cleveland, Ohio.
Josef Hadar.
Western Economic Journal, Vol 7, No 1, pp 51-56, March 1969. 6 p, 7 ref.

Descriptors: *Resource allocation, Monopoly.
Identifiers: *Optimality, *Pareto-optimality, *Imperfect competition, Pareto-optimal distribution, Exchange model.

The author considers an exchange model in which a monopolist sets all market prices. The formulation of this model has given rise to a non-tatonnement process without recontracting in which the price setter is motivated exclusively by his own interest. However, since the competitive traders will engage in exchange only if it will not bring about a deterioration in their own positions, every trader's level of utility becomes a monotomically increasing function of time. It also turns out that so long as there exists a Pareto-superior distribution, the monopolist can raise his own level of utility, so that the process will not converge before a Pareto-optimal distribution is reached. The author concludes that the pure exchange models are not the most general type of resource allocation models, but the distribution of fixed quantities of goods among a number of sellers and buyers is a legitimate economic function which is performed by numerous markets. Hence, the establishment of the optimality properties of such trading processes under different market structures is of some significance. The author suggests that this line of inquiry should be pursued in order to see to what extent the results of this paper must be modified by the introduction of consumption and production. The problems of pricing, water-market structures and benefit measures as related to water projects are the relevant areas treated by this article as it applies to water research. (Loeb-Rutgers)
W69-06722

COST, PRECISION, AND VALUE RELATIONSHIPS OF DATA COLLECTION AND DESIGN ACTIVITIES IN WATER DEVELOPMENT PLANNING,
California Univ., Berkeley, Calif.
For primary bibliographic entry see Field 06B.
W69-06733

THE ROLE OF ALTERNATIVE COST IN PROJECT DESIGN AND SELECTION,
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 06B.
W69-06738

THE OPPORTUNITY COSTS OF PUBLIC INVESTMENT,
Harvard Univ., Cambridge, Mass.
For primary bibliographic entry see Field 06B.
W69-06739

CHOOSING AMONG ALTERNATIVE PUBLIC INVESTMENTS IN THE WATER RESOURCE FIELD,
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 06B.
W69-06740

6D. Water Demand

ESTIMATED WATER USE IN NEVADA, 1950-65,
Geological Survey, Carson City, Nev., and Nevada State Dept. of Conservation and Natural Resources.
J. R. Harrill, and G. F. Worts, Jr.
Nev State Dep Conserv and Natur Resources - Div of Water Resources Inform Ser Rep 7, 1968. 37 p, 2 fig, 14 tab, 21 ref.

Descriptors: *Water utilization, *Data collections, *Nevada, Surface waters, Groundwater, Irrigation, Industrial water, Municipal water, Irrigation water, Consumptive use, Water management (Applied).
Identifiers: Water use (Nev).

Estimated withdrawal use from streams and groundwater in Nevada increased from about 1.8 million acre-ft in 1950 to about 2.3 million acre-ft in 1965. Use of surface water increased from 1.6 to 1.8 million acre-ft during this period, whereas use of groundwater (pumpage and springflow) increased from 190,000 to 540,000 acre-ft. The largest single use increase was in pumpage for irrigation--from about 30,000 acre-ft in 1950 to 290,000 acre-ft in 1965. Irrigation use from streams and groundwater in 1965 accounted for 2.1 million acre-ft, or 93% of the total withdrawals. Most of the surface-water resources already have been developed fully. Thus, little increase usage can be expected to occur in the future, and most of the future increased demand, except for diversions from the Colorado River, probably will be provided by groundwater. During the period 1960-65 groundwater use increased as follows: irrigation 37% public supply 40%, industrial self-supplied 10% and rural use 60%. (Knapp-USGS)
W69-06446

OPERATION OF MULTI-UNIT MULTI-PURPOSE WATER DEVELOPMENT SYSTEMS,
University of the Witwatersrand, Johannesburg (South Africa).
D. C. Midgley.
Int Conf on Water for Peace, Wash, D C, Vol 8, pp 160-169, 1968. 10 p, 7 fig, 1 tab, 5 ref. For the 8 Volume Proc, see Vol 2, No 9, Field 06B and W69-03305.

Descriptors: *Multiple purpose projects, *Optimum development plans, *Water distribution (Applied), *Water resources development, *River basin development, Watershed management, Water storage, Flood control, Hydroelectric power, Irrigation, Recreation, Administration, Management, Meteorology, Water demand.
Identifiers: *South Africa, Multi-unit system.

Centers of water demand and sources of water supply can be viewed as comprising a complex system of multiple storage units connected both to each other and to demand centers by natural channels and artificial conduits. Inputs to a unit of the system take the form of natural river flow, return flow of reclaimed water and gravity or pumped supplies from other units. Outputs from a unit comprise net evaporation losses, withdrawals for multiple uses, including the augmentation of supplies to other units of the system. The advantages to be gained in areas of erratic river flow by combining within a system many different types of demand having widely varying growth rates, seasonal fluctuations and degrees of required assurance of supply are shown and the economies that can be effected by combining, in a single system, supply sources lying in different meteorologic regions are discussed. With examples drawn from possible interconnections of South African watersheds, it is shown that by integrating several river systems to form a single multi-unit system, extremely low total flows within the system will be found to be very infrequent. The concept of the water grid, analogous to the power grid is developed and shown that a given demand configuration can be satisfied from a system of interconnected watersheds with greater security, with a smaller total volume of storage and with lower water losses than from a series of independent units. (Knapp-USGS)
W69-06462

THE IMPACT OF PRICE ON RESIDENTIAL WATER DEMAND AND ITS RELATION TO SYSTEM DESIGN AND PRICE STRUCTURE,
Resources for the Future, Inc., Washington, D. C.; and Johns Hopkins Univ., Baltimore, Md.
Charles W. Howe, and F. P. Linaweaver, Jr.
Water Resources Res, Vol 3, No 1, pp 13-32, 1st Quarter 1967. 20 p, 5 tab, 23 ref.

Descriptors: *Water demand, *Economics, *Regression analysis, *Domestic water, *Pricing, Sprinkling, Spatial distribution, Temporal distribution, Elasticity of demand, Design data, Mathematical models.
Identifiers: Residential water demand, Metered, Flat-rate.

Models of residential water demand were structured, with parameters estimated from multi-city cross-sectional data by regression analysis. Demand was differentiated between domestic (inside) and sprinkling use, and also between metered, flat-rate, septic tank and apartment areas. The major findings were: (1) domestic demands were relatively price inelastic; (2) sprinkling demands were price elastic, but less so in the U. S. west than in the east; (3) maximum day sprinkling demands were inelastic in the west but relatively elastic in the east. The weighted average elasticity of total demand was found to be about -0.4. Longer term adjustments to price were empirically investigated, and the role of demand functions in pricing and system design was discussed. (Gysi-Cornell)
W69-06502

HOUSEHOLD PRODUCTION AND CONSUMER DEMAND FUNCTIONS,
Chicago Univ., Ill.; and Institute for Defense Analyses, Arlington, Va.
Richard F. Muth.
Econometrica, Vol 34, No 3, pp 699-708, July 1966, 10 p, 9 ref.

Descriptors: Elasticity of demand, Income, Prices.
Identifiers: *Household production, *Consumer demand function, Price index.

This paper considers the hypothesis that commodities purchased on the market by consumers are inputs into the production of goods within the household. Its implications for the family of consumer demand functions whose arguments are real income and relative prices are drawn and compared with those of the hypothesis of additive separability. The paper closes with some examples of differences in commodity demand elasticities which are qualitatively consistent with the household production hypothesis and some comments upon how the latter might be utilized in empirical work. The article is relevant to water demand research were as in this article water can be treated as an input into the production of goods within the household. (Loeb-Rutgers)
W69-06566

THE COMPETITION FOR WATER QUALITY: RECREATION,
Associated Sportsmen of California, San Francisco.
James F. McCormick.
For main entry see Field 06B, W69-06572. Proceedings of Conference at University of California at Davis, pp 65-67, January 11-13, 1961. 3 p.

Descriptors: *Recreation, Water allocation (Policy), Water quality, Water utilization, California.

During a major portion of California's history, recreational use of the water supplies has received little or no attention. The 'little orphan' attitude adopted towards such use was justified at the turn of the century on the basis that recreational water use and recreation played a minor part in the state's overall economy. Recently recreationists and sportsmen have made progress in obtaining legal recognition of the principle of recreation as a beneficial water use. They realize that progress cannot and must not be impeded. However, they also realize that recreation, as an important industry, must be given a fair and judicial allocation in the competition for water quality and use. (Winn-Rutgers)
W69-06573

THE COMPETITION FOR WATER QUANTITY,
Bureau of Reclamation, Sacramento, Calif.
H. P. Dugan.
For main entry see Field 06B, W69-06572. Proceedings of Conference at University of California at Davis, pp 76-78, January 11-13, 1961. 3 p.

Descriptors: *Water demand, Water allocation (Policy), Water rights, Water supply, California, Water utilization, Competing uses.

The past history of competition for water quantity reveals the evolution from competition among individual users, usually agricultural, to competition between a large municipal user and an agricultural area, to competition between states, and finally to competition between nations. In resolving these conflicts, agreements appear to show a trend towards apportioning waters before a critical use problem develops by means of compacts and operating agreements. Water uses that are complementary form the basis for resolving future competition into potential projects. In the short run water use may appear to be competitive among agricultural, municipal, industrial and recreational users. However, if the frame of reference is big enough, competition in one area can be complementary to an adjacent area. (Winn-Rutgers)
W69-06574

THE COMPETITION FOR WATER QUANTITY: AGRICULTURE,
Feather River Project Association, Bakersfield, Calif.
Allen Bottorff.
For main entry, see Field 06B, W69-06572. Proceedings of Conference at University of California at Davis, pp 79-83, Jan 11-13, 1961. 5 p, 2 ref.

Descriptors: *Agriculture, *Water allocation (Policy), *California, Water policy, Water supply, Groundwater, Value.
Identifiers: Agribusiness, California Water Bond Act.

A US Senate Select Committee Report has concluded that agricultural water withdrawals and consumption from rivers and streams in California may be expected to decline, while withdrawals and consumptive uses may be expected to increase for other purposes. However, because the report does not consider California's groundwater resources, its conclusion may not be valid. Farmers should receive special attention from policy makers in the competition for water. Farming helps to support whole industries and a vast number of workers in those industries. One team of economists has estimated that 37% of the national working force is employed on the farm and in associated industries essential to growing, preparing and delivering farm products. (Winn-Rutgers)
W69-06575

COMMENTS ON THE COMPETITION FOR WATER QUALITY: AGRICULTURE,
Sierra Club, San Francisco, Calif.
David R. Brower.
For main entry see Field 06B, W69-06572. Proceedings of Conference at University of California at Davis, pp 84-87, Jan 11-13, 1961. 4 p.

Descriptors: *Natural resources, Resources, Water resource development, Withdrawal.
Identifiers: Renewable resources, Non-renewable resources.

It has been customary to view each natural resource as being renewable, such as foods and fibers, or as being non-renewable, such as minerals and fossil fuels. Rather than considering how renewable a resource is, consideration should be given to the prospects of finding a substitute for it. This is so for two reasons; (1) Our rate of depletion of the non-renewables is accelerating and (2) Our renewables depend entirely upon the earth's thin skin of soil and this soil is being wasted at a rapidly increasing rate. Prospects are good for finding substitutes for the non-renewable resources through improved technology. Prospects are not as good for finding substitutes for the forms of life in the soil, on the land and in the air. (Winn-Rutgers)
W69-06576

THE COMPETITION FOR WATER QUANTITY: INDUSTRY,
West Basin Municipal Water District, Hermosa Beach, Calif.
Carl Fossette.
For main entry see Field 06B, W69-06572. Proceedings of Conference at University of California at Davis, pp 88-96, Jan 11-13, 1961. 9 p.

Descriptors: *Water allocation (Policy), *Water supply, *California, *Water management (Applied), Industrial water, Water conservation, Ground water, Water reuse, Water rights, Water quality.
Identifiers: West Basin Water Association, Central Basin Water Association, Los Angeles Flood Control District, California Water Plan.

Although a strong case could be made for industry in competition with other users for its share of the available water resources, this article tries to show the futility of any program directed toward the assignment of water priorities. Such a program would place each user in competition with all other users and would probably lead to wholesale litigation and

eventual rationing of the available supply. This would be inconsistent with a balanced economy and would retard the development of new sources of supply. It is suggested that rather than compete for water, users should recognize that water is no longer virtually free and that it will require human energy and much money to furnish it in requisite quantities where needed. (Winn-Rutgers)
W69-06577

THE COMPETITION FOR WATER QUANTITY: RECREATION,
California Dept. of Fish and Game, Sacramento.
Walter Shannon.
For main entry see Field 06B, W69-06572.
Proceedings of Conference at University of California at Davis, pp 112-115, Jan 11-13, 1961. 4 p.

Descriptors: *Recreation, Water resource development, California, Water demand, Planning, Water policy.

A three year study of California recreation indicates that 69 percent of all outdoor recreation is centered around water. Water development is an essential and continuing process of civilization. However, well-planned water developments which recognize fish and wildlife as a beneficial use of water can provide for perpetuation of these valuable resources at reasonable costs without seriously encroaching on other uses of that water. The public is looking more and more to water developers to recognize and accept some responsibility in developing recreational opportunities and facilities as part of water projects. Consequently, state, federal, local governments and many private developers are coming to recognize the importance of providing for recreation. (Winn-Rutgers)
W69-06578

CONSERVATION'S CHALLENGE TO STATE GOVERNMENTS,
For primary bibliographic entry see Field 06E.
W69-06586

GREAT LAKES COMPACT (AGREEMENT FOR EFFICIENT MANAGEMENT OF THE GREAT LAKES BASIN).
For primary bibliographic entry see Field 06E.
W69-06616

FORECASTING URBAN WATER DEMANDS IN DEVELOPING COUNTRIES,
Edward A. Bryant.
For 8 volume Proceedings see Vol 2, No 9, Field 06B, W69-03305. International Conference on Water for Peace, Vol 7, Washington D C, U S Government Printing Office, pp 1-9, 1968. 9 p, 3 fig, 2 tab, 3 ref.

Descriptors: *Urbanization, *Forecasting, *Water demand, Natural resources, Industrial water, Domestic water, Distribution systems, Weather.
Identifiers: *Population trends, Commercial water, Metering, Unaccounted for water.

A large portion of the world suffers from water shortages. The major causes are (1) lack of natural resources, (2) lack of financing and proper management, and (3) limited water handling facilities. In the latter case the goal of the water-supplying agency should be to meet all demands. 'Demand' is considered to be the amount of water which would be used if it were available at a reasonable cost. The necessary advanced planning to meet all demands requires a reliable estimate of future water demands components of total demand, i.e., domestic, commercial, industrial demands for water are affected by many conditions. Each of these components and the conditions which affect them must be analyzed to obtain a reasonably accurate forecast of water demand. This paper describes the components of demand and some of the conditions which affect them. It also provides data which may be used to determine future water demands. (Sokoloff-Rutgers)
W69-06727

WATER FOR TEXAS,
Texas A and M Univ., College Station. Water Resources Inst.
For primary bibliographic entry see Field 06B.
W69-06790

6E. Water Law and Institutions

INTERGOVERNMENTAL PLANNING OF WATER RESOURCES,
Water Resources Council, Washington, D. C.
For primary bibliographic entry see Field 06B.
W69-06429

SAFETY CONTROL OF PRIVATE DAMS,
New England River Basins Commission, Boston, Mass.
For primary bibliographic entry see Field 04A.
W69-06433

RURAL WATER DEVELOPMENT IN KENYA,
Department of Water Development (Kenya).
For primary bibliographic entry see Field 04A.
W69-06453

THE ROLE OF THE INTERNATIONAL ATOMIC ENERGY AGENCY IN THE DEVELOPMENT, USE AND CONTROL OF WATER RESOURCES.
International Atomic Energy Agency, Vienna (Austria).
For primary bibliographic entry see Field 03A.
W69-06456

BENEFICIAL USES OF WATERS OF INTERNATIONAL RIVERS: INTERNATIONAL LAW AND PRACTICE,
Ministry of Irrigation and Power (India).
P. R. Ahuja, and D. L. Kamat.
Int Conf on Water for Peace, Wash, D C, Vol 5, pp 584-590, 1968. 7 p, 13 ref. For the 8 Volume Proc, see Vol 2, No 9, Field 06B and W69-03305.

Descriptors: *International law, *River basins, *Beneficial use, *Riparian waters, International Bound and Water Comm., Boundary disputes, Water law, Appropriation, Treaties.
Identifiers: *International rivers, Territorial sovereignty.

Theory and practice agree that rivers are part of the riparian State. Territorial sovereignty of States extends as much to land within the respective boundaries as to waters flowing on the land, and practice so far shows that States generally regard all legal questions concerning State territory as internal jurisdiction. No generally recognized rules exist in International Law today which can determine what should be the legitimate shares of coriparian States in the beneficial uses of international rivers. Moreover, State practice in the past 50 years shows there are no general rules to govern all international river problems. Each river has its own individuality, and individual problems must be solved by treaty. In the absence of treaty limitations, the only limitation to a State's sovereign right over the waters of an international river flowing through its territory is the general limitation against 'abuse of rights'. The facts of each case would establish liability. Even without treaties governing specific river problems, the riparian States can cooperate for mutual benefit in prevention and control of floods, cooperation in flood forecasts and flood warnings, exchange of meteorological and rainfall data, etc. (Vorhis-USGS)
W69-06458

CIVIL ENGINEERING AND URBAN SYSTEMS,
Northwestern Univ., Evanston, Ill.
For primary bibliographic entry see Field 06A.
W69-06491

THE INFLUENCE OF OWNERSHIP AND CONTROL ON PROFIT RATES,
Missouri Univ., Columbia.
For primary bibliographic entry see Field 06B.
W69-06545

LEGAL ALTERNATIVES,
William H. Jennings.
For main entry see Field 06B, W69-06572.
Proceedings of Conference at University of California at Davis, pp 122-126, Jan 11-13, 1961. 5 p.

Descriptors: *Legal aspects, *Water resource development, Water rights, Riparian rights, Water law, Governments, Federal government, State governments, Prior appropriation, Water policy.
Identifiers: Public interest, Federal-state rivalry.

The history of the development of water law in California has been a struggle to adjust the concept of the ownership and use of water as a simple matter of property to the broader concept of the public interest in its control and development. The entry of big government into the field of water resource development has forced us to review our system of water law. We have been forced to consider water development and control as an instrument of social reform and as a tool for economic adjustment. Perhaps the most serious result of big water-project development is the growing rivalry between state and federal governments as to which shall be in control of the projects. (Winn-Rutgers)
W69-06579

THE LEGISLATIVE POINT OF VIEW,
Richard Richards.
For main entry see Field 06B, W69-06572.
Proceedings of Conference at University of California at Davis, pp 135-139, Jan 11-13, 1961. 5 p.

Descriptors: *Legislation, *Water resource development, Political aspects, Government, California.
Identifiers: Public opinion.

Legislators, no matter how long they have worked with water problems, are not water experts. The water experts should be allowed to control the water development of California. The avalanche of bills in the state legislature represents a threat to the control of water development by the professionals. This does not mean that there isn't room for constructive legislation designed to augment and facilitate the water program. Water experts should actively try to mold public opinion and thereby influence legislation. Even though a legislator has a natural tendency to want to be popular in his home district, he must consider the interest of the state as a whole. (Winn-Rutgers)
W69-06580

COLEMAN V SCHAEFFER (OBSTRUCTION TO NAVIGABLE STREAM).

163 Ohio St 202, 126 NE 2d 444-449 (1955).

Descriptors: *Ohio, *Navigable waters, *Lake Erie, *Streams, Bridges, Marinas, Legislation, Rivers and Harbors Act, Judicial decisions, Stream fisheries, Flotation, Vegetation effects, Streamflow, Boats, Access routes, Legal aspects, Lakes, Remedies.
Identifiers: *Injunctions (Mandatory), Ingress, Egress.

Plaintiffs brought suit for mandatory injunctions to require defendants to remove steel cables and a wire fence from a stream used by plaintiffs in its boat rental business. Defendants owned land on opposite sides of the stream extending up stream from Lake Erie, and plaintiffs' land was immediately above these properties. Defendants' construction of the fence and cable destroyed plaintiffs' right to travel to and from the navigable lake. The lower courts had denied injunctive relief. On appeal, the supreme court noted that the ultimate question to be decided was whether this stream was a navigable

stream. The court indicated that the lack of commercial traffic does not necessarily indicate the stream is non-navigable. A stream is 'navigable' as long as it is capable of being put to any beneficial public use. Although this stream was crossed by a bridge which had a clearance of but 5 1/2 feet, and although it was often clogged with vegetation, plaintiffs operated their boat rental business for 14 years until stopped by the fence and cables. The court was of the opinion that the stream was navigable and that plaintiffs were entitled to the injunctions prayed for. (Reed-Fla)
W69-06584

CONSERVATION'S CHALLENGE TO STATE GOVERNMENTS,
William E. Richards.
Journal of Soil and Water Conservation, Vol 17, No 1, pp 8-10, Jan-Feb 1962. 3 p.

Descriptors: *State governments, *Federal government, *Administrative agencies, *Water resources, Development, Water conservation, Forest management, Land resources, Land reclamation, Preservation, Natural resources, Flood control, Flood protection, Legislation, Administration, Streams, Irrigation, Navigable rivers, Legal aspects, Financing.

Most resource development programs are funded and managed by the federal government. Public programs concerned with forested land, irrigation districts, navigable rivers, and flood control problems are administered by the United States Forest Service, the Bureau of Reclamation, and the United States Army Corps of Engineers. This concentration of administrative power is not conducive to the maintenance of efficient conservation programs, and state governments must develop local agencies competent to accept primary responsibility in vital conservation programs. These suggested state agencies should immediately inventory the classes of land within the state. Such an inventory should include an evaluation of the available water supply, including a projection of future industrial, municipal, agricultural, and navigational needs of the state. Corrective legislation is necessary to create these state agencies, and revenue allocated to these agencies and their programs should be greatly increased. (Katz-Fla)
W69-06586

TENNESSEE GAS TRANSMISSION CO V GREATER LAFOURCHE PORT COMM'N (PIPELINES ACROSS NAVIGABLE CHANNELS).
293 F Supp 1019-1025 (E D La 1968).

Descriptors: *Channel improvement, *Louisiana, *Pipelines, *Dredging, Navigable waters, Channels, Pipes, Excavation, Right of way, Eminent domain, Harbors, Federal government, State governments, Judicial decisions, Damages, Remedies, United States, Administrative agencies, Costs, Legal aspects.
Identifiers: Third party beneficiary.

Plaintiff gas company in obtaining the rights to lay a pipeline under a navigable channel, agreed with both state and federal agencies to pay the cost of adjusting its pipeline should such adjustment become necessary to some future date. Later, plaintiff sued to recover the cost of lowering the pipeline, an action necessitated by the dredging and deepening of the channel by defendant port commission. The court held for the defendant, finding that the port commission was the beneficiary of the earlier agreement with the state agency. The plaintiff had done no more than it had agreed to do as a precondition to laying the pipeline, and no recovery was justified. The court also noted that because of the substantial federal grant-in-aid supporting plaintiff's operation, the dredging project could be considered the beneficiary of plaintiff's agreement with the federal agency. (Gabrielson-Fla)
W69-06587

BARBER PURE MILK CO V GOLDIN (SURFACE DRAINAGE).

218 So 2d 409-413 (Miss 1969).

Descriptors: *Mississippi, *Surface drainage, *Dairy industry, *Drainage water, Ditches, Water pollution, Contracts, Milk, Cleaning, Public health, Sanitation, Public rights, Insects, Mayflies, Insect attractants, Regulation, Legal aspects, Real property, Land tenure, Cities, Judicial decisions, Legislation, Local governments.
Identifiers: Contracts of sale, Restrictive covenants.

Plaintiff brought action for rescission of a contract to purchase real estate, alleging that the restrictive covenants affecting the property imposed a greater burden than the municipal ordinances. The plaintiff intended to construct a milk processing plant. The cleaning operations would require 25,000 gallons of water daily which the plaintiff proposed to dump in a ditch running across the land. The water would contain some milk residue. The court found that the plaintiff could operate in a manner which would not violate any municipal ordinance but which, nevertheless, would subject it to suit for violation of the covenants. On this basis, the court held the title to be unmerchantable and rescinded the contract. (Stewart-Fla)
W69-06588

RUSSELL V STATE (ILLEGAL POSSESSION OF UNDERSIZED FISH).

220 So 2d 334-340 (Miss 1969).

Descriptors: *Mississippi, *Commercial fishing, *Administrative agencies, *Fish management, Trapping, Regulation, Judicial decisions, Catfishes, Fish conservation, State governments, Freshwater fish, Lakes, Boats, Legal aspects.
Identifiers: *Criminal law, Penalties (Criminal).

Defendant was convicted of possession of undersized catfish. He pleaded guilty when arrested by game wardens after gathering the undersized fish from illegal traps. The court found that the state Game and Fish Commission had legislative authority to make rules and regulations necessary to carry out the provisions which created the Fish and Game Commission. The Commission promulgated regulations which prohibited the possession of catfish under twelve inches in length. Anyone who violates the rules or regulations is guilty of a misdemeanor and shall be fined accordingly. The court upheld the conviction and imposed heavy fines when it was discovered that the defendant was engaged in a commercial venture involving the capture of hundreds of the undersized fish. (Stewart-Fla)
W69-06589

GEORGE V STATE (OBSTRUCTION OF SUBSURFACE FLOW).

205 Misc 992, 130 NYS 2d 8-11 (Ct Cl 1954).

Descriptors: *New York, *Easements, *Percolating water, *Subsurface waters, Judicial decisions, Legal aspects, Condemnation, Eminent domain, Subsurface runoff, Underground streams, Gravitational water, Seepage, Percolation, Subsurface flow, Appropriation, Water wells, Shallow wells, Relative rights, Construction, Obstruction to flow.

Land adjacent to claimant was bought by the state, and a road was constructed thereupon. Immediately thereafter, claimant's well went dry. Claimant alleged that the percolating waters which fed his well were cut off by the construction operations. Claimant brought action to recover damages for the permanent appropriation of an alleged easement (the path of percolating waters) in his land. The court held the fact that percolating waters on adjoining land would naturally gravitate or seep in the general direction of claimant's lands or his well did not, in absence of proof of the existence of a defined underground stream, establish an easement on the adjoining lands for the benefit of the claimants. Rather, the state, which acquired the property through condemnation proceedings, had a right to use the property for any lawful purpose, and it was fully within its rights in intercepting percolating groundwaters. (Logan-Fla)
W69-06590

SBARRA V ERIE RR (DRAINAGE OF SURFACE WATERS AND PRESCRIPTIVE RIGHTS).
68 NYS 2d 478-481 (Sup Ct 1947).

Descriptors: *Discharge water, *Surface drainage, *Prescriptive rights, *New York, Judicial decisions, Surface waters, Surface runoff, Drainage water, Slopes, Streamflow, Flow augmentation, Groundwater movement.
Identifiers: *Adverse possession, Affirmative defenses, Motions to strike.

The plaintiff sued to enjoin defendant from collecting surface waters and discharging them onto plaintiff's land. The defendant alleged that he had acquired a prescriptive right to discharge such waters onto the plaintiff's land. The defendant claimed that he had discharged surface water onto plaintiff's land for fifteen years without interruption. The discharge which prompted this suit was accomplished in the same manner and was equal in volume to those made continuously for several years. The court held that the right to discharge surface water may be acquired by prescription. The defendant alleged that he acquired this right by continuous adverse use without interruption or complaint. The court held that this allegation was sufficient to allow proof of the acquisition of the right as an affirmative defense. The court denied the plaintiff's motion to have such allegations stricken from the pleadings; the retention of such terms would not unduly prejudice the plaintiff. (Stewart-Fla)
W69-06591

NASSAU COUNTY V CHERRY VALLEY ESTATES, INC (OBSTRUCTION OF ALLEGED WATER COURSE).

114 NYS 2d 666-668 (Sup Ct 1952).

Descriptors: *New York, *Obstruction to flow, *Natural streams, *Surface drainage, Judicial decisions, Legal aspects, Watercourses (Legal), Surface waters, Surface runoff, Drainage water, Drainage, Channels, Discharge (Water), Percolation, Flooding, Streams, Backwater, Relative rights, Ponding.

Plaintiff was discharging water upon defendant's land by means of what plaintiff called 'a stream.' Defendant blocked the 'stream' and caused water to collect on plaintiff's property. Plaintiff sought to enjoin defendant from obstructing this watercourse. The court found that plaintiff was not discharging its surface water into a defined watercourse and, thus, that it had no right to continue to drain surface water over defendant's land. The injunction was denied.
W69-06592

SAMYN V TACEY (ARTIFICIAL DRAINAGE OF SURFACE WATERS).
337 Mich 296, 60 NW 2d 152-154 (1953).

Descriptors: *Surface waters, *Natural flow, *Prescriptive rights, *Michigan, Judicial decisions, Channels, Surface runoff, Drainage water, Slopes, Surface drainage, Streamflow, Dams, Obstruction to flow, Running waters, Overlying proprietor, Ditches.
Identifiers: Injunctions (Mandatory).

Plaintiff, an upper proprietor, brought suit to compel defendant to remove a dam placed by him in a ditch draining surface waters from plaintiff's land. The defendant alleged that he had acquired a

prescriptive right to have his land free from any drainage servitude because the plaintiff had not used the ditch for fifteen years. However, the court found to the contrary. As a result, the court held that since the defendant had not acquired a prescriptive right, he had no right to interfere with the drainage of the surface waters from the plaintiff's land. The granting of the injunction was affirmed. (Stewart-Fla)
W69-06593

OHIO OIL CO V FERGUSON (MINERAL RIGHTS AND ROYALTIES).

213 La 183, 34 So 2d 746-777 (1947).

Descriptors: *Louisiana, *Prescriptive rights, *Drilling, *Oil industry, Royalties, Judicial decisions, Mining engineering, Exploration, Oil, Mineral industry, Leases, Natural resources, Land use, Easements, Mineralogy, Relative rights, Mining.
Identifiers: *Divisibility of servitudes, *Mineral servitude.

Plaintiff brought a concursus proceeding to resolve the conflict among creditors regarding the apportionment of the proceeds from a royalty interest in oil. At the outset, the court noted that there was no difference in the applicable principles of law between a servitude which gives to two or more persons the right to draw water and a servitude which gives two or more people the right to draw oil or gas. The primary issue was whether two of the claimants lost their right to the royalties due to their abandonment of mining operations. The court acknowledged that abandonment or non-use of the right to drill may cause the extinguishment of such right. The court found that, since the claimants had not used the right to drill for ten years, they lost the right to the mineral interest. Such right inures to the benefit of the owner of the land. This is because the obligation is only upon the land; therefore, if the obligation is extinguished, it necessarily inures to the owner of the land at the time of extinguishment. (Stewart-Fla)
W69-06594

CANNON V CITY OF MACON (NATURAL DRAINAGE FLOW AND THE LOWER LAND PROPRIETOR).

81 Ga App 310, 58 SE 2d 563-573 (1950).

Descriptors: *Georgia, *Drainage systems, *Natural flow doctrine, *Surface drainage, Storm runoff, Subsurface runoff, Storm drains, Watercourses, Drains, Local governments, Cities, Pipes, Sewers, Eminent domain, Subsurface flow, Erosion, Damages, Operation and maintenance.

Plaintiffs brought suit against the City of Macon to recover for damage to their house caused by the overflow of a storm sewer. The city was found negligent in maintaining the structures which caused a gradual washing away of the ground around the foundations of the plaintiffs' house. In rendering a judgment for the plaintiffs, the court announced that Georgia had adopted the civil law rule regarding natural drainage. Under this rule, a lower land proprietor owes a duty of servitude to the upper landowner to receive water which naturally runs from the upper tract. However, the upper landowner must not increase the flow by artificial means. (Stewart-Fla)
W69-06595

COX V MARTIN (DISCHARGE OF SURFACE WATER THROUGH A DOWNSPOUT).
207 Ga 442, 62 SE 2d 164-166 (1950).

Descriptors: *Georgia, *Drainage water, *Storm runoff, *Natural flow doctrine, Diversion, Rainfall disposition, Relative rights, Gravity, Surface waters, Drainage effects, Natural flow, Deflection, Pipes, Judicial decisions, Legal aspects.
Identifiers: *Downspouts.

Plaintiff brought action to enjoin the discharge of surface water from defendant's land and to recover damages allegedly caused by such discharge. Under Georgia law, the lower of two adjoining city lots is burdened with a servitude to receive water which naturally flows from the upper tract provided the owner of the higher lot has done nothing to increase such flow by artificial means. The court found that defendant was not liable for damages merely because water from a downspout on his land was discharged directly or indirectly upon the adjoining land of plaintiff unless such flow increased the natural flow at a particular locality upon plaintiff's land or caused water to flow thereon in a manner different from simply running down upon it by the law of gravity. Defendant was granted a new trial. (Reed-Fla)
W69-06596

HARRELL V CITY OF CONWAY (USE OF IMPOUNDED WATER).

271 SW 2d 924-930 (Ark 1954).

Descriptors: *Arkansas, *Riparian rights, *Natural flow doctrine, *Reasonable use, Judicial decisions, Legal aspects, Competing uses, Domestic water, Municipal water, Prescriptive rights, Prior appropriation, Watersheds (Divides), Dams, Relative rights, Streams, Cities, Water users, Water levels, Regulation, Impounded waters, Local governments.
Identifiers: Injunctions (Prohibitory).

Plaintiff city brought action to enjoin upstream riparian owners from taking water from a creek when the water reached a certain level. The court, after recognizing that Arkansas is a 'riparian rights' state, ruled that the city did not have the right to seize and use for its own purposes all the water impounded by its dam when the water level, as measured by a gauge on the dam, fell below six feet. The city's rights are the same as any other riparian owner. Furthermore, since the city is selling the water beyond the boundaries of the watershed, it does not fall under either theory of riparian use (natural flow or reasonable use). The court went on to discount plaintiff's claim of superior rights by prescription as being 'untenable.' The concurring opinion was quick to point out that this case in no way represents a decision by the court to accept either the natural flow or reasonable use doctrines. (Logan-Fla)
W69-06597

FIRES.

Mich Comp Laws Ann secs 70.2, 70.12 (1967).

Descriptors: *Michigan, *Water supply, *Burning, *Cities, Local governments, Damages, Pipelines, Reservoir storage, Water delivery, Legislation, Navigable waters, Boating regulations, Legal aspects, Harbors, Reservoirs, Construction.

The council of any village within the State of Michigan may construct reservoirs in the streets or other suitable places to provide an adequate and convenient supply of water. The council of any village located upon navigable waters may prescribe by ordinance fire prevention regulations which are to be observed by owners, masters, and employees of vessels in the harbor area. (Stewart-Fla)
W69-06598

HARRIS V BROOKS (RECREATION RIGHTS OF RIPARIAN OWNER).
283 SE 2d 129-136 (Ark 1955).

Descriptors: *Arkansas, *Riparian rights, *Reasonable use, *Recreation, Legal aspects, Judicial decisions, Natural flow doctrine, Competing uses, Prior appropriation, Fishing, Lakes, Nonnavigable waters, Domestic water, Water levels, Irrigation, Riparian waters, Riparian land, Pumping, Swimming, Relative rights.
Identifiers: Injunctions (Prohibitory).

Plaintiff and defendant were riparian owners on a nonnavigable lake. Plaintiff, owner of a fish camp, sought to enjoin defendant from pumping water out of the lake, claiming that continued pumping would make the lake unsuitable for fishing and recreation. The reasonable use doctrine as applied to riparian owners allows the riparian owner to make any reasonable use of his property, so long as such use does not injure other riparian owners. Here, the pumping of water by the defendant lowered the level of the lake to such an extent that the aquatic life in the lake was endangered. The right to use water for domestic purposes is superior to the right to use water for recreational purposes, but all other lawful uses are equal in the eyes of the law. Since defendant's continued pumping for irrigation would interfere with plaintiff's equal right to use the lake, plaintiff was entitled to injunctive relief. (Shevin-Fla)
W69-06599

DRAPER V MOSHIER (INTERFERENCE WITH DRAINAGE DITCH).

92 A 2d 715-717 (Ch Del 1952).

Descriptors: *Delaware, *Prescriptive rights, *Surface drainage, Overflow, Easements, Right of way, Ditches, Real property, Legal aspects, Drainage systems, Judicial decisions, Relative rights, Benefits.
Identifiers: Parol license, Injunctions (Mandatory), Estoppel.

Plaintiff brought suit against an adjoining landowner for a mandatory injunction to abate or discontinue interference with a drainage ditch constructed by plaintiff's predecessor in title across defendant's land. Plaintiff contended that the ditch was dug for the mutual benefit of the adjoining lands and that this was an action for specific enforcement of a mutually beneficial agreement. The court concluded from the evidence that the ditch was dug solely for the benefit of the property owned by plaintiff. Furthermore, the testimony was undisputed that plaintiff's predecessor in title was granted merely a parol license to maintain a ditch. Such a license could be revoked by defendant at any time as no prescriptive rights had attached. There being no evidence of fraud or other inequitable conduct justifying the requested relief, the court concluded that defendant was entitled to fill the ditch. The complaint was dismissed. (Reed-Fla)
W69-06600

WHITE OAR BOROUGH AUTH V PENN PUB U COMM'N (AQUISITION OF PUBLIC WATER FACILITIES).

175 Pa Super 114, 103 A 2d 502-507 (Pa Super Ct 1954).

Descriptors: *Administrative agencies, *Jurisdiction, *Waterworks, *Pennsylvania, Judicial decisions, Water conveyance, Eminent domain, Public utilities, Water rates, Cities, Contracts, Condemnation.

Plaintiff applied to defendant Public Utility Commission for a certificate of public convenience and necessity evidencing the defendant's approval of the plaintiff's proposed acquisition of water facilities owned by the municipality. The facilities, which were owned and operated by the municipality, were located outside the city limits and entirely within the Borough. Since the plaintiff had not shown any procedure or authority by which it could coerce acquisition, the Commission ruled that it was without jurisdiction. In a prior judicial proceeding, the state superme court ruled that the plaintiff had no right to use eminent domain to compel acquisition. In attempting to establish that defendant did have jurisdiction, the plaintiff relied upon the Municipal Authorities Act. However, that Act contemplates acquisition by agreement from a consenting owner. The Legislature provided for acquisition of water works only by agreement, not by compulsory process. Therefore, the refusal of

the defendant to entertain jurisdiction was affirmed. (StewartsFla)
W69-06601

CITY OF PORTSMOUTH V CULPEPPER (SUIT FOR DAMAGES RESULTING FROM OVERFLOW OF OBSTRUCTED CANAL).
192 Va 362, 64 SE 2d 799-804 (1951).

Descriptors: *Virginia, *Earth dams, *Obstruction to flow, *Overflow, Dams, Banks, Spillways, Canals, Natural flow, Rain water, Excess water (Soils), Rainfall, Excessive precipitation, Flood damage, Crops, Flooding, Shrubs, Trees, Weeds, Cities, Judicial decisions, Legal aspects, Damages, Local governments.
Identifiers: Act of God, Debris.

Plaintiff brought action against defendant city to recover for damage to crops sustained when a canal maintained by the city overflowed. Evidence showed that the city had begun to build a dam across its canal. The dam was never completed, but was allowed to remain in the canal. Trees, bushes and weeds were allowed to grow over the dam to such an extent that the court found the canal was necessarily obstructed. The court held that this obstruction caused the overflow of the canal during heavy rains which resulted in the damage to plaintiff's crops. The court rejected defendant's contention that this was an act of God. The court felt the jury was justified in finding that this dam was a nuisance which the city had permitted to stand unabated. (Logan-Fla)
W69-06602

ZOMBKOWSKI V WISCONSIN RIVER POWER CO (FLOODING DAMAGES CAUSED BY DAM CONSTRUCTION).

267 Wis 77, 64 NW 2d 236-240 (1954).

Descriptors: *Wisconsin, *Dams, *Obstruction to flow, *Flooding, Power plants, Reservoirs, Dam construction, Sewers, Reservoir leakage, Remedies, Judicial decisions, Eminent domain, Condemnation, Water levels, Legal aspects, Flood damage, Backwater, Legislation.
Identifiers: Wisconsin River.

Plaintiff brought action to recover for damage allegedly caused by defendant's dam. The dam caused the waters of the Wisconsin River to rise to such a level that plaintiff's land was partially flooded. The waters did extensive damage to plaintiff's buildings and merchandise. Defendant admitted liability, and only the amount of the damages was at issue. Based upon answers in a special verdict, damages were set at a figure in excess of $14,000. Defendant appealed, alleging that plaintiff's only remedy was by condemnation. The supreme court of Wisconsin held that, under section 330.17 of the Wisconsin Statutes, plaintiff could sue for damages where the power company did not take the land by condemnation before the damage occurred. Defendant could not allege on appeal that damages were caused by percolating groundwater since it had admitted liability at trial. Finally, evidence supported the jury's finding that a sewage system installed after construction of the dam would not be as effective as one installed prior to such construction. (Kahle-Fla)
W69-06603

IOWA-WISCONSIN BRIDGE CO V UNITED STATES (LIABILITY FOR RESERVOIR OPERATION).

84 F Supp 852-870 (Ct Cl 1949).

Descriptors: *Mississippi River, *Impounded waters, *Dams, *Compensation, Hydraulic structures, Reservoirs, Reservoir stages, Ice jams, Ice breakup, Eminent domain, Bridges, Condemnation, Prescriptive rights, Easements, United States, Federal government, Dikes, Permeability, Underseepage, Retaining walls, Earthworks, Access routes, Roadbanks, Streams, Judicial decisions, Legal aspects, Competing uses, Reservoir operation, Navigable waters, Ownership of beds, River beds, Remedies, Damages, Right-of-way.

Plaintiff sued to recover for alleged taking of its property by the government's construction of a downstream lock and dam. Plaintiff owned the right-of-way to construct and maintain a bridge across the Mississippi River as well as the right-of-way to maintain approaches to the bridge across nonnavigable sloughs adjacent to the river. The damage complained of was done to the approach dikes and bridges across these sloughs. Defendant operated its dam in such a manner as to keep the water level at 620 feet, a level equal to the height of plaintiff's dikes and 4 feet above normal level. This resulted in supersaturation of the dikes and consequent road surface crumbling. The wooden bridges over the sloughs were weakened by the increased ice flowage attributable to the dam. The court, in awarding plaintiff damages, noted that since the sloughs were nonnavigable and not subject to a public servitude in the interests of commerce, the government was liable. (Katz-Fla)
W69-06604

STATE V TAYLOR (FISH DYNAMITED IN PRIVATE POND).
214 SW 2d 34-38 (Mo 1948).

Descriptors: *Missouri, *Explosives, *Legislation, *Fish conservation, Ponds, Public rights, Nonnavigable waters, Jurisdiction, Fish management, Public benefits, Fishkill, State governments, Legal aspects, Regulation, Fish, Relative rights, Wildlife, Judicial decisions.
Identifiers: *Criminal law, Private ponds.

Defendant appealed from a conviction of the criminal offense of dynamiting fish in a private pond. Defendant assigned as error the fact that a private pond is not included within the term 'waters of this state,' as mentioned in the statute under which he was convicted. The court held that while title to fish reduced to one's possession by lawful means is released by the state to the taker, fish in a private pond have not been so reduced to possession as to vest unqualified to the fish in the owner of the pond and thereby destroy all regulatory power of the state. The title to fish asserted by the statute to be in the state for the purposes of preservation, propagation, and protection is not inconsistent with the qualified special property right of the owner of the soil where they are found, as against trespassers. Thus, the court concluded that defendant, as a trespasser who dynamited and killed fish in a private pond, was properly convicted under the statute prohibiting the placing of explosive substances in 'waters of the state' whereby fish may be destroyed. (Reed-Fla)
W69-06605

LAWKINS V CITY OF NEW YORK (EROSION AND ACCRETION OF BOUNDARY SHORE LINE).

272 App Div 920, 71 NYS 2d 112-115 (1947).

Descriptors: *New York, *Boundaries (Surfaces), *Beach erosion, *Accretion (Legal aspects), Cities, Atlantic Ocean, Shores, Islands, Legislation, Tidal waters, Avulsion, Boundary disputes, Coasts, Deposition (Sediments), Taxes, Beaches, Land tenure.
Identifiers: Suit for refund.

Plaintiff brought this action against city to recover taxes paid under protest. From a summary judgment for plaintiff, defendant appealed. The city's right to tax property depends upon whether the property taxed was located within the city's territorial limits as fixed by charter. After a consideration of pertinent cases, the court stated that it was the intention of the legislature that the city's boundary line should extend to the ocean shore line of the then existing beach. The court noted further that if in time the beach disappeared and later another piece of land reappeared in the same location (this latter formation being in no way identified with the former beach), the city boundary line was not to extend to the ocean shore line of the new land if that land was further south than the original shore line. Later, the beach lands were washed away by the process of erosion. The court ruled that the accretions to plaintiffs' tract formed after erosion of the beach lands within the city's boundaries did not serve to advance the city boundaries to include such accretions. Therefore, the court held that summary judgment had been properly granted to plaintiff. (Reed-Fla)
W69-06606

GIBSON V STATE (CONSTRUCTION AND MAINTENANCE OF SEWERS).

64 NYS 2d 632-644 (Ct Cl 1946).

Descriptors: *New York, *Storm runoff, *Sewers, *Highway effects, Overflow, Floods, Drainage, Drainage engineering, Storms, Rainwater, Surface runoff, Surface waters, Damages, Remedies, Judicial decisions, Legal aspects, Operation and maintenance, Rainfall-runoff relationships, Cities, Local governments, State governments, Highways.

Following a severe rain storm, water flowed from a nearby highway intersection onto plaintiff's property, damaging said property rather extensively. Plaintiff brought suit, alleging that the damage resulted from defendant's negligence in building and maintaining a highway sewerage system. The court granted defendant's motion for dismissal. It found that the state was under no duty to provide drainage for plaintiff's property. However, when a municipal corporation puts a sewerage plan into operation, it becomes liable for damages resulting from negligence in the construction and/or the maintenance thereof. In the case at bar, the evidence failed to establish any such negligence. The court also held that a municipality is not liable for an increase in flow of surface waters resulting solely from the paving of streets and the placement of other improvements. Liability may exist if the state diverts the surface runoff of a water shed from the course of its natural flow or collects such runoff in an artificial channel and discharges it in great volume upon the lands of another. But, in this case, the evidence disclosed no accumulation of water beyond that which would normally result from the construction of streets and roadbeds. (Gabrielson-Fla)
W69-06607

UNITED STATES V GROEN (TITLE TO FILLED IN LAND BORDERING ON A RIVER).
72 F Supp 713-723 (DDC 1947).

Descriptors: *District of Columbia, *Bulkhead line, *Riparian rights, *Ownership of beds, United States, Rivers, Federal government, Landfills, Piers, High water mark, Relative rights, Riparian land, Shores, Judicial decisions, Legal aspects, Navigable waters, Land tenure, Legislation, Public benefits.
Identifiers: Anacostia River.

The United States brought suit in equity, to determine title to waterfront land and adjacent beds in the District of Columbia, to define the nature and extent of any interest adverse to the United States, and to ascertain the value of any such interest. It was conceded that defendants owned the land bordering on the Anacostia River to the high water mark as that mark existed in 1794. The principal issue to be resolved was whether defendants' predecessors in title had the right to fill the land and to erect a wharf beyond that high water mark extending to a bulkhead line established in 1899. The court held that defendants had acquired ownership of the filled-in land since such filling was a proper exercise of riparian rights. Defendants could not be deprived of this property except for

ublic purposes and then only upon the payment of ust compensation. The court held that title to the roperty in question had been in plaintiff when the ederal government acquired the city, but that the stablishment of the bulkhead line operated as a icense to fill or wharf out to that line. The court tated that local law was controlling as to the naure and extent of riparian rights. (Wheeler-Fla)
W69-06608

BINGENHEIMER V DIAMOND IRON MINING CO (DEFINITION OF NAVIGABLE WATER TO DETERMINE OWNERSHIP OF BEDS).

54 NW 2d 912-926 (Minn 1952).

Descriptors: *Navigable waters, *Minnesota, *Ownership of beds, *Land tenure, Dams, Sluices, State governments, Lakes, Saw log test, Judicial decisions, Legal aspects, Land classification, Real property, Beds, Water utilization, Nonnavigable waters.

Plaintiffs brought action to register title to certain lands, joining the state as defendant. Defendants claimed title to the bed of a chain of lakes on plaintiffs' property and asserted that the entire tract should therefore not be registered. The district court denied the application for registration, On appeal, the supreme court considered the issue whether the waters were navigable at the time the state was admitted to the union; if they were navigable, title to the beds would have vested in the state and not in plaintiffs' predecessor in title. The court held that waters navigable in fact were considered navigable in law. Navigable waters were defined as waters used, or susceptible of use, in their ordinary or natural condition, as highways of commerce. The court held artificial aids were acceptable if reasonable, to make a water way navigable. The court held on the facts of this case, however, that a waterway capable only of floating logs for three days a year with artificial aids from sluices and dams, was not navigable. Therefore title passed by mesne conveyances to plaintiffs and should be registered. (Harris-Fla)
W69-06609

BELL TEL CO V DRAVO CORP (UNDERWATER OBSTRUCTION TO NAVIGATION).
371 Pa 98, 88 A 2d 737-741 (1952).

Descriptors: *Navigation, *Pennsylvania, *Ships, *Damages, Admiralty, Ohio River, Rivers, Navigable waters, Shallow water, Boats, Remedies, Judicial decisions, Permits, Federal government, Legal aspects, Channels, Stream beds.
Identifiers: *Cables, *Obstruction to navigation.

Plaintiff was granted a permit in 1922 to lay a submarine cable in a trench three feet beneath the bed of a navigable river. In 1948, plaintiff sued for damages after defendant's towboat, maneuvering in shallow water, apparently struck and damaged this cable. The jury returned a verdict for the plaintiff and defendant appealed. The supreme court held that the trial judge should have granted a judgment notwithstanding the verdict for defendant. Ships have the paramount right to use navigable waters free from obstruction. Thus, the plaintiff had the burden of showing that the cable was maintained in its original position, or at least in a position where it would not obstruct navigation. However, the only reasonable inference from the evidence was that the cable had not been properly maintained and had become uncovered so as to create an obstruction to navigation. Defendant was not negligent in operating his towboat in shallow water. In a navigable stream, a ship has the right to operate wherever it can do so under its own power. (Gabrielson-Fla)
W69-06610

LEONARD V STATE HIGHWAY DEPT (ACQUISITION OF TITLE BY STATE THROUGH PERMANENT FLOODING OF LAND).

29 N J Super 188, 103 A 2d 97-101 (1954).

Descriptors: *New Jersey, *Ownership of beds, *Boundaries (Property), *Tidal effects, Condemnation, Land reclamation, Legal aspects, Tidal waters, Riparian rights, Land tenure, Dikes, State governments, Road construction, Judicial decisions, Avulsion, Appropriation, Ownership of beds, Water level fluctuations, Eminent domain.
Identifiers: *Riparian grants.

Plaintiffs brought suit to set aside a riparian grant to the State of New Jersey, to confirm that plaintiffs were the owners of the tract in question, and to require defendants to institute proceedings to condemn the land already taken for highway purposes. Plaintiffs' predecessor in title constructed a dike along a creek, excluding tidewaters from plaintiffs' land. Breaches in the dike had permitted flooding of the land to the extent experienced before the dike was constructed. After obtaining its riparian grant, defendant highway department removed the dike embankments which allegedly were the plaintiff's property. The Chancery Division dismissed the complaint. On appeal, the superior court held that a riparian owner might appropriate land which was previously a tide-flowed shore. However, the natural flooding of the land subsequent to the exclusion by the dike revested title in the state. The principle of avulsion applies with the result that a temporary flooding would not divest title already vested. The state need not give notice of its application for a riparian grant. (Harris-Fla)
W69-06611

WATERS AND WATER SUPPLY.

58 N J Stat Ann secs 19-15 to 19-20 (1966).

Descriptors: *New Jersey, *Legislation, *Administrative agencies, *Condemnation, Eminent domain, Water districts, Remedies, Water distribution (Applied), Public utilities, Public utility districts, Compensation, Condemnation value, Legal aspects, Water conservation, Water sources, Adjudication procedure, Real property, Water supply, Supervisory control (Power), Regulation.

The commissioner of a regional water division may perform all acts which the division may perform. To facilitate performance of division duties, Department of Conservation personnel may be assigned by the commissioner to division tasks. Public and private property may be condemned by the Division, however, public or private water systems may be condemned only for purposes of construction, development, or acquisition of a water supply system. Any person entitled to a compensation award who holds over on condemned property will be charged the reasonable value of use and occupancy of the property for the period subsequent to condemnation. To commence condemnation proceedings, the Division files a bill of taking describing the property, declaring the estate condemned and estimating reasonable compensation. Title vests in the state subsequent to such filing and on deposit of the compensation estimate with the court. The Board shall have the power to make reasonable regulations concerning public utility facilities. The Board may order a public utility to relocate providing that expenses incurred thereby are paid by the Division. (Katz-Fla)
W69-06612

CALIFORNIA CO V PRICE (OWNERSHIP OF NAVIGABLE WATER BED).
225 La 706, 74 So 2d 1-29 (1953).

Descriptors: *Louisiana, *Ownership of beds, *Boundaries (Property), *Bays, Beds, Gulf of Mexico, Legislation, Prescriptive rights, Tidal waters, Oil, Oil wells, Patents, Royalties, Leases, Proprietary power, Riparian land, Riparian rights, State governments, Administrative agencies, Legal aspects, Judicial decisions, Navigable waters.
Identifiers: Concursus proceedings.

Plaintiff instituted a concursus proceeding to determine ownership of accumulated oil royalties from wells drilled in the bed of a navigable bay. Louisiana claimed the funds by virtue of inherent sovereignty over navigable waters and beds. The Beckwith group asserted a rival claim founded on an 1874 patent from the state. The state contended that the rival claim was invalid in that it was against public policy to permit private ownership of the beds of navigable waters. The state also asserted title to the property by tax deed. The court recognized that Beckwith's patent was irregularly granted but determined that the legislature had ratified the grant by passage of an 1912 Act requiring all suits to vacate or annul a state patent to be brought within 6 years of the grant or passage of the act. The court noted that the tax deed had been officially cancelled. On rehearing, title was affirmed in the Beckwith group over a vigorous dissent protesting the ability of a private person to own the bed of navigable waters. (Katz-Fla)
W69-06613

BALL CREEK COAL CO V NAPIER (MEANDERS AS A BOUNDARY).

305 Ky 308, 202 SW 2d 728-731 (1947).

Descriptors: *Kentucky, *Accretion (Legal aspects), *Streams, *Boundaries (Property), Judicial decisions, Legal aspects, Meanders, Abatement, Riparian land, Boundary disputes, Riparian rights, Bank erosion, Relative rights, Land, Real property, Land tenure.
Identifiers: Calls.

The plaintiff owned a tract of land across from and south of a creek which flowed from defendant's tract. Plaintiff's deed affixed the northern property boundary as the meanders of the creek. Plaintiff brought this action in trespass to enjoin defendant from using an irregular strip on the north boundary of the dividing creek. Plaintiff contended defendant's grantor had not affixed defendant's southern boundary as the meanders of the creek. The court examined defendant's deed and ascertained that, although the word 'meanders' was not used in the deed, the call set forth conformed substantially to the meanders of the creek. Title was therefore found to be vested in the defendant. (Katz-Fla)
W69-06614

BURNQUIST V FISCHER (FLOWAGE EASEMENT APPURTENANT TO DAM).

71 NW 2d 161-167 (Minn 1955).

Descriptors: *Minnesota, *Dams, *Prescriptive rights, *Overflow, Easements, Lakes, Navigable waters, Public rights, Legal aspects, Water levels, Water level fluctuations, Judicial decisions, Structures, State governments, Flood damage, Flow, Maintenance.
Identifiers: *Perpetual flowage easements, Common law dedication, Presumptions.

The state brought action against certain persons who owned lands over which the state sought to establish a flowage easement appurtenant to an existing dam. The trial court found that defendants had dedicated a perpetual flowage easement over the lands in question for all overflow resulting from the existence of the dam at a crest elevation of 1065.40. To establish a common law dedication, the owner's intent to surrender or appropriate property to public use and acceptance thereof by the public must be shown. The statutes governing perpetual flowage easements do not supersede the common law regarding dedication of flowage easements; however, they do provide a minimum factual standard under which common law implied dedication will be presumed. The mere failure of defendants to bring action to abate the dam immediately after flooding of a portion of their lands did not imply acquiescence in all possible overflow resulting from maintenance of the dam. The court,

finding that the evidence did not sustain a finding of common law dedication for overflow on defendants' lands resulting from existence of the crest elevation of the dam, reversed the trial court's order and entered judgment for defendants. (Reed-Fla)
W69-06615

GREAT LAKES COMPACT (AGREEMENT FOR EFFICIENT MANAGEMENT OF THE GREAT LAKES BASIN).

Mich Comp Laws Ann, secs 3.601-3.607, 3.651-3.655 (1967).

Descriptors: *Michigan, *Interstate compacts, *International commissions, *Great Lakes, Interstate commissions, Legislation, Great Lakes Region, Lakes, International joint commission, International law, Federal government, State governments, Water law, Water policy, International waters, Fishing, Hydroelectric power, Water resources, Bank erosion, Navigation, Water pollution, Treaties.
Identifiers: *Great Lakes Commission, *Great Lakes Compact, Great Lakes Basin.

The governor of Michigan is empowered to execute an agreement with states and provinces bordering on the Great Lakes for the purpose of insuring proper management, control, and supervision of the waters of the Great Lakes. Michigan, by this statute, ratified the Great Lakes Basin Compact, the purposes of which are: (1) to promote the development, use, and conservation of the Great Lakes Basin; (2) to plan for water resources development and welfare; (3) to promote benefit from public works; (4) to secure a proper balance in the use of the Basin; and (5) to establish an agency to accomplish these purposes. The statute creates an intergovernmental agency, The Great Lakes Commission, and delineates its powers and functions. The Commission may consider and recommend policy, regulations, and agreements effecting parties to the Compact. The parties agree to consider the recommendations of the Commission regarding such areas as pollution, navigation, lake levels, fishing, hydroelectric power, soil and bank erosion and water diversion. The state pledges its cooperation in carrying out the Compact. (Helwig-Fla)
W69-06616

FRODERMAN V DIETZ (PRIVATE DAMS FOR FLOOD CONTROL).

92 NE 2d 553-555 (Ind 1950).

Descriptors: *Indiana, *Easements, *Dam construction, *Flood control, Judicial decisions, Flow control, Gates, Outlet works, Ponding, Water supply, Water conservation, Water control, Ponds, Drainage control, Flood protection, Water levels, Contracts.
Identifiers: *Oral agreements, Injunction (Prohibitory).

Plaintiff sued to enjoin the opening of outlets on a dam. The dam was necessary to maintain a constant water level in a pond subject to seasonal fluctuations. Originally, the plaintiff and two other landowners agreed to construct the dam. They were to have joint and several control over the outlets so that flooding would be prevented. The defendant, on whose land the pond was located, had purchased his tract from the prior owner with full knowledge of the existing agreement. Later, however, he refused to comply with the terms of the contract. He assumed complete control over the operation of the outlets. The court entered a judgment for the plaintiff, whose business depended upon a steady flow of water. The court granted the plaintiff the right to enter upon the defendant's land for the purpose of maintaining, operating, and controlling the dam. The decision was affirmed on appeal. (Stewart-Fla)
W69-06617

BAILEY V DRISCOLL (IMPLIED LIMITATION ON GRANT OF SUBMERGED LAND).

19 NJ 363, 117 A 2d 265-271 (1955).

Descriptors: *New Jersey, *Beds, *Ownership of beds, *Tidal waters, Administrative agencies, State governments, Legislation, Legal aspects, Riparian rights, Riparian lands, Islands, Boundaries (Property), Prescriptive rights, Navigable waters, Judicial decisions, Public lands, Public benefits, High water mark, Low water mark, Beds under water, Remedies, Rivers, River beds.

Plaintiff owner of an island located beyond the mainland property of defendant brought this action to have a grant of submerged lands declared invalid. The grant was made to defendant by the Council of Planning and Development Division of the State Conservation Department and conveyed to him the submerged lands in front of his riparian property to the center of the estuary. The court held that the legislation authorizing grants of underwater lands in front of property of a riparian tidewater owner implied a limitation on outward extension of such grants. The court determined that the established bulkhead or pier line was the proper limitation on the extent of such grants. The court, in correcting the termination point of defendant's grant, found that the plaintiff's property interest in submerged lands extending outward from his island was not infringed upon by defendant's grant. (Katz-Fla)
W69-06618

STATE V CITY OF CLEVELAND (RIGHT OF ACCESS TO NAVIGABLE WATERS).
150 Ohio St 303, 82 NE 2d 709-730 (1948).

Descriptors: *Landfills, *Ownership of beds, *Appropriation, *Ohio, Littoral, Riparian rights, Shallow water, Lake Erie, Condemnation, Compensation, Right of way, State governments, Local governments, Docks, Navigable waters, Navigation, Water law, Shores, Cities, Great Lakes, Damages, Remedies, Judicial decisions, Eminent domain, Legal aspects, Nonnavigable waters, Highways.
Identifiers: Fact questions.

Plaintiff owned land on Lake Erie and had commenced to fill in the shallow nonnavigable waters of the lake for the dual purpose of adding upland and wharfing out to navigable waters. Defendant entered this fill and constructed a highway across it, cutting off plaintiff's access to the sea. Plaintiff sued for compensation, and the trial court ordered the jury to assess damages. Defendant appealed; the court of appeals reversed, basing its decision on a statute which provided that a municipal corporation could build any work in aid of navigation and water commerce upon fill on submerged land without compensation. Plaintiff appealed this decision. The supreme court found that the state holds title to subaqueous land in trust for the protection of the public rights of navigation and commerce. The littoral owner has the right to wharf out to navigable waters provided he does not interfer with those public rights. The case turned on whether the highway was built in aid of navigation and water commerce. Determination of such a question is province of the jury, and thus, the court reversed and remanded for a new trial. (Gabrielson-Fla)
W69-06619

NANTAHALA POWER AND LIGHT CO V SLOAN (FLOWAGE EASEMENTS).

227 NC 151, 41 SE 2d 361-364 (1947).

Descriptors: *North Carolina, *Easements, *Condemnation, *Dams, Condemnation value, Flooding, Reservoirs, Power plants, Local governments, Judicial decisions, Damages, Power operation and maintenance, Eminent domain, Public utilities, Legal aspects.

The petitioner power company instituted this condemnation proceeding to acquire a flowage easement on respondent's land for an increase in the level of a reservoir created by a 25 foot dam. A consent judgment had been entered in 1928 granting an easement on respondent's land for the original reservoir level, and, over respondent's objection, this judgment was entered into evidence at trial. This court ordered a new trial, holding that the original judgment was inadmissable since respondent had admitted the existence of the prior easement. The judgment was not admissable on the issue of damages to be awarded respondent for the easement since it was too remote and there was evidence of a compromise. Respondent was entitled to recover the difference in the fair market value of her property immediately before the additional burden was placed upon it and the fair market value of the property immediately thereafter. (Kahle-Fla)
W69-06620

XIDIS V CITY OF GULFPORT (USE OF SUBMERGED LANDS FOR PUBLIC PURPOSE).
72 So 2d 153-160 (Miss 1954).

Descriptors: *Mississippi, *Harbors, *Eminent domain, *Beds under water, Public lands, Riparian rights, Condemnation, Public benefits, Public rights, Legal aspects, Navigable waters, Ownership of beds, Cities, Compensation, Remedies, State governments, Judicial decisions, Legislation, Financing.
Identifiers: *Bond issue, Injunctions (Mandatory), Injunctions (Prohibitory).

The plaintiffs brought this action for an injunction to restrain the defendant from constructing a small craft harbor in front of plaintiff's property. Plaintiffs' land was separated from the shoreline by a four-lane highway. The plaintiffs alleged that construction of the harbor would deprive them of their riparian rights. They also claimed that their property was being taken without just compensation. Finally, they charged that the defendant did not have authority to use the funds derived from a bond issue because the electors did not receive sufficient notice of the purposes for which the bonds were issued. The court ruled against the plaintiff on all three counts and dismissed the complaint. Land below navigable waters belongs to the state and is held in trust for public benefit. The city's use of land underlying navigable waters for a public purpose does not constitute a 'taking' of private property for which compensation must be paid. Furthermore, the court found that the deeds, statutes, and bonds upon which the defendant relied for authorization were valid. Therefore, the defendant was allowed to construct the small craft commercial harbor according to plan. (Stewart-Fla)
W69-06621

FONADELLAS V UNITED STATES (TEMPORARY TAKING OF PROPERTY FOR PUBLIC PURPOSE).

107 F Supp 1019-1023 (Ct Cl 1952).

Descriptors: *Puerto Rico, *Compensation, *Channel improvement, *Flood damage, Federal government, Canal construction, Easements, Condemnation, Channel erosion, Dredging, Depth, Channel flow, River basin development, Water spreading, Beds, Saline water, Mud, Silts, Eminent domain, Damages, Condemnation value, Judicial decisions.
Identifiers: *Tucker Act.

Plaintiff brought this action under the Tucker Act to recover compensation for the taking of his property by the government. Defendant constructed an additional channel in the harbor area of San Juan, Puerto Rico, and, while doing so, caused some of the plaintiff's land to become buried under mud and silt. Also, because of the construction, portions of the plaintiff's lands were flooded with

alt water. Defendant had plaintiff's permission for he construction of the canal; however, the court aid that this did not constitute, as defendant con-ended, a waiver of claim for any damages. The ourt ruled that such action on behalf of the defen-ant constituted a taking, not by appropriation but y destruction. The fact that the taking was tempo-ary did not relieve the defendant from the duty to eimburse plaintiff for his damages. (Stewart-Fla)
V69-06622

KANSAS CITY LIFE INS CO V UNITED TATES (IMPAIRMENT OF LAND VALUE DUE O DAM CONSTRUCTION).

4 F Supp 653-656 (Ct Cl 1947).

Descriptors: *United States, *Groundwater bar-iers, *Condemnation, *Drainage, Groundwater ovement, Groundwater, High water mark, Judi-ial decisions, Legal aspects, Eminent domain, Mis-ouri, Mississippi River, Surface runoff, Creeks, lon-navigable waters, Water levels, Dams, ackwater, Locks, Drainage systems, Surface aters, Federal government.
Identifiers: Due process.

he construction by the government of a lock and am in the Mississippi River raised the water level n the river and in a non-navigable creek bordering laintiff's land. The raised creek level prevented rainage of underground and surface water from laintiff's land. Plaintiff sued the United States to ecover compensation for impairment of the land's arming value. The court awarded judgment for laintiff. It was held that the impairment con-tituted a taking of land within the meaning of the th amendment of the Federal Constitution. The overnment was not privileged to deprive plaintiff f the right to drain his land even though such eprivation was incidental to the improvement of avigation in the Mississippi River. The dissent oted that numerous Supreme Court cases had de-ied recovery for property damage where the water evel was not raised above the high water mark. (Wheeler-Fla)
V69-06623

CHRISTMAN V STATE (NEGLIGENCE IN CUL-VERT CONSTRUCTION).

0 NYS 12-16 (Ct Cl 1947).

Descriptors: *New York, *Road construction, Drainage systems, *Culverts, Storm runoff, Sur-ace runoff, State governments, Ditches, Drainage, ighways, Topsoil, Humus, Erosion, Watersheds Basins), Flood control, Streams, Topography, Ac-elerated erosion, Storm drains, Legal aspects, Ju-icial decisions, Excessive precipitation, Rainfall ntensity, Obstruction to flow, Damages.
Identifiers: Proximate cause.

Claimant sued the State of New York for property amages arising from State's alleged failure to exer-ise due care and diligence in providing an dequate drainage system and culverts in connec-on with the construction of a highway. The court ound that the State had a duty to provide culverts hich would adequately carry off reasonable quan-ties of water from the watershed area. It further eld that the State had breached this duty and ould be liable for all damages to plaintiff. The ourt also based liability upon the State's failure to eep culverts free from obstructions. Defendant's rgument that a rainfall of two inches in three ours, similar to past rainfalls in that area, was an act of God' was rejected since such a quantity of ainfall could have been reasonably anticipated. (Logan-Fla)
V69-06624

HARDY V KANSAS CITY (FLOODING CAUSED BY OBSTRUCTION TO WATER FLOW).

84 SW 2d 27-31 (Mo Kansas City Ct App 1955).

Descriptors: *Missouri, *Obstruction to flow, *Negligent inundation, *Cities, Flooding, Flood damage, Drainage, Storm drains, Surface runoff, Sewers, Embankments, Rainfall intensity, Drainage water, Project planning, Engineers estimates, Contract administration, Remedies.
Identifiers: Independent contractors, Proximate cause.

Plaintiff brought suit against defendant city to recover damages for flooding of her land. The flooding was allegedly caused by obstruction of the natural flow of a creek and by the removal or destruction of existing drainage facilities by constructing of a sanitary and storm sewer. Defendant alleged that the acts complained of were the voluntary acts of a construction company, an independent contractor. The court pointed out that the evidence failed to sustain this contention. Defendant also contended that plaintiff failed to establish every essential element of his cause of action since the evidence disclosed that the flooding would have occurred regardless of the acts complained of. The court concluded that there was evidence sufficient to go to the jury on the issue whether the flooding was due to the filling of the creek, the destruction of existing drainage facilities, and the failure of defendant to provide other facilities. As the question of defendant's liability was properly decided in plaintiff's favor by the jury, defendant was liable for damages resulting from the flooding of plaintiff's land. (Reed-Fla)
W69-06625

POTEETE V CITY OF WATER VALLEY (ARTIFICIAL CONTROL OF SUBSURFACE DRAINAGE).

57 So 2d 565-567 (Miss 1952).

Descriptors: *Mississippi, *Local governments, *Subsurface drainage, *Drainage water, Culverts, Drains, Outlet works, Judicial decisions, Damages, Levees, Barriers, Slopes, Grading, Embankments, Roadbanks, Elevation, Cities, Legal aspects.

The plaintiff brought this suit to recover for damages allegedly resulting from the raising of the street level by the defendant. The plaintiff contended that this caused large quantities of water to be cast upon his property. In addition, the plaintiff alleged that the defendant had substituted a smaller drainage culvert for the one previously used. The court held that in order for plaintiff to recover damages the burden was upon him to show that defendant had raised, or changed, the grade of the street, so as to cast the water on plaintiff's property. The jury verdict must be sustained if plaintiffs do not meet this burden. (Stewart-Fla)
W69-06626

CLEMENTS V TOWN OF CARROLLTON (DAM ACROSS DRAINAGE DITCH).
63 So 2d 398-400 (Miss 1953).

Descriptors: *Mississippi, *Obstruction to flow, *Dams, *Surface runoff, Ditches, Natural flow, Cities, Check structures, Overflow, Culverts, Diversion, Surface waters, Judicial decisions, Diversion structures, Drainage effects, Road construction.
Identifiers: *Injunctions (Mandatory).

Plaintiff town brought this suit for damages and for an injunction to have a dam across a drainage ditch on defendants' property removed. Defendants filed a cross-bill for damages to their property on the ground that the town had increased the natural flow of water into the drainage ditch by blacktopping a street, and had negligently failed to deepen and clean the ditch. A preliminary injunction was issued and served upon defendants and, within two weeks, they removed the dam. The trial court entered a perpetual injunction requiring the removal of the ditch but denied damages to the town. The cross-bill was dismissed. Defendants appealed, contending that the chancellor's findings were not supported by the evidence. As to defendants' contention that the town was negligent in its failure to deepen and clean the ditches, the court indicated that the decision of the chancellor, who viewed the premises, would not be disturbed unless not supported by substantial evidence. The court held that the chancellor's decree was amply supported by the evidence and should not be disturbed. Accordingly, the decree of the trial court was affirmed. (Reed-Fla)
W69-06627

UNITED STATES V TURNER (OWNERSHIP OF BEDS UNDER SHALLOW WATERS).

175 F 2d 644-651 (5th Cir 1949).

Descriptors: *Alabama, *Ownership of beds, *Landfills, *Shallow water, Dredging, Riparian rights, Navigation, Beds, State governments, Bays, Accretion (Legal aspects), Erosion, Condemnation, Compensation, Damages, Remedies, Judicial decisions, Right of way, Navigable waters, United States, Legal aspects, High water mark.
Identifiers: *Right of access.

Appellant sought to condemn land held by appellee. Appellant alleged that most of the land had been submerged prior to being filled in by appellee, and therefore, that the title to such land was still in the state. The trial judge ruled: (1) that the state had lost title to the formerly submerged land because the waters covering it had been too shallow for navigation; (2) that even if the state had owned the submerged portions, appellee acquired title by exercizing his right to fill in the shallows out to deep water. The jury awarded a substantial sum to the appellee, and appellant appealed. The court of appeals held that the appellee was entitled to compensation only for that portion of the land which was above the high water mark prior to filling. The court ruled that the state had title to the navigable waters and the soils under them regardless of whether certain portions of those waters were too shallow for navigation. The court also held that an individual cannot acquire title by artificially filling in submerged lands. In addition, the right to make such fills exists only for the purpose of reaching deep navigable water. Such was not the purpose in this case. (Gabrielson-Fla)
W69-06628

STATE V KIVETT (SUIT TO ENJOIN PRIVATE MINING OF STATE-OWNED RIVER BEDS).

95 NE 2d 145-153 (Ind 1950).

Descriptors: *Indiana, *Navigable waters, *Ownership of beds, *Rivers, Navigation, Judicial decisions, Damages, Permits, Dredging, Mining, Legal aspects, State governments, Federal jurisdiction, Control, Regulation, Gravel, Sands.
Identifiers: Injunction (Prohibitory).

Defendant owned land on the White River and began to remove sand and other materials from the river bed. Defendant refused to secure a state permit to operate his drag line. Subsequently, the state brought action to enjoin defendant from taking the materials and for an accounting for all materials he had taken. The appellate court reversed the trial court's judgment for defendant. The court found the controlling issue to be the ownership of the river bed. It held that title to the particular portion of the bed in question was in the state. The court said the question of ownership depended upon whether the particular section of the river was navigable at the time the state was admitted to the Union; the determination of navigability was to be made by applying federal law. Under federal law, a river which is navigable in fact is navigable for all purposes. Evidence was sufficient to show navigability in fact at the time Indiana was admitted to the Union. The case was remanded for hearing on the question of damages. (Wheeler-Fla)
W69-06629

WATER SUPPLY DISTRICTS.

N J Stat Ann secs 58:5-16, 58:5-19, 58:5-27, 58:5-36 (1966).

Descriptors: *New Jersey, *Water districts, *Water supply, *Contract administration, Legal aspects, Legislation, Maintenance, Construction, Costs, Facilities, Condemnation, Canals, Cities, Municipal water, Reservoirs, Administrative agencies, Contracts, Operation and maintenance, Local governments, Water rights, Regulation, Water works.

The district water supply commission shall have the power to acquire all existing water rights and distribution systems owned by existing corporations or municipalities which are necessary to carry out the execution of water supply contracts. The commission has the power to acquire by purchase or condemnation all property necessary for construction or operation of a water supply network. The power to construct all facilities necessary to provide contracting municipalities in the water supply district with a sufficient water supply is also given to the commission. The commission may acquire by agreement, purchase, or condemnation, from any canal corporations, the water rights necessary for its reservoirs. Municipalities within a water supply district may not extend their existing water supply network without the consent of the commission. The commission shall have the power to: (1) maintain and use water transmission facilities; (2) acquire any property deemed necessary for such facilities; and (3) enter into any agreements necessary to carry out any power conferred by this act. The commission shall not have the power to condemn municipal water works. (Holt-Fla)
W69-06630

ICE DEALERS; BATHING; WATER SUPPLY FOR RURAL FIRE PROTECTION.
N J Stat Ann 58:7-1 to 58:9-1 (1966).

Descriptors: *New Jersey, *Ice, *Swimming, *Navigation, Legal aspects, Legislation, Public rights, Relative rights, Riparian rights, Dams, Beds under water, Local governments, Ownership of beds, Navigable waters, Right-of-way, Fresh water, Judicial decisions, Alteration of flow, Hydrants, Ponds.
Identifiers: *Fire protection, *Ice dealers.

All persons with ice houses on the waters of this state may gather ice to the middle of the water body upon which they are located. No persons shall interfere with such gathering of ice except for purposes of navigation. The right to gather ice does not extend to owners of mill ponds nor to parties having a mere right-of-way upon the shore of the state's watercourses. Persons may bathe or swim in any fresh waters of the state so long as no trespass is thereby committed. Any governing body in the state may alter stream beds and construct dams, fire hydrants, or obtain any other necessary equipment in order to provide adequate rural fire protection. (Harris-Fla)
W69-06631

SEWERAGE DISTRICTS AND BOARDS.
For primary bibliographic entry see Field 05G.
W69-06632

SEWERAGE DISTRICTS AND BOARDS.

N J Stat Ann secs 58:12-24 to 58:12-28 (1966).

Descriptors: *New Jersey, *Sewage districts, *Construction, *Drainage systems, Legislation, Water law, Planning, Water policy, Condemnation, Sewage disposal, Cities, Roads, Grading, Drainage programs, Administrative agencies, Alteration of flow, Operation and maintenance, Sewers, Real property.
Identifiers: *Channel alteration, Intercepting sewers.

Any incorporated board may, within its respective district, construct, maintain, and operate a sewerage and drainage system. All parties owning or controlling such sewerage and drainage systems shall provide for their connection to existing or proposed intercepting or main sewers. Any lands necessary for the construction of sewers, drains, or disposals may be acquired by purchase or condemnation by the board. The board is authorized to enter upon any land for survey purposes providing no unnecessary damage is done to private or other property. The board is given the power to construct the sewers in any place they deem necessary provided they do not impede navigation or travel and provided they restore all roads and streets to their conditions prior to construction. For constructions outside of the sewer district, consent from the governing body of the municipality is required. The board has the power to change the course or direction of any watercourse, and, with consent of the controlling body, to alter the grade of highways and streets. (Holt-Fla)
W69-06633

JURISDICTION OVER WATERS.

Minn Stat Ann secs 1.02, 1.03, 1.044, 1.12 (1946), as amended, (Supp 1968).

Descriptors: *Minnesota, *Wildlife, *Jurisdiction, *Bodies of water, Shores, Mississippi River, Wildlife conservation, Fish conservation, State jurisdiction, United States, Legislation, Easements, Right of way, Highways, Flow, Public benefits, State governments, Federal government, Interstate rivers, Interstate, Projects, Boundaries (Property), Lakes, Rivers.

All courts currently exercising jurisdiction over Big Stone Lake, Lake Traverse, Bois de Sioux River, or Red River of the North, shall continue to exercise jurisdiction in all civil and criminal cases involving such waters concurrently with the courts of other states bordering on such waters, so far as any of these waters form a common boundary between this state and any other state. The concurrent jurisdiction of the courts shall extend over such water areas as if the boundaries of the county were extended to the opposite shore. The state gives consent to the United States to acquire lands and water within the state for use in the establishment of the Upper Mississippi River Wild Life and Fish Refuge. The state maintains jurisdiction over the area as long as such retention is not inconsistent with the purposes of the United States in establishing the preserve. The state may convey to the United States any easement for flowage owned by the state for trunk highway right of way purposes when it shall be required by the United States for public improvement. (Shevin-Fla)
W69-06634

CERTAIN GAME PRESERVES, AREAS, PROJECTS; CONTROL.
Minn Stat Ann sec 84A.55 (1964).

Descriptors: *Minnesota, *Public lands, *Conservation, *Land management, Drainage, Land development, Forests, Recreation, Fishing, Hunting, Wildlife, Land use, Camping, Regulation, Legislation, Land resources, Parks, Wildlife conservation, Forest management, Natural resources, Condemnation, Administrative agencies, Construction, Maintenance, Eminent domain.
Identifiers: Game preserves.

The Commissioner of Conservation shall manage, operate, and control all game preserves, areas, and projects established by sections 84A.01, 84A.20 or 84A.31 of the Minnesota Statutes. The powers and duties of the Commissioner are: (1) care of the forests and fire prevention; (2) sale of timber; (3) regulation of the waters of lakes and streams; (4) protection of wildlife; (5) issuance of hunting, fishing, and camping licenses; (6) policing of the game preserves; (7) investigations and surveys for and construction of drainage projects on state land; (8) construction and maintenance of roads and landing fields; and (9) promulgation of rules and regulations for the execution of his duties and powers. Nothing shall be done under this Act which will interfere with or damage any ditch, road, or highway of any governmental subdivision, agency, or person unless just compensation is paid. The Commissioner may acquire by purchase or condemnation any land, public work, or project necessary for any authorized purpose. (Helwig-Fla)
W69-06635

PETITION OF MARTIN (OBSTRUCTION TO NAVIGATION).

102 F Supp 43-51 (E D Pa 1951).

Descriptors: *Pennsylvania, *Navigation, *Admiralty, *Navigable waters, Rivers, Shallow waters, Ships, Boats, Damages, Remedies, Judicial decisions, Permits, Federal government, Legal aspects, Channels, Streambeds, Piers.
Identifiers: *Cables, *Obstruction to navigation.

Because of emergency conditions, respondant received a government permit to lay untrenched power cables across the bottom of a navigable river. Petitioner's tugboat, while executing a necessary and orthodox maneuver 100 feet off of the end of respondant's pier, struck and damaged some of those cables. Petitioner sought an exemption from and limitation of liability resulting from the collision. The court granted the petition. It held that the right of a vessel to operate in navigable waters free from obstructions was paramount to the right of the owner of unentrenched cables lying beneath the surface. The permit from the proper governmental agency allowing the cables to be laid unentrenched did not alter petitioner's rights. In laying the unentrenched cables, respondant assumed the risk that vessels operating on the navigable waterway might collide with the cables in the shallow waters off respondant's pier. The court could not find the tugboat captain negligent in assuming the power cables would be located a safe distance below the soft mud bottom in waters where his vessel could navigate. (Gabrielson-Fla)
W69-06636

SOUTHERN TRANSPORTATION CO V CITY OF NEW YORK (NEGLIGENCE OF BRIDGE OPERATOR AND TUG MASTER CAUSING BARGE COLLISION).

98 F Supp 967-972 (SD NY 1950).

Descriptors: *New York, *Bridges, *Navigation, *Cities, Abutments, Currents (Water), Transportation, Piers, Judicial decisions, Inland waterways, Mechanical equipment, Boats, Navigable waters, Warning systems, Damages, Streams.
Identifiers: *Barges, *Tug boats.

A barge owner filed suit against the city, as bridge owner and operator, and against certain steamtug owners to recover for damage to its barge sustained in a collision with a bridge abutment. Plaintiff alleged that city's bridge operator was negligent in failing to open the bridge upon timely signal and that defendants' steamtug, towing the barge, was operated at an excessive speed and negligently lost control of its tow, causing it to sheer into the bridge abutment. The court stated that a bridge spanning a navigable body of water is an obstruction to navigation and that bridge operators have duty to open bridge promptly upon signal from vessels desiring passage. The record showed that, while bridge operator must have heard tug's signal, he failed to open the bridge or give warning that it would not open. This failure to open was ruled a fault contributing to the collision. Furthermore, the court held the tug's continued movement toward the bridge at full speed, when, in a reasonable view of the situation, it was apparent that the bridge was not opening, was a contributing cause of the collision for which its owners, with city, would be held liable for damages. (Reed-Fla)
W69-06638

OWEN V JOHNSON (OWNERSHIP OF THE BED OF A NAVIGABLE STREAM).

263 SW 2d 480-482 (Ark 1954).

Descriptors: *Arkansas, *Navigable waters, *Riparian rights, *Boundaries (Property), Ownership of beds, State governments, High water mark, Legal aspects, Judicial decisions, Real property, Watercourses (Legal), Beds.
Identifiers: Adverse possession.

In an action to quiet title, plaintiff asserted ownership of certain lands acquired by adverse possession and by certain recorded deeds. Defendants also claimed title to the 3.5 acre tract. A town and the Commissioner of state lands intervened claiming interests in certain part of the land. The supreme court upheld the trial court's judgment for plaintiff as against defendant and the town. As to the claims of the state, the court took judicial notice that White River was a navigable stream where it bordered plaintiff's land. Consequently plaintiff owned only to the high water mark. Title to the beds was in the state. (Harris-Fla)
W69-06639

ERICKSON V GREUB (TITLE TO ACCRETION).

287 SW 2d 873-876 (Mo 1956).

Descriptors: *Missouri, *Erosion, *Erosion control, *Accretion (Legal aspects), Missouri River, Bank erosion, Boundaries (Property), Dikes, Retaining walls, Stream improvement, Federal government, Riparian rights, Judicial decisions, Remedies, Legal aspects, Relative rights, Real property, Islands.

Plaintiff brought action to quiet title to a 40 acre tract on the west bank of the Missouri River. Previously a large portion of the tract had been eroded by the swift flowing river currents. However, following government construction of retaining walls and dikes, a process of accretion began which culminated in the formation of an island which eventually became attached to what had been the west bank of the river. Defendant, who owned property adjacent to plaintiff's tract, claimed title to this land, alleging that plaintiff's entire tract had washed away and that the accretion had formed on land which, in reality, belonged to the defendant. The trial found that one small corner of plaintiff's land had not washed away and entered a judgment for plaintiff. Defendant appealed. The appellate court affirmed the lower court's decisions, holding that accreted land belongs to the person who owns the land to which the accretions become attached. Since the trial court found that defendant's land was separated from the accreted land by plaintiff's land, the accretion could not have been to defendant's land. (Gabrielson-Fla)
W69-06641

EMINENT DOMAIN.
Minn Stat Ann secs 117.01, 117.38 to 117.47 (1967).

Descriptors: *Minnesota, *Legislation, *Eminent domain, *Riparian rights, Cities, Conservation, Mining, Land tenure, Road construction, Drainage systems, Federal government, State governments, Condemnation, Easements, Alteration of flow, Judicial decisions, Industries, Transportation.
Identifiers: *Taconite mining.

The taking of private property for public purposes shall be by power of eminent domain, unless the taking relates to laws concerning roads and drainage, where the law prescribes a specific procedure. When any governmental authority authorizes any change in any watercourse in Minnesota, any company licensed to transport freight or passengers may acquire lands needed to improve its property as necessitated by such changes. The acquisition may be either by purchase or condemnation by right of eminent domain, but any interested municipality may question the necessity for condemnation. Upon acquiring title, the corporation shall convey them to the governmental authority. An award of compensation for condemnation confirmed by a city shall be paid only to one showing a right to it and only under such conditions as the city shall deem proper. The Commissioner of Conservation and any corporation or association mining or beneficiating taconite or semitaconite are authorized to acquire property or water rights by eminent domain to facilitate operations or shipping. The Commissioner of Conservation may grant permits or leases on or across lands, and may license the flooding of state lands in connection with legislative authorization to use public waters. (Harris-Fla)
W69-06642

HAYNES V SMITH (PRIVATE COMMERCIAL VENTURES ON PUBLIC WATERS).

85 So 2d 326-332 (La Ct App 1956).

Descriptors: *Louisiana, *Commercial fishing, *Ownership of beds, *Marinas, Judicial decisions, Fishing, Freshwater fish, Riparian land, Riparian rights, Water supply, Water rights, Recreation, Boats, Lakes, Public health, Sanitation, Public lands, Lakes, Appropriation, Administrative agencies, Construction, Cities.
Identifiers: Injunctions (Prohibitory).

Plaintiffs, lakeshore owners, brought suit to enjoin construction of a commercial fishing camp on nearby lakeshore property. Plaintiffs contended that defendant had no legal right to engage in a private commercial venture on waters which were held in trust for the public. Such venture would constitute an illegal appropriation of public property for a private purpose. In addition, plaintiffs contended that the fish camp would constitute a nuisance because of noise and conjestion. Finally, plaintiffs claimed that lake had been dedicated to the city as a municipal water source and that this dedication precluded any other use. The court found that the only basis for the plaintiffs' objection was their desire to enjoy a completely private and restricted area. Consequently, a judgment for the defendant was affirmed. The court ruled that the defendant had obtained permission from the proper authorities and that there were no restrictions affecting the use of the lake for private commercial ventures. (Stewart-Fla)
W69-06643

CARNASION V PAUL (RIGHT OF A COUNTY TO TAX TIDELAND PROPERTY).

53 So 2d 304-306 (Fla 1951).

Descriptors: *Florida, *Taxation, *Piers, *Navigable waters, Atlantic Ocean, Coastal structures, Concrete structures, Tides, Seashores, Low water mark, Tidal waters, Federal government, Federal-state water rights conflicts, State governments, Permits, Jurisdiction, Oil, Ownership of beds, Legal aspects, Judicial decisions, Local governments.
Identifiers: *Tidelands, Police power.

Appellee filed a bill in equity questioning the authority of the county to tax a pier constructed pursuant to a permit from the federal government. The pier was located below the low water mark of the Atlantic Ocean. Appellant contended that exclusive dominion over the tidelands was vested in the United States and therefore, these lands were beyond the taxing jurisdiction of the state. The court held that the exclusive dominion of the United States over the tidelands applied only to oil deposits beneath them. The court stated that the paramount right of possession was in the United States with a concurrent right of possession in the sovereign states to be exercised when not in conflict with the rights of the United States. The court held that the county had a right to tax the area by virtue of its police powers as long as such taxes did not conflict with the authority of the United States. (Shevin-Fla)
W69-06644

DAVIS V CITY OF ALEXANDRIA (PUBLIC USE OF LEVEE BANK AS ROADWAY).

69 So 2d 587-589 (La Ct App 1953).

Descriptors: *Louisiana, *Levees, *Cities, *Easements, Berms, Public rights, Riparian rights, Embankments, Legislation, Sewers, Banks, Roadbanks, Highways, Engineering structures, Meanders, Rivers, Right of way, Maintenance.
Identifiers: *Public servitudes.

Plaintiff brought suit to prevent the city of Alexandria from using a roadway crossing plaintiff's property on the berm of a river levee bank or in the alternative, to recover compensation for the city's alleged appropriation of said roadway. A portion of plaintiff's lot was occupied by a levee, at the toe of which was a strip of ground following the meanders of the levee. Defendant alleged that this strip had been used as a public street for many years. Defendant further asserted that the roadway was a public highway before being included within the city limits, and that there had never been any appropriation by the city. The roadway in question was built on the levee berm, that is, on the embankment superimposed on the natural ground toward the levee proper. The court observed that a state statute provided that public servitudes relate to the space to be left by the adjacent proprietors on the shores of navigable rivers for public use and for the making and repairing of levees. The court held that, under the provisions of this law, the city had the right of public passage, and plaintiff could not prevent the use of the embankment as a roadway. Since this land was subject to a public servitude, plaintiff was not entitled to compensation. (Reed-Fla)
W69-06645

EARLE V MCCARTY (TITLE TO LAND BETWEEN SOUND AND DEDICATED ROAD).

70 So 2d 314-317 (Fla 1954).

Descriptors: *Florida, *Proprietary power, *Land tenure, *Boundaries (Property), Cities, Accretion (Legal aspects), Atlantic Ocean, Legislation, Right of way, Navigable waters, Rivers, Access routes, Roads, Public rights, Beds, Legal aspects, Surveys, Land forming.
Identifiers: *Abandonment, *Dedication, Plats.

The owner of a lot bounded on east by the sea and on west by a street brought suit to determine title to land which was not platted and which was situated to the west of the street. Plaintiff alleged that, although his grantor had dedicated the street to the public, such roadway had never been accepted by the city. Plaintiff further alleged that where a dedicated street is not accepted, or is abandoned, title reverts to abutting landowners. Thus, plaintiff argued that he owned the street together with the dedicated, but unaccepted, land in controversy. The tract had greatly increased in size due to accretion. Plaintiff's lot had disappeared under the ocean. The court declared that the dedication of the street must be deemed to have been 'accepted' by the city upon its acceptance of grantor's deed to the street. Furthermore, the city cannot be said to have abandoned the street because of its failure to improve it; the need for improvement had never arisen. Finally, the court held that, even assuming abandonment of the street or nonacceptance of its dedication, the fact that this land did not appear on the plat indicated a reservation rather than a dedication by the grantor. Therefore, plaintiff had no claim to the unmarked strip of land. (Reed-Fla)
W69-06646

FLOOD WALL BOARD.

W Va Code Ann sec 8-4A-21a (1966).

Descriptors: *West Virginia, *Flood control, *Administrative agencies, *Barriers, Obstruction to flow, Cities, Structures, Concrete structures, Flood protection, Flood routing, Floodwater, Regulation, Supervisory control (Power), Legislation, Local governments, Operation and maintenance, Taxes, Financing, Assessments, Costs.
Identifiers: *Flood walls.

Municipal authorities may provide by ordinance that the custody, administration, operation, and maintenance of flood walls shall be under the supervision and control of a flood wall board. Any such ordinance enacted may not later be repealed or amended in such a manner as to impair or defeat the purposes for which it was enacted. The board may establish rules and regulations but are not empowered to levy or collect ad valorem or other taxes or assessments. Municipal authorities are to provide adequate funds to the board. (Wheeler-Fla)
W69-06647

HAMMEL V CAMP RANGER, INC (PRESUMPTIONS REGARDING CONVEYANCE OF INLAND, NON-NAVIGABLE POND).

87 NYS 2d 892-899 (App Div 1949).

Descriptors: *Land tenure, *Ponds, *Boundary disputes, *Boundaries (Property), Judicial decisions, Legal aspects, Ownership of beds, Water level fluctuations, Low water mark, Banks, Recreation, Adjudication procedure, Water rights, Remedies.
Identifiers: *Evidence, Suit to quiet title, Rebuttable presumptions.

The defendant appealed from an adverse ruling below concerning title to a portion of land claimed by both litigants. The lower court determined that the phrase 'the said premises to run along the said Pleasant Pond, and to the low water mark thereof,' contained in defendant's deed, indicated that the defendant did not have title to the pond itself. The supreme court reversed, stating that the law of New York requires that the terms of a grant be liberally construed in favor of the grantee, especially as to a grant of land on a small inland body of water. A strong presumption arises in cases such as this one that the grantor intended to convey ownership under water at least to the center of the pond. Nothing short of express language to the contrary will overcome the force of this presumption. The dissent vigorously contended that the presumption was overcome by the express terms of deed. (Katz-Fla)
W69-06648

ELDER V DELCOUR (MISSOURI ADHERES TO STRICT TEST OF NAVIGABILITY IN DETERMINING TITLE TO RIVER BED).

269 SW 2d 17-27 (Miss 1954).

Descriptors: *Mississippi, *Ownership of beds, *Navigable waters, *Non-navigable waters, River beds, Riparian rights, Streambeds, Public rights, Legal aspects, Judicial decisions, State jurisdiction, Water rights, Wildlife, Obstruction to flow, Barriers, Streams, Damages, Remedies, Fishing, Fish.
Identifiers: Meramec River, Declaratory judgment.

Plaintiff brought this action for a declaratory judgment to determine the rights of the general public to float down and fish in a river flowing across defendant's farm. The supreme court determined that title to a submerged river bed remains in the public domain as long as the river is used as a highway for commerce and travel. The court found the river to be nonnavigable in the sense that it was not used for commerce or travel and declared that defendant had title to the submerged bed. The title was not absolute, but subject to the burdens imposed by the river itself. Though the river was not navigable in the sense that title to the bed would remain in the public domain, the court held that it was navigable in fact and that defendant's title was subject to a public easement for purposes of navigation. It was also determined that the right to fish in the stream was incident to the right of navigation as title to fish in the stream remains in the state until they are reduced to possession. (Katz-Fla)
W69-06649

SKALITSKY V CONSOL BADGER CO-OPERATIVE (OWNERSHIP OF FILLED POND BED).

252 Wisc 132, 31 NW 2d 153-155 (1948).

Descriptors: *Wisconsin, *Ownership of beds, *Boundary disputes, *Landfills, Judicial decisions, Boundaries (Property), Backwater, Bodies of water, Damages, Proprietary power, Pipes, Streambeds, Shores, Relative rights, Legal aspects, Great ponds, Cities, Land forming, Ponds.

Plaintiffs acquired land along the shoreline of an artificially created pond. Later, by quit-claim deed, a city acquired a strip of the pond bed. A portion of the city's tract bordered on plaintiff's land. After filling in the bed, the city permitted defendant to lay pipes across the filled land for the purpose of supplying water to defendant's industrial plant. Plaintiffs brought suit to void the city's title, to compel removal of the structures, and for damages. Plaintiffs alleged that they owned the filled in land bordering the original shoreline of their lot. This claim was based on the rule that when one purchases land bordering on a stream, he takes title to the stream's thread unless otherwise provided. The appellate court affirmed the lower court's dismissal. The court ruled plaintiffs' grantors did not intend to convey title to the bed, and since plaintiffs had no title to the filled land they had no right of action. The court noted that plaintiffs' land did not border a stream; it bordered a pond, which had no thread. The court also stated that title to the bed rests on title to the bed itself, not on title to the bank. (Wheeler-Fla)
W69-06650

HANCOCK V STULL (INTERFERENCE WITH NATURAL DRAINAGE OF SURFACE WATER).
86 A 2d 734-736 (Md 1952).

Descriptors: *Maryland, *Obstruction to flow, *Surface drainage, *Natural flow, Surface waters, Surface runoff, Rainwater, Drainage effects, Drainage systems, Judicial decisions, Drainage water, Repulsion (Legal aspects), Relative rights, Alteration of flow, Storms, Remedies, Walls, Engineering structures, Diversion.

Plaintiff sought to have defendant enjoined from maintaining a wall which diverted the natural flow of surface waters onto plaintiff's land. Plaintiff admitted that he had placed a wall in the course of the natural surface flow, and that this caused concentrated amounts of surface water to flow onto defendant's land. The court held that the construction of the wall so as to divert the flow onto plaintiff's land was an invasion of plaintiff's rights. The fact that plaintiff increased the flow onto defendant's land was not sufficient cause to deny plaintiff relief. Appropriate relief, including removal of portions of the wall should be conditioned on plaintiff's rectification of his own wrongdoing. An agreement between adjoining landowners with respect to diversion of surface waters naturally flowing across the rear of their lots must be made by the landowners and not by the court. (G Kelly-Fla)
W69-06652

NASSAU COUNTY V CHERRY VALLEY ESTATES (LANDOWNERS RIGHT TO PREVENT FLOW OF SURFACE WATER ONTO HIS PROPERTY).
281 App Div 692, 117 NYS 2d 616-617 (1952).

Descriptors: *New York, *Surface drainage, *Drainage systems, *Obstruction to flow, Water law, Legal aspects, Judicial decisions, Topography, Surface waters, Cities, Surface runoff, Repulsion (Legal aspects), Riddance (Legal aspects), Relative rights, Remedies.

Plaintiff town had constructed a drainage system which collected surface water in an area north of defendants' land and channeled it into a watercourse the source of which was on defendants' property. Defendants filled in the watercourse to prevent surface water from flowing onto its land. This obstruction caused a stagnant pool of water to form which was claimed to be a public nuisance. Plaintiff sought to have the channel restored. The court held that defendants had the right to improve their property by preventing the flow of surface water onto their land. (Holt-Fla)
W69-06653

SAVOIE V TOWN OF BOURBONNAIS (PRESCRIPTIVE RIGHTS).
339 111 App 551, 90 NE 2d 645-652 (1950).

Descriptors: *Illinois, *Repulsion (Legal aspects), *Prescriptive rights, *Riddance (Legal aspects), Ditches, Easements, Drainage water, Runoff, Overland flow, Diversion, Natural flow doctrine, Precipitation excess, Rain water, Storm runoff, Legal aspects, Judicial decisions, Real property, Cities, Relative rights, Damages.
Identifiers: Injunctions (Mandatory).

Plaintiff brought suit to recover damages and to secure a mandatory injunction compelling defendants to repair and maintain a drainage ditch located on defendant's property. The ditch had previously diverted waters from plaintiff's land. The plaintiff contended that the defendant town, by allowing the ditch to deteriorate, had violated his prescriptive right of forty years which entitled him to be relieved from the natural flowage of surface waters over his property. The court recognized that such a right may be prescriptively acquired against a municipality if that body is engaged in a private, nongovernmental capacity with relation to the right involved. If such a right had been established, it merely imposed a duty on the municipality not to restore the original watercourse to its natural state by a wrongful overt act; implying that the municipality could otherwise restore same. Plaintiff argued that the individual defendants had created a mutual ditch which under statute created a vested interest in all benefited landowners and that the defendants should be liable for the costs of restoring the ditch. The court noted that the statute was silent as to the burden of repair of such a ditch and that the plaintiff was merely an incidental beneficiary without vested rights concerning the ditch. (Katz-Fla)
W69-06655

RAU V WILDEN ACRES, INC (DIVERSION OF NATURAL FLOW BY ARTIFICIAL CHANNEL).

376 Pa 493, 103 A 2d 422-424 (1954).

Descriptors: *Pennsylvania, *Natural flow doctrine, *Diversion, *Discharge (Water), Surface runoff, Surface drainage, Diversion structures, Diffusion, Ditches, Legal aspects, Flow augmentation, Judicial decisions, Surface waters.
Identifiers: Injunctions (Prohibitory).

Plaintiff landowner brought action to restrain the owner of higher, neighboring land from artificially draining surface water from his property onto that of plaintiff. The governing principle of law in such a situation is that a landowner may not alter the natural flow of surface water on his property by concentrating it in an artificial channel and discharging it upon the lower land of his neighbor, even though no more water is thereby collected than would naturally have flowed upon neighbor's land in a diffused condition. The court found that evidence sustained findings that defendant diverted the natural flow of water from its property onto and over plaintiff's field by concentrating the water at an ar-

tificial point of flow and by cutting a ditch. Since the natural flow of water, in the absence of defendant's acts, would have been naturally diffused and dissipated in the main into a low point, or hollow, upon defendant's own premises, plaintiff was entitled to a cease and desist order. (Reed-Fla)
W69-06656

RINZLER V FOLSOM (ARTIFICIAL INCREASE OF SURFACE RUNOFF).

209 Ga 549, 74 SE 2d 661-665 (1953).

Descriptors: *Georgia, *Discharge (Water), *Natural flow doctrine, *Surface runoff, Overland flow, Overflow, Rain, Culverts, Mole drainage, Dikes, Floodwater, Saturation, Water spreading, Storm drains, Domestic wastes, Water pollution, Drainage systems.
Identifiers: *Freshets, Injunctions (Mandatory).

Plaintiff, owner of an improved lot brought action against the owners of the upper adjoining lot to restrain them from increasing, by artificial means, the natural flow of surface waters running across their lot onto the plaintiff's lot. The governing principle of law in such situations is that where the owner of the higher lot constructs and maintains culverts and embankments to control the flow of surface waters over his lot, he is under a duty to lower lot owners to construct and maintain such culverts and embankments so that the accumulation of waters from freshets will not cause breaks in the embankments and inundate lots of lower landowners. Therefore, the granting of an inter-locutory injunction restraining defendants from increasing, by artificial means, the natural flow of surface waters across their lot onto plaintiff's lot was not an abuse of discretion. There was ample evidence of the inadequacy of the retaining wall and storm sewer to handle the increased flow of surface waters due to the construction of apartment houses and paved driveways on defendant's land. (Reed-Fla)
W69-06657

ADKINS V HUGHES (BOUNDARY DISPUTE DUE TO AVULSION).

239 SW 2d 253-255 (Ky 1951).

Descriptors: *Kentucky, *Boundary disputes, *Accretion (Legal aspects), *Streams, Judicial decisions, Legal aspects, Stream erosion, Boundaries (Property), Rain avulsion, Real property, Land tenure.
Identifiers: Questions of fact, Deeds.

Plaintiffs brought suit in ejectment to recover land which was located on the defendants' side of a creek which was the designated boundary between the properties in the original deeds. The parties stipulated that the verdict should be for the plaintiffs if it was shown that the creek had taken a sudden change in course subsequent to the date of the deeds; if the change in the course was due to a gradual wearing away, the verdict was to be for the defendants. The jury found for the plaintiff. The court of appeals of Kentucky affirmed the decision of the trial court on the grounds the evidence supported the finding of the jury that the change in the creek course had been sudden. (Watson-Fla)
W69-06658

HUGHES V KNIGHT (RIGHT TO UNOBSTRUCTED DRAINAGE OF SURFACE WATERS).

33 NJ Super 519, 111 A 2d 69-72 (App Div 1955).

Descriptors: *New Jersey, *Dams, *Prescriptive rights, Surface waters, Flow augmentation, Damages, Water spreading, Legal aspects, Culverts, Drainage effects, Drainage water, Natural flow doctrine, Drainage, Obstruction to flow, Alteration of flow, Judicial decisions.
Identifiers: Servient estates, Dominant estates, Injunctions (Mandatory), Injunctions (Prohibitory).

Plaintiff brought action to enjoin maintenance of a dam across a watercourse carrying surface waters from lands of plaintiff. Both parties demanded compensatory damages for alleged injury to their respective lands. The governing principle of law in such a situation is that where a channel for surface waters was created by cooperating forces of nature and exertions of man more than 40 years ago, plaintiff upper landowner became the owner of a dominant tenement to which the right to flow surface waters attached, and defendant lower owners became the owners of the servient tenement upon whom the obligation to respect this right devolved. Plaintiff, as the upper proprietor, cannot be denied relief on the basis of the 'clean hands doctrine' since, even though he went upon defendants' lands and enlarged the ditch, these acts were not done insolently and in defiance of any contemporaneous protest by defendants. Thus, the court restrained plaintiff from draining through the ditch such an increased volume of water as would cause any additional material injury to defendant's lands; defendants were commanded to remove the dams constructed by them on their property. (Reed-Fla)
W69-06660

SEWERS AND DRAINS: PRIVATE DRAINS.

Me Rev Stat Ann tit 30, secs 4401-4408 (1965); Me Rev Stat Ann tit 30, secs 4401A, 4402A, 4403 (Supp 1968-69).

Descriptors: *Legislation, *Maine, *Drainage systems, *Permits, Subsurface drainage, Drainage water, Drainage programs, Sewers, Local governments, Cities, Drainage districts, Construction, Cost allocation, Cost-benefit analysis, Compensation, Legal aspects, Legislation, Regulation, Public benefits, Financing.

A person is authorized to connect his private drain into any public drain or sewer while the public drain is under construction. However, he must first obtain a permit from the proper authorities. After the public drain has been completed, no person shall connect his private drain until he has paid an assessment and received a permit. However, the above provisions shall not apply to any municipality until accepted by the inhabitants or government of the municipality. In addition, the statute provides that any connection made without a permit may be destroyed. Furthermore, if a person violates any provision of his permit, his drain may be disconnected and his permit forfeited. The statute describes the procedure to be used in applying for a permit. (Stewart-Fla)
W69-06661

GENERAL PROVISIONS RELATING TO RIVERS AND STREAMS.
38 Me Rev Stat Ann secs 611-854 (1965).

Descriptors: *Maine, *Legislation, *Mill dams, *Adjudication procedure, State governments, Reasonable use, Hydraulic structures, Canals, Conveyance structures, Streams, Water level fluctuations, Flooding, Overflow, Eminent domain, Condemnation, Damages, Remedies, Riparian lands, Riparian rights, Diversion loss returns, Riparian waterloss, Competing uses, Legal aspects, Regulation, Rivers.

Mills, and dams erected in conjunction with mills, within the state and on rivers constituting a state boundary are subject to this act. Liability of mill owners, occupiers and lessees for damages resulting from overflow of waters kept for milling purposes is set forth in detail. Subject to certain regulations, water may be diverted from any nonnavigable stream for use in mill dams. A mill owner cannot make unreasonable use of stream waters to the detriment of lower riparian owners, nor can he maintain a reservoir level detrimental to other riparian owners. While recognizing the privilege of dam owners to inundate riparian lands along a stream, the act requires adequate and reasonable compensation to be paid therefor. Procedure is provided whereby annual damages to property may be assessed by judgment of the court or by appraisal by local county commissioners. The mill owner is required to furnish security for the annual damage payment and failure to tender payment enables the complaining owner to impress a lien on the mill or dam. (Katz-Fla)
W69-06662

GENERAL PROVISIONS RELATING TO RIVERS AND STREAMS.
38 Me Rev Stat Ann, secs 651-655 (1965).

Descriptors: *Maine, *Legislation, *Mill dams, State governments, Reasonable use, Hydraulic structures, Canals, Conveyance structures, Streams, Water level fluctuations, Flooding, Overflow, Damages, Remedies, Riparian lands, Riparian rights, Legal aspects, Impounded waters, Embankments, Diversion, Alteration of flow, Land tenure, Compensation, Nonnavigable waters.

Any person may erect and maintain on his own land a water mill and dams upon and across any nonnavigable stream. Any person may cut a canal or raise embankments upon his land and divert water from its natural channel provided that the canal does not exceed one mile in length and provided that he is the owner of all riparian rights between the point of diversion and the point at which the waters are returned to the stream. A dam may not be constructed or erected to the injury of any mill site on which a mill has been erected and used unless the right to maintain such a mill has thereon been lost or defeated. The height to which the water level in these working ponds, the length of time during which such water may be impounded, and the amount of water that may be diverted by a canal may be restricted and regulated by jury verdict or report of the commissioners. Any person who sustains damage from excess mill dam flowage or by diversion of water by a canal shall obtain just compensation by application to the county court where any part of the lands are located. (Katz-Fla)
W69-06663

GENERAL PROVISIONS, REGULATING TO RIVERS AND STREAMS.
38 Me Rev Stat Ann secs 701-707 (1965).

Descriptors: *Maine, *Legislation, *Mill dams, *Adjudication procedure, State governments, Reasonable use, Hydraulic structures, Canals, Conveyance structures, Streams, Water level fluctuations, Flooding, Overflow, Eminent domain, Condemnation, Damages, Remedies, Riparian lands, Riparian rights, Diversion loss returns, Compensation riparian waterloss, Competing uses, Legal aspects, Assessments, Administrative agencies.
Identifiers: Complaints, Causes of action, Court costs, Attorney's fees, Default judgments.

A complaint for damages to land overflowed by backwater from a mill dam shall contain a description of the land and a statement of damage. Service of such a complaint shall be made as in other civil actions. The defendant owner of a mill or canal may assert every and any available defense against the plaintiff but he may not answer that the land described is not injured by such dam or canal. All issues raised in such suits shall be decided as similar issues are decided at common law. If judgment is for defendant, he shall recover his costs. If the issue is decided in favor of plaintiff or if defendant is defaulted, the court shall appoint 3 or more disinterested county commissioners who shall go upon the land, appraise the damages, and report a sum as reasonable compensation in gross for such damage and shall estimate a fair sum for the right of maintaining such a dam forever. Annual damages may be determined by judgment of the court, subject to the right of the owner of the dam or mill to appl[illegible] to the court by new complaint for assessment in gross

by commissioners. Payment in gross by the owner shall be a bar to future action so long as the dam height is not raised. (Katz-Fla)
W69-06664

GENERAL PROVISIONS RELATING TO RIVERS AND STREAMS.

38 Me Rev Stat Ann sec 708-712 (1965)

Descriptors: *Maine, *Legislation, *Mill dams, *Adjudication procedure, State governments, Reasonable use, Hydraulic structures, Canals, Conveyance structures, Streams, Water level fluctuation, Flooding, Overflow, Eminent domain, Condemnation, Damages, Remedies, Riparian lands, Riparian rights, Diversion loss returns, Riparian waterloss, Competing uses, Legal aspects, Administrative agencies.
Identifiers: Trials, Evidence.

The report of the commissioners as to the damage to complainant's property is admissable as evidence before a jury, and such report cannot be refuted except by showing misconduct by some commissioner. If neither party requests a trial by jury, the commissioners' report may be accepted by the court and a judgment rendered thereon. The verdict of the jury or the report of the commissioners so accepted is a bar to further action for such damages and shall be the measure of yearly damages between the parties until a new complaint is filed by either party. Whenever an action is brought to ascertain or increase damages, the complainant may request the court to require the defendant to furnish security for yearly damages. (Katz-Fla)
W69-06665

GENERAL PROVISIONS RELATING TO RIVERS AND STREAMS.

38 Me Rev Stat Ann secs 713-719 (1965).

Descriptors: *Maine, *Legislation, *Mill dams, *Adjudication, Procedure, State governments, Reasonable use, Hydraulic structures, Canals, Conveyance structures, Streams, Water level fluctuations, Flooding, Overflow, Eminent domain, Condemnation, Damages, Remedies, Riparian lands, Riparian rights, Diversion loss returns, Flood damage, Riparian waterloss, Competing uses, Legal aspects, Interest rate, Compensation.
Identifiers: Liens, Execution.

A party entitled under this act to annual compensation for flowage damage may maintain a civil action to enforce collection of the sum due with costs. Procurement of a favorable judgment shall give rise to a lien enforceable against the mill, canal, or mill-dam complained of and the land thereunder. The judgment may be executed at any time within 30 days by public auction as in selling an equity of redemption. Any person entitled to the premises may redeem them within one year after the sale by paying the purchaser or his grantee the sum paid therefor with interest of 12%. Whenever any party is dissatisfied with the annual compensation established, a new complaint may be filed provided that no new complaint shall issue until one month after the preceding year's payment is due. If the dam owner offers to increase future compensation for damages and the landowner does not accept it but brings suit to recover more damages, the land owner can only recover costs if he is awarded increased damages in an amount greater than that offered by the dam owner. The owner of injured land may offer to accept reduced compensation and the dam owner will not recover costs if he brings suit and is awarded a reduction less than offered. (Katz-Fla)
W69-06666

GENERAL PROVISIONS RELATING TO RIVERS AND STREAMS.

38 Me Rev Stat Ann secs 720-725 (1965).

Descriptors: *Maine, *Legislation, *Mill dams, *Adjudication procedure, State governments, Reasonable uses, Hydraulic structures, Canals, Conveyance structures, Streams, Water level fluctuation, Flooding, Overflow, Eminent domain, Condemnation, Damages, Remedies, Riparian lands, Riparian rights, Diversion loss returns, Riparian waterloss, Competing uses, Legal aspects, Compensation.
Identifiers: Default judgments.

Compensation agreements entered into between tenants are binding as to immediate parties but are not binding as to owners unless such owners consent thereto. Remedies available under this act supersede common law remedies for damages occasioned by the overflow or diversion of waters except as to enforcement of damage awards. If the use restrictions imposed by report of the commissioners or finding of the jury respecting flowage are violated, the injured party may collect double damages. Annual compensation agreements shall be recorded in the office of the clerk in which the judgment was rendered. No such agreement shall preclude filing of a new complaint. A defendant in an original action may tender damages to the court or may offer to be defaulted for a reasonable sum. (Katz-Fla)
W69-06667

GENERAL PROVISIONS RELATING TO RIVERS AND STREAMS.

38 Me Rev Stat Ann secs 726-728 (1965).

Descriptors: *Maine, *Legislation, *Mill dams, *Adjudication procedure, State governments, Reasonable use, Hydraulic structures, Canals, Conveyance structures, Streams, Water level fluctuations, Flooding, Overflow, Eminent domain, Condemnation, Damages, Remedies, Riparian lands, Riparian rights, Diversion loss returns, Riparian waterloss, Competing uses, Legal aspects, Compensation, Taxes, Costs.

Causes of action for land damage or water diversion do not abate by the death of any party thereto but may be prosecuted or defended by surviving plaintiffs or defendants, or the executors or administrators of such deceased parties. If a judgment for the plaintiff is reversed, a new complaint may be filed within one year to recover damages sustained during the three years preceding the institution of the first complaint. Commissioners shall be awarded suitable compensation. The prevailing party shall recover costs except where expressly provided otherwise. (Katz-Fla)
W69-06668

GENERAL PROVISIONS RELATING TO RIVERS AND STREAMS.

38 Me Rev Stat Ann secs 771-776 (1965).

Descriptors: *Maine, *Legislation, *Mill dams, *Adjudication procedure, State governments, Reasonable use, Hydraulic structures, Canals, Conveyance structures, Streams, Water level fluctuation, Flooding, Overflow, Eminent domain, Condemnation, Damages, Remedies, Riparian lands, Riparian rights, Riparian waterloss, Competing uses, Legal aspects, Highways, Cities, Administrative agencies, Cost sharing, Water zoning.
Identifiers: Water vents.

When the owners of water power for operating mills find that they cannot obtain the necessary head of water for operation without overflowing some highway or town, they may petition the county commissioners for permission to raise such ways and enlarge the water vent thereof. A hearing shall be held to consider the petition, and all parties shall be notified thereof. The Commissioners shall decide the extent which such highways are to be raised and vents enlarged and shall prescribe the manner in which the work is to be done. The commissioners may order the town to make the alterations prescribed, and, if the town fails to act, the plaintiff shall perform the alterations. The commissioners shall affix proportionate expenses for the construction. Any aggrieved party may appeal from the decision of the commissioners. (Katz-Fla)
W69-06669

GENERAL PROVISIONS RELATING TO RIVERS AND STREAMS.

38 Me Rev Stat Ann secs 811-813 (1965).

Descriptors: *Maine, *Legislation, *Dams, *Mill dams, Adjudication procedure, State governments, Reasonable use, Hydraulic structures, Canals, Streams, Water level fluctuations, Flooding, Overflow, Condemnation, Damages, Remedies, Riparian lands, Riparian rights, Competing uses, Legal aspects, Compensation, Reservoirs, Discharge (Water), Hazards, safety, Impounded waters, Inspection.

Upon request by either the selectmen or assessors of any town, or upon request by the county commissioners or 10 resident taxpayers, the civil engineer appointed by the governor shall inspect any dam or reservoir and shall file a report as to the safety thereof with the governor. If the engineer finds the dam to be hazardous to person or property he shall order the owners to make immediate repairs and in default thereof shall enjoin use of such dam and may cause the impounded waters to be safely discharged. The engineer shall be compensated at the rate of $5.00 per day plus expenses, recoverable from the mill or dam owners should a hazard be found to exist. (Katz-Fla)
W69-06670

GENERAL PROVISIONS RELATING TO RIVERS AND STREAMS.

38 Me Rev Stat Ann secs 851-854 (1965).

Descriptors: *Maine, *Legislation, *Mill dams, *Adjudication procedure, Safety, State governments, Reasonable use, Hydraulic structures, Canals, Conveyance structures, Streams, Flooding, Overflow, Eminent domain, Condemnation, Damages, Remedies, Riparian rights, Riparian lands, Riparian waterloss, Competing uses, Legal aspects, Operation and maintenance, debt, interest rate, publications, repairing.

If repairs are thought necessary, the owner of a mill or dam may apply to the justice of the peace to call a meeting of the owners to consider repairs. Notice to the owners may be by publication. At such a duly called meeting, the owners of at least a 50% interest in such mill or dam may authorize action to repair or rebuild the structure. If the authorizing owners are not reimbursed by the profits of the mill or the other owners within 6 months after completion of the work, they may charge % interest for each succeeding month that the debt remains outstanding. (Katz-Fla).
W69-06671

SOME POSSIBLE ROLES FOR INSTITUTIONS AND ECONOMICS IN WATER RESOURCE MANAGEMENT,
For primary bibliographic entry see Field 06B.
W69-06725

REGIONAL PLANNING FOR WATER DEVELOPMENT IN THE WESTERN UNITED STATES - THE RELEVANCE OF AMERICAN EXPERIENCE FOR OTHER NATIONS,
For primary bibliographic entry see Field 06B.
W69-06726

6F. Nonstructural Alternatives

KANSAS RIVER BASIN FLOOD CONTROL,
For primary bibliographic entry see Field 06B.
W69-06729

07. RESOURCES DATA

7A. Network Design

A HEURISTIC AID FOR THE DESIGN OF SEWER NETWORKS,
Cornell Univ., Ithaca, N. Y.
For primary bibliographic entry see Field 05E.
W69-06498

AN ANALYSIS OF NATIONAL BASIC INFORMATION NEEDS IN URBAN HYDROLOGY,
American Society of Civil Engineers, Cambridge, Mass. Urban Hydrology Research Council.
For primary bibliographic entry see Field 04C.
W69-06770

WATER-QUALITY RECORDS FOR THE HUBBARD CREEK WATERSHED, TEXAS, OCTOBER 1966-SEPTEMBER 1967,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 02H.
W69-06786

7B. Data Acquisition

A DESIGN METHOD FOR DEEP WELL DEWATERING INSTALLATIONS,
Birmingham Univ. (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02F.
W69-06430

APPLICATION OF AN ELECTRONIC PARTICLE COUNTER IN ANALYZING NATURAL POPULATIONS OF PHYTOPLANKTON,
Cornell Univ., Ithaca, N. Y. Dept. of Botany.
Hugh F. Mulligan, and John M. Kingsbury.
Limnol Oceanogr, Vol 13, No 3, pp 499-506, July 1968. 6 fig, 3 tab, 20 ref.

Descriptors: *Phytoplankton, *Ponds, *Eutrophication, Algae, Biomass, Chlorophyll, New York.
Identifiers: *Coulter counter, *Population dynamics, Cellular size, Chlorella vulgaris, Cornell University, Electronic particle counting, Eudorina elegans, Euglena gracilis, Forest centrifuge, Glenodinium pulvisculus, Haemocytometer counting, Ithaca (NY), Glenodinium quadridens, Oocystis pusilla, Oocystis solitaria, Pandorina morum, Pediastrum boryanum, Pleodorina californica, Scenedesmus bijuga, Schroederia judayi, Sedgwick-Rafter method, Sphaerocystis schroeteri.

Utilizing Coulter counter with orifice of 100-micron diameter, authors analyzed, from 10 small morphometrically identical ponds, phytoplanktonic populations by 10 size intervals (mean volume, in microns, by interval: 9.1, 23.8, 49.5, 89.3, 191, 396, 715, 1530, 3170, 5720). They compared determinations of biomass by Coulter counting (B) in milligrams/liter, with chlorophyll-a (C) in milligrams/cubic meter and dry weight (D) in milligrams/liter. For example, in a single pond for five dates, ratio B:C had values 0.215, 0.270, 0.94, 0.302, 0.66; and B:D, 1.77, 1.76, 2.32, 1.82, 1.81. While counter cannot distinguish living from dead particles, nor species from species, its use in sizing and counting planktonic populations yields values of biomass with time which constitute highly resolved and characteristic profile of pond dynamics. Peak biomasses can often be correlated with a dominant phytoplankter, observable by direct microscopic examination. Biomass determined in this way is more precise than determinations of chlorophyll or dry weights, and method is more efficient than estimations utilizing haemocytometer. Authors emphasize that method is particularly effective when used in conjunction with standard methods. (Eichhorn-Wis)
W69-06540

GRAPHIC DETERMINATION OF SLOPE AND OF DIP AND STRIKE,
University Coll., London (England).
R. W. R. Rutland.
Photogramm Eng, Vol 35, No 2, pp 178-184, Feb 1969. 7 p, 5 fig, 7 ref.

Descriptors: *Aerial photography, *Photogrammetry, Photographs, *Dips, Stereoscopes, Stereoscopic photography, Surveying, *Mapping, Engineering geology, Reconnaissance surveys, *Slopes, Beds (Geology), Geological surveys, Geologic formations, Geologic investigations, *Geologic mapping, Graphical analysis.
Identifiers: Aerial reconnaissance, Photographic analysis, Plotting, *Photointerpretation, Slope angles, Strikes (Geology), Great Britain.

A stereographic method is presented for determining slope, strike, and dip from aerial photographs. A Wulff net is the only specialized equipment needed. The method can be used when a stereometer and mirror stereoscope are not available, and can be applied to more limited data than other methods. Strike and dip determination requires only that 2 outcrop lines of the bedding be observed; these lines do not need to be from the same level or from the same bedding plane. Slope determination is simpler and requires the attitude of only one line. No corrections for relief displacement or vertical exaggeration are necessary. The method can also be applied to oblique photographs. (USBR)
W69-06681

SOILS STUDIES USING COLOR PHOTOS,
McGill Univ., Montreal (Quebec).
J. T. Parry, W. R. Cowan, and J. A. Heginbottom.
Photogramm Eng, Vol 35, No 1, pp 44-56, Jan 1969. 12 p, 15 fig, 1 tab, 24 ref.

Descriptors: *Aerial photography, Photography, Photographs, *Soils, *Photogrammetry, Soil classifications, *Soil surveys, Gradation, Soil groups, Soil types, Soil texture, *Color, Soil physical properties, Bibliographies.
Identifiers: *Color photography, *Photointerpretation, Quebec (Canada).

Air photo interpretation and field survey in the Lac Bevin basin, Quebec, of exposures of bare soils varying in texture from clay to sandy loam, demonstrated the superiority of color photography over panchromatic in identifying and plotting soil boundaries, differentiating soil types within a series, and distinguishing variations of moisture and organic content. Exact correspondence between field and photo colors (as defined in the Munsell system) was not obtained. Very few soils provided a unique color signature at either the soil series level (U S Department of Agriculture) or the Unified Soil Classification System group level. A greater degree of differentiation between soil types was possible with color photos than with the panchromatic because the color image provided more varied stimuli to the interpreter. (USBR)
W69-06696

COMPUTER-AIRPLANE COMBO SAVES QUARTER MILLION DOLLARS ON SURVEYS AND ADMINISTRATION OF CONSTRUCTION CONTRACTS,
Bureau of Reclamation, Boise, Idaho.
Ervin E. Miller.
Pap, Bur Reclam, Reg 1, Boise, Idaho, 1969. 26 p, 8 fig, 8 ref.

Descriptors: *Photogrammetry, Photographic equipment, Computer systems, Components, Topographic surveys, Topographic mapping, Computer programs, Construction, Construction costs, Contract administration, Grand Coulee Dam, Powerplants, Cross-sections, *Aerial photography, *Surveying, Costs, Surveying instruments, Earthworks.
Identifiers: Construction practices, Computer capability, Grand Coulee Powerplant (Wash), Color photography, *Construction control.

Photogrammetric surveys, including topographic mapping and digitized cross-section data, are being used successfully on construction of the Grand Coulee Dam Third Powerplant. Topographic maps having scale ratio and contour intervals ranging from 1:240 to 1:4800 and from 2 to 10 ft, respectively, are used for general layout and detail design purposes. Digitized cross-section data, obtained at 10- and 20-ft intervals, are provided on standard IBM 80-column punch cards for preparing maps by automatic cartographic processes. Computer program linkage with digitized data and construction specifications is providing earthwork volumes and monthly construction summaries for payment purposes. Savings by the Government in time and man-days by adopting photogrammetric survey methods and automated procedures in administering construction contracts equal approximately $250,000, with good acceptance of the methods from general contractors. (USBR)
W69-06697

MEASUREMENT OF ROTATING MACHINERY VIBRATION AND FACTORS AFFECTING INSTRUMENT ACCURACY,
Carrier Corp., Syracuse, N. Y.
D. E. Neill.
Pap 68 WA/FE 18, Amer Soc Mech Eng Winter Annu Meet Energy Syst Exposition, New York, N. Y., Dec 1968. 9 p, 13 fig.

Descriptors: *Transducers, *Instrumentation, *Vibrations, Electronics, Monitoring, Shafts (Machinery), Errors, *Electronic equipment, *Sensors, Velocity, Detection, Frequency, Sensitivity, Conductivity, Calibrations, Magnetic fields, Mechanical engineering, Warning systems.
Identifiers: Eddy currents, *Rotating machines, Accuracy, Magnetic links.

Vibration monitoring systems can be a valuable tool for detecting incipient trouble or impending failure in rotating machinery. Some ascertainable defects are caused by unbalance, misalignment, bent shafts, and defective bearings. These monitoring systems, in addition to detecting trouble, often can automatically sound an alarm or shut the machine down if vibration exceeds a predetermined level. If a monitoring system is to be valuable and economical, the system must suit the particular application and must perform with reasonable accuracy. Error sources that can be introduced into systems measuring rotating machinery vibration are examined, and a typical system is described. Various contacting and noncontacting transducers are described and their error sources defined; inaccuracies introduced within the cable linking the transducer and monitor are outlined; and error sources within the monitor are discussed. (USBR)
W69-06702

USE OF TRACER TECHNIQUE IN SOIL EROSION RESEARCH,
Agricultural Research Service, Oxford, Miss.
For primary bibliographic entry see Field 04D.
W69-06704

TOWARDS STANDARDIZING THE ARTIFICIAL-POLLUTION TEST FOR HIGH-VOLTAGE INSULATORS.
Brown Boveri and Co. Ltd., Baden (Switzerland).
For primary bibliographic entry see Field 08C.
W69-06708

POTENTIAL OF RADAR REMOTE SENSORS AS TOOLS IN RECONNAISSANCE GEOMORPHIC, VEGETATION AND SOIL MAPPING,
Kansas Univ., Lawrence.
David S. Simonett.
9th Int Congr Soil Sci, Trans, Vol 4, Adelaide, Australia, pp 271-280, 1968. 10 p, 5 fig, 21 ref.

Descriptors: *Radar, *Remote sensing, Sensors, Reconnaissance surveys, Geomorphology, *Mapping, Aerial photography, Soil classifications, *Vegetation, Agriculture, Crops, Bibliographies.

Identifiers: Radar equipment, *Soil maps.

Aerial photographs have been used extensively to aid ground studies for reconnaissance mapping of vegetation, soils, and geomorphic surfaces in remote, difficult-of-access, and underdeveloped areas in tropical and arctic latitudes. Studies using nonphotographic remote sensors (particularly infrared and radar) show that these systems, used in concert with photography, may add materially to information available and improve the efficiency of ground reconnaissance. Attention is focused on side-looking radar as a tool for such reconnaissance. Since radar imagery may be obtained in swaths up to 40 mi wide and is largely independent of the weather, its usefulness for reconnaissance mapping needs careful evaluation. A review is given of recent radar studies on: (1) the mapping of lineaments and lithologic units and use as a surrogate for 1:24,000 scale maps in hydrologic analysis; (2) the mapping of vegetation types, especially in relation to structure; and (3) its successes and shortcomings as an adjunct to photographs in soil reconnaissance surveys. (USBR)
W69-06718

NICKEL-63 IN MARINE AND TERRESTRIAL BIOTA, SOIL, AND SEDIMENT,
Washington Univ., Seattle. Lab. of Radiation Ecology.
For primary bibliographic entry see Field 05A.
W69-06766

TRACER METHOD FOR DETERMINING THE VELOCITY OF FLOW IN A CONFINED KARSTIC AQUIFER,
Research Inst. for Water Resources Development, Budapest (Hungary).
I. Sarvary.
Bull Int Ass Sci Hydrol, Vol 14, No 1, pp 121-127, Mar 1969. 7 p, 4 fig, 2 ref.

Descriptors: *Groundwater movement, *Karst, *Tracers, *Dye releases, Fluorometry, Tracking techniques, Subsurface drainage, Mine drainage, Drainage, Discharge (Water).
Identifiers: *Hungary.

The control of karstic water presents continuous difficulties at the Dorog coal-mines in the northwestern part of Hungary. To determine the rate of recharge and flow velocity within a few hundred metres of the mine workings, fluorescein used as tracer material was introduced through a borehole into the waterbearing formation. Samples were retrieved from water which entered the mine at several points. The tracer material was observed first 49 days after introduction, at a point situated 426 m distant from the borehole. Calculations of flow velocity were based on the geometry pattern of a single point sink. Basic criteria were the velocity computed on the basis of straight-line flow and constant discharge. From these data the dimensions of zones could be determined where the velocity or flow was higher than the average value. Information was obtained on the time or residence of dyed water in the high velocity zones, and thence on the areal flow velocity of karstic water. (Knapp-USGS)
W69-06774

PRELIMINARY REMOTE SENSING OF THE DELAWARE ESTUARY,
Geological Survey, Philadelphia, Pa.
For primary bibliographic entry see Field 02L.
W69-06793

A SYSTEM FOR MAKING REMOTE AND UNDISTURBED MEASUREMENTS OF SNOW SETTLEMENT AND TEMPERATURES,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 02C.
W69-06803

A UNIVERSAL SURFACE PRECIPITATION GAGE,
Agricultural Research Service, Boise, Idaho. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 02B.
W69-06804

GUIDEBOOK ON NUCLEAR TECHNIQUES IN HYDROLOGY,
B. R. Payne, E. Halevy, E. Eriksson, J. Martinec, and A. I. Danilin.
Int At Energy Agency Tech Rep Ser 91, 1968. 214 p, 85 fig, 12 tab, 288 ref.

Descriptors: *Radioactivity techniques, *Radioisotopes, *Stable isotopes, Instrumentation, Nuclear meters, Nuclear moisture meters, Equipment, Radioactivity, Soil density, Soil density probes, Soil moisture meters, Tracers, Radioactive dating, Radioactive well logging, Tracking techniques, Meteorology, Hydrology, Groundwater movement, Soil water movement.
Identifiers: *Nuclear techniques (Hydrology).

General information is provided on the principles and applications of the nuclear and isotopic methods used in hydrological research. The Guidebook is not detailed enough for the unaided hydrologist in applications of particular techniques, but is intended to enable hydrologists to select the proper techniques for solving particular hydrologic problems with the help of nuclear scientists. Nuclear techniques for studies of the atmosphere, surface water, soil water, groundwater, and interrelations such as water balance, surface-groundwater relations, etc, are discussed. (Knapp-USGS)
W69-06811

RADAR MEASUREMENT OF PRECIPITATION FOR HYDROLOGICAL PURPOSES,
National Severe Storms Lab., Norman, Okla.
For primary bibliographic entry see Field 02B.
W69-06812

7C. Evaluation, Processing and Publication

RESPONSE OF BUBBLE-GAGE SERVOMANOMETERS TO OSCILLATIONS IN WATER LEVEL,
Geological Survey, Menlo Park, Calif.
J. R. Beck, and C. R. Goodwin.
Geol Surv open-file rep, 1969. 49 p, 10 fig, 5 tab.

Descriptors: *Stream gages, *Calibrations, Manometers, Water levels, Gaging stations, Lakes, Streams.
Identifiers: Bubble gages, Bubble-gage servomanometers.

Tests were conducted to evaluate the performance of bubble-gage servomanometers operating where the water level is oscillating at amplitudes and frequencies likely to be found at medium or high states in bodies of water subject to wind action. The dominant factors controlling the magnitude of registration errors at a given installation are the size and frequencies of the waves and the purge rate of gas flowing into the system. Other factors, are the depth of water over the orifice, the internal gas-filled volume of the manometer, and the volume of tubing used to connect with the orifice. The magnitude of underregistration may be reduced by increasing the purge rate, but the laboratory tests reported herein still show significant errors at a purge rate of 160 bubbles per minute. Gas-purged servomanometer systems tend to indicate a stage value less than the mean of the surge when surface waves are present. In some instances these errors are negligible or may be compensated for by the manner in which the record is used. A technique is given to predict the magnitude of errors but unless the wave characteristics are actually known, minor errors must be expected. A knowledge of this system characteristic should improve the quality of interpretation of stage records obtained by use of a bubble gage and permit corrective steps to be taken in instances where real problems exist. (Knapp-USGS)
W69-06434

USE OF DIGITAL COMPUTERS IN DISTRIBUTION SYSTEM ANALYSES,
Horner and Shifrin, Inc., Cons. Engrs., St. Louis, Mo.
William O. Shirley, and John J. Bailey.
J Amer Water Works Ass, Vol 58, No 12, pp 1575-1584, Dec 1966. 10 p, 3 fig, 4 ref.

Descriptors: *Digital computers, *Networks, *Water distribution (Applied), Hydraulic design, Hydraulic gradient, Analytical techniques, Compter programs.
Identifiers: St. Louis (Missouri).

The results of three digital computer studies were reported in which solutions were found for the hydraulic flow conditions in three municipal water systems in the St. Louis, Missouri area. The programs used the Hardy Cross method with the Hazen-Williams flow formula. The first study used a standard program available at the Washington University computer center. The program was modified for the other two studies to provide for reduced calculations and increased readability of output, and to allow for more rapid convergence to the solution by use of an overrelaxation technique and a control loop method. A computer check assured the proper number of loops in the input. It was concluded that the digital computer was an efficient tool for the solution of hydraulic network analysis problems, and that setting initial flows by computer required more iterations, but cost less than using engineering judgement computations for initial flows. (Gysi-Cornell)
W69-06503

A COMPUTER-ORIENTED GROUND-WATER INFORMATION STORAGE AND RETRIEVAL SYSTEM,
Research Council of Alberta, Edmonton.
William R. Turner.
Ground Water, Vol 5, No 4, 1967, pp 30-37. 7 p, 5 fig, 4 ref.

Descriptors: *Information retrieval, *Data storage and retrieval, *Hydrologic data, *Groundwater, *Computers, Data processing, Data collections, Wells, Logging (Recording), Scheduling, Water quality, Hydrogeology, Geology, Data transmission.
Identifiers: *Hydrodat system, Canada.

The ever-increasing volume of information being collected by the Groundwater Division of the Research Council of Alberta required that a storage and retrieval system be devised. The HYDRODAT computer-oriented system developed is a modification of the format developed by the U.S. Geological Survey. Basic elements of the system are: a well-schedule form for recording and coding of geologic, hydrologic, and water quality data (illustrated); and five 80-column IBM punch cards for transferring coded data to magnetic tape. Selective and rapid retrieval of large columns of ground-water information provides the geologist and engineer with analytical methods which would otherwise be tedious, if not impossible, to supply. (Affleck-Ariz)
W69-06764

STREAMFLOW RECORD LENGTH FOR MODELLING CATCHMENT DYNAMICS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W69-06781

HEC-2, WATER SURFACE PROFILES.
Corps of Engineers, Sacramento, Calif.
For primary bibliographic entry see Field 04A.

W69-06787

HEC-3, RESERVIOR SYSTEM ANALYSIS.
Corps of Engineers, Sacramento, Calif.
For primary bibliographic entry see Field 04A.
W69-06788

EFFECTS OF TRUNCATION ON DEPENDENCE IN HYDROLOGICAL TIME SERIES,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02A.
W69-06789

ON MULTILEVEL OPTIMIZATION IN GROUND WATER SYSTEMS,
California Univ., Los Angeles. Dept. of Engineering.
For primary bibliographic entry see Field 02F.
W69-06813

QUASILINEARIZATION APPROACH TO THE IDENTIFICATION OF HYDROLOGIC SYSTEMS,
California Univ., Los Angeles. Dept. of Engineering; and Nevada Univ., Reno. Dept. of Water Resources.
For primary bibliographic entry see Field 02A.
W69-06822

08. ENGINEERING WORKS

8A. Structures

THE POSSIBILITY OF USING A MOVABLE DAM: THE 'FABRIDAM' AND ITS APPLICATION IN ARID REGIONS,
Plan Organization (Iran). Water Planning Group.
For primary bibliographic entry see Field 04A.
W69-06455

A CENTURY OF DESIGN AND CONSTRUCTION OF IRRIGATION WORKS IN INDIA,
Central Water and Power Commission (India).
For primary bibliographic entry see Field 04A.
W69-06461

BURNQUIST V FISCHER (FLOWAGE EASEMENT APPURTENANT TO DAM).
For primary bibliographic entry see Field 06E.
W69-06615

DESIGN AND CONSTRUCTION OF DAMS FOR RETENTION OF SOLID WASTES,
Bechtel Corp., San Francisco, Calif.
For primary bibliographic entry see Field 05G.
W69-06675

INNOVATIONS AND THE FUTURE OF CATHODIC PROTECTION,
Marshall E. Parker.
Mater Prot, Vol 8, No 2, pp 21-25, Feb 1969. 5 p, 20 ref.

Descriptors: *Cathodic protection, Corrosion, *Corrosion control, Direct current, Rectifiers, Electric potential, Digital computers, Anodes, Telemetry systems, Pipelines, Operation and maintenance, Bibliographies.
Identifiers: *Underground corrosion, Stray current corrosion, Ground currents, *Power supplies, Deep-well electrodes.

Although very few new advances have been made in the principles of cathodic protection, the application technology has changed during the past few years. One topic of great interest in cathodic protection is the prevention of corrosion to underground metallic structures caused by high-voltage direct-current transmission lines. Problems involved in designing corrosion control systems for stray currents and currents discharged from hvdc lines are described. The selection of selenium versus silicon rectifiers is discussed and the application of constant current and automatic control rectifiers is covered. Developments are discussed in monitoring and surveying pipe-to-soil potentials, computer applications for design and operation, using deep-well anodes, and direct-current power sources. Direct-current power sources include fuel cells, thermoelectric generators, atomic cells, solar cells, and the rectifier. (USBR)
W69-06677

PRESSURE TRANSIENTS IN HYDRAULIC PIPELINES,
City Univ., London (England).
A. R. D. Thorley.
Pap No 68-WA/FE-2, Amer Soc Mech Eng Winter Annu Meet Energy Syst Exposition, New York, N. Y., Dec 1968. 8 p, 8 fig, 2 tab, 13 ref, append.

Descriptors: *Hydraulic transients, *Pipelines, *Transients, Pipes, Boundary values, Hydraulics, Tubes, Fluid flow, *Water hammer, Head loss, Equations, Transducers, Waves (Water).
Identifiers: Boundary conditions, *Pressure waves.

Equations of fluid motion in a pipe are developed from a consideration of the forces and moments in the pipe wall. The equations are solved for boundary conditions representing the situation where the fluid is flowing steadily through a horizontal pipe and a valve at the downstream end is closed instantaneously. The solution gives theoretical results for the usual water-hammer wave and predicts the existence of a precursor wave. Expressions are derived for the velocities of propagation of both transients and their associated pressure changes. A comprehensive series of experiments was performed. Some interesting and probably unique results were obtained, demonstrating the behavior of both transients. Velocity and pressure change measurements were made. The effect of axial restraint on the pipe was demonstrated. (USBR)
W69-06700

8B. Hydraulics

PIPELINE PLANNING BY DYNAMIC COMPUTER PROGRAMMING,
Tahal Construction Engineers Ltd., Tel Aviv (Israel).
For primary bibliographic entry see Field 06A.
W69-06493

USE OF DIGITAL COMPUTERS IN DISTRIBUTION SYSTEM ANALYSES,
Horner and Shifrin, Inc., Cons. Engrs., St. Louis, Mo.
For primary bibliographic entry see Field 07C.
W69-06503

A COMPARATIVE STUDY OF HYDRAULIC CONDUCTIVITY IN THE ALLUVIAL SOILS OF EGYPT,
Ain Shams Univ., Cairo (Egypt). Dept. of Soils.
For primary bibliographic entry see Field 02F.
W69-06517

COMPUTATION OF PRESSURES AND VELOCITIES IN THE CURVILINEAR ZONE OF PRESSURE SPILLWAYS, FOR PREDICTING CAVITATION,
S. M. Slisskii, and A. E. El-Ansari.
Hydrotech Constr, No 5, pp 426-430, May 1968. 5 p, 4 fig, 3 tab, 5 ref.

Descriptors: *Pressure conduits, Pressure distribution, *Spillways, Pressure tunnels, Outlets, *Cavitation, Conduits, Model tests, Head loss, Hydraulic models, Hydraulic conduits, Hydraulics, Roughness, Foreign research, Laboratory tests, Linings.
Identifiers: Pressure shafts, Outlet tunnels, Bernoulli theorem, USSR, Curvature.

The conduit portion of pressure spillways conveying high-velocity flows should be profiled to preclude cavitation. Considering this criterion in design for a hydroelectric station, the permissible conduit-ceiling curvature was determined by hydraulic laboratory investigations conducted on several alternative spillway models. Theoretical and experimental pressure values at the ceiling of a particular section with various radii are compared. Computing pressures along the curved zone of a pressure spillway, specifically at the ceiling, requires: (1) determining the piezometric head corresponding to the mean velocity computed by applying Bernoulli's equation, (2) computing the kinetic pressure on the boundary of greatest curvature, and (3) determining the piezometric head corresponding to the velocity and pressure at the ceiling of the section. Predetermining pressures by computation leads to a reduction in the number of alternatives requiring investigation and permits detection of inaccuracies introduced during the experiment setup. Investigation of the lining requirements for the spillway is discussed. (USBR)
W69-06713

GEOLOGY, DESIGN, AND CONSTRUCTION OF DEEP WELLS IN SEDIMENTARY FOUNDATIONS,
For primary bibliographic entry see Field 02F.
W69-06759

8C. Hydraulic Machinery

NANTAHALA POWER AND LIGHT CO V SLOAN (FLOWAGE EASEMENTS).
For primary bibliographic entry see Field 06E.
W69-06620

ELECTRICAL FEATURES OF THE GRAND COULEE THIRD POWER PLANT,
Bureau of Reclamation, Denver, Colo.
John V. Baptist, and Roy Y. Nitta.
Inst Elec Electron Eng Spectrum, Vol 6, No 1, pp 89-95, Jan 1969. 7 p, 5 fig, 3 tab.

Descriptors: *Hydroelectric plants, *Electric power production, Extra high voltage, Control systems, Electric powerplants, Hydraulic turbines, Electric generators, *Switchyards (Electrical), Specifications, Handling equipment, Installation, Electric cables, Construction, Scheduling, Bus (Electrical), Contracts, Washington.
Identifiers: *Grand Coulee Powerplant (Wash), *Power cables, Cable terminations.

Addition of the Grand Coulee Third Powerplant, having an installed nameplate capacity of 7200 mw, will increase the 1974 nameplate capacity of the Grand Coulee power complex to 9374 mw. The Third Powerplant will have twelve 600-mw hydroelectric generating units, the largest units in the world; 525-kv insulated power cables from transformer high-voltage bushings to overhead powerlines, the first installation in the world of such high-voltage power cables; and an 1800-tonne (metric ton)-capacity hydraulic-hoist-type gantry crane. The status of electrical designs for the proposed 7200-mw powerplant is described. The modification of existing switchyards and construction of a new 500-kv switchyard are discussed. The large dimensions and great weights of such large turbines and generators impose complex problems in transportation and handling. Some methods of overcoming these problems are presented. The control system for the powerplant and switchyard, including functions, is reviewed. (USBR)
W69-06684

SUBSTATION EXPANSION, RELIABILITY, AND TRANSFORMER LOADING POLICY ANALYSIS,
Cleveland Electric Illuminating Co., Ohio; and Westinghouse Electric Corp., Pittsburgh, Pa.

For primary bibliographic entry see Field 06A.
W69-06685

500-KV AC SUBSTATION DESIGN CRITERIA--SUMMARY OF INDUSTRY PRACTICES,
Paul R. Dolan, L. M. Berry, and R. R. Blanchard.
Pap 69 TP 45-PWR, Inst Elec Electron Eng Winter Power Meet, New York, N Y, Jan 1969. 12 p, 4 tab, 20 ref.

Descriptors: *Extra high voltage, *Substations (Electrical), Electric relays, *Design criteria, Clearances, Electrical design, Electrical insulators, Bus (Electrical), Circuit breakers, Power transformers, Environmental effects, Electrical equipment, Foreign design practices, Lightning arresters, Bibliographies.
Identifiers: Design improvements, Switching surges, Canada, Protection (Electrical), *Design analysis, Electric conductors, *Electric utilities.

To determine major trends in 500-kv substation design practices, a survey was made of 10 major electric utility systems in the United States and Canada. Results are presented in tabular form for easy comparison of design features. Major variations in data are identified and explained. These data are invaluable to those having 500-kv systems under study, and will serve as a permanent record of the state of the art at this point. These data represent latest design criteria of the participating agencies, but all stations constructed by these companies do not conform to the exact criteria because individual circumstances usually require design changes or modifications. Some companies used more than one design and changed criteria with experience or to meet special conditions. Although these data reflect individual design philosophies of the 10 agencies involved, they do not show the alternatives considered or give the reasoning behind these decisions. Prospective designers are cautioned against using this information verbatim and out of context with the total design setting from which it is taken. (USBR)
W69-06686

A SWING RELAY FOR THE EAST-WEST INTERTIE,
Bureau of Reclamation, Denver, Colo.
F. R. Schleif, L. W. Lloyd, and R. W. World.
Pap 69 TP 60-PWR, Inst Elec Electron Eng Winter Power Meet, New York, N Y, Jan 1969. 6 p, 10 fig, 1 ref.

Descriptors: *Electric relays, *Electric power, Characteristics, Field tests, Power system operations, *Transmission (Electrical), Oscillation, Electric power production, Electric power demand, Electric power failure, Electronic equipment, Analog computers.
Identifiers: *Interties, *Interconnected systems, Interchanges, Power system stability, Separation.

Closing the ties to interconnect power systems across the continent causes new relaying problems. A special relay developed as a solution to these problems has been monitoring the East-West Intertie since reestablishment of this system on Dec 3, 1967. The relay is designed to sense conditions of the intertie and to anticipate when interchange is approaching difficulty. Power, rate-of-change of power, and oscillation quantities are sensed. The relay, installed at Yellowtail Powerplant, Mont, also effects transfer tripping at Fort Peck, Mont, and Stegall, Nebr, for prompt and clean East-West separations and minimum disturbance to the system. The basic principles, design and construction, coordination characteristics, and operating experience of the relay are discussed. (USBR)
W69-06687

OPEN BREAKER PROTECTION OF EHV SYSTEMS,
Westinghouse Electric Corp., East Pittsburgh, Pa.; and Monongahela Power Co., Fairmont, W. Va.
Andrew R. Hileman, Charles L. Wagner, and Richard B. Kisner, Jr.
Pap 69 TP 84-PWR, Inst Elec Electron Eng Winter Power Meet, New York, N Y, Jan 1969. 15 p, 4 fig, 5 tab, 6 ref.

Descriptors: *Extra high voltage, *Circuit breakers, Laboratory tests, Electrical equipment, Lightning arresters, Resistors, Test procedures, Impulse tests (Electrical), Electric arcs, Electric insulation.
Identifiers: *Lightning protection, *Switching surges, Test results, *Spark gaps, Selection, Lightning surges, Recommendations, Flashover.

Lightning arresters on the line side of every circuit breaker provide absolute protection for an open breaker condition but at a high cost. No line-entrance protection presents some risk of breaker damage. Line-entrance rod-gaps offer a compromise between these extremes. The probabilities of failure using these 3 alternatives are discussed, and a procedure whereby the spacing of the line-entrance gap can be determined is described. Since this procedure depends on the particular configuration of the gap being used, test data are presented for one particular configuration used on a 345-kv system. Based on these data, recommended gap spacings for 345- and 500-kv systems are developed. Results of lightning impulse and switching surge tests are summarized. (USBR)
W69-06688

SHUNT CAPACITOR ENERGIZATION WITH VACUUM INTERRUPTERS--A POSSIBLE SOURCE OF OVERVOLTAGE,
I-T-E Imperial Corp., Philadelphia, Pa.; and City of Los Angeles, Calif.
E. W. Boehne, and S. S. Low.
Pap 69 TP 83-PWR, Inst Elec Electron Eng Winter Power Meet, New York, N Y, Jan 1969. 20 p, 18 fig, 14 ref, 2 append.

Descriptors: *Capacitors, *Interrupters, Failure (Power), Analysis, Electrical studies, Frequency, Electric power, Field tests, Damages, Transients, Switching circuits, Electric potential, Power transformers, Disturbances, Analog computers, Differential equations, Electrical impedance.
Identifiers: *Interrupter switches, *Overvoltage, *Switching, Test results, Protection (Electrical).

Energization of a large capacitor bank with vacuum interrupters coupled with simultaneous failure of a load transformer on a radial feeder prompted this study. The study reveals a source of overvoltage accompanied by sudden and severe voltage reversals at the transformer terminals. This phenomenon is characterized by the momentary interruption and subsequent reignition of the 2 predominant transient high natural-frequency oscillatory capacitor closing currents. Momentary interruptions occur at numerous higher natural-frequency current zeros during the short interval between the prestrike of the arc and metal-to-metal closure of the contacts, and at the first lower natural-frequency current zero either during the short interval between the prestrike of the arc and the closing of the metallic contacts, or during contact separation caused by mechanical contact bounce, or both. Field tests and computer analyses were studied. Computer studies duplicate field test results and permit evaluating various combinations of overhead and underground circuit parameters and corrective measures. (USBR)
W69-06689

CALCULATION OF BALANCED AND UNBALANCED FAULT CURRENTS IN AC-DC POWER SYSTEMS,
Wisconsin Univ., Madison.
A. G. Phadke.
Pap 69 TP 117-PWR, Inst Elec Electron Eng Winter Power Meet, New York, N Y, Jan 1969. 7 p, 4 fig, 1 tab, 7 ref, 2 append.

Descriptors: *Faults (Electrical), *Electrical networks, Sequence, *Alternating current, *Direct current, Transmission (Electrical), Bus (Electrical), Calculations, Digital computers, Computer programs, Converters (Electrical), Electrical studies, Control systems, Electric power, Electric currents, Electric converters.
Identifiers: Accuracy, Impedance, Harmonics, Electric converter stations.

As high-power direct-current transmission lines become integrated in a-c networks, analytical tools for calculating the performance of composite ac-dc networks under various normal and abnormal operating conditions must be developed. A method is presented for calculating fault currents in composite ac-dc networks for balanced and unbalanced faults on the a-c portion of the network. As in the case of a-c network fault studies, only steady-state 60-cycle quantities are assumed to exist on the a-c network; the current in the d-c line is assumed to be without an a-c component. The calculation procedure is suitable for programming on a digital computer; a numerical sample is included. Limitations of the method are contained in the assumptions noted and in the approximations used to represent the converter impedance functions. The present method should not be considered an exact solution procedure for the unbalanced fault study, but a somewhat better approximation to a complicated problem. (USBR)
W69-06690

COMPUTER-AIRPLANE COMBO SAVES QUARTER MILLION DOLLARS ON SURVEYS AND ADMINISTRATION OF CONSTRUCTION CONTRACTS,
Bureau of Reclamation, Boise, Idaho.
For primary bibliographic entry see Field 07B.
W69-06697

THEORETICAL AND EXPERIMENTAL INVESTIGATIONS OF THE VIBRATIONS OF THE ROTOR OF A FULL-SCALE-MODEL HYDROELECTRIC INSTALLATION,
A. U. Bugov, V. A. Kovalenko, and A. S. Belinskii.
Transl from Energomashinostr, No 3, pp 24-26, 1963. Bur Reclam Transl 803, Feb 1969. 10 p, 3 fig, 2 tab, 2 ref.

Descriptors: *Vibrations, Oscillation, *Hydraulic turbines, Damping, Electric generators, *Francis turbines, Rotation, Field tests, Design, Dynamics, Hydraulic machinery, Shafts (Machinery), Supports, Resonance, Foreign research, Natural frequency, Turbine runners, Prototype tests, Theoretical analysis.
Identifiers: *Torsional vibrations, *Gyroscopic effects, *Harmonics, Baksansk Powerplant (USSR), Critical velocity, Leningrad Metalworks (USSR).

When designing a large hydroelectric unit, certain problems must be resolved relating to the vibrational strength of rotating parts subjected to the effect of disturbing forces of mechanical and hydrodynamic origin. Information on disturbing forces that act upon a rotor is limited, but the fact is known that a rotor is constantly subjected to action of disturbing forces with torsional frequency, and a frequency equal to the product of the torsional frequency multiplied by the number of turbine blades. Rotors are designed for natural vibration frequencies that should not be equal to, or a multiple of, the frequencies of the disturbing forces. During design, the values of the natural vibration of a rotor must be determined quite closely. Results are given of experimental investigations and theoretical analyses made by Leningrad Metalworks (LMZ) on full-scale models at the Baksansk Powerplant. Good agreement was shown between theoretical and field test data of such vibrational characteristics of a rotor as natural vibration frequencies, damping properties of the design, and the effect of yield and number of supports and additional masses of water and mass of the runner on natural vibration frequencies in the unit rotor. (USBR)
W69-06698

SOME ASPECTS OF INSULATION CO-ORDINATION IN HVDC SYSTEMS,
Brown, Boveri and Co. Ltd., Baden (Switzerland).
E. Sarbach.
Brown Boveri Rev, Vol 55, No 7, pp 344-351, July 1968. 8 p, 6 fig, 1 tab, 3 ref, append.

Descriptors: Extra high voltage, *Direct current, Foreign research, *Electric insulation, *Lightning arresters, Lightning, Transmission lines, Stress, Economics, Electric potential, Electric currents, Electric converters, Rectifiers, Transmission (Electrical), Electrical design.
Identifiers: *Protection (Electrical), *Thyristors, *High voltage, Overvoltage, Switzerland, Outages.

Keeping the protection level as low as possible in hvdc transmission systems using thyristors as rectifier devices is economically essential. This requirement can be accomplished by using lightning arresters, but selecting the appropriate rated arrester voltage can be a problem. Various factors involved in properly selecting arrester voltage ratings for hvdc systems are discussed. Thyristors are very sensitive to rapid voltage changes. A discussion is given of the stresses that thyristors are subjected to by high rates of rise of atmospheric overvoltages that can enter a station from overhead lines. (USBR)
W69-06707

TOWARDS STANDARDIZING THE ARTIFICIAL-POLLUTION TEST FOR HIGH-VOLTAGE INSULATORS.
Brown Boveri and Co. Ltd., Baden (Switzerland).
T. Weinmann.
Brown Boveri Rev, Vol 55, No 7, pp 351-358, July 1968. 8 p, 10 fig, 1 tab, 4 ref.

Descriptors: *Electrical insulators, Electric insulation, Wetting, Conductivity, *Test procedures, *Contamination, Test facilities, Fog, Atmospheric pollution, Electric potential, Electrical equipment, Wet condition, Transmission (Electrical), Electrical conductance, Laboratory tests, Foreign research.
Identifiers: *Test results, *Flashover, *Salt spray tests, Leakage current, Electrical insulation tests, Testing equipment, Switzerland.

Results of many years experience in high-voltage testing of artificially contaminated insulators in the Brown Boveri laboratory are discussed. Methods used for artificially contaminating insulators to simulate field conditions are described. These methods provide a simple and reliable means for comparing insulators of different shapes but having the same voltage rating. A salt-fog method for simulating coastal conditions and an infusorial earth coating for simulating industrial pollution have caused no difficulties during tests. Some more important factors influencing artificial-pollution testing of insulators are considered and test results given. A fundamental reason for artificial-pollution testing is to determine relative values and to reach absolute conclusions regarding the extent of natural contamination that will cause a breakdown. (USBR)
W69-06708

BROWN BOVERI DISTANCE PROTECTION SYSTEMS EMPLOYING CARRIER TRANSFER,
Brown, Boveri and Co. Ltd., Baden (Switzerland).
J. Gantner.
Brown Boveri Rev, Vol 55, No 7, pp 365-371, July 1968. 7 p, 8 fig, 10 ref.

Descriptors: *Electric relays, Distance, *Transmission lines, Faults (Electrical), Powerline carriers, Circuits, Resistance, *Reliability, *Selectivity, Electrical currents, Reactance, Inductance, Coordination, Microwaves, Electrical equipment, Electric potential, Foreign research.
Identifiers: *Protection (Electrical), *Protective distance, Series capacitors, Short circuits, Switzerland.

To ensure that distance relays at both ends of a transmission line trip when a fault occurs, a method of transmitting signals between the ends of the line is essential. Various facilities are available for accomplishing this task. Several circuit arrangements used in conjunction with distance protection systems are described and their operations explained. When selecting the type of protective circuit to be used, these aspects must be considered: (1) reliability with which tripping is effected; (2) reliability with which undesired tripping caused by noise signals is avoided; (3) selectivity; and (4) tripping times. Special attention should be directed to those cases where operating a distance relay is difficult. These are: (1) earth faults in parallel lines (caused by the effect of mutual zero-sequence impedances); (2) very high resistances to earth; (3) very weak infeed at one end; and (4) transmission lines with 3 or more ends. (USBR)
W69-06709

DISTANCE PROTECTION OF HIGH-VOLTAGE LINES CONTAINING SERIES CAPACITORS,
Brown, Boveri and Co. Ltd., Baden (Switzerland).
C. V. Narayan.
Brown Boveri Rev, Vol 55, No 7, pp 372-382, July 1968. 11 p, 9 fig, 2 tab, 14 ref.

Descriptors: *Electric relays, *Transmission lines, Reactance, Faults (Electrical), Electric currents, Inductance, *Capacitors, Transmission (Electrical), Distance, Electric potential, Electrical equipment, Powerline carriers, Coordination, Foreign research.
Identifiers: *Protection (Electrical), *Protective distance, Spark gaps, *Series capacitors, Short circuits, Switzerland.

High-voltage transmission lines containing series capacitors impose special requirements regarding distance protection because the capacitors represent a negative reactance and because the reactance measured by the relay (before and after the protective spark-gap of the capacitor break down) may vary considerably. Fault currents and voltages along a 2-circuit line equipped with series capacitors, compensating up to about 80% of the line's inductive reactance, are analyzed. Functions of a protective system before and after the protective spark-gap breaks down because of line faults are described. A special arrangement of the distance protection system suitable for high-voltage lines having series capacitors is studied. The lines have a high-speed basic step and backup steps, and use a transmitted signal. Transmission lines having series capacitors at the beginning of the protected section can be protected selectively with distance relays. (USBR)
W69-06710

8D. Soil Mechanics

HIGH EARTHFILL DAM FOUNDATION GROUTING DESIGN AND CONSTRUCTION PROCEDURES,
Bureau of Reclamation, Denver, Colo.
Lloyd R. Gebhart.
Pap, Amer Soc Civ Eng Nat Meet Water Resour Eng, New Orleans, La, Feb 1969. 8 p.

Descriptors: *Earth dams, Dams, *Dam foundations, Dam construction, Dam failure, Dam design, Specifications, Grout curtains, Safety, Cracks, *Grouting, Foundation investigations, Cutoffs, Permeability, Geology, Drill holes, Geologic investigations.
Identifiers: Grouting pressure, Permeability tests, Blanket grouting, Grout mixes, Geologic defects.

Adequate exploratory investigations for determining rock structure, permeability, and other geological information are desirable to prepare a realistic grouting design and dependable quantities. Water tests of exploratory holes are the most commonly used indicators for estimating drilling and grouting quantities. Grouting specifications should remain flexible to allow the foundation treatment to be modified to fit the conditions as the foundation is uncovered and drilling and grouting get underway during construction. The general grout plan for the hypothetical dam provides for shallow low-pressure blanket grouting to fill voids in the cavernous limestone near the surface to protect the dam embankment and foundation contact. Two deep, high-pressure grout curtains will provide a cutoff and increase the percolation path under the dam. The circulating line and manifold of the grout equipment are vital to closely regulate grout pressures. The method of closures or split spacing determines when the grout program is adequate. Using a grout with an optimum water-cement ratio without slugging the hole is essential for repairing the foundation to fit requirements for a safe structure. (USBR)
W69-06674

HORIZONTAL MOVEMENTS RELATED TO SUBSIDENCE,
California, Univ., Los Angeles; and California Univ., Davis.
Kenneth L. Lee, and C. K. Shen.
Proc Amer Soc Civ Eng, J Soil Mech Found Div, Vol 95, No SM1, pp 139-166, Jan 1969. 28 p, 18 fig, 45 ref, 2 append.

Descriptors: Earth dams, *Settlement, *Subsidence, *Consolidation, Shear stress, Mining, Groundwater mining, Compressibility, Poisson ratio, Test procedures, Model tests, Elastic deformation, Strain, Internal friction, Soil mechanics, Embankments, Stress, Bibliographies, Rock foundations.
Identifiers: Arching, Finite element method, Compressible soils, Soil modulus, *Horizontal movement, Compressible foundation.

A review of many documented field examples shows that horizontal surface movements often accompany vertical subsidence and that, although these movements may result from a wide variety of different situations, they all appear to follow a well-defined pattern. The pattern is the same for (1) horizontal movements associated with mining subsidence; (2) subsidence caused by gas, oil, or water pumping, or subsidence caused by deep consolidation under a heavy fill load such as at an industrial development or an earth dam. A semiempirical and simple equation is presented for predicting the nature and magnitude of horizontal movements correctly, provided the vertical subsidence profile is known. An application of the finite-element method of analysis in computing vertical and horizontal movement is illustrated. Results of the 2 methods are compared with data obtained from (1) a laboratory model, (2) a hypothetical earth dam on a compressible foundation, and (3) a rockfill dam that settled as the water level rose in the reservoir. (USBR)
W69-06692

PREDICTION OF SWELLING PRESSURE OF CLAYS,
Technion - Israel Inst. of Tech., Haifa (Israel); and Ministry of Housing (Israel).
Amos Komornik, and David David.
Proc Amer Soc Civ Eng, J Soil Mech Found Div, Vol 95, No SM1, pp 209-225, Jan 1969. 17 p, 8 fig, 1 tab, 11 ref, 2 append.

Descriptors: Clay minerals, *Atterberg limits, Moisture content, *Clays, Density, Soil mechanics, *Soil physical properties, *Swelling, Dry density, Chemical properties, Soil structure, Foreign research, *Expansive clays, Preconsolidation.
Identifiers: *Swelling pressures, Swelling pressure tests, Surface area, Compression index.

Swelling pressure of naturally occurring clays is related to chemico-physical properties such as specific surface area or particle spacing represented by simple indicative parameters. Significant statistical correlation exists between swelling pressure and combined data comprising density, moisture content, and liquid limit. Swelling

pressure increases with an increase in the initial density and liquid limit and with a decrease in moisture content. Almost no correlation was found between swelling pressure and any of the above factors separately. Good correlation was found between the free swell and plasticity index, irrespective of chalk content. Almost no correlation was found between the shrinkage limit and plasticity index or free swell. An expression was derived relating compression index to liquid limit. Preloading of clays resulted in considerably higher swelling pressures. This result is caused by an increase in the number of particles oriented perpendicular to the external load and a density increase. (USBR)
W69-06693

CIRCULAR AND LOGARITHMIC SPIRAL SLIP SURFACES,
Manchester Univ. (England).
Eric Spencer.
Proc Amer Soc Civ Eng, J Soil Mech Found Div, Vol 95, No SM1, pp 227-234, Jan 1969. 8 p, 4 fig, 1 tab, 9 ref, 2 append.

Descriptors: *Slope stability, *Stability, *Stability analysis, Shear resistance, *Embankments, Slipping, Safety factors, Foreign research, Soil mechanics, Earth dams, Shear strength, Internal friction, Cohesion, Effective stress, Slip-circle method.
Identifiers: *Slip surface, Failure surfaces.

A method of analyzing embankment stability is described that applies equally to slip surfaces having a cross section either in the form of a circular arc or a logarithmic spiral arc. The method applies to several stability problems arising because of wide variations in embankment slope and soil properties. Solutions to critical cases are obtained for both types of slip surfaces and values of the overall factor of safety, F, are compared. The circular arc gives the lower value for the factor of safety. The shape of the logarithmic spiral is not determined by the value of the angle of shearing resistance of the soil. The factor of safety against shearing on vertical planes, F sub v, was also investigated for each of the critical cases; in every case, values of F sub v exceeded the corresponding value of F. (USBR)
W69-06694

NON-ENGINEERING ELEMENTS IN FACTORS OF SAFETY IN SOIL AND FOUNDATION ENGINEERING,
Connecticut State Highway Dept., Wethersfield.
Philip Keene.
Pap, Annu Meet Highw Res Board, Jan 1969. 14 p, 10 ref.

Descriptors: *Safety factors, *Safety, Earth dams, *Earthworks, Costs, Foundations, Economics, Economic impact, Construction, Soil engineering, Political aspects, Psychological aspects, Social aspects, Failures, Soil mechanics, Design, Public relations, Failure (Mechanics), Foundation failure, Risks.

In earthwork and foundation engineering, technical elements that enter into producing an approximate factor of safety against failure are usually recognized, although not always understood. Other elements that should influence the choice of a factor of safety are economic, sociological, psychological, and political. The economic element is usually considered, but costs resulting from a failure may be difficult to estimate. Sociological and psychological elements overlap and may be grouped together. The most ethical in this group are the humanitarian elements-avoiding a failure that would cause personal injuries, deaths, and undue hardships. Less justifiable elements that increase costs and the safety factor are: aggrandizement of highly expensive projects, increase in fee for design and construction, lack of publicity for savings effected, and cost of project borne by the owner. Similar elements are fear of being blamed (fairly or unfairly) for defective design or construction, and the desire to design quickly to save expenses. The political element arises on public projects when fear that a failure or alleged poor construction could come to the attention of persons wishing to discredit the administration. (USBR)
W69-06695

SOIL AS AN ENGINEERING MATERIAL,
Bureau of Reclamation, Denver, Colo.
W. G. Holtz.
J Mater, Vol 4, No 4, pp 847-915, Dec 1968. 69 p, 52 fig, 4 tab, 80 ref.

Descriptors: *Soil engineering, *Soil mechanics, Soil properties, Soil formation, Pore pressure, Consolidation, Soil compression tests, Seismic investigations, Shear tests, Soil physical properties, Expansive soils, Soil density, Soil dynamics, Soil classifications, Bibliographies, Clay minerals, Settlement, Soil tests, Foundations, Earthquakes.
Identifiers: Construction control, American Society for Test and Mat, *Marburg Lecture.

The 42nd Edgar Marburg Lecture is a general discussion concerning soil as an engineering material, pointing out particular properties, the current state of knowledge, and needs for future developments. The forming processes of soils are many and varied. These processes produce natural deposits and formations that are seldom homogeneous, and soil components having a variety of characteristics. The job of the soils engineer is largely one of investigation to determine physical properties of the material and reactions of the soil mass to imposed conditions. Compared with other common building materials, soils are difficult to sample and test. To obtain meaningful data for designing earth structures and foundations, consideration must be given to geological history, present conditions, construction sequences, and anticipated operating conditions. Proper construction control procedures are important to assure that the properties assumed in the design are obtained. While advances have been made in theory, in determining meaningful parameters, and in understanding soil mass behavior, practitioners of the discipline still rely heavily on empirical procedures and judgment developed by training and experience. (USBR)
W69-06699

STABILIZATION OF UNDISTURBED QUICK CLAY BY SALT WELLS,
Norwegian Geotechnical Inst., Oslo.
Johan Moum, Olva Ihlen Sopp, and Tor Loken.
Norw Geotech Inst, Publ 81, pp 1-7, 1968. 7 p, 3 fig, 6 tab, 9 ref.

Descriptors: *Quick clays, *Soil stabilization, *Salts, *Wells, Clays, Sodium chloride, *Chlorides, Soils, Aluminum compounds, Diffusion, Lime, Laboratory tests, Iron compounds, Calcium hydroxide, Foreign research, Undisturbed samples, Illite, *Soil mechanics, Soil engineering, Costs, Engineering geology, Potassium compounds.
Identifiers: Potassium chloride, Sulfuric acid, Norway, Undisturbed soils, Sweden.

Laboratory test results from Norway indicate that diffusion of salt through wells may be a practical solution to many soil stabilization problems. For quick clay of illitic-chloritic composition, potassium chloride has the best overall effect. The investigated quick clay is of a composition very common in Norway and some parts of Sweden, and the results are generally valid for clays of this type. In other types of clay, other chemicals may give better results. Probably in no case does stabilization by diffusion with slaked lime (calcium hydroxide) seem to be practical. The price of potassium chloride in Norway is between 0.30 and 0.50 krone ($0.042 and $0.07) per kg. About 5.5 kg of potassium (corresponding to 10.5 kg of potassium chloride) are required for the fastest stabilization of 1 cu m of soil of this type. A field project has been started to check these results. (USBR)
W69-06719

8E. Rock Mechanics and Geology

FOUNDATION PROBLEMS OF RUEDI DAM AND RESERVOIR,
Bureau of Reclamation, Denver, Colo.
Edward R. Lewandowski, and Alexander Zlaten.
Pap, Water Resour Eng Conf, Amer Soc Civ Eng, New Orleans, La, Feb 1969. 28 p, 9 fig, 4 ref.

Descriptors: *Earth dams, Dams, Dam design, *Dam foundations, Geology, Foundations, Reservoirs, Grouting, Excavation, Engineering geology, Rock bolts, Gypsum, Grout curtains, Spillways, Outlet works, *Rockfill dams, Foundation investigations, Geologic investigations, Reservoir leakage.
Identifiers: Ruedi Dam (Colo), Fryingpan-Arkansas Proj (Colo).

The presence of a large mass of gypsum in the area of Ruedi Dam and Reservoir necessitated detailed geologic investigations of the sites. The main concern at Ruedi was that the gypsum was a plug containing major cavities and channels or that the gypsum would dissolve; either situation would provide major escape routes for the reservoir water. Extensive explorations showed that Gyp Hill was formed by gypsum beds deforming under plastic flow under relatively low differential stresses. This process prevents large openings from developing by solution at great depths. The plasticity of the gypsum renders the mass essentially impervious to any large passage of water, especially downstream of Ruedi Dam where the load consists of over 4000 ft of rock. Design features incorporated in constructing the dam included: (1) selective excavation, (2) extensive grouting, and (3) rock bolting. The dam was completed in 1968, and impounded water to a depth of over 190 ft the first year. (USBR)
W69-06673

GRAPHIC DETERMINATION OF SLOPE AND OF DIP AND STRIKE,
University Coll., London (England).
For primary bibliographic entry see Field 07B.
W69-06681

WATER LAWS AND CONCEPTS,
Geological Survey, Washington, D. C.
Harold E. Thomas.
Eos, Trans Amer Geophys Union, Vol 50, No 2, pp 40-50, Feb 1969. 11 p, 30 ref.

Descriptors: *Water law, Legal aspects, Environment, Laws, Cultures, Consumptive use, Humid climates, Water shortage, *Water rights, Water utilization, History, Bibliographies.
Identifiers: Litigation.

Throughout human history various laws and customs have developed concerning rights to water resources. Many existing laws and concepts are influenced by the environment in which they originated and reflect the relative abundance or scarcity of water. Many concepts reflect users' initial interests in the water, and have been passed from generation to generation. Some laws and concepts have been transplanted through migrations and colonial expansions to different environments. In many places, water laws that had been well adapted to natural environment have become less tenable because of man's activities in modifying that environment, or because of increased water use. The water rights systems in the U S vary from state to state; some are reasonably fitted to their environment, some have outlived their place in history, some are wasteful, and some show favoritism to special interests or segments of the population. Water use rights are universally recognized as real property, with constitutional protection against deprivation without due process of law. Until recently the rights in common to water, applicable to each member of the mass population, have received far less attention than the individual rights

to use water, recognized as property rights. (USBR)
W69-06683

BRITTLE ROCK FAILURE UNDER TRIAXIAL STRESS,
Georgia Univ., Athens.
A. A. Giardini.
Pap 68-WA/PT-3, Amer Soc Mech Eng Winter Annu Meet Energy Syst Exposition, New York, N. Y., Dec 1968. 4 p, 4 fig, 7 ref.

Descriptors: *Rock mechanics, *Rock properties, Rocks, Stress-strain curves, Slipping, *Triaxial compression, *Triaxial shear, Triaxial stress, Shear strength, *Brittle failures, Compressive strength, Shear failures, Granites, Strength of materials, Materials testing, Cracks.
Identifiers: Triaxial load tests, Triaxial tests, Microcracks, Confining pressure, Coulomb failure theory.

Granitic rock specimens were tested to failure by triaxial testing with confining pressures to about 7 kilobars. Tests were conducted on normal rock and similar rock subjected to prior shock pressure of about 20 and 40 kb. At or near atmospheric confining pressure, the mode of failure ranged from brittle shear for normal rock to crumbling for severely preshocked rock. Between 1/2- and 3-1/2-kb confining pressure, all specimens failed by a quiet slip shear and showed similar strength. Beyond 3-1/2-kb confining pressure, all specimens failed by an abrupt brittle shear and showed similar strength. Failures under confining pressures typically were along a single shear surface inclined 30 deg to the longitudinal axis. Plastic deformation was not observed. Slip failures occurred when the total bulk Coulomb strength of the stressed rock remained less than the Coulomb fundamental cohesive strength. Beyond this point, a rebounding mechanism apparently produced an appreciably stronger material with a brittle failure mode. The termination of the quiet slip mode of failure at 3-kb confining pressure agrees with theoretically derived conditions for the collapse of shallow small cracks. (USBR)
W69-06701

DETERMINATION OF STRESSES IN THE ARCH OF LARGE UNDERGROUND STRUCTURES, APPEARING AT THE TIME OF EXCAVATION OF THE CORE,
N. S. Chetyrkin.
Soil Mech Found Eng, No 4, pp 266-272, July-Aug 1968. 7 p, 4 fig, 1 tab, 7 ref.

Descriptors: *Arch, Concrete structures, *Stress analysis, Structural analysis, Stress concentration, Stress distribution, Structural design, Structural engineering, Foreign design practices, Tunnel pressures, Rock excavation, *Underground powerplants, *Underground structures.
Identifiers: Arch action, Arching, Concrete linings, Rock pressures, USSR, Underground openings, Subsurface openings, Tunnel supports.

When constructing a large underground structure, the top heading is first excavated and then a concrete arch is constructed. The arch is grouted to achieve full contact with the rock mass, and then the main heading is excavated. Elastic deformations of the rock mass begin almost immediately and practically vanish when the arch starts working. The rock load taken by the concrete arch results from the interaction between the rock mass and the lining, as variations in the state of stress of the rock mass arise from excavation of the main heading. A method is presented for determining these stresses. Results are given from a determination of the stresses in the arch of a large underground powerhouse. (USBR)
W69-06706

8F. Concrete

TEMPERATURE VOLUMETRIC CHANGES OF CONCRETE AT SUBZERO TEMPERATURES,
V. M. Moskvin, M. M. Kapkin, and B. M. Mazur.
Transl from Gidrotekh Stroit, No 6, pp 17-20, 1964. Bur Reclam Transl 534, Apr 1966. 22 p, 5 fig, 2 tab, 17 ref.

Descriptors: Deformation, Volume, *Temperature, Autoclaves, *Concrete testing, Concrete technology, Concrete structures, *Reinforced concrete, Curing, Steam curing, Moisture content, *Freezing, Hydrostatic pressure, *Freeze thaw tests, Expansion, Contractions, Cooling, Bibliographies, Shrinkage, Concretes, Cold weather construction, *Thermal expansion.
Identifiers: USSR, Frost resistance, Foreign testing, *Volume change, Cold climates, Concrete properties.

Volume changes in normally cured, steam-cured, and autoclaved concretes were measured in a controlled temperature cabinet having a range of+100 to -70 deg C. At subzero temperatures the linear expansion coefficient of concrete fluctuates in relation to (1) the degree of temperature lowering and water saturation, (2) the water-cement ratio, and (3) the curing preliminary to testing. Residual volumetric deformations accumulated during freezing and thawing cycles can exceed the expansion limit of concrete. Temperature expansion of steam-cured and autoclaved concretes is significantly higher than that for normally cured concretes of the same mix. Raising the water-cement ratio increases expansion and the accumulated residual volume changes. Conflicting volume changes of concrete and steel under given conditions can lead to significant stresses in reinforced concrete, requiring further study of reinforced concrete behavior at low subzero temperatures. Peculiarities of subzero temperature deformation of concrete shown by these tests should be included in designs for reinforced concrete hydraulic structures in severe climates and particularly in prefabricated reinforced concrete structures. (USBR)
W69-06672

SHEAR TRANSFER IN REINFORCED CONCRETE,
Naval Air Station, Moffet Field, Calif.; Ministry of Works (Sudan); and Washington Univ., Seattle.
J. A. Hofbeck, I. O. Ibrahim, and Alan H. Mattock.
J Amer Concr Inst, No 2, Proc V 66, pp 119-128, Feb 1969. 10 p, 11 fig, 2 tab, 6 ref.

Descriptors: *Reinforced concrete, Shear strength, Shear resistance, Composite structures, Connectors (Mechanical), Precast concrete, Shear, *Shear planes, Shear strain, Shear stress, *Shear tests, Reinforcement, Beams (Structural), Structural behavior, Cracking, Mohr failure theory, Dowels, Slipping.
Identifiers: Ultimate shear stresses, Ultimate strength, Stirrups, Slip surface.

In some situations shear failure is constrained to occur along a plane, as at the interface between a precast beam and a cast-in-place deck slab, or at certain locations in precast concrete connections. Transferring shear across such a plane is called shear transfer, to distinguish this type of shearing action from the type that usually occurs in a reinforced concrete beam. Thirty-eight pushoff specimens (some with and some without a preexisting crack along the shear plane) were tested. A preexisting crack along the shear plane will reduce the ultimate shear transfer strength and increase slip at all load levels. Dowel action of reinforcing bars crossing the shear plane is insignificant in initially uncracked concrete, but is substantial in concrete with a preexisting crack along the shear plane. The shear-friction theory gave a conservative estimate of shear transfer strength of initially cracked concrete. A method, based on the Zia envelope to Mohr circles representing failure conditions for concrete, is presented for calculating shear transfer strength in initially uncracked concrete. (USBR)
W69-06676

RX CONCRETE,
Sidney Freedman.
Mod Concr, Vol 32, No 10, pp 31-37, Feb 1969. 5 p, 1 fig, 13 ref.

Descriptors: *Concrete testing, Concrete technology, Concretes, Cores, Concrete structures, Compressive strength, Core drilling, Calibrations, Hardness tests, Impact tests, Field tests, *Non-destructive tests.
Identifiers: Ultrasonic impulse method, Soniscopes, Impact hammers, Pulse velocity tests, Schmidt test hammer, Test hammers.

Field methods for measuring concrete strength discussed are: drilled cores, cast-in-place pushout cores, Swiss hammer, Windsor test probe, and ultrasonic pulse velocity. Core strengths are affected by orientation of drilling, embedded reinforcement, specimen size, moisture content, and curing conditions. The calibration and test procedure of the Swiss hammer are covered. The Windsor probe, a recently developed hardness tester, is compared with the Swiss hammer. The ultrasonic pulse velocity method is explained; concrete variables affecting pulse velocity are listed. Pulse velocity may be used to assess concrete uniformity but should not be used to measure strength unless a velocity-strength calibration curve is obtained from concrete cylinders made from the concrete mix used on the structure. Nondestructive testing of field structures requires an accurate knowledge of factors affecting test results; trying to develop general relationships for all concrete on the basis of any nondestructive test is dangerous. (USBR)
W69-06678

USE OF ASPHALTIC CONCRETE IN COASTAL AND CANAL CONSTRUCTION,
Hans Mosslang.
Transl from Die Wasserwirt, Vol 58, No 9, pp 258-260, 1968. Bur Reclam Transl 805, Feb 1969. 9 p, 7 fig, 2 ref.

Descriptors: *Asphaltic concrete, Asphalt, *Canal linings, Bituminous materials, Coastal structures, Coastal engineering, *Dikes, Wave action, Foreign construction, Foreign design practices, Embankments, *Paving, *Shore protection, Mechanization, *Bank protection, *Levees.
Identifiers: Navigable canals, Protective coverings, West Germany.

Two notable asphaltic concrete hydraulic structures were built in 1967: a 4.5-km ring dike around an artificial island in the middle of the Eider estuary on the west coast of Schleswig-Holstein, and the Hausen reach of the Rhein-Main-Danube large-vessel navigation canal. The dike, designed to withstand North Sea hurricane tides, was built to protect the artificial island from the damming of the Eider River. The dike has a crest height of 7.5 to 7.8 m, a slope of 1:4, and an asphaltic concrete layer from 40 cm to 15 cm thick at the crest. The Hausen reach of the navigation canal is completely lined with asphaltic concrete and is designed for watertightness and protection of the banks from bumps and water waves from 1350-ton ships. Some design details for the asphaltic concrete linings and mechanized paving operations are discussed. (USBR)
W69-06682

DETERMINATION OF STRESSES IN THE ARCH OF LARGE UNDERGROUND STRUCTURES, APPEARING AT THE TIME OF EXCAVATION OF THE CORE,
For primary bibliographic entry see Field 08E.
W69-06706

THERMAL STRESS CONDITION OF EXPERIMENTAL LONG BLOCKS DURING CONSTRUCTION PERIOD OF THE BRATSK HYDROELECTRIC STATION DAM,
S. Ya Eidel'man, and G. M. Makedonskii.
Hydrotech Constr, No 5, pp 397-404, May 1968. 8 p, 7 fig, 3 tab, 6 ref.

Descriptors: *Concrete construction, Concrete mixes, Concrete placing, Concrete structures, Concrete technology, Concrete testing, Monoliths, Foreign construction, *Mass concrete, Cold weather construction, Thermal expansion, Thermal properties, *Thermal stress, Temperature, Cooling, Heating, Cracking, Stress distribution.
Identifiers: *Concrete blocks, Concrete properties, Bratsk Powerplant (USSR), *Thermal gradients, Temperature distribution, USSR.

Experimental studies were made of the temperature and thermal stress in long concrete blocks at the Bratsk hydroelectric plant. Details of the investigation and results of tests are given. On-site investigations confirmed results from the long experimental blocks. Maintaining temperatures as determined by the experimental long blocks assures favorable development of thermal stresses, but large temperature drops result in surface cracks along edges. A thermal stress field in a monolith is caused by overall cooling and nonuniform temperature distribution. Favorable factors are (1) minimum temperature differences between adjacent blocks, (2) low concrete mix temperatures, and (3) prolonged exothermic heating. These factors develop compressive stresses, compensating for tensile stresses arising from cooling the blocks and prevent cracks from forming in the central zone of the monolith. Stresses in the reinforcement of the plate separating long blocks from columnar blocks reach high magnitudes because of seasonal openings of the intercolumnar joints covered by the plate, and should be taken into account in calculating the reinforcement. (USBR)
W69-06711

THE MECHANISM OF WATER SEEPAGE THROUGH CONCRETE,
A. P. Kirillov.
Hydrotech Constr, No 5, pp 411-415, May 1968. 5 p, 4 fig, 1 tab.

Descriptors: *Seepage, Seepage losses, Permeability, Plugs, Hydration, Pores, Concretes, *Concrete technology, Concrete testing, Pressure head, Concrete structures, Concrete pipes, Hydrostatic pressure, Percolation, Percolating water.
Identifiers: Permeability tests, Permeability coefficients, USSR, Foreign testing, Cement hydration, Concrete properties.

Water seepage through concrete varies with time. Laboratory tests show that seepage initially increases, then decreases, and tends to stabilize after about 15 days. Field observations of pipelines, reservoirs, and other structures operating under water pressure show that seepage diminishes with time and may completely cease. The processes causing increases and decreases in seepage rates are discussed. Internal sealing is the principal cause of reducing permeability of old concrete; in younger concrete, secondary hydration also reduces seepage. After prolonged seepage, seepage decreases with an increased pressure gradient. Concrete of a given composition has a limiting minimum value for the seepage coefficient; after this value is reached, the coefficient remains nearly constant for any gradient. Concrete permeability diminishes continually during the initial seepage period; the seepage coefficient reached after a period of time under a given pressure gradient is significantly lower than the initial value. (USBR)
W69-06712

8H. Rapid Excavation

NUCLEAR EXPLOSIVES,
California Univ., Livermore. Lawrence Radiation Lab.
Gerald W. Johnson.
For main entry see Field 06B, W69-06572.
Proceedings of a Conference at University of California at Davis, pp 147-153, Jan 11-13, 1961. 7 p, 1 tab, 1 ref.

Descriptors: *Nuclear explosions, Explosives, Excavation, Water resources development.
Identifiers: Plowshare Program, Project Chariot.

Through an active research program, it may be possible to find ways to use nuclear explosives in water development projects. In some projects, such as floodwater diversion, the excavation requirement is simply for a large hole. For this situation the cost advantage of nuclear explosives would be a maximum. Where it is necessary to obtain both a definite width and depth for a project, conventional excavation methods may be more economical. There are two other possible uses for nuclear explosives: (1) the displacement of material down a slope in order to expose ore bodies, to produce fill, or to provide earth dams; (2) the fracturing or shattering of a large formation in order to permit subsequent removal or perhaps to increase its permeability for such purpose as water storage. (Winn-Rutgers)
W69-06581

09. MANPOWER, GRANTS AND FACILITIES

9A. Education (Extramural)

MANPOWER REQUIREMENTS FOR POLLUTION CONTROL AND WATER RESOURCES IN INDIANA AND A RELATED POLLUTION CONTROL TECHNOLOGY CURRICULUM,
Purdue Univ., Lafayette, Ind.
For primary bibliographic entry see Field 05G.
W69-06507

9C. Research Facilities

REPORT OF THE BUREAU OF COMMERCIAL FISHERIES BIOLOGICAL LABORATORY, ST. PETERSBURG BEACH, FLORIDA, FISCAL YEAR 1968,
Fish and Wildlife Service, Washington D. C.; and Bureau of Commercial Fisheries, Washington, D. C.
James E. Sykes.
U S Fish and Wildlife Serv Circ 313, May 1969. 25 p, 19 fig, 8 tab.

Descriptors: *Estuaries, *Aquatic habitats, *Estuarine environment, *Estuarine fisheries, *Florida Oceanography, Water quality, Fish, Fisheries, Commercial fishing, Fishkill.
Identifiers: *Bureau of Commercial Fisheries (U.S.).

The major goals of the Bureau of Commercial Fisheries Biological Laboratory are to explore the relatively unknown scope of biological productivity in the coastal zone of the eastern Gulf of Mexico, to measure the effect of changes in that zone, and to develop methods of increasing estuarine fishery resources. Current research on projects in the Estuarine, Red-Tide, and Industrial Schoolfishes Programs is described. The projects include studies of sediments and organisms in bay bottoms, plankton crops and fishes residing in and transferring between estauaries and the Gulf of Mexico, toxicity of the red-tide organism, and experimental rearing of pompano in an impounded lagoon. A physical, hydrological, biological, and sedimentological inventory of Florida estuaries is also in progress as part of a cooperative effort with the National Oceanographic Data Center and the States of Alabama, Mississippi, and Louisiana. (Knapp-USGS).
W69-06767

PROGRESS REPORT OF THE BUREAU OF COMMERCIAL FISHERIES RADIOBIOLOGICAL LABORATORY, BEAUFORT, N. C., FISCAL YEAR 1968,
Bureau of Commercial Fisheries, Beaufort, N. C. Radiobiological Lab.
T. R. Rice.
Dept of Interior - Bur of Com Fish Circ No 309, Apr 1969. 59 p, 32 fig, 12 tab.

Descriptors: *Radioecology, *Research facilities, *Radioactivity effects, *Environmental effects, Biology, Commercial fishing, Estuaries, Radiosensitivity, Water pollution effects, Laboratories.
Identifiers: *Radioecological research.

Radiobiological Laboratory is concerned with the fate of radioactive materials in the estuarine environment, and the effect of radiation on marine organisms, and the application of radioactive tracer techniques to fishery biology. To obtain the data pertinent to these problems, many data were collected in the laboratory to use to predict the fate of radioactive materials introduced into the marine environment, tanks and ponds were used to test questionable findings obtained in the laboratory, and the cycling of radioisotopes in certain natural bodies of water, restricted from the public, is observed. Data collected by these 3 approaches, when integrated and correlated, will make for a better understanding of the role of plants and animals in the cycling of radioactivity in estuaries and marine areas. (Knapp-USGS)
W69-06769

9D. Grants, Contracts, and Research Act Allotments

WATER RESOURCES DEVELOPMENT BY THE US ARMY CORPS OF ENGINEERS IN COLORADO.
Corps of Engineers, Omaha, Nebr.

Missouri River Div, Corps Eng Water Resources Develop Rep, Jan 1969. 22 p, 3 fig, 1 map, 3 photo.

Descriptors: *Water management (Applied), *Colorado, *Water resources development, Navigation, River basin development, Flood control, Multiple-purpose projects, Hydroelectric power, Dams, River training.
Identifiers: U S Army Corps of Engineers projects (Colo).

U. S. Army Corps of Engineers water resources development projects in Colorado are listed. The role of the Corps of Engineers in planning and building water resources improvements is described briefly, and the procedure for initiating such studies, authorization procedures, and status of projects are outlined. Projects described include naviation, flood control, multiple-purpose projects, river surveys, erosion control, water supply, water pollution, power, recreation, and flood plain studies. (Knapp-USGS)
W69-06782

WATER RESOURCES DEVELOPMENT BY THE US ARMY CORPS OF ENGINEERS IN DELAWARE.
Corps of Engineers, Philadelphia, Pa.

N Atlantic Div, Corps Eng Water Resources Develop Rep, Jan 1969. 36 p, 17 photo, 1 tab, 3 chart, 1 exhibit, index.

Descriptors: *Water management (Applied), *Water resources development, *Delaware, Navigation, River basin development, Beach erosion, Flood control.
Identifiers: U S Army Corps of Engineers projects (Del).

The water resources activities of the U. S. Army Corps of Engineers in Delaware as of Jan 1, 1969 are reviewed. The projects include navigation, river

basin development, beach protection, water resources investigations, and flood control. (K-napp-USGS)
W69-06783

WATER RESOURCES DEVELOPMENT IN MINNESOTA.
Corps of Engineers, Chicago, Ill.

Corps Eng Water Resources Rep, 1969. 56 p, 4 map, 19 photo.

Descriptors: *Water management (Applied), *Water resources, *Minnesota, Navigation, River basin development, Erosion control, Flood control.
Identifiers: U. S. Army Corps of Engineers projects (Minn).

Water resources activities by the U. S. Army Corps of Engineers in Minnesota as of 1 January 1969 are reviewed. Projects include navigation, flood control, flood plain studies, and river basin studies. (K-napp-USGS)
W69-06784

10. SCIENTIFIC AND TECHNICAL INFORMATION

PERMUTED TITLE INDEX TO WATER RESEARCH JOURNALS, 1967.
Cornell Univ., Ithaca, N. Y. Water Resources and Marine Sciences Center.

Water Resources Scientific Information Center, US Dept of Interior, 394 p.

Descriptors: *Bibliographies, *Water resources, Reviews, Publications, Documentation.
Identifiers: *Current awareness, KWIC index, Cornell Univ Water Resources and Marine Sciences Ctr.

This report, a product of the current-awareness service operated by Water Resources and Marine Sciences Center of Cornell University, is comprised of a computer-generated key-word-in-context (KWIC) index of some 10,547 entries covering 167 serials and 1670 individual citations published or otherwise appearing in 1967. Publication contains a foreword, instructions for use, a list of journals screened, the KWIC index, and a citation list indexed by indentification numbers referred to in the KWIC index. (Eichhorn-Wis)
W69-06539

A COMPUTER-ORIENTED GROUND-WATER INFORMATION STORAGE AND RETRIEVAL SYSTEM,
Research Council of Alberta, Edmonton.
For primary bibliographic entry see Field 07C.
W69-06764

WATER FOR TEXAS,
Texas A and M Univ., College Station. Water Resources Inst.
For primary bibliographic entry see Field 06B.
W69-06790

SUBJECT INDEX

ABANDONMENT
EARLE V MCCARTY (TITLE TO LAND BETWEEN SOUND AND DEDICATED ROAD).
W69-06646 06E

ACCRETION(LEGAL ASPECTS)
LAWKINS V CITY OF NEW YORK (EROSION AND ACCRETION OF BOUNDARY SHORE LINE).
W69-06606 06E

BALL CREEK COAL CO V NAPIER (MEANDERS AS A BOUNDARY).
W69-06614 06E

ERICKSON V GREUB (TITLE TO ACCRETION).
W69-06641 06E

ADKINS V HUGHES (BOUNDARY DISPUTE DUE TO AVULSION).
W69-06658 06E

ACID MINE WATER
EFFECTS OF MINE DRAINAGE ON GROUND WATER,
W69-06425 05C

ADJUDICATION
GENERAL PROVISIONS RELATING TO RIVERS AND STREAMS.
W69-06666 06E

ADJUDICATION PROCEDURE
GENERAL PROVISIONS RELATING TO RIVERS AND STREAMS.
W69-06662 06E

GENERAL PROVISIONS, REGULATING TO RIVERS AND STREAMS.
W69-06664 06E

GENERAL PROVISIONS RELATING TO RIVERS AND STREAMS.
W69-06665 06E

W69-06667 06E

W69-06668 06E

W69-06669 06E

W69-06671 06E

ADMINISTRATIVE AGENCIES
CONSERVATION'S CHALLENGE TO STATE GOVERNMENTS,
W69-06586 06E

RUSSELL V STATE (ILLEGAL POSSESSION OF UNDERSIZED FISH).
W69-06589 06E

WHITE OAK BOROUGH AUTH V PENN PUB U COMM'N (AQUISITION OF PUBLIC WATER FACILITIES).
W69-06601 06E

WATERS AND WATER SUPPLY.
W69-06612 06E

SEWERAGE DISTRICTS AND BOARDS.
W69-06632 05G

FLOOD WALL BOARD.
W69-06647 06E

ADMIRALTY
PETITION OF MARTIN (OBSTRUCTION TO NAVIGATION).
W69-06636 06E

ADVERSE POSSESSION
SBARRA V ERIE RR (DRAINAGE OF SURFACE WATERS AND PRESCRIPTIVE RIGHTS).
W69-06591 06E

AERIAL PHOTOGRAPHY
GRAPHIC DETERMINATION OF SLOPE AND OF DIP AND STRIKE,
W69-06681 07B

SOILS STUDIES USING COLOR PHOTOS,
W69-06696 07B

COMPUTER-AIRPLANE COMBO SAVES QUARTER MILLION DOLLARS ON SURVEYS AND ADMINISTRATION OF CONSTRUCTION CONTRACTS,
W69-06697 07B

AFRICA
GROUND WATER, GRAVITY AND RIFT VALLEYS IN MALAWI,
W69-06431 02F

AGGREGATE KOYCK FUNCTION
AGGREGATE KOYCK FUNCTIONS,
W69-06561 06B

AGRICULTURE
THE COMPETITION FOR WATER QUANTITY AGRICULTURE,
W69-06575 06D

AGRO-INDUSTRIAL COMPLEXES
DESALTED SEAWATER FOR AGRICULTURE IS IT ECONOMIC,
W69-06765 03F

AIRCRAFT
EVAPORATION REDUCTION ON LARGE RESERVOIRS,
W69-06531 03F

ALABAMA
WATER AVAILABILITY, CONECUH COUNTY, ALABAMA,
W69-06451 02E

WATER AVAILABILITY, COFFEE COUNTY, ALABAMA,
W69-06452 02F

UNITED STATES V TURNER (OWNERSHIP OF BEDS UNDER SHALLOW WATERS).
W69-06628 06E

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF PIKE COUNTY, ALABAMA,
W69-06815 02F

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF HENRY COUNTY, ALABAMA,
W69-06816 02F

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF CRENSHAW COUNTY, ALABAMA,
W69-06817 02F

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF DALE COUNTY, ALABAMA,
W69-06818 02F

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF COVINGTON COUNTY, ALABAMA,
W69-06819 02F

ALASKA
RECENT HISTORY OF GULKANA AND COLLEGE GLACIERS, CENTRAL ALASKA RANGE, ALASKA,
W69-06808 02C

ALBEDO
THE EFFECT OF CROP AND CLIMATIC FACTORS ON THE RADIATION BALANCE OF AN IRRIGATED MAIZE CROP,
W69-06757 03F

ALGORITHMS
ITERATIVE ANALYSIS BOUNDED LEAKY ARTESIAN AQUIFER,
W69-06508 02F

ALKALINE SOILS
EXPERIENCE IN ACCELERATED IRREVERSIBLE DESALINIZATION OF SOILS IN GOLODNAYA STEPPE,
W69-06716 03F

ALLUVIAL CHANNELS
DYNAMICS OF CHANNEL FLOW,
W69-06835 02E

ALLUVIUM
A COMPARATIVE STUDY OF HYDRAULIC CONDUCTIVITY IN THE ALLUVIAL SOILS OF EGYPT,
W69-06517 02F

ALPINE GLACIER BUDGET
RELATIONS BETWEEN GLACIER RUNOFF AND METEOROLOGICAL FACTORS OBSERVED ON AND OUTSIDE THE GLACIER,
W69-06481 02C

ALSACE(FRANCE)
THE USE OF ELECTRIC ANALOG MODELS IN HYDRODYNAMICAL STUDY OF THE ALSACE AQUIFERS (FRENCH),
W69-06806 02F

ALTERNATING CURRENT
CALCULATION OF BALANCED AND UNBALANCED FAULT CURRENTS IN AC-DC POWER SYSTEMS,
W69-06690 08C

ALTERNATIVE COSTS
SLUDGE DISPOSAL ALTERNATIVES -- SOCIO-ECONOMIC CONSIDERATIONS,
W69-06492 05E

THE ROLE OF ALTERNATIVE COST IN PROJECT DESIGN AND SELECTION,
W69-06738 06B

ANALOG COMPUTERS
DYNAMIC SIMULATION MODEL OF THE TRANSPIRATION PROCESS,
W69-06504 02D

ANALOG MODELS
ANALOG OF GROUND WATER IN EAST-CENTRAL NEW MEXICO,
W69-06509 02F

ANALYSICAL TECHNIQUES
FACTORS INFLUENCING THE CONDENSATION OF 4-AMINOANTIPYRINE WITH DERIVATIVES OF HYDROXYBENZENE-III. A STUDY OF PHENOL CONTENT IN SURFACE WATERS,
W69-06444 05A

ANALYTICAL TECHNIQUES
A SIMPLIFIED TECHNIQUE FOR WELL-FIELD DESIGN,
W69-06421 02F

EXTENDED TECHNIQUES OF CALCULATION OF SOIL-WATER MOVEMENT, WITH SOME PHYSICAL CONSEQUENCES,
W69-06714 02G

ANTARCTIC ICE CAP
THE ANNUAL HEAT ENERGY TRANSFER ABOVE AND INSIDE ANTARCTICA BLUE ICE,
W69-06480 02C

APPLICATION EQUIPMENT
EVAPORATION REDUCTION ON LARGE RESERVOIRS,
W69-06531 03F

APPROPRIATION
STATE V CITY OF CLEVELAND (RIGHT OF ACCESS TO NAVIGABLE WATERS).
W69-06619 06E

AQUATIC HABITATS
REPORT OF THE BUREAU OF COMMERCIAL FISHERIES BIOLOGICAL LABORATORY, ST. PETERSBURG BEACH, FLORIDA, FISCAL YEAR 1968,
W69-06767 09C

AQUATIC WEED CONTROL
ARSENIC ACCUMULATION BY FISH IN LAKES TREATED WITH SODIUM ARSENITE,
W69-06541 05B

AQUIFER
ARTIFICIAL RECHARGE TO THE EDWARDS LIMESTONE AQUIFER IN SOUTH TEXAS,
W69-06483 04B

AQUIFER CHARACTERISTICS
GEOLOGY, DESIGN, AND CONSTRUCTION OF DEEP WELLS IN SEDIMENTARY FOUNDATIONS,
W69-06759 02F

AQUIFERS
CONTROL OF SEA-WATER INTRUSION IN A GROUND-WATER AQUIFER,
W69-06422 02F

CONCEPTUAL MODELS FOR CARBONATE AQUIFERS,
W69-06423 02F

ITERATIVE ANALYSIS BOUNDED LEAKY ARTESIAN AQUIFER,
W69-06508 02F

DRAINING AREA UNDERLAIN BY HIGHLY PERMEABLE SHALLOW SAND AQUIFER,
W69-06512 02G

THE USE OF ELECTRIC ANALOG MODELS IN HYDRODYNAMICAL STUDY OF THE ALSACE AQUIFERS (FRENCH),
W69-06806 02F

RANDOM PROCESSES AND LITHOLOGIC TRANSITIONS,
W69-06807 02J

ARCH
DETERMINATION OF STRESSES IN THE ARCH OF LARGE UNDERGROUND STRUCTURES, APPEARING AT THE TIME OF EXCAVATION OF THE CORE,
W69-06706 08E

AREAL RAINFALL
FREQUENCY AND AREAL DISTRIBUTIONS OF TROPICAL STORM RAINFALL, U.S. COASTAL REGION, GULF OF MEXICO,
W69-06797 02B

ARID CLIMATE
SOME CHARACTERISTICS AND FREQUENCIES OF OCCURRENCE OF DROUGHTS IN THE DRY CLIMATIC ZONES OF INDIA,
W69-06524 02G

ARID CLIMATES
EVALUATION OF SOME PRACTICAL METHODS OF ESTIMATING EVAPOTRANSPIRATION IN ARID CLIMATES AT LOW LATITUDES,
W69-06530 02D

ARID LANDS
MODERN IRRIGATION FOR INCREASED AGRICULTURAL PRODUCTION,
W69-06454 03F

ARIZONA
GROUNDWATER IN FRACTURED VOLCANIC ROCKS IN SOUTHERN ARIZONA,
W69-06831 02F

ARKANSAS
HARRELL V CITY OF CONWAY (USE OF IMPOUNDED WATER).
W69-06597 06E

HARRIS V BROOKS (RECREATION RIGHTS OF RIPARIAN OWNER).
W69-06599 06E

OWEN V JOHNSON (OWNERSHIP OF THE BED OF A NAVIGABLE STREAM).
W69-06639 06E

ARSENIC COMPOUNDS
ARSENIC ACCUMULATION BY FISH IN LAKES TREATED WITH SODIUM ARSENITE,
W69-06541 05B

ARTIFICIAL PRECIPITATION
ON THE DISTRIBUTION OF STATISTICS SUITABLE FOR EVALUATING RAINFALL STIMULATION EXPERIMENTS,
W69-06679 03B

ARTIFICIAL RECHARGE
ARTIFICIAL RECHARGE TO THE EDWARDS LIMESTONE AQUIFER IN SOUTH TEXAS,
W69-06483 04B

ARTIFICIAL RECHARGE OF A FISSURED SANDSTONE AQUIFER, TANGIERS, MOROCCO (FRENCH),
W69-06487 04B

ASPHALTIC CONCRETE
USE OF ASPHALTIC CONCRETE IN COASTAL AND CANAL CONSTRUCTION,
W69-06682 08F

ATLANTIC COUNTY(NJ)
SUMMARY OF GROUND-WATER RESOURCES OF ATLANTIC COUNTY, NEW JERSEY,
W69-06448 02F

ATTERBERG LIMITS
PREDICTION OF SWELLING PRESSURE OF CLAYS,
W69-06693 08D

AUGER HOLES
A COMPARATIVE STUDY OF HYDRAULIC CONDUCTIVITY IN THE ALLUVIAL SOILS OF EGYPT,
W69-06517 02F

AUSTRALIA
PREDICTION OF RAINSPLASH EROSION IN THE SEASONALLY WET TROPICS,
W69-06768 02J

IMPROVED TECHNIQUES FOR ESTIMATING RUNOFF WITH BRIEF RECORDS,
W69-06830 02E

AUTOCORRELATED DISTURBANCES
TESTING SINGLE-EQUATION LEAST SQUARES REGRESSION MODELS FOR AUTOCORRELATED DISTURBANCES,
W69-06565 06A

AUTOREGRESSIVE RESIDUALS
SPECIFICATION ANALYSIS IN THE ESTIMATION OF PARAMETERS OF A SIMULTANEOUS EQUATION MODEL WITH AUTOREGRESSIVE RESIDUALS,
W69-06567 06A

BALCONES FAULT ZONE
ARTIFICIAL RECHARGE TO THE EDWARDS LIMESTONE AQUIFER IN SOUTH TEXAS,
W69-06483 04B

BANK PROTECTION
USE OF ASPHALTIC CONCRETE IN COASTAL AND CANAL CONSTRUCTION,
W69-06682 08F

BARGES
SOUTHERN TRANSPORTATION CO V CITY OF NEW YORK (NEGLIGENCE OF BRIDGE OPERATOR AND TUG MASTER CAUSING BARGE COLLISION).
W69-06638 06E

BAROMETRIC EFFICIENCY
A RIGID PLATE MODEL OF THE BAROMETRIC EFFECT,
W69-06775 02F

BARRIERS
FLOOD WALL BOARD.
W69-06647 06E

BASALTS
SOME DETAILS ON THE CIRCULATION OF GROUNDWATER IN NON-KARSTIFIED FISSURED FORMATIONS IN CZECHOSLOVAKIA (FRENCH),
W69-06485 02F

BASE FLOW
PRECIPITATION AND BASE FLOW VARIABILITY,
W69-06443 02B

BAYS
CALIFORNIA CO V PRICE (OWNERSHIP OF NAVIGABLE WATER BED).
W69-06613 06E

BEACH EROSION
LAWKINS V CITY OF NEW YORK (EROSION AND ACCRETION OF BOUNDARY SHORE LINE).
W69-06606 06E

TREND SURFACE ANALYSIS OF SAND TRACER DISTRIBUTIONS ON A CARBONATE BEACH, BIMINI, BWI,
W69-06809 02L

BEACH STRATIGRAPHY
COASTAL EROSION AND TRANSGRESSIVE STRATIGRAPHY,
W69-06798 02L

BEACHES
COASTAL EROSION AND TRANSGRESSIVE STRATIGRAPHY,
W69-06798 02L

TREND SURFACE ANALYSIS OF SAND TRACER DISTRIBUTIONS ON A CARBONATE BEACH, BIMINI, BWI,
W69-06809 02L

BEDS
BAILEY V DRISCOLL (IMPLIED LIMITATION ON GRANT OF SUBMERGED LAND).
W69-06618 06E

BEDS UNDER WATER
XIDIS V CITY OF GULFPORT (USE OF SUBMERGED LANDS FOR PUBLIC PURPOSE).
W69-06621 06E

BENEFICIAL USE
BENEFICIAL USES OF WATERS OF INTERNATIONAL RIVERS INTERNATIONAL LAW AND PRACTICE,
W69-06458 06E

BIBLIOGRAPHIES
PERMUTED TITLE INDEX TO WATER RESEARCH JOURNALS, 1967.
W69-06539 10

BIMINI(BWI)
TREND SURFACE ANALYSIS OF SAND TRACER DISTRIBUTIONS ON A

CARBONATE BEACH, BIMINI, BWI,
W69-06809 02L

BIOTA
NICKEL-63 IN MARINE AND TERRESTRIAL BIOTA, SOIL, AND SEDIMENT,
W69-06766 05A

BODIES OF WATER
JURISDICTION OVER WATERS.
W69-06634 06E

BOND ISSUE
XIDIS V CITY OF GULFPORT (USE OF SUBMERGED LANDS FOR PUBLIC PURPOSE).
W69-06621 06E

BOREHOLES
RECORDS OF WELLS AND TEST HOLES IN THE NEVADA TEST SITE AND VICINITY,
W69-06820 02F

BOULE FLOTATION
BEHAVIOR OF LIQUID SURFACES DURING EVAPORATION AND CONDENSATION,
W69-06840 03A

BOUNDARIES(PROPERTY)
LEONARD V STATE HIGHWAY DEPT (ACQUISITION OF TITLE BY STATE THROUGH PERMANENT FLOODING OF LAND).
W69-06611 06E

CALIFORNIA CO V PRICE (OWNERSHIP OF NAVIGABLE WATER BED).
W69-06613 06E

BALL CREEK COAL CO V NAPIER (MEANDERS AS A BOUNDARY).
W69-06614 06E

OWEN V JOHNSON (OWNERSHIP OF THE BED OF A NAVIGABLE STREAM).
W69-06639 06E

EARLE V MCCARTY (TITLE TO LAND BETWEEN SOUND AND DEDICATED ROAD).
W69-06646 06E

HAMMEL V CAMP RANGER, INC (PRESUMPTIONS REGARDING CONVEYANCE OF INLAND, NON-NAVIGABLE POND).
W69-06648 06E

BOUNDARIES(SURFACES)
ITERATIVE ANALYSIS BOUNDED LEAKY ARTESIAN AQUIFER,
W69-06508 02F

LAWKINS V CITY OF NEW YORK (EROSION AND ACCRETION OF BOUNDARY SHORE LINE).
W69-06606 06E

BOUNDARY DISPUTES
HAMMEL V CAMP RANGER, INC (PRESUMPTIONS REGARDING CONVEYANCE OF INLAND, NON-NAVIGABLE POND).
W69-06648 06E

SKALITSKY V CONSOL BADGER CO-OPERATIVE (OWNERSHIP OF FILLED POND BED).
W69-06650 06E

ADKINS V HUGHES (BOUNDARY DISPUTE DUE TO AVULSION).
W69-06658 06E

BRIDGES
SOUTHERN TRANSPORTATION CO V CITY OF NEW YORK (NEGLIGENCE OF BRIDGE OPERATOR AND TUG MASTER CAUSING BARGE COLLISION).
W69-06638 06E

BRINE DISPOSAL
RECOVERY OF METAL SALTS FROM CONCENTRATED BRINES BY CHELATION,
W69-06837 03A

BRINES
A FEASIBILITY STUDY ON THE UTILIZATION OF WASTE BRINE FROM SALINATION PLANTS PART 1,
W69-06556 03C

THE ORIGIN OF THE TIBERIAS-NOIT MINERAL WATER ASSOCIATION IN THE TIBERIAS-DEAD SEA RIFT VALLEY, ISRAEL,
W69-06749 02F

THE STABLE ISOTOPE COMPOSITION OF MINERAL WATERS IN THE JORDON RIFT VALLEY, ISRAEL,
W69-06750 02F

BRITTLE FAILURES
BRITTLE ROCK FAILURE UNDER TRIAXIAL STRESS,
W69-06701 08E

BULKHEAD LINE
UNITED STATES V GROEN (TITLE TO FILLED IN LAND BORDERING ON A RIVER).
W69-06608 06E

BUREAU OF COMMERCIAL FISHERIES(U
REPORT OF THE BUREAU OF COMMERCIAL FISHERIES BIOLOGICAL LABORATORY, ST. PETERSBURG BEACH, FLORIDA, FISCAL YEAR 1968,
W69-06767 09C

BUREAU OF RECLAMATION
KANSAS RIVER BASIN FLOOD CONTROL,
W69-06729 06B

BURNING
FIRES.
W69-06598 06E

BY-PRODUCTS
RECOVERY OF METAL SALTS FROM CONCENTRATED BRINES BY CHELATION,
W69-06837 03A

RECOVERY OF SALTS FROM SALINE WATER VIA SOLVENT EXTRACTION (FINAL REPORT),
W69-06839 03A

CABLES
BELL TEL CO V DRAVO CORP (UNDERWATER OBSTRUCTION TO NAVIGATION).
W69-06610 06E

PETITION OF MARTIN (OBSTRUCTION TO NAVIGATION).
W69-06636 06E

CALIBRATIONS
RESPONSE OF BUBBLE-GAGE SERVOMANOMETERS TO OSCILLATIONS IN WATER LEVEL,
W69-06434 07C

CALIFORNIA
CONTROL OF SEA-WATER INTRUSION IN A GROUND-WATER AQUIFER,
W69-06422 02F

SIGNIFICANCE OF GROUNDWATER MANAGEMENT STRATEGY-A SYSTEMS APPROACH,
W69-06424 06A

THE COMPETITION FOR WATER QUANTITY AGRICULTURE,
W69-06575 06D

THE COMPETITION FOR WATER QUANTITY INDUSTRY,
W69-06577 06D

FLOOD PLAIN INFORMATION OF SPRING VALLEY CREEK, SAN DIEGO COUNTY, CALIFORNIA.
W69-06824 04A

SYSTEMS APPROACH FOR INTEGRATING GROUND WATER AND SURFACE WATER USE.
W69-06834 06A

CANADA
THE PERFORMANCE OF SOIL MOISTURE ESTIMATES AS COMPARED WITH THE DIRECT USE OF CLIMATOLOGICAL DATA FOR ESTIMATING CROP YIELDS,
W69-06519 02G

CLIMATOLOGY STUDIES OF BAFFIN ISLAND, NORTHWEST TERRITORIES,
W69-06814 02B

CANAL LININGS
USE OF ASPHALTIC CONCRETE IN COASTAL AND CANAL CONSTRUCTION,
W69-06682 08F

CANALS
A CENTURY OF DESIGN AND CONSTRUCTION OF IRRIGATION WORKS IN INDIA,
W69-06461 04A

CANONICAL CORRELATION
CANONICAL CORRELATION AND MULTIPLE EQUATION SYSTEMS IN ECONOMICS,
W69-06735 06B

CAPACITORS
SHUNT CAPACITOR ENERGIZATION WITH VACUUM INTERRUPTERS--A POSSIBLE SOURCE OF OVERVOLTAGE,
W69-06689 08C

CAPILLARY CONDUCTIVITY
SOIL-WATER DIFFUSIVITY BY THE ONE-STEP METHOD,
W69-06528 02G

CARBONATE AQUIFERS
CONCEPTUAL MODELS FOR CARBONATE AQUIFERS,
W69-06423 02F

CATHODIC PROTECTION
INNOVATIONS AND THE FUTURE OF CATHODIC PROTECTION,
W69-06677 08A

CAVITATION
COMPUTATION OF PRESSURES AND VELOCITIES IN THE CURVILINEAR ZONE OF PRESSURE SPILLWAYS, FOR PREDICTING CAVITATION,
W69-06713 08B

CES PRODUCTION FUNCTION
THE CES PRODUCTION FUNCTION A DERIVATION,
W69-06720 06B

ESTIMATION OF RETURNS TO SCALE AND THE ELASTICITY OF SUBSTITUTION,
W69-06732 06B

CHANNEL ALTERATION
SEWERAGE DISTRICTS AND BOARDS.
W69-06633 06E

CHANNEL FLOW
HEC-2, WATER SURFACE PROFILES.
W69-06787 04A

DYNAMICS OF CHANNEL FLOW,
W69-06835 02E

CHANNEL IMPROVEMENT
TENNESSEE GAS TRANSMISSION CO V GREATER LAFOURCHE PORT COMM'N (PIPELINES ACROSS NAVIGABLE CHANNELS).
W69-06587 06E

FONADELLAS V UNITED STATES (TEMPORARY TAKING OF PROPERTY FOR PUBLIC PURPOSE).
W69-06622 06E

CHELATION
RECOVERY OF METAL SALTS FROM CONCENTRATED BRINES BY CHELATION,
W69-06837 03A

CHEMICAL ANALYSIS
GEOCHEMICAL TRACING OF MINERAL WATER SOURCES IN THE SOUTH WESTERN DEAD SEA BASIN, ISRAEL,
W69-06747 02F

GEOCHEMICAL TRACING OF MINERAL AND FRESH WATER SOURCES IN THE LAKE TIBERIAS BASIN, ISRAEL,
W69-06748 02F

CHESAPEAKE BAY
CHESAPEAKE BAY CASE STUDY.
W69-06794 06B

CHLORIDES
STABILIZATION OF UNDISTURBED QUICK CLAY BY SALT WELLS,
W69-06719 08D

CIRCUIT BREAKERS
OPEN BREAKER PROTECTION OF EHV SYSTEMS,
W69-06688 08C

CITIES
FIRES.
W69-06598 06E

HARDY V KANSAS CITY (FLOODING CAUSED BY OBSTRUCTION TO WATER FLOW).
W69-06625 06E

SOUTHERN TRANSPORTATION CO V CITY OF NEW YORK (NEGLIGENCE OF BRIDGE OPERATOR AND TUG MASTER CAUSING BARGE COLLISION).
W69-06638 06E

DAVIS V CITY OF ALEXANDRIA (PUBLIC USE OF LEVEE BANK AS ROADWAY).
W69-06645 06E

CIVIL ENGINEERING
CIVIL ENGINEERING AND URBAN SYSTEMS,
W69-06491 06A

CLAY MINERALS
POTASSIUM, ILLITE AND THE OCEAN,
W69-06506 02K

CLAYS
PREDICTION OF SWELLING PRESSURE OF CLAYS,
W69-06693 08D

CLIMATIC DATA
THE PERFORMANCE OF SOIL MOISTURE ESTIMATES AS COMPARED WITH THE DIRECT USE OF CLIMATOLOGICAL DATA FOR ESTIMATING CROP YIELDS,
W69-06519 02G

ESTIMATING PAN EVAPORATION AND EVAPOTRANSPIRATION FROM CLIMATIC DATA,
W69-06522 02D

CLIMATIC ZONES
SOME CHARACTERISTICS AND FREQUENCIES OF OCCURRENCE OF DROUGHTS IN THE DRY CLIMATIC ZONES OF INDIA,
W69-06524 02G

CLIMATOLOGY
FURTHER STUDIES OF DROUGHT OVER NORTHEASTERN UNITED STATES,
W69-06438 02B

SOME REMARKS ON THE PREDICTABILITY OF DROUGHT AND RELATED CLIMATIC ANOMALIES,
W69-06439 02B

THE ANNUAL HEAT ENERGY TRANSFER ABOVE AND INSIDE ANTARCTICA BLUE ICE,
W69-06480 02C

THE EFFECT OF CROP AND CLIMATIC FACTORS ON THE RADIATION BALANCE OF AN IRRIGATED MAIZE CROP,
W69-06757 03F

CLIMATOLOGY STUDIES OF BAFFIN ISLAND, NORTHWEST TERRITORIES,
W69-06814 02B

CLOUD SEEDING
ON THE DISTRIBUTION OF STATISTICS SUITABLE FOR EVALUATING RAINFALL STIMULATION EXPERIMENTS,
W69-06679 03B

REGIONAL HYDROLOGIC AREA STUDY AS AN ANALYSIS TOOL IN WEATHER MODIFICATION,
W69-06805 02A

COASTAL PLAINS
ECONOMIC ANALYSIS OF THE DEVELOPMENT POTENTIAL OF THE COMMERCIAL FISHERIES INDUSTRY OF THE COASTAL PLAINS REGION,
W69-06554 06B

COBB-DOUGLAS PRODUCTION FUNCTION
SPECIFICATION AND ESTIMATION OF COBB-DOUGLAS PRODUCTION FUNCTION MODELS,
W69-06560 06A

COLOR
SOILS STUDIES USING COLOR PHOTOS,
W69-06696 07B

COLOR PHOTOGRAPHY
SOILS STUDIES USING COLOR PHOTOS,
W69-06696 07B

COLORADO
WATER RESOURCES DEVELOPMENT BY THE US ARMY CORPS OF ENGINEERS IN COLORADO.
W69-06782 09D

COLORIMETRY
FACTORS INFLUENCING THE CONDENSATION OF 4-AMINOANTIPYRINE WITH DERIVATIVES OF HYDROXYBENZENE-III. A STUDY OF PHENOL CONTENT IN SURFACE WATERS,
W69-06444 05A

COMMERCIAL FISHING
RUSSELL V STATE (ILLEGAL POSSESSION OF UNDERSIZED FISH).
W69-06589 06E

HAYNES V SMITH (PRIVATE COMMERCIAL VENTURES ON PUBLIC WATERS).
W69-06643 06E

COMMUNITY STRUCTURE
SPECIES DIVERSITY AND COMMUNITY STRUCTURE IN LACUSTRINE PHYTOPLANKTON,
W69-06542 02H

COMPENSATION
IOWA-WISCONSIN BRIDGE CO V UNITED STATES (LIABILITY FOR RESERVOIR OPERATION).
W69-06604 06E

FONADELLAS V UNITED STATES (TEMPORARY TAKING OF PROPERTY FOR PUBLIC PURPOSE).
W69-06622 06E

COMPUTER PROGRAMS
PIPELINE PLANNING BY DYNAMIC COMPUTER PROGRAMMING,
W69-06493 06A

HEC-2, WATER SURFACE PROFILES.
W69-06787 04A

COMPUTERS
A COMPUTER-ORIENTED GROUND-WATER INFORMATION STORAGE AND RETRIEVAL SYSTEM,
W69-06764 07C

COMPUTOR MODELS
WATER QUALITY MANAGEMENT ENGINEERING-ECONOMIC FACTORS IN MUNICIPAL WASTE DISPOSAL,
W69-06505 05D

CONCRETE BLOCKS
THERMAL STRESS CONDITION OF EXPERIMENTAL LONG BLOCKS DURING CONSTRUCTION PERIOD OF THE BRATSK HYDROELECTRIC STATION DAM,
W69-06711 08F

CONCRETE CONSTRUCTION
THERMAL STRESS CONDITION OF EXPERIMENTAL LONG BLOCKS DURING CONSTRUCTION PERIOD OF THE BRATSK HYDROELECTRIC STATION DAM,
W69-06711 08F

CONCRETE TECHNOLOGY
THE MECHANISM OF WATER SEEPAGE THROUGH CONCRETE,
W69-06712 08F

CONCRETE TESTING
TEMPERATURE VOLUMETRIC CHANGES OF CONCRETE AT SUBZERO TEMPERATURES,
W69-06672 08F

RX CONCRETE,
W69-06678 08F

CONDEMNATION
WATERS AND WATER SUPPLY.
W69-06612 06E

NANTAHALA POWER AND LIGHT CO V SLOAN (FLOWAGE EASEMENTS).
W69-06620 06E

KANSAS CITY LIFE INS CO V UNITED STATES (IMPAIRMENT OF LAND VALUE DUE TO DAM CONSTRUCTION).
W69-06623 06E

CONDENSATION
BEHAVIOR OF LIQUID SURFACES DURING EVAPORATION AND CONDENSATION,
W69-06840 03A

CONDITIONAL PREDICTION
LEAST SQUARES, CONDITIONAL PREDICTIONS, AND ESTIMATOR PROPERTIES,
W69-06551 06A

CONFINED WATER
ITERATIVE ANALYSIS BOUNDED LEAKY ARTESIAN AQUIFER,
W69-06508 02F

CONNATE WATER

THE ORIGIN OF THE TIBERIAS-NOIT MINERAL WATER ASSOCIATION IN THE TIBERIAS-DEAD SEA RIFT VALLEY, ISRAEL,
W69-06749 02F

CONSERVATION
CERTAIN GAME PRESERVES, AREAS, PROJECTS CONTROL.
W69-06635 06E

CONSOLIDATION
HORIZONTAL MOVEMENTS RELATED TO SUBSIDENCE,
W69-06692 08D

CONSTRUCTION
SEWERAGE DISTRICTS AND BOARDS.
W69-06633 06E

CONSUMER DEMAND FUNCTION
HOUSEHOLD PRODUCTION AND CONSUMER DEMAND FUNCTIONS,
W69-06566 06D

CONSUMPTIVE USE
PHOTOSYNTHESIS AND WATER USE BY SALTCEDAR,
W69-06771 03B

CONTAMINATION
TOWARDS STANDARDIZING THE ARTIFICIAL-POLLUTION TEST FOR HIGH VOLTAGE INSULATORS.
W69-06708 08C

CONTRACT ADMINISTRATION
WATER SUPPLY DISTRICTS.
W69-06630 06E

CORPS OF ENGINEERS
KANSAS RIVER BASIN FLOOD CONTROL,
W69-06729 06B

CORRELATION ANALYSIS
ESTIMATION OF RAINFALL IN SPARSELY GAUGED AREAS,
W69-06773 02B

CORROSION
ECONOMIC EFFECTS OF MINERAL CONTENT IN MUNICIPAL WATER SUPPLIES.
W69-06555 03A

CORROSION CONTROL
INNOVATIONS AND THE FUTURE OF CATHODIC PROTECTION,
W69-06677 08A

COSTS
A HEURISTIC AID FOR THE DESIGN OF SEWER NETWORKS,
W69-06498 05E

ECONOMIC EFFECTS OF MINERAL CONTENT IN MUNICIPAL WATER SUPPLIES.
W69-06555 03A

MANUAL OF PROCEDURES AND METHODS FOR CALCULATING COMPARATIVE COSTS OF MUNICIPAL WATER SUPPLY FROM SALINE AND CONVENTIONAL WATER SOURCES IN TEXAS,
W69-06559 03A

COST-BENEFIT ANALYSIS
IMPLICATIONS OF PROPERTY RIGHTS FOR GOVERNMENT INVESTMENT CHOICES,
W69-06548 06B

COTTON
WATER USE BY IRRIGATED COTTON IN SUDAN. II. NET RADIATION AND SOIL HEAT FLUX,
W69-06756 03F

COULTER COUNTER
APPLICATION OF AN ELECTRONIC PARTICLE COUNTER IN ANALYZING NATURAL POPULATIONS OF PHYTOPLANKTON,
W69-06540 07B

CRIMINAL LAW
RUSSELL V STATE (ILLEGAL POSSESSION OF UNDERSIZED FISH).
W69-06589 06E

STATE V TAYLOR (FISH DYNAMITED IN PRIVATE POND).
W69-06605 06E

CROP PRODUCTION
EFFICIENT WHEAT IRRIGATION WITH LIMITED WATER,
W69-06511 03F

THE PERFORMANCE OF SOIL MOISTURE ESTIMATES AS COMPARED WITH THE DIRECT USE OF CLIMATOLOGICAL DATA FOR ESTIMATING CROP YIELDS,
W69-06519 02G

DROUGHT AND SOIL MOISTURE,
W69-06529 02G

CROP RESPONSE
WATER USE BY IRRIGATED COTTON IN SUDAN. II. NET RADIATION AND SOIL HEAT FLUX,
W69-06756 03F

THE EFFECT OF CROP AND CLIMATIC FACTORS ON THE RADIATION BALANCE OF AN IRRIGATED MAIZE CROP,
W69-06757 03F

CROSS SECTION DATA
THE USE OF ERROR COMPONENTS MODELS IN COMBINING CROSS SECTION WITH TIME SERIES DATA,
W69-06552 06A

CRYSTALLINE ROCKS
SOME DETAILS ON THE CIRCULATION OF GROUNDWATER IN NON-KARSTIFIED FISSURED FORMATIONS IN CZECHOSLOVAKIA (FRENCH),
W69-06485 02F

CRYSTALLIZATION
THE METAMORPHISM OF WET SNOW,
W69-06477 02C

THE METAMORPHISM OF DRY SNOW AT A UNIFORM TEMPERATURE,
W69-06479 02C

CRYSTALLOGRAPHY
THE IMPORTANCE OF THE HYDROGEN ATOM ARRANGEMENT IN DETERMINING HOW ICE CAN DEFORM PLASTICALLY,
W69-06476 02C

CULTIVATION
DROUGHT AND SOIL MOISTURE,
W69-06529 02G

CULTURAL EUTROPHICATION
THE AGING OF LAKES,
W69-06535 02H

CULVERTS
CHRISTMAN V STATE (NEGLIGENCE IN CULVERT CONSTRUCTION).
W69-06624 06E

CURRENT AWARENESS
PERMUTED TITLE INDEX TO WATER RESEARCH JOURNALS, 1967.
W69-06539 10

CZECHOSLOVAKIA
SOME DETAILS ON THE CIRCULATION OF GROUNDWATER IN NON-KARSTIFIED FISSURED FORMATIONS IN CZECHOSLOVAKIA (FRENCH),
W69-06485 02F

DAIRY INDUSTRY
BARBER PURE MILK CO V GOLDIN (SURFACE DRAINAGE).
W69-06588 06E

DAM CONSTRUCTION
PRODERMAN V DIETZ (PRIVATE DAMS FOR FLOOD CONTROL).
W69-06617 06E

DESIGN AND CONSTRUCTION OF DAMS FOR RETENTION OF SOLID WASTES,
W69-06675 05G

DAM DESIGN
THE POSSIBILITY OF USING A MOVABLE DAM THE 'FABRIDAM' AND ITS APPLICATION IN ARID REGIONS,
W69-06455 04A

DESIGN AND CONSTRUCTION OF DAMS FOR RETENTION OF SOLID WASTES,
W69-06675 05G

DAM FOUNDATIONS
FOUNDATION PROBLEMS OF RUEDI DAM AND RESERVOIR,
W69-06673 08E

HIGH EARTHFILL DAM FOUNDATION GROUTING DESIGN AND CONSTRUCTION PROCEDURES,
W69-06674 08D

DAM SAFETY
SAFETY CONTROL OF PRIVATE DAMS,
W69-06433 04A

DAMAGES
BELL TEL CO V DRAVO CORP (UNDERWATER OBSTRUCTION TO NAVIGATION).
W69-06610 06E

EFFECT OF SUBSIDENCE ON WELL FIELDS,
W69-06763 04B

DAMS
THE POSSIBILITY OF USING A MOVABLE DAM THE 'FABRIDAM' AND ITS APPLICATION IN ARID REGIONS,
W69-06455 04A

A CENTURY OF DESIGN AND CONSTRUCTION OF IRRIGATION WORKS IN INDIA,
W69-06461 04A

ZOMBKOWSKI V WISCONSIN RIVER POWER CO (FLOODING DAMAGES CAUSED BY DAM CONSTRUCTION).
W69-06603 06E

IOWA-WISCONSIN BRIDGE CO V UNITED STATES (LIABILITY FOR RESERVOIR OPERATION).
W69-06604 06E

BURNQUIST V FISCHER (FLOWAGE EASEMENT APPURTENANT TO DAM).
W69-06615 06E

NANTAHALA POWER AND LIGHT CO V SLOAN (FLOWAGE EASEMENTS).
W69-06620 06E

CLEMENTS V TOWN OF CARROLLTON (DAM ACROSS DRAINAGE DITCH).
W69-06627 06E

HUGHES V KNIGHT (RIGHT TO UNOBSTRUCTED DRAINAGE OF SURFACE WATERS).
W69-06660 06E

GENERAL PROVISIONS RELATING TO RIVERS AND STREAMS.
W69-06670 06E

DATA COLLECTIONS
ESTIMATED WATER USE IN NEVADA, 1950-65,
W69-06446 06D

EXTENSIONS OF STREAMFLOW RECORDS IN UTAH,
W69-06447 02E

COST, PRECISION, AND VALUE RELATIONSHIPS OF DATA COLLECTION AND DESIGN ACTIVITIES IN WATER DEVELOPMENT PLANNING,
W69-06733 06B

WATER-QUALITY RECORDS FOR THE HUBBARD CREEK WATERSHED, TEXAS, OCTOBER 1966-SEPTEMBER 1967,
W69-06786 02H

CLIMATOLOGY STUDIES OF BAFFIN ISLAND, NORTHWEST TERRITORIES,
W69-06814 02B

RECORDS OF WELLS AND TEST HOLES IN THE NEVADA TEST SITE AND VICINITY,
W69-06820 02F

DATA NEEDS
AN ANALYSIS OF NATIONAL BASIC INFORMATION NEEDS IN URBAN HYDROLOGY,
W69-06770 04C

DATA STORAGE AND RETRIEVAL
A COMPUTER-ORIENTED GROUND-WATER INFORMATION STORAGE AND RETRIEVAL SYSTEM,
W69-06764 07C

DECISION MAKING
IMPLICATIONS OF PROPERTY RIGHTS FOR GOVERNMENT INVESTMENT CHOICES,
W69-06548 06B

DEDICATION
EARLE V MCCARTY (TITLE TO LAND BETWEEN SOUND AND DEDICATED ROAD).
W69-06646 06E

DELAWARE
DRAPER V MOSHIER (INTERFERENCE WITH DRAINAGE DITCH).
W69-06600 06E

WATER RESOURCES DEVELOPMENT BY THE US ARMY CORPS OF ENGINEERS IN DELAWARE.
W69-06783 09D

DELAWARE ESTUARY
PRELIMINARY REMOTE SENSING OF THE DELAWARE ESTUARY,
W69-06793 02L

DEMINERALIZATION
THE STATUS OF SEA WATER CONVERSION,
W69-06583 03A

DEPOSITION(SEDIMENTS)
A GEOMORPHIC APPROACH TO EROSION CONTROL IN SEMIARID REGIONS,
W69-06513 02J

DESALINATION
THE POTENTIAL CONTRIBUTION OF DESALTING TO FUTURE WATER SUPPLY IN TEXAS.
W69-06558 03A

MANUAL OF PROCEDURES AND METHODS FOR CALCULATING COMPARATIVE COSTS OF MUNICIPAL WATER SUPPLY FROM SALINE AND CONVENTIONAL WATER SOURCES IN TEXAS,
W69-06559 03A

DESALTED SEAWATER FOR AGRICULTURE IS IT ECONOMIC,
W69-06765 03F

DESALINATION PLANTS
OPTIMIZATION THEORY APPLIED TO PRELIMINARY DESIGN OF A SINGLE EFFECT MULTISTAGE FLASH DESALINATION PLANT,
W69-06495 03A

DESALINATION PROCESSES
SUL-BISUL(T) ION EXCHANGE PROCESS FIELD EVALUATION ON BRACKISH WATERS,
W69-06836 03A

RECOVERY OF METAL SALTS FROM CONCENTRATED BRINES BY CHELATION,
W69-06837 03A

DESERT PLANTS
TRANSPIRATION OF DESERT PLANTS UNDER DIFFERENT ENVIRONMENTAL CONDITIONS,
W69-06526 02D

DESIGN
PIPELINE PLANNING BY DYNAMIC COMPUTER PROGRAMMING,
W69-06493 06A

OPTIMIZATION THEORY APPLIED TO PRELIMINARY DESIGN OF A SINGLE EFFECT MULTISTAGE FLASH DESALINATION PLANT,
W69-06495 03A

DESIGN CRITERIA
A SIMPLIFIED TECHNIQUE FOR WELL-FIELD DESIGN,
W69-06421 02F

500-KV AC SUBSTATION DESIGN CRITERIA--SUMMARY OF INDUSTRY PRACTICES,
W69-06686 08C

GEOLOGY, DESIGN, AND CONSTRUCTION OF DEEP WELLS IN SEDIMENTARY FOUNDATIONS,
W69-06759 02F

DEWATERING
A DESIGN METHOD FOR DEEP WELL DEWATERING INSTALLATIONS,
W69-06430 02F

DEWATERING SYSTEM DESIGN
A DESIGN METHOD FOR DEEP WELL DEWATERING INSTALLATIONS,
W69-06430 02F

DIFFERENTIAL EQUATIONS
NONRECURSIVE MODELS AS DISCRETE APPROXIMATIONS TO SYSTEMS OF STOCHASTIC DIFFERENTIAL EQUATIONS,
W69-06571 06A

DIFFUSION
THE HYDROLOGIC IMPORTANCE OF TRANSPIRATION CONTROL BY STOMATA,
W69-06520 02D

DIFFUSIVITY
SOIL-WATER DIFFUSIVITY BY THE ONE-STEP METHOD,
W69-06528 02G

DIGITAL COMPUTER
KANSAS RIVER BASIN FLOOD CONTROL,
W69-06729 06B

DIGITAL COMPUTERS
A HEURISTIC AID FOR THE DESIGN OF SEWER NETWORKS,
W69-06498 05E

WATER QUALITY MANAGEMENT IN IRRIGATION SYSTEMS,
W69-06499 05G

USE OF DIGITAL COMPUTERS IN DISTRIBUTION SYSTEM ANALYSES,
W69-06503 07C

DIKES
USE OF ASPHALTIC CONCRETE IN COASTAL AND CANAL CONSTRUCTION,
W69-06682 08F

DIPS
GRAPHIC DETERMINATION OF SLOPE AND OF DIP AND STRIKE,
W69-06681 07B

DIRECT CURRENT
CALCULATION OF BALANCED AND UNBALANCED FAULT CURRENTS IN AC-DC POWER SYSTEMS,
W69-06690 08C

SOME ASPECTS OF INSULATION CO-ORDINATION IN HVDC SYSTEMS,
W69-06707 08C

DISCHARGE WATER
SBARRA V ERIE RR (DRAINAGE OF SURFACE WATERS AND PRESCRIPTIVE RIGHTS).
W69-06591 06E

DISCHARGE(WATER)
INFLOW TO SNAKE RIVER BETWEEN MILNER AND KING HILL, IDAHO,
W69-06427 02E

RAU V WILDEN ACRES, INC (DIVERSION OF NATURAL FLOW BY ARTIFICIAL CHANNEL).
W69-06656 06E

RINZLER V FOLSOM (ARTIFICIAL INCREASE OF SURFACE RUNOFF).
W69-06657 06E

DISCRETE APPROXIMATION
NONRECURSIVE MODELS AS DISCRETE APPROXIMATIONS TO SYSTEMS OF STOCHASTIC DIFFERENTIAL EQUATIONS,
W69-06571 06A

DISCRIMINANT FUNCTION
LINEAR PROBABILITY FUNCTIONS AND DISCRIMINANT FUNCTIONS,
W69-06563 06A

DISPENSERS
EVAPORATION REDUCTION ON LARGE RESERVOIRS,
W69-06531 03F

DISPLACEMENT
DISPLACEMENT FRONT UNDER PONDED LEACHING,
W69-06510 02G

DISTRIBUTED LAG ANALYSIS
LONG-RUN COEFFICIENTS AND DISTRIBUTED LAG ANALYSIS A REFORMULATION,
W69-06557 06A

DISTRIBUTION PATTERNS
LABORATORY EXPERIMENTS ON THE PRODUCTION OF GRAIN ORIENTATION IN SHEARING SAND,
W69-06799 02J

DISTRICT OF COLUMBIA
UNITED STATES V GROFN (TITLE TO FILLED IN LAND BORDERING ON A RIVER).
W69-06608 06E

DIVERSION
RAU V WILDEN ACRES, INC (DIVERSION OF NATURAL FLOW BY ARTIFICIAL CHANNEL).
W69-06656 06E

DIVISIBILITY OF SERVITUDES

OHIO OIL CO V FERGUSON (MINERAL RIGHTS AND ROYALTIES).
W69-06594 06E

DOMESTIC WATER
THE IMPACT OF PRICE ON RESIDENTIAL WATER DEMAND AND ITS RELATION TO SYSTEM DESIGN AND PRICE STRUCTURE,
W69-06502 06D

DOWNSPOUTS
COX V MARTIN (DISCHARGE OF SURFACE WATER THROUGH A DOWNSPOUT).
W69-06596 06E

DRAINAGE
KANSAS CITY LIFE INS CO V UNITED STATES (IMPAIRMENT OF LAND VALUE DUE TO DAM CONSTRUCTION).
W69-06623 06E

PROCEEDINGS OF TILE DRAINAGE RESEARCH CONFERENCE,
W69-06795 04A

DRAINAGE ENGINEERING
A DESIGN METHOD FOR DEEP WELL DEWATERING INSTALLATIONS,
W69-06430 02F

DRAINAGE SYSTEMS
DRAINING AREA UNDERLAIN BY HIGHLY PERMEABLE SHALLOW SAND AQUIFER,
W69-06512 02G

CANNON V CITY OF MACON (NATURAL DRAINAGE FLOW AND THE LOWER LAND PROPRIETOR).
W69-06595 06E

CHRISTMAN V STATE (NEGLIGENCE IN CULVERT CONSTRUCTION).
W69-06624 06E

SEWERAGE DISTRICTS AND BOARDS.
W69-06633 06E

NASSAU COUNTY V CHERRY VALLEY ESTATES (LANDOWNERS RIGHT TO PREVENT FLOW OF SURFACE WATER ONTO HIS PROPERTY).
W69-06653 06E

SEWERS AND DRAINS PRIVATE DRAINS.
W69-06661 06E

PROCEEDINGS OF TILE DRAINAGE RESEARCH CONFERENCE,
W69-06795 04A

DRAINAGE WATER
BARBER PURE MILK CO V GOLDIN (SURFACE DRAINAGE).
W69-06588 06E

COX V MARTIN (DISCHARGE OF SURFACE WATER THROUGH A DOWNSPOUT).
W69-06596 06E

POTEETE V CITY OF WATER VALLEY (ARTIFICIAL CONTROL OF SUBSURFACE DRAINAGE).
W69-06626 06E

DRAINAGE WELLS
A DESIGN METHOD FOR DEEP WELL DEWATERING INSTALLATIONS,
W69-06430 02F

DRAINS
DISPLACEMENT FRONT UNDER PONDED LEACHING,
W69-06510 02G

DRAINING AREA UNDERLAIN BY HIGHLY PERMEABLE SHALLOW SAND AQUIFER,
W69-06512 02G

DRAWDOWN
ITERATIVE ANALYSIS BOUNDED LEAKY ARTESIAN AQUIFER,
W69-06508 02F

DREDGING
TENNESSEE GAS TRANSMISSION CO V GREATER LAFOURCHE PORT COMM'N (PIPELINES ACROSS NAVIGABLE CHANNELS).
W69-06587 06E

DRILLING
OHIO OIL CO V FERGUSON (MINERAL RIGHTS AND ROYALTIES).
W69-06594 06E

DROUGHT
THE ABNORMALLY DRY WEATHER OF 1961-1966 IN THE NORTHEASTERN UNITED STATES,
W69-06437 02B

DROUGHT PREDICTION
SOME REMARKS ON THE PREDICTABILITY OF DROUGHT AND RELATED CLIMATIC ANOMALIES,
W69-06439 02B

DROUGHTS
DROUGHT IN THE NORTHEASTERN UNITED STATES,
W69-06436 02B

FURTHER STUDIES OF DROUGHT OVER NORTHEASTERN UNITED STATES,
W69-06438 02B

SOME REMARKS ON THE PREDICTABILITY OF DROUGHT AND RELATED CLIMATIC ANOMALIES,
W69-06439 02B

EFFECTS OF THE DROUGHT ON WATER RESOURCES-SURFACE AND SUBSURFACE HYDROLOGY,
W69-06440 02B

SOME CHARACTERISTICS AND FREQUENCIES OF OCCURRENCE OF DROUGHTS IN THE DRY CLIMATIC ZONES OF INDIA,
W69-06524 02G

DROUGHT AND SOIL MOISTURE,
W69-06529 02G

DURABILITY
ECONOMIC EFFECTS OF MINERAL CONTENT IN MUNICIPAL WATER SUPPLIES.
W69-06555 03A

DYE RELEASES
TRACER METHOD FOR DETERMINING THE VELOCITY OF FLOW IN A CONFINED KARSTIC AQUIFER,
W69-06774 07B

DYNAMIC PROGRAMMING
PIPELINE PLANNING BY DYNAMIC COMPUTER PROGRAMMING,
W69-06493 06A

DYNAMICS
THE USE OF ELECTRIC ANALOG MODELS IN HYDRODYNAMICAL STUDY OF THE ALSACE AQUIFERS (FRENCH),
W69-06806 02F

EARTH DAMS
CITY OF PORTSMOUTH V CULPEPPER (SUIT FOR DAMAGES RESULTING FROM OVERFLOW OF OBSTRUCTED CANAL).
W69-06602 06E

FOUNDATION PROBLEMS OF RUEDI DAM AND RESERVOIR,
W69-06673 08E

HIGH EARTHFILL DAM FOUNDATION GROUTING DESIGN AND CONSTRUCTION PROCEDURES,
W69-06674 08D

DESIGN AND CONSTRUCTION OF DAMS FOR RETENTION OF SOLID WASTES,
W69-06675 05G

EARTHWORKS
NON-ENGINEERING ELEMENTS IN FACTORS OF SAFETY IN SOIL AND FOUNDATION ENGINEERING,
W69-06695 08D

EASEMENTS
GEORGE V STATE (OBSTRUCTION OF SUBSURFACE FLOW).
W69-06590 06E

PRODERMAN V DIETZ (PRIVATE DAMS FOR FLOOD CONTROL).
W69-06617 06E

NANTAHALA POWER AND LIGHT CO V SLOAN (FLOWAGE EASEMENTS).
W69-06620 06E

DAVIS V CITY OF ALEXANDRIA (PUBLIC USE OF LEVEE BANK AS ROADWAY).
W69-06645 06E

ECONOMIC DEVELOPMENT
WATER TRANSPORTATION-IMPACT ON ECONOMIC DEVELOPMENT,
W69-06730 06B

ECONOMIC FEASIBILITY
A FEASIBILITY STUDY ON THE UTILIZATION OF WASTE BRINE FROM SALINATION PLANTS PART 1,
W69-06556 03C

ECONOMIC JUSTIFICATION
ECONOMIC FRAMEWORK FOR SALINITY CONTROL PROJECTS,
W69-06490 05D

ECONOMICS
SLUDGE DISPOSAL ALTERNATIVES -- SOCIO-ECONOMIC CONSIDERATIONS,
W69-06492 05E

THE IMPACT OF PRICE ON RESIDENTIAL WATER DEMAND AND ITS RELATION TO SYSTEM DESIGN AND PRICE STRUCTURE,
W69-06502 06D

DESALTED SEAWATER FOR AGRICULTURE IS IT ECONOMIC,
W69-06765 03F

ECOSYSTEMS
SIMULATION OF AN AQUATIC ECOSYSTEM,
W69-06536 02H

THE DESIRABILITY AND APPLICABILITY OF SIMULATING ECOSYSTEMS,
W69-06537 06A

EDUCATION
MANPOWER REQUIREMENTS FOR POLLUTION CONTROL AND WATER RESOURCES IN INDIANA AND A RELATED POLLUTION CONTROL TECHNOLOGY CURRICULUM,
W69-06507 05G

EGYPTO-ARABIAN DESERT
TRANSPIRATION OF DESERT PLANTS UNDER DIFFERENT ENVIRONMENTAL CONDITIONS,
W69-06526 02D

ELASTICITY OF SUBSTITUTION
THE CES PRODUCTION FUNCTION A DERIVATION,
W69-06720 06B

ESTIMATION OF RETURNS TO SCALE AND THE ELASTICITY OF SUBSTITUTION,

W69-06732 06B

ELECTRIC FLOOD MODEL
KANSAS RIVER BASIN FLOOD CONTROL,
W69-06729 06B

ELECTRIC INSULATION
SOME ASPECTS OF INSULATION CO-ORDINATION IN HVDC SYSTEMS,
W69-06707 08C

ELECTRIC POWER
A SWING RELAY FOR THE EAST-WEST INTERTIE,
W69-06687 08C

ELECTRIC POWER PRODUCTION
ELECTRICAL FEATURES OF THE GRAND COULEE THIRD POWER PLANT,
W69-06684 08C

ELECTRIC RELAYS
A SWING RELAY FOR THE EAST-WEST INTERTIE,
W69-06687 08C

BROWN BOVERI DISTANCE PROTECTION SYSTEMS EMPLOYING CARRIER TRANSFER,
W69-06709 08C

DISTANCE PROTECTION OF HIGH-VOLTAGE LINES CONTAINING SERIES CAPACITORS,
W69-06710 08C

ELECTRICAL INSULATORS
TOWARDS STANDARDIZING THE ARTIFICIAL-POLLUTION TEST FOR HIGH VOLTAGE INSULATORS.
W69-06708 08C

ELECTRICAL NETWORKS
CALCULATION OF BALANCED AND UNBALANCED FAULT CURRENTS IN AC-DC POWER SYSTEMS,
W69-06690 08C

EMBANKMENTS
CIRCULAR AND LOGARITHMIC SPIRAL SLIP SURFACES,
W69-06694 08D

EMINENT DOMAIN
KIDIS V CITY OF GULFPORT (USE OF SUBMERGED LANDS FOR PUBLIC PURPOSE).
W69-06621 06E

EMINENT DOMAIN.
W69-06642 06E

EMSCHER ASSOCIATION
WATER SUPPLY AND WASTEWATER TREATMENT PROBLEMS OF INDUSTRIAL AND TRADE ENTERPRISES,
W69-06723 05D

ENVIRONMENTAL EFFECTS
TRANSPIRATION OF DESERT PLANTS UNDER DIFFERENT ENVIRONMENTAL CONDITIONS,
W69-06526 02D

PROGRESS REPORT OF THE BUREAU OF COMMERCIAL FISHERIES RADIOBIOLOGICAL LABORATORY, BEAUFORT, N. C., FISCAL YEAR 1968,
W69-06769 09C

EROSION
ERICKSON V GREUB (TITLE TO ACCRETION).
W69-06641 06E

USE OF TRACER TECHNIQUE IN SOIL EROSION RESEARCH,
W69-06704 04D

PREDICTION OF RAINSPLASH EROSION IN THE SEASONALLY WET TROPICS,
W69-06768 02J

COASTAL EROSION AND TRANSGRESSIVE STRATIGRAPHY,
W69-06798 02L

DYNAMICS OF CHANNEL FLOW,
W69-06835 02E

EROSION CONTROL
A GEOMORPHIC APPROACH TO EROSION CONTROL IN SEMIARID REGIONS,
W69-06513 02J

ERICKSON V GREUB (TITLE TO ACCRETION).
W69-06641 06E

GRADED FURROWS FOR WATER EROSION CONTROL,
W69-06746 02J

ERROR COMPONENT
THE USE OF ERROR COMPONENTS MODELS IN COMBINING CROSS SECTION WITH TIME SERIES DATA,
W69-06552 06A

ESTIMATED PROPERTIES
LEAST SQUARES, CONDITIONAL PREDICTIONS, AND ESTIMATOR PROPERTIES,
W69-06551 06A

ESTIMATING
THE PERFORMANCE OF SOIL MOISTURE ESTIMATES AS COMPARED WITH THE DIRECT USE OF CLIMATOLOGICAL DATA FOR ESTIMATING CROP YIELDS,
W69-06519 02G

ESTIMATING PAN EVAPORATION AND EVAPOTRANSPIRATION FROM CLIMATIC DATA,
W69-06522 02D

EVALUATION OF SOME PRACTICAL METHODS OF ESTIMATING EVAPOTRANSPIRATION IN ARID CLIMATES AT LOW LATITUDES,
W69-06530 02D

SPECIFICATION ANALYSIS IN THE ESTIMATION OF PARAMETERS OF A SIMULTANEOUS EQUATION MODEL WITH AUTOREGRESSIVE RESIDUALS,
W69-06567 06A

ESTIMATION
FIRST ORDER AUTO REGRESSION INFERENCE, ESTIMATION, AND PREDICTION,
W69-06550 06A

SPECIFICATION AND ESTIMATION OF COBB-DOUGLAS PRODUCTION FUNCTION MODELS,
W69-06560 06A

SPECIFICATION ANALYSIS IN THE ESTIMATION OF PARAMETERS OF A SIMULTANEOUS EQUATION MODEL WITH AUTOREGRESSIVE RESIDUALS,
W69-06567 06A

ESTIMATORS
ON THE RELATIVE SMALL-SAMPLE PROPERTIES OF SEVERAL STRUCTURAL-EQUATION ESTIMATORS,
W69-06734 06B

ESTUARIES
REPORT OF THE BUREAU OF COMMERCIAL FISHERIES BIOLOGICAL LABORATORY, ST. PETERSBURG BEACH, FLORIDA, FISCAL YEAR 1968,
W69-06767 09C

ESTUARINE ENVIRONMENT
REPORT OF THE BUREAU OF COMMERCIAL FISHERIES BIOLOGICAL LABORATORY, ST. PETERSBURG BEACH, FLORIDA, FISCAL YEAR 1968,
W69-06767 09C

ESTUARINE FISHERIES
REPORT OF THE BUREAU OF COMMERCIAL FISHERIES BIOLOGICAL LABORATORY, ST. PETERSBURG BEACH, FLORIDA, FISCAL YEAR 1968,
W69-06767 09C

EUTROPHICATION
THE AGING OF LAKES,
W69-06535 02H

APPLICATION OF AN ELECTRONIC PARTICLE COUNTER IN ANALYZING NATURAL POPULATIONS OF PHYTOPLANKTON,
W69-06540 07B

EVAPORATION
ESTIMATING PAN EVAPORATION AND EVAPOTRANSPIRATION FROM CLIMATIC DATA,
W69-06522 02D

TRANSPIRATION OF DESERT PLANTS UNDER DIFFERENT ENVIRONMENTAL CONDITIONS,
W69-06526 02D

ON THE ESTIMATION OF EVAPORATION FROM A LAND SURFACE,
W69-06833 02D

BEHAVIOR OF LIQUID SURFACES DURING EVAPORATION AND CONDENSATION,
W69-06840 03A

EVAPORATION CONTROL
EVAPORATION REDUCTION ON LARGE RESERVOIRS,
W69-06531 03F

EVAPORATION PANS
ESTIMATING PAN EVAPORATION AND EVAPOTRANSPIRATION FROM CLIMATIC DATA,
W69-06522 02D

EVAPOTRANSPIRATION
EVALUATION OF THE GAMMA TRANSMISSION METHOD FOR DETERMINING SOIL WATER BALANCE AND EVAPOTRANSPIRATION,
W69-06514 02G

ESTIMATING PAN EVAPORATION AND EVAPOTRANSPIRATION FROM CLIMATIC DATA,
W69-06522 02D

EVALUATION OF SOME PRACTICAL METHODS OF ESTIMATING EVAPOTRANSPIRATION IN ARID CLIMATES AT LOW LATITUDES,
W69-06530 02D

EVIDENCE
HAMMEL V CAMP RANGER, INC (PRESUMPTIONS REGARDING CONVEYANCE OF INLAND, NON-NAVIGABLE POND).
W69-06648 06E

EXPANSION
SUBSTATION EXPANSION, RELIABILITY, AND TRANSFORMER LOADING POLICY ANALYSIS,
W69-06685 06A

EXPANSIVE CLAYS
PREDICTION OF SWELLING PRESSURE OF CLAYS,
W69-06693 08D

EXPLOSIVES
STATE V TAYLOR (FISH DYNAMITED IN PRIVATE POND).
W69-06605 06E

EXPORT BASE CONCEPT
ECONOMIC ANALYSIS OF THE DEVELOPMENT POTENTIAL OF THE

COMMERCIAL FISHERIES INDUSTRY OF THE COASTAL PLAINS REGION,
W69-06554 06B

EXTRA HIGH VOLTAGE
500-KV AC SUBSTATION DESIGN CRITERIA--SUMMARY OF INDUSTRY PRACTICES,
W69-06686 08C

OPEN BREAKER PROTECTION OF EHV SYSTEMS,
W69-06688 08C

FAULTS(ELECTRICAL)
CALCULATION OF BALANCED AND UNBALANCED FAULT CURRENTS IN AC-DC POWER SYSTEMS,
W69-06690 08C

FEDERAL GOVERNMENT
CONSERVATION'S CHALLENGE TO STATE GOVERNMENTS,
W69-06586 06E

FEDERAL REPUBLIC OF GERMANY
WATER SUPPLY AND WASTEWATER TREATMENT PROBLEMS OF INDUSTRIAL AND TRADE ENTERPRISES,
W69-06723 05D

FINANCIAL CONSTRAINT
THE IMPROVEMENT OF WATER QUALITY UNDER A FINANCIAL CONSTRAINT A COMMENTARY ON 'LINEAR PROGRAMMING APPLIED TO WATER QUALITY MANAGEMENT',
W69-06547 05F

FIRE PROTECTION
ICE DEALERS BATHING WATER SUPPLY FOR RURAL FIRE PROTECTION.
W69-06631 06E

FIRST ORDER AUTOREGRESSION
FIRST ORDER AUTO REGRESSION INFERENCE, ESTIMATION, AND PREDICTION,
W69-06550 06A

FISH
A REVIEW OF THE LIFESPANS AND MORTALITY RATES OF FISH IN NATURE, AND THEIR RELATION TO GROWTH AND OTHER PHYSIOLOGICAL CHARACTERISTICS,
W69-06533 05C

ARSENIC ACCUMULATION BY FISH IN LAKES TREATED WITH SODIUM ARSENITE,
W69-06541 05B

FISH AND WILDLIFE
ALLOCATION AND REALLOCATION OF WATER RESOURCES,
W69-06691 06B

FISH CONSERVATION
STATE V TAYLOR (FISH DYNAMITED IN PRIVATE POND).
W69-06605 06E

FISH MANAGEMENT
RUSSELL V STATE (ILLEGAL POSSESSION OF UNDERSIZED FISH).
W69-06589 06E

FISHERIES
ECONOMIC ANALYSIS OF THE DEVELOPMENT POTENTIAL OF THE COMMERCIAL FISHERIES INDUSTRY OF THE COASTAL PLAINS REGION,
W69-06554 06B

FISSURES
ARTIFICIAL RECHARGE OF A FISSURED SANDSTONE AQUIFER, TANGIERS, MOROCCO (FRENCH),
W69-06487 04B

FISSURES(GEOLOGY)
GROUNDWATER IN FRACTURED VOLCANIC ROCKS IN SOUTHERN ARIZONA,
W69-06831 02F

FLASH DISTILLATION
OPTIMIZATION THEORY APPLIED TO PRELIMINARY DESIGN OF A SINGLE EFFECT MULTISTAGE FLASH DESALINATION PLANT,
W69-06495 03A

FLASHOVER
TOWARDS STANDARDIZING THE ARTIFICIAL-POLLUTION TEST FOR HIGH VOLTAGE INSULATORS.
W69-06708 08C

FLOOD CONTROL
RESERVOIR MANAGEMENT THE TRADEOFF BETWEEN LOW-FLOW REGULATION AND FLOOD CONTROL,
W69-06496 04A

FRODERMAN V DIETZ (PRIVATE DAMS FOR FLOOD CONTROL).
W69-06617 06E

FLOOD WALL BOARD.
W69-06647 06E

KANSAS RIVER BASIN FLOOD CONTROL,
W69-06729 06B

FLOOD DAMAGE
FLOOD PLAIN INFORMATION, WILSON CREEK AND TRIBUTARIES, SPRINGFIELD, MISSOURI-PART 1.
W69-06467 04A

FLOOD PLAIN INFORMATION, ROCKY RIVER IN CITIES OF ROCKY RIVER AND LAKEWOOD, CUYAHOGA COUNTY, OHIO.
W69-06468 04A

FLOOD PLAIN INFORMATION, WALLA WALLA RIVER TRIBUTARIES IN THE VICINITY OF WALLA WALLA, WASHINGTON.
W69-06469 04A

FLOOD PLAIN INFORMATION, YAKIMA RIVER, BENTON COUNTY, WASHINGTON.
W69-06470 04A

FLOOD PLAIN INFORMATION, OMAHA METROPOLITAN REGION, NEBRASKA - VOLUME 1.
W69-06471 04A

FLOOD PLAIN INFORMATION, CEDAR RIVER, LINN COUNTY, IOWA.
W69-06472 04A

FLOOD PLAIN INFORMATION, GUAYANILLA RIVER, GUAYANILLA, PUERTO RICO.
W69-06473 04A

FONADELLAS V UNITED STATES (TEMPORARY TAKING OF PROPERTY FOR PUBLIC PURPOSE).
W69-06622 06E

FLOOD PLAIN INFORMATION, BOISE RIVER AND NORTHSIDE TRIBUTARIES, BOISE, IDAHO AND VICINITY.
W69-06823 04A

FLOOD PLAIN INFORMATION OF SPRING VALLEY CREEK, SAN DIEGO COUNTY, CALIFORNIA.
W69-06824 04A

FLOOD PLAIN INFORMATION OF SENECA LAKE, NEW YORK.
W69-06825 04A

FLOOD PLAIN INFORMATION, CAYUGA LAKE, NEW YORK.
W69-06826 04A

FLOOD PLAIN INFORMATION, CANANDAIGUA LAKE, NEW YORK.
W69-06827 04A

FLOOD ESTIMATE
A NEW TABLE OF PERCENTAGE POINTS OF THE PEARSON TYPE III DISTRIBUTION,
W69-06680 02E

FLOOD FORECASTING
A NEW TABLE OF PERCENTAGE POINTS OF THE PEARSON TYPE III DISTRIBUTION,
W69-06680 02E

FLOOD PEAKS
A NEW TABLE OF PERCENTAGE POINTS OF THE PEARSON TYPE III DISTRIBUTION,
W69-06680 02E

FLOOD PROBABILITY
A NEW TABLE OF PERCENTAGE POINTS OF THE PEARSON TYPE III DISTRIBUTION,
W69-06680 02E

FLOOD PROTECTION
KANSAS RIVER BASIN FLOOD CONTROL,
W69-06729 06B

FLOOD WALLS
FLOOD WALL BOARD.
W69-06647 06E

FLOODING
ZOMBKOWSKI V WISCONSIN RIVER POWER CO (FLOODING DAMAGES CAUSED BY DAM CONSTRUCTION).
W69-06603 06E

FLOODS
FLOOD INUNDATION AND EFFECTS OF URBANIZATION IN METROPOLITAN CHARLOTTE, NORTH CAROLINA,
W69-06445 04C

FLOOD PLAIN INFORMATION, WILSON CREEK AND TRIBUTARIES, SPRINGFIELD, MISSOURI-PART 1.
W69-06467 04A

FLOOD PLAIN INFORMATION, ROCKY RIVER IN CITIES OF ROCKY RIVER AND LAKEWOOD, CUYAHOGA COUNTY, OHIO.
W69-06468 04A

FLOOD PLAIN INFORMATION, WALLA WALLA RIVER TRIBUTARIES IN THE VICINITY OF WALLA WALLA, WASHINGTON.
W69-06469 04A

FLOOD PLAIN INFORMATION, YAKIMA RIVER, BENTON COUNTY, WASHINGTON.
W69-06470 04A

FLOOD PLAIN INFORMATION, OMAHA METROPOLITAN REGION, NEBRASKA - VOLUME 1.
W69-06471 04A

FLOOD PLAIN INFORMATION, CEDAR RIVER, LINN COUNTY, IOWA.
W69-06472 04A

FLOOD PLAIN INFORMATION, GUAYANILLA RIVER, GUAYANILLA, PUERTO RICO.
W69-06473 04A

A NEW TABLE OF PERCENTAGE POINTS OF THE PEARSON TYPE III DISTRIBUTION,
W69-06680 02E

FLOOD PLAIN INFORMATION, BOISE RIVER AND NORTHSIDE TRIBUTARIES, BOISE, IDAHO AND VICINITY.
W69-06823 04A

FLOOD PLAIN INFORMATION OF SPRING VALLEY CREEK, SAN DIEGO COUNTY, CALIFORNIA.
W69-06824 04A

FLOOD PLAIN INFORMATION OF SENECA LAKE, NEW YORK.
W69-06825 04A

FLOOD PLAIN INFORMATION, CAYUGA LAKE, NEW YORK.
W69-06826 04A

FLOOD PLAIN INFORMATION, CANANDAIGUA LAKE, NEW YORK.
W69-06827 04A

FLORIDA
CARNASION V PAUL (RIGHT OF A COUNTY TO TAX TIDELAND PROPERTY).
W69-06644 06E

EARLE V MCCARTY (TITLE TO LAND BETWEEN SOUND AND DEDICATED ROAD).
W69-06646 06E

FLORIDA OCEANOGRAPHY
REPORT OF THE BUREAU OF COMMERCIAL FISHERIES BIOLOGICAL LABORATORY, ST. PETERSBURG BEACH, FLORIDA, FISCAL YEAR 1968,
W69-06767 09C

FLOW
THE MECHANICAL PROPERTIES OF SINGLE CRYSTALS OF ICE AT LOW TEMPERATURES,
W69-06474 02C

DEFORMATION OF POLYCRYSTALLINE ICE UNDER COMBINED UNIAXIAL AND HYDROSTATIC PRESSURE,
W69-06475 02C

FLOW PROFILES
HEC-2, WATER SURFACE PROFILES.
W69-06787 04A

FOLIAR APPLICATION
TRANSPIRATION REDUCTION BY SURFACE FILMS,
W69-06532 03F

FORECASTING
SOME REMARKS ON THE PREDICTABILITY OF DROUGHT AND RELATED CLIMATIC ANOMALIES,
W69-06439 02B

FIRST ORDER AUTO REGRESSION INFERENCE, ESTIMATION, AND PREDICTION,
W69-06550 06A

FORECASTING URBAN WATER DEMANDS IN DEVELOPING COUNTRIES,
W69-06727 06D

ON THE ESTIMATION OF EVAPORATION FROM A LAND SURFACE,
W69-06833 02D

FORMULAE
ESTIMATING PAN EVAPORATION AND EVAPOTRANSPIRATION FROM CLIMATIC DATA,
W69-06522 02D

FOURIER ANALYSIS
AN HARMONIC ANALYSIS OF NONSTATIONARY MULTIVARIATE ECONOMIC PROCESSES,
W69-06553 06A

FRANCIS TURBINES
THEORETICAL AND EXPERIMENTAL INVESTIGATIONS OF THE VIBRATIONS OF THE ROTOR OF A FULL-SCALE-MODEL HYDROELECTRIC INSTALLATION,
W69-06698 08C

FREEZE THAW TESTS
TEMPERATURE VOLUMETRIC CHANGES OF CONCRETE AT SUBZERO TEMPERATURES,
W69-06672 08F

FREEZING
TEMPERATURE VOLUMETRIC CHANGES OF CONCRETE AT SUBZERO TEMPERATURES,
W69-06672 08F

FREQUENCY ANALYSIS
FREQUENCY AND AREAL DISTRIBUTIONS OF TROPICAL STORM RAINFALL, U.S. COASTAL REGION, GULF OF MEXICO,
W69-06797 02B

FRESH WATER
GEOCHEMICAL TRACING OF MINERAL AND FRESH WATER SOURCES IN THE LAKE TIBERIAS BASIN, ISRAEL,
W69-06748 02F

FRESHETS
RINZLER V FOLSOM (ARTIFICIAL INCREASE OF SURFACE RUNOFF).
W69-06657 06E

FURROW SYSTEMS
GRADED FURROWS FOR WATER EROSION CONTROL,
W69-06746 02J

GAMMA RAYS
EVALUATION OF THE GAMMA TRANSMISSION METHOD FOR DETERMINING SOIL WATER BALANCE AND EVAPOTRANSPIRATION,
W69-06514 02G

GAUSSIAN MARKOV RESIDUALS
SIMULTANEOUS TESTS FOR TREND AND SERIAL CORRELATIONS FOR GAUSSIAN MARKOV RESIDUALS,
W69-06569 06A

GENERAL WATER SCHEMES
THE GENERAL WATER SCHEME - AN ESSENTIAL BASIS FOR THE MOST RATIONAL USE OF WATER RESOURCES,
W69-06724 06B

GEOCHEMISTRY
POTASSIUM, ILLITE AND THE OCEAN,
W69-06506 02K

GEOCHEMICAL TRACING OF MINERAL WATER SOURCES IN THE SOUTH WESTERN DEAD SEA BASIN, ISRAEL,
W69-06747 02F

GEOMORPHOLOGY
A GEOMORPHIC APPROACH TO EROSION CONTROL IN SEMIARID REGIONS,
W69-06513 02J

GEORGIA
CANNON V CITY OF MACON (NATURAL DRAINAGE FLOW AND THE LOWER LAND PROPRIETOR).
W69-06595 06E

COX V MARTIN (DISCHARGE OF SURFACE WATER THROUGH A DOWNSPOUT).
W69-06596 06E

RINZLER V FOLSOM (ARTIFICIAL INCREASE OF SURFACE RUNOFF).
W69-06657 06E

GLACIERS
THE ANNUAL HEAT ENERGY TRANSFER ABOVE AND INSIDE ANTARCTICA BLUE ICE,
W69-06480 02C

RELATIONS BETWEEN GLACIER RUNOFF AND METEOROLOGICAL FACTORS OBSERVED ON AND OUTSIDE THE GLACIER,
W69-06481 02C

A TEMPERATURE PROFILE THROUGH THE MEIGHEN ICE CAP, ARCTIC CANADA,
W69-06482 02C

RECENT HISTORY OF GULKANA AND COLLEGE GLACIERS, CENTRAL ALASKA RANGE, ALASKA,
W69-06808 02C

GOLODNAIA STEPPE(USSR)
EXPERIENCE IN ACCELERATED IRREVERSIBLE DESALINIZATION OF SOILS IN GOLODNAYA STEPPE,
W69-06716 03F

GOVERNMENT SUPPORTS
CONSTRUCTION AND MANAGEMENT OF RIVER VALLEY PROJECTS IN INDIA,
W69-06457 04A

GRADIENT METHOD
MAXIMIZATION BY QUADRATIC HILL-CLIMBING,
W69-06564 06A

GRADING
GRADED FURROWS FOR WATER EROSION CONTROL,
W69-06746 02J

GRAND COULEE POWERPLANT(WASH)
ELECTRICAL FEATURES OF THE GRAND COULEE THIRD POWER PLANT,
W69-06684 08C

GRAVEL MULCHES
CONSERVATION OF SOIL WATER BY GRAVEL MULCHES,
W69-06796 03F

GRAVITY STUDIES
GROUND WATER, GRAVITY AND RIFT VALLEYS IN MALAWI,
W69-06431 02F

GRAY HYDROCAL HYGROMETER
TENSION OF THE SOIL WATER WHEN PERMANENT WILTING OCCURS, AS MEASURED BY THE GRAY HYDROCAL HYGROMETER METHOD,
W69-06516 02G

GREAT LAKES
GREAT LAKES COMPACT (AGREEMENT FOR EFFICIENT MANAGEMENT OF THE GREAT LAKES BASIN).
W69-06616 06E

GREAT LAKES COMMISSION
GREAT LAKES COMPACT (AGREEMENT FOR EFFICIENT MANAGEMENT OF THE GREAT LAKES BASIN).
W69-06616 06E

GREAT LAKES COMPACT
GREAT LAKES COMPACT (AGREEMENT FOR EFFICIENT MANAGEMENT OF THE GREAT LAKES BASIN).
W69-06616 06E

GROUND WATER
CONTROL OF SEA-WATER INTRUSION IN A GROUND-WATER AQUIFER,
W69-06422 02F

GROUNDWATER
A SIMPLIFIED TECHNIQUE FOR WELL-FIELD DESIGN,
W69-06421 02F

SIGNIFICANCE OF GROUNDWATER MANAGEMENT STRATEGY-A SYSTEMS APPROACH,
W69-06424 06A

EFFECTS OF MINE DRAINAGE ON GROUND WATER,
W69-06425 05C

MICROBIAL PROBLEMS IN GROUNDWATER,
W69-06426 05C

WATER-RESOURCES APPRAISAL OF THE LOWER MOAPA-LAKE MEAD AREA, CLARK COUNTY, NEVADA,
W69-06435 02F

SUMMARY OF GROUND-WATER RESOURCES OF ATLANTIC COUNTY, NEW JERSEY,
W69-06448 02F

GEOLOGY AND GROUND-WATER RESOURCES OF BURLINGTON COUNTY, NEW JERSEY,
W69-06449 02F

GEOLOGY AND GROUND-WATER RESOURCES OF THE RAHWAY AREA, NEW JERSEY,
W69-06450 02F

WATER AVAILABILITY, CONECUH COUNTY, ALABAMA,
W69-06451 02E

WATER AVAILABILITY, COFFEE COUNTY, ALABAMA,
W69-06452 02F

GROUND WATER FAVORABILITY MAP OF THE OTTAUQUECHEE-SAXTONS RIVER BASIN, VERMONT,
W69-06463 02F

GROUND WATER FAVORABILITY MAP OF THE WEST-DEERFIELD RIVER BASIN, VERMONT,
W69-06464 02F

GROUND WATER FAVORABILITY MAP OF THE WELLS-OMPOMPANOOSUC RIVER BASIN, VERMONT,
W69-06465 02F

GROUND WATER FAVORABILITY MAP OF THE WHITE RIVER BASIN, VERMONT,
W69-06466 02F

GEOLOGY AND HYDROLOGY OF CLAY COUNTY SOUTH DAKOTA-PART 1, GEOLOGY, AND PART 2, WATER RESOURCES,
W69-06486 02F

PRINCIPLES OF CHOOSING EXPERIMENTAL PLOTS FOR WATER BALANCE STUDIES IN IRRIGATION REGIONS OF THE ARID ZONE,
W69-06523 02G

ALLOCATION AND REALLOCATION OF WATER RESOURCES,
W69-06691 06B

THE STABLE ISOTOPE COMPOSITION OF MINERAL WATERS IN THE JORDON RIFT VALLEY, ISRAEL,
W69-06750 02F

ROLE OF GROUND WATER CONTAMINATION IN WATER MANAGMENT,
W69-06762 05G

A COMPUTER-ORIENTED GROUND-WATER INFORMATION STORAGE AND RETRIEVAL SYSTEM,
W69-06764 07C

THE GROUNDWATER PROVINCES OF IRAN,
W69-06772 04B

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF PIKE COUNTY, ALABAMA,
W69-06815 02F

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF HENRY COUNTY, ALABAMA,
W69-06816 02F

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF CRENSHAW COUNTY, ALABAMA,
W69-06817 02F

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF DALE COUNTY, ALABAMA,
W69-06818 02F

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF COVINGTON COUNTY, ALABAMA,
W69-06819 02F

GROUNDWATER IN FRACTURED VOLCANIC ROCKS IN SOUTHERN ARIZONA,
W69-06831 02F

GROUNDWATER BARRIERS
KANSAS CITY LIFE INS CO V UNITED STATES (IMPAIRMENT OF LAND VALUE DUE TO DAM CONSTRUCTION).
W69-06623 06E

GROUNDWATER BASINS
GEOLOGY, DESIGN, AND CONSTRUCTION OF DEEP WELLS IN SEDIMENTARY FOUNDATIONS,
W69-06759 02F

GROUNDWATER CONTAMINATION
MICROBIAL PROBLEMS IN GROUNDWATER,
W69-06426 05C

GROUNDWATER MANAGEMENT
SIGNIFICANCE OF GROUNDWATER MANAGEMENT STRATEGY-A SYSTEMS APPROACH,
W69-06424 06A

GROUNDWATER MINING
ANALOG OF GROUND WATER IN EAST-CENTRAL NEW MEXICO,
W69-06509 02F

GROUNDWATER MOVEMENT
SOME DETAILS ON THE CIRCULATION OF GROUNDWATER IN NON-KARSTIFIED FISSURED FORMATIONS IN CZECHOSLOVAKIA (FRENCH),
W69-06485 02F

TRACER METHOD FOR DETERMINING THE VELOCITY OF FLOW IN A CONFINED KARSTIC AQUIFER,
W69-06774 07B

GROUNDWATER RECHARGE
A CONTRIBUTION TO THE STUDY OF GROUNDWATER INTAKE RECHARGE IN KARST,
W69-06484 02F

GROUND-WATER POLLUTION
EFFECTS OF MINE DRAINAGE ON GROUND WATER,
W69-06425 05C

GROUTING
HIGH EARTHFILL DAM FOUNDATION GROUTING DESIGN AND CONSTRUCTION PROCEDURES,
W69-06674 08D

GROWTH RATES
A REVIEW OF THE LIFESPANS AND MORTALITY RATES OF FISH IN NATURE, AND THEIR RELATION TO GROWTH AND OTHER PHYSIOLOGICAL CHARACTERISTICS,
W69-06533 05C

GROWTH STAGES
EFFICIENT WHEAT IRRIGATION WITH LIMITED WATER,
W69-06511 03F

GULF COASTAL PLAIN
FREQUENCY AND AREAL DISTRIBUTIONS OF TROPICAL STORM RAINFALL, U.S. COASTAL REGION, GULF OF MEXICO,
W69-06797 02B

GYROSCOPIC EFFECTS
THEORETICAL AND EXPERIMENTAL INVESTIGATIONS OF THE VIBRATIONS OF THE ROTOR OF A FULL-SCALE-MODEL HYDROELECTRIC INSTALLATION,
W69-06698 08C

HARBORS
XIDIS V CITY OF GULFPORT (USE OF SUBMERGED LANDS FOR PUBLIC PURPOSE).
W69-06621 06E

HARMONICS
THEORETICAL AND EXPERIMENTAL INVESTIGATIONS OF THE VIBRATIONS OF THE ROTOR OF A FULL-SCALE-MODEL HYDROELECTRIC INSTALLATION,
W69-06698 08C

HEAT BUDGET
RELATIONS BETWEEN GLACIER RUNOFF AND METEOROLOGICAL FACTORS OBSERVED ON AND OUTSIDE THE GLACIER,
W69-06481 02C

HEAT TRANSFER
THE ANNUAL HEAT ENERGY TRANSFER ABOVE AND INSIDE ANTARCTICA BLUE ICE,
W69-06480 02C

HERBICIDES
ARSENIC ACCUMULATION BY FISH IN LAKES TREATED WITH SODIUM ARSENITE,
W69-06541 05B

HIGH VOLTAGE
SOME ASPECTS OF INSULATION CO-ORDINATION IN HVDC SYSTEMS,
W69-06707 08C

HIGHWAY EFFECTS
GIBSON V STATE (CONSTRUCTION AND MAINTENANCE OF SEWERS).
W69-06607 06E

HISTORY
A CENTURY OF DESIGN AND CONSTRUCTION OF IRRIGATION WORKS IN INDIA,
W69-06461 04A

HORIZONTAL MOVEMENT
HORIZONTAL MOVEMENTS RELATED TO SUBSIDENCE,
W69-06692 08D

HOUSEHOLD PRODUCTION
HOUSEHOLD PRODUCTION AND CONSUMER DEMAND FUNCTIONS,
W69-06566 06D

HOUTHAKKER'S CAPACITY METHOD
A PARAMETRIC SIMPLICAL FORMULATION OF HOUTHAKKER'S CAPACITY METHOD,
W69-06568 06A

HUNGARY
TRACER METHOD FOR DETERMINING THE VELOCITY OF FLOW IN A CONFINED KARSTIC AQUIFER,
W69-06774 07B

HYDRAULIC CONDUCTIVITY
A COMPARATIVE STUDY OF HYDRAULIC CONDUCTIVITY IN THE ALLUVIAL SOILS OF EGYPT,
W69-06517 02F

HYDRAULIC TRANSIENTS
PRESSURE TRANSIENTS IN HYDRAULIC PIPELINES,
W69-06700 08A

HYDRAULIC TURBINES
THEORETICAL AND EXPERIMENTAL INVESTIGATIONS OF THE VIBRATIONS OF THE ROTOR OF A FULL-SCALE-MODEL HYDROELECTRIC INSTALLATION,
W69-06698 08C

HYDRODAT SYSTEM
A COMPUTER-ORIENTED GROUND-WATER INFORMATION STORAGE AND RETRIEVAL SYSTEM,
W69-06764 07C

HYDROELECTRIC PLANTS
ELECTRICAL FEATURES OF THE GRAND COULEE THIRD POWER PLANT,
W69-06684 08C

HYDROGEOLOGY
GROUND WATER, GRAVITY AND RIFT VALLEYS IN MALAWI,
W69-06431 02F

PRINCIPLES OF CHOOSING EXPERIMENTAL PLOTS FOR WATER BALANCE STUDIES IN IRRIGATION REGIONS OF THE ARID ZONE,
W69-06523 02G

GEOCHEMICAL TRACING OF MINERAL WATER SOURCES IN THE SOUTH WESTERN DEAD SEA BASIN, ISRAEL,
W69-06747 02F

THE HYDROLOGIC AND GEOLOGIC ASPECTS OF A PERCHING LAYER - SAN JOAQUIN VALLEY, WESTERN FRESNO COUNTY, CALIFORNIA,
W69-06758 02F

THE GROUNDWATER PROVINCES OF IRAN,
W69-06772 04B

HYDROLOGIC BUDGET
RELATIONS BETWEEN GLACIER RUNOFF AND METEOROLOGICAL FACTORS OBSERVED ON AND OUTSIDE THE GLACIER,
W69-06481 02C

HYDROLOGIC CYCLE
HYDROLOGIC CYCLE AS A CLOSED SYSTEM,
W69-06442 02A

HYDROLOGIC DATA
PRINCIPLES OF CHOOSING EXPERIMENTAL PLOTS FOR WATER BALANCE STUDIES IN IRRIGATION REGIONS OF THE ARID ZONE,
W69-06523 02G

A COMPUTER-ORIENTED GROUND-WATER INFORMATION STORAGE AND RETRIEVAL SYSTEM,
W69-06764 07C

REGIONAL HYDROLOGIC AREA STUDY AS AN ANALYSIS TOOL IN WEATHER MODIFICATION,
W69-06805 02A

HYDROLOGIC PROPERTIES
A CONTRIBUTION TO THE STUDY OF GROUNDWATER INTAKE RECHARGE IN KARST,
W69-06484 02F

ARTIFICIAL RECHARGE OF A FISSURED SANDSTONE AQUIFER, TANGIERS, MOROCCO (FRENCH),
W69-06487 04B

HYDROLOGICAL TIME SERIES
EFFECTS OF TRUNCATION ON DEPENDENCE IN HYDROLOGICAL TIME SERIES,
W69-06789 02A

HYDROSTATIC PRESSURE
DEFORMATION OF POLYCRYSTALLINE ICE UNDER COMBINED UNIAXIAL AND HYDROSTATIC PRESSURE,
W69-06475 02C

HYGROMETRY
TENSION OF THE SOIL WATER WHEN PERMANENT WILTING OCCURS, AS MEASURED BY THE GRAY HYDROCAL HYGROMETER METHOD,
W69-06516 02G

ICE DEALERS
ICE DEALERS BATHING WATER SUPPLY FOR RURAL FIRE PROTECTION.
W69-06631 06E

IDAHO
INFLOW TO SNAKE RIVER BETWEEN MILNER AND KING HILL, IDAHO,
W69-06427 02E

FLOOD PLAIN INFORMATION, BOISE RIVER AND NORTHSIDE TRIBUTARIES, BOISE, IDAHO AND VICINITY.
W69-06823 04A

IGNEOUS ROCKS
GROUNDWATER IN FRACTURED VOLCANIC ROCKS IN SOUTHERN ARIZONA,
W69-06831 02F

ILLINOIS
SAVOIE V TOWN OF BOURBONNAIS (PRESCRIPTIVE RIGHTS).
W69-06655 06E

ILLITE
POTASSIUM, ILLITE AND THE OCEAN,
W69-06506 02K

IMPACT(RAINFALL)
PREDICTION OF RAINSPLASH EROSION IN THE SEASONALLY WET TROPICS,
W69-06768 02J

IMPERFECT COMPETITION
OPTIMALITY OF IMPERFECTLY COMPETITIVE RESOURCE ALLOCATION,
W69-06722 06C

IMPERVIOUS SOILS
THE HYDROLOGIC AND GEOLOGIC ASPECTS OF A PERCHING LAYER - SAN JOAQUIN VALLEY, WESTERN FRESNO COUNTY, CALIFORNIA,
W69-06758 02F

IMPOUNDED WATERS
IOWA-WISCONSIN BRIDGE CO V UNITED STATES (LIABILITY FOR RESERVOIR OPERATION).
W69-06604 06E

INDIA
CONSTRUCTION AND MANAGEMENT OF RIVER VALLEY PROJECTS IN INDIA,
W69-06457 04A

A CENTURY OF DESIGN AND CONSTRUCTION OF IRRIGATION WORKS IN INDIA,
W69-06461 04A

SOME CHARACTERISTICS AND FREQUENCIES OF OCCURRENCE OF DROUGHTS IN THE DRY CLIMATIC ZONES OF INDIA,
W69-06524 02G

INDIANA
PRODERMAN V DIETZ (PRIVATE DAMS FOR FLOOD CONTROL).
W69-06617 06E

STATE V KIVETT (SUIT TO ENJOIN PRIVATE MINING OF STATE-OWNED RIVER BEDS).
W69-06629 06E

INDUSTRIAL CHEMICAL SPILLS
OIL AND HAZARDOUS MATERIALS-EMERGENCY PROCEDURES IN THE WATER ENVIRONMENT.
W69-06791 05G

INDUSTRIAL PRODUCTION
WATER TRANSPORTATION-IMPACT ON ECONOMIC DEVELOPMENT,
W69-06730 06B

WATER POLLUTION CONTROL,
W69-06731 05G

INDUSTRIAL WASTE CONFERENCE
22 ND INDUSTRIAL WASTE CONFERENCE, 1967, PART ONE,
W69-06821 05D

INDUSTRIAL WASTES
22 ND INDUSTRIAL WASTE CONFERENCE, 1967, PART ONE,
W69-06821 05D

INFERENCE
FIRST ORDER AUTO REGRESSION INFERENCE, ESTIMATION, AND PREDICTION,
W69-06550 06A

INFILTRATION
A CONTRIBUTION TO THE STUDY OF GROUNDWATER INTAKE RECHARGE IN KARST,
W69-06484 02F

THE ORIGIN OF THE TIBERIAS-NOIT MINERAL WATER ASSOCIATION IN THE TIBERIAS-DEAD SEA RIFT VALLEY, ISRAEL,
W69-06749 02F

CONSERVATION OF SOIL WATER BY GRAVEL MULCHES,
W69-06796 03F

INFILTRATON RATE
EXTENDED TECHNIQUES OF CALCULATION OF SOIL-WATER MOVEMENT, WITH SOME PHYSICAL CONSEQUENCES,
W69-06714 02G

INFLOW
INFLOW TO SNAKE RIVER BETWEEN MILNER AND KING HILL, IDAHO,
W69-06427 02E

INFORMATION RETRIEVAL
A COMPUTER-ORIENTED GROUND-WATER INFORMATION STORAGE AND RETRIEVAL SYSTEM,
W69-06764 07C

INFORMATION THEORY
SPECIES DIVERSITY AND COMMUNITY STRUCTURE IN LACUSTRINE PHYTOPLANKTON,
W69-06542 02H

INFRARED RADIATION
PRELIMINARY REMOTE SENSING OF THE DELAWARE ESTUARY,
W69-06793 02L

INJUNCTIONS(MANDATORY)
COLEMAN V SCHAEFFER (OBSTRUCTION TO NAVIGABLE STREAM).
W69-06584 06E

CLEMENTS V TOWN OF CARROLLTON (DAM ACROSS DRAINAGE DITCH).
W69-06627 06E

INPUT-OUTPUT ANALYSIS
INTERREGIONAL PRODUCTION AND WATER RESOURCE DEPENDENCIES AMONG THE WESTERN STATES,
W69-06721 06B

INSTITUTIONS

SOME POSSIBLE ROLES FOR INSTITUTIONS AND ECONOMICS IN WATER RESOURCE MANAGEMENT,
W69-06725 06B

INSTRUMENTATION
A METHOD OF DETERMINING THE WATER POTENTIAL OF INTACT PLANTS,
W69-06527 02I

MEASUREMENT OF ROTATING MACHINERY VIBRATION AND FACTORS AFFECTING INSTRUMENT ACCURACY,
W69-06702 07B

A SYSTEM FOR MAKING REMOTE AND UNDISTURBED MEASUREMENTS OF SNOW SETTLEMENT AND TEMPERATURES,
W69-06803 02C

INTACT PLANTS
A METHOD OF DETERMINING THE WATER POTENTIAL OF INTACT PLANTS,
W69-06527 02I

INTERCONNECTED SYSTEMS
A SWING RELAY FOR THE EAST-WEST INTERTIE,
W69-06687 08C

INTERMOLECULAR POTENTIALS
INTERMOLECULAR FORCES AND THE LIQUID STATE,
W69-06838 01A

INTERNATIONAL ATOMIC ENERGY AGENCY
THE ROLE OF THE INTERNATIONAL ATOMIC ENERGY AGENCY IN THE DEVELOPMENT, USE AND CONTROL OF WATER RESOURCES.
W69-06456 03A

INTERNATIONAL COMMISSIONS
GREAT LAKES COMPACT (AGREEMENT FOR EFFICIENT MANAGEMENT OF THE GREAT LAKES BASIN).
W69-06616 06E

INTERNATIONAL LAW
BENEFICIAL USES OF WATERS OF INTERNATIONAL RIVERS INTERNATIONAL LAW AND PRACTICE,
W69-06458 06E

INTERNATIONAL RIVERS
BENEFICIAL USES OF WATERS OF INTERNATIONAL RIVERS INTERNATIONAL LAW AND PRACTICE,
W69-06458 06E

INTERREGIONAL PRODUCTION
INTERREGIONAL PRODUCTION AND WATER RESOURCE DEPENDENCIES AMONG THE WESTERN STATES,
W69-06721 06B

INTERRUPTER SWITCHES
SHUNT CAPACITOR ENERGIZATION WITH VACUUM INTERRUPTERS--A POSSIBLE SOURCE OF OVERVOLTAGE,
W69-06689 08C

INTERRUPTERS
SHUNT CAPACITOR ENERGIZATION WITH VACUUM INTERRUPTERS--A POSSIBLE SOURCE OF OVERVOLTAGE,
W69-06689 08C

INTERSTATE COMPACTS
GREAT LAKES COMPACT (AGREEMENT FOR EFFICIENT MANAGEMENT OF THE GREAT LAKES BASIN).
W69-06616 06E

INTERTIES
A SWING RELAY FOR THE EAST-WEST INTERTIE,
W69-06687 08C

INTER-INDUSTRY SECTORS
SOME POSSIBLE ROLES FOR INSTITUTIONS AND ECONOMICS IN WATER RESOURCE MANAGEMENT,
W69-06725 06B

INVESTMENT
ALLOCATION AND REALLOCATION OF WATER RESOURCES,
W69-06691 06B

ION EXCHANGE
SUL-BISUL(T) ION EXCHANGE PROCESS FIELD EVALUATION ON BRACKISH WATERS,
W69-06836 03A

IOWA
FLOOD PLAIN INFORMATION, CEDAR RIVER, LINN COUNTY, IOWA.
W69-06472 04A

IRAN
THE POSSIBILITY OF USING A MOVABLE DAM THE 'FABRIDAM' AND ITS APPLICATION IN ARID REGIONS,
W69-06455 04A

THE GROUNDWATER PROVINCES OF IRAN,
W69-06772 04B

IRRIGATED LAND
SALT BALANCE AND SALT TRANSPORT PROCESSES IN IRRIGATED SOILS,
W69-06717 03F

IRRIGATION
AGRICULTURE USE OF WATER IN TAIWAN, REPUBLIC OF CHINA,
W69-06460 03F

A CENTURY OF DESIGN AND CONSTRUCTION OF IRRIGATION WORKS IN INDIA,
W69-06461 04A

IRRIGATION EFFECTS
WATER QUALITY MANAGEMENT IN IRRIGATION SYSTEMS,
W69-06499 05G

THE EFFECT OF CROP AND CLIMATIC FACTORS ON THE RADIATION BALANCE OF AN IRRIGATED MAIZE CROP,
W69-06757 03F

IRRIGATION EFFICIENCY
MODERN IRRIGATION FOR INCREASED AGRICULTURAL PRODUCTION,
W69-06454 03F

EFFICIENT WHEAT IRRIGATION WITH LIMITED WATER,
W69-06511 03F

IRRIGATION OPERATION AND MAINTENANCE
IRRIGATION WATER SYSTEM--ISRAEL'S NATIONAL WATER GRID,
W69-06459 03F

IRRIGATION PRACTICES
MODERN IRRIGATION FOR INCREASED AGRICULTURAL PRODUCTION,
W69-06454 03F

IRRIGATION PROGRAMS
CONSTRUCTION AND MANAGEMENT OF RIVER VALLEY PROJECTS IN INDIA,
W69-06457 04A

IRRIGATION WELLS
THE HYDROLOGIC AND GEOLOGIC ASPECTS OF A PERCHING LAYER - SAN JOAQUIN VALLEY, WESTERN FRESNO COUNTY, CALIFORNIA,
W69-06758 02F

ISRAEL
MODERN IRRIGATION FOR INCREASED AGRICULTURAL PRODUCTION,
W69-06454 03F

IRRIGATION WATER SYSTEM--ISRAEL'S NATIONAL WATER GRID,
W69-06459 03F

GEOCHEMICAL TRACING OF MINERAL WATER SOURCES IN THE SOUTH WESTERN DEAD SEA BASIN, ISRAEL,
W69-06747 02F

GEOCHEMICAL TRACING OF MINERAL AND FRESH WATER SOURCES IN THE LAKE TIBERIAS BASIN, ISRAEL,
W69-06748 02F

THE ORIGIN OF THE TIBERIAS-NOIT MINERAL WATER ASSOCIATION IN THE TIBERIAS-DEAD SEA RIFT VALLEY, ISRAEL,
W69-06749 02F

THE EFFECT OF CROP AND CLIMATIC FACTORS ON THE RADIATION BALANCE OF AN IRRIGATED MAIZE CROP,
W69-06757 03F

ITERATIVE ANALYSIS
ITERATIVE ANALYSIS BOUNDED LEAKY ARTESIAN AQUIFER,
W69-06508 02F

JORDON RIFT VALLEY
THE STABLE ISOTOPE COMPOSITION OF MINERAL WATERS IN THE JORDON RIFT VALLEY, ISRAEL,
W69-06750 02F

JURISDICTION
WHITE OAK BOROUGH AUTH V PENN PUB U COMM'N (AQUISITION OF PUBLIC WATER FACILITIES).
W69-06601 06E

JURISDICTION OVER WATERS.
W69-06634 06E

KANSAS RIVER BASIN
KANSAS RIVER BASIN FLOOD CONTROL,
W69-06729 06B

KARST
CONCEPTUAL MODELS FOR CARBONATE AQUIFERS,
W69-06423 02F

A CONTRIBUTION TO THE STUDY OF GROUNDWATER INTAKE RECHARGE IN KARST,
W69-06484 02F

TRACER METHOD FOR DETERMINING THE VELOCITY OF FLOW IN A CONFINED KARSTIC AQUIFER,
W69-06774 07B

KENTUCKY
BALL CREEK COAL CO V NAPIER (MEANDERS AS A BOUNDARY).
W69-06614 06E

ADKINS V HUGHES (BOUNDARY DISPUTE DUE TO AVULSION).
W69-06658 06E

LAKE BASINS
GEOCHEMICAL TRACING OF MINERAL AND FRESH WATER SOURCES IN THE LAKE TIBERIAS BASIN, ISRAEL,
W69-06748 02F

LAKE ERIE
COLEMAN V SCHAEFFER (OBSTRUCTION TO NAVIGABLE STREAM).
W69-06584 06E

LAKE TIBERIAS BASIN
GEOCHEMICAL TRACING OF MINERAL AND FRESH WATER SOURCES IN THE LAKE TIBERIAS BASIN, ISRAEL,
W69-06748 02F

THE ORIGIN OF THE TIBERIAS-NOIT MINERAL WATER ASSOCIATION IN THE TIBERIAS-DEAD SEA RIFT VALLEY, ISRAEL,
W69-06749 02F

LAKES
THE AGING OF LAKES,
W69-06535 02H

ARSENIC ACCUMULATION BY FISH IN LAKES TREATED WITH SODIUM ARSENITE,
W69-06541 05B

SPECIES DIVERSITY AND COMMUNITY STRUCTURE IN LACUSTRINE PHYTOPLANKTON,
W69-06542 02H

LAND FORMING
A GEOMORPHIC APPROACH TO EROSION CONTROL IN SEMIARID REGIONS,
W69-06513 02J

LAND MANAGEMENT
CERTAIN GAME PRESERVES, AREAS, PROJECTS CONTROL.
W69-06635 06E

LAND RECLAMATION
EXPERIENCE IN ACCELERATED IRREVERSIBLE DESALINIZATION OF SOILS IN GOLODNAYA STEPPE,
W69-06716 03F

LAND TENURE
BINGENHEIMER V DIAMOND IRON MINING CO (DEFINITION OF NAVIGABLE WATER TO DETERMINE OWNERSHIP OF BEDS).
W69-06609 06E

EARLE V MCCARTY (TITLE TO LAND BETWEEN SOUND AND DEDICATED ROAD).
W69-06646 06E

HAMMEL V CAMP RANGER, INC (PRESUMPTIONS REGARDING CONVEYANCE OF INLAND, NON-NAVIGABLE POND).
W69-06648 06E

LANDFILLS
STATE V CITY OF CLEVELAND (RIGHT OF ACCESS TO NAVIGABLE WATERS).
W69-06619 06E

UNITED STATES V TURNER (OWNERSHIP OF BEDS UNDER SHALLOW WATERS).
W69-06628 06E

SKALITSKY V CONSOL BADGER CO-OPERATIVE (OWNERSHIP OF FILLED POND BED).
W69-06650 06E

LAS VEGAS VALLEY(NEV)
RECLAIMED WASTE WATER IN LAS VEGAS VALLEY,
W69-06832 05D

LATITUDINAL STUDIES
EVALUATION OF SOME PRACTICAL METHODS OF ESTIMATING EVAPOTRANSPIRATION IN ARID CLIMATES AT LOW LATITUDES,
W69-06530 02D

LEACHING
DISPLACEMENT FRONT UNDER PONDED LEACHING,
W69-06510 02G

EXPERIENCE IN ACCELERATED IRREVERSIBLE DESALINIZATION OF SOILS IN GOLODNAYA STEPPE,
W69-06716 03F

SALT BALANCE AND SALT TRANSPORT PROCESSES IN IRRIGATED SOILS,
W69-06717 03F

LEAKAGE
ITERATIVE ANALYSIS BOUNDED LEAKY ARTESIAN AQUIFER,
W69-06508 02F

LEAST SQUARES METHOD
LEAST SQUARES, CONDITIONAL PREDICTIONS, AND ESTIMATOR PROPERTIES,
W69-06551 06A

LEAVES
THE HYDROLOGIC IMPORTANCE OF TRANSPIRATION CONTROL BY STOMATA,
W69-06520 02D

A METHOD OF DETERMINING THE WATER POTENTIAL OF INTACT PLANTS,
W69-06527 02I

LECTURE
HYDROLOGIC CYCLE AS A CLOSED SYSTEM,
W69-06442 02A

LEGAL ASPECTS
LEGAL ALTERNATIVES,
W69-06579 06E

LEGISLATION
THE LEGISLATIVE POINT OF VIEW,
W69-06580 06E

STATE V TAYLOR (FISH DYNAMITED IN PRIVATE POND).
W69-06605 06E

WATERS AND WATER SUPPLY.
W69-06612 06E

EMINENT DOMAIN.
W69-06642 06E

SEWERS AND DRAINS PRIVATE DRAINS.
W69-06661 06E

GENERAL PROVISIONS RELATING TO RIVERS AND STREAMS.
W69-06662 06E

W69-06663 06E

GENERAL PROVISIONS, REGULATING TO RIVERS AND STREAMS.
W69-06664 06E

GENERAL PROVISIONS RELATING TO RIVERS AND STREAMS.
W69-06665 06E

W69-06666 06E

W69-06667 06E

W69-06668 06E

W69-06669 06E

W69-06670 06E

W69-06671 06E

LEVEES
DAVIS V CITY OF ALEXANDRIA (PUBLIC USE OF LEVEE BANK AS ROADWAY).
W69-06645 06E

USE OF ASPHALTIC CONCRETE IN COASTAL AND CANAL CONSTRUCTION,
W69-06682 08F

LIFESPANS
A REVIEW OF THE LIFESPANS AND MORTALITY RATES OF FISH IN NATURE, AND THEIR RELATION TO GROWTH AND OTHER PHYSIOLOGICAL CHARACTERISTICS,
W69-06533 05C

LIGHTNING ARRESTERS
SOME ASPECTS OF INSULATION CO-ORDINATION IN HVDC SYSTEMS,
W69-06707 08C

LIGHTNING PROTECTION
OPEN BREAKER PROTECTION OF EHV SYSTEMS,
W69-06688 08C

LIMESTONES
ARTIFICIAL RECHARGE TO THE EDWARDS LIMESTONE AQUIFER IN SOUTH TEXAS,
W69-06483 04B

LINEAR PROBABILITY FUNCTION
LINEAR PROBABILITY FUNCTIONS AND DISCRIMINANT FUNCTIONS,
W69-06563 06A

LINEAR PROGRAMMING
RESERVOIR MANAGEMENT THE TRADEOFF BETWEEN LOW-FLOW REGULATION AND FLOOD CONTROL,
W69-06496 04A

THE IMPROVEMENT OF WATER QUALITY UNDER A FINANCIAL CONSTRAINT A COMMENTARY ON 'LINEAR PROGRAMMING APPLIED TO WATER QUALITY MANAGEMENT',
W69-06547 05F

LIQUID STATE
INTERMOLECULAR FORCES AND THE LIQUID STATE,
W69-06838 01A

LIQUIDS
INTERMOLECULAR FORCES AND THE LIQUID STATE,
W69-06838 01A

BEHAVIOR OF LIQUID SURFACES DURING EVAPORATION AND CONDENSATION,
W69-06840 03A

LOCAL GOVERNMENTS
POTEETE V CITY OF WATER VALLEY (ARTIFICIAL CONTROL OF SUBSURFACE DRAINAGE).
W69-06626 06E

LONG-RUN COEFFICIENTS
LONG-RUN COEFFICIENTS AND DISTRIBUTED LAG ANALYSIS A REFORMULATION,
W69-06557 06A

LONG-TERM PLANNING
SIGNIFICANCE OF GROUNDWATER MANAGEMENT STRATEGY-A SYSTEMS APPROACH,
W69-06424 06A

REGIONAL PLANNING FOR WATER DEVELOPMENT IN THE WESTERN UNITED STATES - THE RELEVANCE OF AMERICAN EXPERIENCE FOR OTHER NATIONS,
W69-06726 06B

LONG-WAVE RADIATION
THE EFFECT OF CROP AND CLIMATIC FACTORS ON THE RADIATION BALANCE OF AN IRRIGATED MAIZE CROP,
W69-06757 03F

LOUISIANA

TENNESSEE GAS TRANSMISSION CO V GREATER LAFOURCHE PORT COMM'N (PIPELINES ACROSS NAVIGABLE CHANNELS).
W69-06587 06E

OHIO OIL CO V FERGUSON (MINERAL RIGHTS AND ROYALTIES).
W69-06594 06E

CALIFORNIA CO V PRICE (OWNERSHIP OF NAVIGABLE WATER BED).
W69-06613 06E

HAYNES V SMITH (PRIVATE COMMERCIAL VENTURES ON PUBLIC WATERS).
W69-06643 06E

DAVIS V CITY OF ALEXANDRIA (PUBLIC USE OF LEVEE BANK AS ROADWAY).
W69-06645 06E

RAINFALL-RUNOFF RELATIONS FOR SOUTHEASTERN LOUISIANA AND SOUTHWESTERN MISSISSIPPI,
W69-06829 02A

LOW-FLOW AUGMENTATION
RESERVOIR MANAGEMENT THE TRADEOFF BETWEEN LOW-FLOW REGULATION AND FLOOD CONTROL,
W69-06496 04A

MAGNESIUM COMPOUNDS
RECOVERY OF SALTS FROM SALINE WATER VIA SOLVENT EXTRACTION (FINAL REPORT),
W69-06839 03A

MAINE
SEWERS AND DRAINS PRIVATE DRAINS.
W69-06661 06E

GENERAL PROVISIONS RELATING TO RIVERS AND STREAMS.
W69-06662 06E

W69-06663 06E

GENERAL PROVISIONS, REGULATING TO RIVERS AND STREAMS.
W69-06664 06E

GENERAL PROVISIONS RELATING TO RIVERS AND STREAMS.
W69-06665 06E

W69-06666 06E

W69-06667 06E

W69-06668 06E

W69-06669 06E

W69-06670 06E

W69-06671 06E

MANPOWER
MANPOWER REQUIREMENTS FOR POLLUTION CONTROL AND WATER RESOURCES IN INDIANA AND A RELATED POLLUTION CONTROL TECHNOLOGY CURRICULUM,
W69-06507 05G

MAPPING
GRAPHIC DETERMINATION OF SLOPE AND OF DIP AND STRIKE,
W69-06681 07B

POTENTIAL OF RADAR REMOTE SENSORS AS TOOLS IN RECONNAISSANCE GEOMORPHIC, VEGETATION AND SOIL MAPPING,
W69-06718 07B

MARBURG LECTURE
SOIL AS AN ENGINEERING MATERIAL,
W69-06699 08D

MARINAS
HAYNES V SMITH (PRIVATE COMMERCIAL VENTURES ON PUBLIC WATERS).
W69-06643 06E

MARKOV PROCESSES
SIMULTANEOUS TESTS FOR TREND AND SERIAL CORRELATIONS FOR GAUSSIAN MARKOV RESIDUALS,
W69-06569 06A

EFFECTS OF TRUNCATION ON DEPENDENCE IN HYDROLOGICAL TIME SERIES,
W69-06789 02A

RANDOM PROCESSES AND LITHOLOGIC TRANSITIONS,
W69-06807 02J

MARYLAND
HANCOCK V STULL (INTERFERENCE WITH NATURAL DRAINAGE OF SURFACE WATER).
W69-06652 06E

CHESAPEAKE BAY CASE STUDY.
W69-06794 06B

MASS CONCRETE
THERMAL STRESS CONDITION OF EXPERIMENTAL LONG BLOCKS DURING CONSTRUCTION PERIOD OF THE BRATSK HYDROELECTRIC STATION DAM,
W69-06711 08F

MASSACHUSETTS
POLLUTION OF THE INTERSTATE WATERS OF THE BLACKSTONE AND TEN MILE RIVERS AND THEIR TRIBUTARIES,
W69-06802 05B

MATHEMATICAL MODELS
STOCHASTIC MODEL FOR BOD AND DO IN STREAMS,
W69-06500 05B

COST, PRECISION, AND VALUE RELATIONSHIPS OF DATA COLLECTION AND DESIGN ACTIVITIES IN WATER DEVELOPMENT PLANNING,
W69-06733 06B

STREAMFLOW RECORD LENGTH FOR MODELLING CATCHMENT DYNAMICS,
W69-06781 02E

HEC-2, WATER SURFACE PROFILES.
W69-06787 04A

HEC-3, RESERVIOR SYSTEM ANALYSIS.
W69-06788 04A

ON MULTILEVEL OPTIMIZATION IN GROUND WATER SYSTEMS,
W69-06813 02F

QUASILINEARIZATION APPROACH TO THE IDENTIFICATION OF HYDROLOGIC SYSTEMS,
W69-06822 02A

IMPROVED TECHNIQUES FOR ESTIMATING RUNOFF WITH BRIEF RECORDS,
W69-06830 02E

MATHEMATICAL STUDIES
HYDROLOGIC CYCLE AS A CLOSED SYSTEM,
W69-06442 02A

MAXIMIZATION
MAXIMIZATION BY QUADRATIC HILL-CLIMBING,
W69-06564 06A

MEASUREMENT
EVALUATION OF THE GAMMA TRANSMISSION METHOD FOR DETERMINING SOIL WATER BALANCE AND EVAPOTRANSPIRATION,
W69-06514 02G

A COMPARATIVE STUDY OF HYDRAULIC CONDUCTIVITY IN THE ALLUVIAL SOILS OF EGYPT,
W69-06517 02F

A METHOD OF DETERMINING THE WATER POTENTIAL OF INTACT PLANTS,
W69-06527 02I

A UNIVERSAL SURFACE PRECIPITATION GAGE,
W69-06804 02B

RADAR MEASUREMENT OF PRECIPITATION FOR HYDROLOGICAL PURPOSES,
W69-06812 02B

MEIGHEN ICE CAP(CANADA)
A TEMPERATURE PROFILE THROUGH THE MEIGHEN ICE CAP, ARCTIC CANADA,
W69-06482 02C

MEL · WATER
A UNIVERSAL SURFACE PRECIPITATION GAGE,
W69-06804 02B

MELTING
THE METAMORPHISM OF WET SNOW,
W69-06477 02C

METEOROLOGY
RELATIONS BETWEEN GLACIER RUNOFF AND METEOROLOGICAL FACTORS OBSERVED ON AND OUTSIDE THE GLACIER,
W69-06481 02C

MICHIGAN
SAMYN V TACEY (ARTIFICIAL DRAINAGE OF SURFACE WATERS).
W69-06593 06E

FIRES.
W69-06598 06E

GREAT LAKES COMPACT (AGREEMENT FOR EFFICIENT MANAGEMENT OF THE GREAT LAKES BASIN).
W69-06616 06E

MICROENVIRONMENT
TRANSPIRATION OF DESERT PLANTS UNDER DIFFERENT ENVIRONMENTAL CONDITIONS,
W69-06526 02D

MICROLAMINATION
FIELD OBSERVATIONS OF SOME PHYSICAL PROPERTIES IN ALLUVIAL SOILS OF ARID AND SEMI-ARID REGIONS,
W69-06515 02G

MILL DAMS
GENERAL PROVISIONS RELATING TO RIVERS AND STREAMS.
W69-06662 06E

W69-06663 06E

GENERAL PROVISIONS, REGULATING TO RIVERS AND STREAMS.
W69-06664 06E

GENERAL PROVISIONS RELATING TO RIVERS AND STREAMS.
W69-06665 06E

W69-06666 06E

W69-06667 06E

W69-06668 06E

W69-06669 06E

W69-06670 06E

W69-06671 06E

MINERAL RECOVERY
A FEASIBILITY STUDY ON THE UTILIZATION OF WASTE BRINE FROM SALINATION PLANTS PART 1,
W69-06556 03C

MINERAL SERVITUDE
OHIO OIL CO V FERGUSON (MINERAL RIGHTS AND ROYALTIES).
W69-06594 06E

MINERAL WATER
GEOCHEMICAL TRACING OF MINERAL WATER SOURCES IN THE SOUTH WESTERN DEAD SEA BASIN, ISRAEL,
W69-06747 02F

GEOCHEMICAL TRACING OF MINERAL AND FRESH WATER SOURCES IN THE LAKE TIBERIAS BASIN, ISRAEL,
W69-06748 02F

THE ORIGIN OF THE TIBERIAS-NOIT MINERAL WATER ASSOCIATION IN THE TIBERIAS-DEAD SEA RIFT VALLEY, ISRAEL,
W69-06749 02F

THE STABLE ISOTOPE COMPOSITION OF MINERAL WATERS IN THE JORDON RIFT VALLEY, ISRAEL,
W69-06750 02F

MINNESOTA
BINGENHEIMER V DIAMOND IRON MINING CO (DEFINITION OF NAVIGABLE WATER TO DETERMINE OWNERSHIP OF BEDS).
W69-06609 06E

BURNQUIST V FISCHER (FLOWAGE EASEMENT APPURTENANT TO DAM).
W69-06615 06E

JURISDICTION OVER WATERS.
W69-06634 06E

CERTAIN GAME PRESERVES, AREAS, PROJECTS CONTROL.
W69-06635 06E

EMINENT DOMAIN.
W69-06642 06E

WATER RESOURCES DEVELOPMENT IN MINNESOTA.
W69-06784 09D

MISSISSIPPI
BARBER PURE MILK CO V GOLDIN (SURFACE DRAINAGE).
W69-06588 06E

RUSSELL V STATE (ILLEGAL POSSESSION OF UNDERSIZED FISH).
W69-06589 06E

XIDIS V CITY OF GULFPORT (USE OF SUBMERGED LANDS FOR PUBLIC PURPOSE).
W69-06621 06E

POTEETE V CITY OF WATER VALLEY (ARTIFICIAL CONTROL OF SUBSURFACE DRAINAGE).
W69-06626 06E

CLEMENTS V TOWN OF CARROLLTON (DAM ACROSS DRAINAGE DITCH).
W69-06627 06E

ELDER V DELCOUR (MISSOURI ADHERES TO STRICT TEST OF NAVIGABILITY IN DETERMINING TITLE TO RIVER BED).
W69-06649 06E

RAINFALL-RUNOFF RELATIONS FOR SOUTHEASTERN LOUISIANA AND SOUTHWESTERN MISSISSIPPI,
W69-06829 02A

MISSISSIPPI RIVER
IOWA-WISCONSIN BRIDGE CO V UNITED STATES (LIABILITY FOR RESERVOIR OPERATION).
W69-06604 06E

MISSOURI
FLOOD PLAIN INFORMATION, WILSON CREEK AND TRIBUTARIES, SPRINGFIELD, MISSOURI-PART 1.
W69-06467 04A

STATE V TAYLOR (FISH DYNAMITED IN PRIVATE POND).
W69-06605 06E

HARDY V KANSAS CITY (FLOODING CAUSED BY OBSTRUCTION TO WATER FLOW).
W69-06625 06E

ERICKSON V GREUB (TITLE TO ACCRETION).
W69-06641 06E

MIXING
THE STABLE ISOTOPE COMPOSITION OF MINERAL WATERS IN THE JORDON RIFT VALLEY, ISRAEL,
W69-06750 02F

MODEL STUDIES
THE DESIRABILITY AND APPLICABILITY OF SIMULATING ECOSYSTEMS,
W69-06537 06A

LABORATORY EXPERIMENTS ON THE PRODUCTION OF GRAIN ORIENTATION IN SHEARING SAND,
W69-06799 02J

THE USE OF ELECTRIC ANALOG MODELS IN HYDRODYNAMICAL STUDY OF THE ALSACE AQUIFERS (FRENCH),
W69-06806 02F

MODIFIED TWO-STAGE LEAST SQUARES
SPECIFICATION ANALYSIS IN THE ESTIMATION OF PARAMETERS OF A SIMULTANEOUS EQUATION MODEL WITH AUTOREGRESSIVE RESIDUALS,
W69-06567 06A

MOISTURE AVAILABILITY
DROUGHT AND SOIL MOISTURE,
W69-06529 02G

MOISTURE CONTENT
TENSION OF THE SOIL WATER WHEN PERMANENT WILTING OCCURS, AS MEASURED BY THE GRAY HYDROCAL HYGROMETER METHOD,
W69-06516 02G

A METHOD OF DETERMINING THE WATER POTENTIAL OF INTACT PLANTS,
W69-06527 02I

SOIL-WATER DIFFUSIVITY BY THE ONE-STEP METHOD,
W69-06528 02G

MOISTURE TENSION
TENSION OF THE SOIL WATER WHEN PERMANENT WILTING OCCURS, AS MEASURED BY THE GRAY HYDROCAL HYGROMETER METHOD,
W69-06516 02G

MOLECULAR STRUCTURE
INTERMOLECULAR FORCES AND THE LIQUID STATE,
W69-06838 01A

MONOMOLECULAR FILMS
EVAPORATION REDUCTION ON LARGE RESERVOIRS,
W69-06531 03F

TRANSPIRATION REDUCTION BY SURFACE FILMS,
W69-06532 03F

MONTE CARLO STUDY
FIRST ORDER AUTO REGRESSION INFERENCE, ESTIMATION, AND PREDICTION,
W69-06550 06A

MONTMORILLONITE
POTASSIUM, ILLITE AND THE OCEAN,
W69-06506 02K

MOROCCO
ARTIFICIAL RECHARGE OF A FISSURED SANDSTONE AQUIFER, TANGIERS, MOROCCO (FRENCH),
W69-06487 04B

MORTALITY
A REVIEW OF THE LIFESPANS AND MORTALITY RATES OF FISH IN NATURE, AND THEIR RELATION TO GROWTH AND OTHER PHYSIOLOGICAL CHARACTERISTICS,
W69-06533 05C

MORTALITY RATES
A REVIEW OF THE LIFESPANS AND MORTALITY RATES OF FISH IN NATURE, AND THEIR RELATION TO GROWTH AND OTHER PHYSIOLOGICAL CHARACTERISTICS,
W69-06533 05C

MOVABLE DAMS
THE POSSIBILITY OF USING A MOVABLE DAM THE 'FABRIDAM' AND ITS APPLICATION IN ARID REGIONS,
W69-06455 04A

MULCHING
CONSERVATION OF SOIL WATER BY GRAVEL MULCHES,
W69-06796 03F

MULTILEVEL OPTIMIZATION
ON MULTILEVEL OPTIMIZATION IN GROUND WATER SYSTEMS,
W69-06813 02F

MULTIPLE EQUATION SYSTEMS
CANONICAL CORRELATION AND MULTIPLE EQUATION SYSTEMS IN ECONOMICS,
W69-06735 06B

MULTIPLE PURPOSE PROJECTS
OPERATION OF MULTI-UNIT MULTI-PURPOSE WATER DEVELOPMENT SYSTEMS,
W69-06462 06D

REGIONAL PLANNING FOR WATER DEVELOPMENT IN THE WESTERN UNITED STATES - THE RELEVANCE OF AMERICAN EXPERIENCE FOR OTHER NATIONS,
W69-06726 06B

NATURAL FLOW
SAMYN V TACEY (ARTIFICIAL DRAINAGE OF SURFACE WATERS).
W69-06593 06E

HANCOCK V STULL (INTERFERENCE WITH NATURAL DRAINAGE OF SURFACE WATER).
W69-06652 06E

NATURAL FLOW DOCTRINE
CANNON V CITY OF MACON (NATURAL DRAINAGE FLOW AND THE LOWER LAND PROPRIETOR).
W69-06595 06E

COX V MARTIN (DISCHARGE OF SURFACE WATER THROUGH A DOWNSPOUT).
W69-06596 06E

HARRELL V CITY OF CONWAY (USE OF IMPOUNDED WATER).
W69-06597 06E

RAU V WILDEN ACRES, INC (DIVERSION OF NATURAL FLOW BY ARTIFICIAL CHANNEL).
W69-06656 06E

RINZLER V FOLSOM (ARTIFICIAL INCREASE OF SURFACE RUNOFF).
W69-06657 06E

NATURAL RESOURCES
COMMENTS ON THE COMPETITION FOR WATER QUALITY AGRICULTURE,
W69-06576 06D

NATURAL STREAMS
NASSAU COUNTY V CHERRY VALLEY ESTATES, INC (OBSTRUCTION OF ALLEGED WATER COURSE).
W69-06592 06E

NAVIGABLE WATERS
COLEMAN V SCHAEFFER (OBSTRUCTION TO NAVIGABLE STREAM).
W69-06584 06E

BINGENHEIMER V DIAMOND IRON MINING CO (DEFINITION OF NAVIGABLE WATER TO DETERMINE OWNERSHIP OF BEDS).
W69-06609 06E

STATE V KIVETT (SUIT TO ENJOIN PRIVATE MINING OF STATE-OWNED RIVER BEDS).
W69-06629 06E

PETITION OF MARTIN (OBSTRUCTION TO NAVIGATION).
W69-06636 06E

OWEN V JOHNSON (OWNERSHIP OF THE BED OF A NAVIGABLE STREAM).
W69-06639 06E

CARNASION V PAUL (RIGHT OF A COUNTY TO TAX TIDELAND PROPERTY).
W69-06644 06E

ELDER V DELCOUR (MISSOURI ADHERES TO STRICT TEST OF NAVIGABILITY IN DETERMINING TITLE TO RIVER BED).
W69-06649 06E

NAVIGATION
BELL TEL CO V DRAVO CORP (UNDERWATER OBSTRUCTION TO NAVIGATION).
W69-06610 06E

ICE DEALERS BATHING WATER SUPPLY FOR RURAL FIRE PROTECTION.
W69-06631 06E

PETITION OF MARTIN (OBSTRUCTION TO NAVIGATION).
W69-06636 06E

SOUTHERN TRANSPORTATION CO V CITY OF NEW YORK (NEGLIGENCE OF BRIDGE OPERATOR AND TUG MASTER CAUSING BARGE COLLISION).
W69-06638 06E

NEBRASKA
FLOOD PLAIN INFORMATION, OMAHA METROPOLITAN REGION, NEBRASKA - VOLUME 1.
W69-06471 04A

NEGEV(ISRAEL)
A PRELIMINARY FIELD STUDY OF SURFACE TREATMENTS FOR RUNOFF INDUCEMENT IN THE NEGEV OF ISRAEL,
W69-06715 02A

NEGLIGENT INUNDATION
HARDY V KANSAS CITY (FLOODING CAUSED BY OBSTRUCTION TO WATER FLOW).
W69-06625 06E

NETWORK DESIGN
A HEURISTIC AID FOR THE DESIGN OF SEWER NETWORKS,
W69-06498 05E

NETWORKS
USE OF DIGITAL COMPUTERS IN DISTRIBUTION SYSTEM ANALYSES,
W69-06503 07C

NEVADA
WATER-RESOURCES APPRAISAL OF THE LOWER MOAPA-LAKE MEAD AREA, CLARK COUNTY, NEVADA,
W69-06435 02F

ESTIMATED WATER USE IN NEVADA, 1950-65,
W69-06446 06D

RECORDS OF WELLS AND TEST HOLES IN THE NEVADA TEST SITE AND VICINITY,
W69-06820 02F

RECLAIMED WASTE WATER IN LAS VEGAS VALLEY,
W69-06832 05D

NEW ENGLAND
SAFETY CONTROL OF PRIVATE DAMS,
W69-06433 04A

NEW JERSEY
SUMMARY OF GROUND-WATER RESOURCES OF ATLANTIC COUNTY, NEW JERSEY,
W69-06448 02F

GEOLOGY AND GROUND-WATER RESOURCES OF BURLINGTON COUNTY, NEW JERSEY,
W69-06449 02F

GEOLOGY AND GROUND-WATER RESOURCES OF THE RAHWAY AREA, NEW JERSEY,
W69-06450 02F

LEONARD V STATE HIGHWAY DEPT (ACQUISITION OF TITLE BY STATE THROUGH PERMANENT FLOODING OF LAND).
W69-06611 06E

WATERS AND WATER SUPPLY.
W69-06612 06E

BAILEY V DRISCOLL (IMPLIED LIMITATION ON GRANT OF SUBMERGED LAND).
W69-06618 06E

WATER SUPPLY DISTRICTS.
W69-06630 06E

ICE DEALERS BATHING WATER SUPPLY FOR RURAL FIRE PROTECTION.
W69-06631 06E

SEWERAGE DISTRICTS AND BOARDS.
W69-06632 05G

W69-06633 06E

HUGHES V KNIGHT (RIGHT TO UNOBSTRUCTED DRAINAGE OF SURFACE WATERS).
W69-06660 06E

NEW YORK
GEORGE V STATE (OBSTRUCTION OF SUBSURFACE FLOW).
W69-06590 06E

SBARRA V ERIE RR (DRAINAGE OF SURFACE WATERS AND PRESCRIPTIVE RIGHTS).
W69-06591 06E

NASSAU COUNTY V CHERRY VALLEY ESTATES, INC (OBSTRUCTION OF ALLEGED WATER COURSE).
W69-06592 06E

LAWKINS V CITY OF NEW YORK (EROSION AND ACCRETION OF BOUNDARY SHORE LINE).
W69-06606 06E

GIBSON V STATE (CONSTRUCTION AND MAINTENANCE OF SEWERS).
W69-06607 06E

CHRISTMAN V STATE (NEGLIGENCE IN CULVERT CONSTRUCTION).
W69-06624 06E

SOUTHERN TRANSPORTATION CO V CITY OF NEW YORK (NEGLIGENCE OF BRIDGE OPERATOR AND TUG MASTER CAUSING BARGE COLLISION).
W69-06638 06E

NASSAU COUNTY V CHERRY VALLEY ESTATES (LANDOWNERS RIGHT TO PREVENT FLOW OF SURFACE WATER ONTO HIS PROPERTY).
W69-06653 06E

FLOOD PLAIN INFORMATION OF SENECA LAKE, NEW YORK.
W69-06825 04A

FLOOD PLAIN INFORMATION, CAYUGA LAKE, NEW YORK.
W69-06826 04A

FLOOD PLAIN INFORMATION, CANANDAIGUA LAKE, NEW YORK.
W69-06827 04A

NEW ZEALAND
ESTIMATION OF RAINFALL IN SPARSELY GAUGED AREAS,
W69-06773 02B

NICKEL-63
NICKEL-63 IN MARINE AND TERRESTRIAL BIOTA, SOIL, AND SEDIMENT,
W69-06766 05A

NITROGEN
THE WORK OF THE FRESHWATER BIOLOGICAL ASSOCIATION OF GREAT BRITAIN IN REGARD TO WATER SUPPLIES. (A) THE NITROGEN BALANCE OF LARGE QUANTITIES OF WATER,
W69-06538 02K

NITROGEN CYCLE
THE WORK OF THE FRESHWATER BIOLOGICAL ASSOCIATION OF GREAT BRITAIN IN REGARD TO WATER SUPPLIES. (A) THE NITROGEN BALANCE OF LARGE QUANTITIES OF WATER,
W69-06538 02K

NONLINEAR ECONOMETRIC SYSTEMS
THE ESTIMATION OF NONLINEAR ECONOMETRIC SYSTEMS,
W69-06562 06A

NONRECURSIVE MODELS
NONRECURSIVE MODELS AS DISCRETE APPROXIMATIONS TO SYSTEMS OF STOCHASTIC DIFFERENTIAL EQUATIONS,
W69-06571 06A

NONSTATIONARY PROCESS
AN HARMONIC ANALYSIS OF NONSTATIONARY MULTIVARIATE ECONOMIC PROCESSES,
W69-06553 06A

NON-DESTRUCTIVE TESTS

NON-OWN
RX CONCRETE,
W69-06678 08F

NON-NAVIGABLE WATERS
ELDER V DELCOUR (MISSOURI ADHERES TO STRICT TEST OF NAVIGABILITY IN DETERMINING TITLE TO RIVER BED).
W69-06649 06E

NORTH CAROLINA
FLOOD INUNDATION AND EFFECTS OF URBANIZATION IN METROPOLITAN CHARLOTTE, NORTH CAROLINA,
W69-06445 04C

NANTAHALA POWER AND LIGHT CO V SLOAN (FLOWAGE EASEMENTS).
W69-06620 06E

NORTHEAST U S
DROUGHT IN THE NORTHEASTERN UNITED STATES,
W69-06436 02B

THE ABNORMALLY DRY WEATHER OF 1961-1966 IN THE NORTHEASTERN UNITED STATES,
W69-06437 02B

FURTHER STUDIES OF DROUGHT OVER NORTHEASTERN UNITED STATES,
W69-06438 02B

EFFECTS OF THE DROUGHT ON WATER RESOURCES-SURFACE AND SUBSURFACE HYDROLOGY,
W69-06440 02B

NORTHEASTERN U S DROUGHT (1961-67)
DROUGHT IN THE NORTHEASTERN UNITED STATES,
W69-06436 02B

NUCLEAR ENERGY
THE ROLE OF THE INTERNATIONAL ATOMIC ENERGY AGENCY IN THE DEVELOPMENT, USE AND CONTROL OF WATER RESOURCES.
W69-06456 03A

NUCLEAR REACTORS,
W69-06582 03A

NUCLEAR EXPLOSIONS
NUCLEAR EXPLOSIVES,
W69-06581 08H

NUCLEAR TECHNIQUES(HYDROLOGY)
GUIDEBOOK ON NUCLEAR TECHNIQUES IN HYDROLOGY,
W69-06811 07B

OBSTRUCTION TO FLOW
NASSAU COUNTY V CHERRY VALLEY ESTATES, INC (OBSTRUCTION OF ALLEGED WATER COURSE).
W69-06592 06E

CITY OF PORTSMOUTH V CULPEPPER (SUIT FOR DAMAGES RESULTING FROM OVERFLOW OF OBSTRUCTED CANAL).
W69-06602 06E

ZOMBKOWSKI V WISCONSIN RIVER POWER CO (FLOODING DAMAGES CAUSED BY DAM CONSTRUCTION).
W69-06603 06E

HARDY V KANSAS CITY (FLOODING CAUSED BY OBSTRUCTION TO WATER FLOW).
W69-06625 06E

CLEMENTS V TOWN OF CARROLLTON (DAM ACROSS DRAINAGE DITCH).
W69-06627 06E

HANCOCK V STULL (INTERFERENCE WITH NATURAL DRAINAGE OF SURFACE WATER).
W69-06652 06E

NASSAU COUNTY V CHERRY VALLEY ESTATES (LANDOWNERS RIGHT TO PREVENT FLOW OF SURFACE WATER ONTO HIS PROPERTY).
W69-06653 06E

OBSTRUCTION TO NAVIGATION
BELL TEL CO V DRAVO CORP (UNDERWATER OBSTRUCTION TO NAVIGATION).
W69-06610 06E

PETITION OF MARTIN (OBSTRUCTION TO NAVIGATION).
W69-06636 06E

OCCUPATIONS
MANPOWER REQUIREMENTS FOR POLLUTION CONTROL AND WATER RESOURCES IN INDIANA AND A RELATED POLLUTION CONTROL TECHNOLOGY CURRICULUM,
W69-06507 05G

OCEANS
POTASSIUM, ILLITE AND THE OCEAN,
W69-06506 02K

OHIO
FLOOD PLAIN INFORMATION, ROCKY RIVER IN CITIES OF ROCKY RIVER AND LAKEWOOD, CUYAHOGA COUNTY, OHIO.
W69-06468 04A

COLEMAN V SCHAEFFER (OBSTRUCTION TO NAVIGABLE STREAM).
W69-06584 06E

STATE V CITY OF CLEVELAND (RIGHT OF ACCESS TO NAVIGABLE WATERS).
W69-06619 06E

OIL INDUSTRY
OHIO OIL CO V FERGUSON (MINERAL RIGHTS AND ROYALTIES).
W69-06594 06E

OIL SPILLS
OIL AND HAZARDOUS MATERIALS-EMERGENCY PROCEDURES IN THE WATER ENVIRONMENT.
W69-06791 05G

OILS
TRANSPIRATION REDUCTION BY SURFACE FILMS,
W69-06532 03F

ONE-STEP METHOD
SOIL-WATER DIFFUSIVITY BY THE ONE-STEP METHOD,
W69-06528 02G

OPEN CHANNEL FLOW
DYNAMICS OF CHANNEL FLOW,
W69-06835 02E

OPERATION AND MAINTENANCE
SAFETY CONTROL OF PRIVATE DAMS,
W69-06433 04A

OPPORTUNITY COST
THE OPPORTUNITY COSTS OF PUBLIC INVESTMENT,
W69-06739 06B

OPTIMALITY
OPTIMALITY OF IMPERFECTLY COMPETITIVE RESOURCE ALLOCATION,
W69-06722 06C

OPTIMIZATION
OPTIMIZATION THEORY APPLIED TO PRELIMINARY DESIGN OF A SINGLE EFFECT MULTISTAGE FLASH DESALINATION PLANT,
W69-06495 03A

A HEURISTIC AID FOR THE DESIGN OF SEWER NETWORKS,
W69-06498 05E

ON MULTILEVEL OPTIMIZATION IN GROUND WATER SYSTEMS,
W69-06813 02F

OPTIMUM DEVELOPMENT PLANS
OPERATION OF MULTI-UNIT MULTI-PURPOSE WATER DEVELOPMENT SYSTEMS,
W69-06462 06D

ORAL AGREEMENTS
PRODERMAN V DIETZ (PRIVATE DAMS FOR FLOOD CONTROL).
W69-06617 06E

OUT-OF-KILTER ALGORITHM
SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE.
W69-06494 04A

OVERDRAFT
EFFECT OF SUBSIDENCE ON WELL FIELDS,
W69-06763 04B

OVERFLOW
CITY OF PORTSMOUTH V CULPEPPER (SUIT FOR DAMAGES RESULTING FROM OVERFLOW OF OBSTRUCTED CANAL).
W69-06602 06E

BURNQUIST V FISCHER (FLOWAGE EASEMENT APPURTENANT TO DAM).
W69-06615 06E

OVERVOLTAGE
SHUNT CAPACITOR ENERGIZATION WITH VACUUM INTERRUPTERS--A POSSIBLE SOURCE OF OVERVOLTAGE,
W69-06689 08C

OWNERSHIP OF BEDS
UNITED STATES V GROEN (TITLE TO FILLED IN LAND BORDERING ON A RIVER).
W69-06608 06E

BINGENHEIMER V DIAMOND IRON MINING CO (DEFINITION OF NAVIGABLE WATER TO DETERMINE OWNERSHIP OF BEDS).
W69-06609 06E

LEONARD V STATE HIGHWAY DEPT (ACQUISITION OF TITLE BY STATE THROUGH PERMANENT FLOODING OF LAND).
W69-06611 06E

CALIFORNIA CO V PRICE (OWNERSHIP OF NAVIGABLE WATER BED).
W69-06613 06E

BAILEY V DRISCOLL (IMPLIED LIMITATION ON GRANT OF SUBMERGED LAND).
W69-06618 06E

STATE V CITY OF CLEVELAND (RIGHT OF ACCESS TO NAVIGABLE WATERS).
W69-06619 06E

UNITED STATES V TURNER (OWNERSHIP OF BEDS UNDER SHALLOW WATERS).
W69-06628 06E

STATE V KIVETT (SUIT TO ENJOIN PRIVATE MINING OF STATE-OWNED RIVER BEDS).
W69-06629 06E

HAYNES V SMITH (PRIVATE COMMERCIAL VENTURES ON PUBLIC WATERS).
W69-06643 06E

ELDER V DELCOUR (MISSOURI ADHERES TO STRICT TEST OF NAVIGABILITY IN DETERMINING TITLE TO RIVER BED).
W69-06649 06E

SKALITSKY V CONSOL BADGER CO-OPERATIVE (OWNERSHIP OF FILLED POND BED).
W69-06650 06E

OXYGEN SAG
STOCHASTIC MODEL FOR BOD AND DO IN STREAMS,
W69-06500 05B

PACIFIC NORTHWEST U S
SOME POSSIBLE ROLES FOR INSTITUTIONS AND ECONOMICS IN WATER RESOURCE MANAGEMENT,
W69-06725 06B

PACIFIC OCEAN
NICKEL-63 IN MARINE AND TERRESTRIAL BIOTA, SOIL, AND SEDIMENT,
W69-06766 05A

PARETO-OPTIMALITY
OPTIMALITY OF IMPERFECTLY COMPETITIVE RESOURCE ALLOCATION,
W69-06722 06C

PATH OF POLLUTANTS
DISTRIBUTION OF RADIONUCLIDES IN BOTTOM SEDIMENT OF THE CLINCH RIVER, EASTERN TENNESSEE,
W69-06785 05B

PAVING
USE OF ASPHALTIC CONCRETE IN COASTAL AND CANAL CONSTRUCTION,
W69-06682 08F

PEARSON TYPE III DISTRIB
A NEW TABLE OF PERCENTAGE POINTS OF THE PEARSON TYPE III DISTRIBUTION,
W69-06680 02E

PENNSYLVANIA
EFFECTS OF MINE DRAINAGE ON GROUND WATER,
W69-06425 05C

WHITE OAK BOROUGH AUTH V PENN PUB U COMM'N (AQUISITION OF PUBLIC WATER FACILITIES).
W69-06601 06E

BELL TEL CO V DRAVO CORP (UNDERWATER OBSTRUCTION TO NAVIGATION).
W69-06610 06E

PETITION OF MARTIN (OBSTRUCTION TO NAVIGATION).
W69-06636 06E

RAU V WILDEN ACRES, INC (DIVERSION OF NATURAL FLOW BY ARTIFICIAL CHANNEL).
W69-06656 06E

PERCHED WATER
THE HYDROLOGIC AND GEOLOGIC ASPECTS OF A PERCHING LAYER - SAN JOAQUIN VALLEY, WESTERN FRESNO COUNTY, CALIFORNIA,
W69-06758 02F

PERCOLATING WATER
GEORGE V STATE (OBSTRUCTION OF SUBSURFACE FLOW).
W69-06590 06E

PERMEABILITY
LIQUID PERMEABILITY OF SNOW,
W69-06478 02C

PERMEAMETERS
LIQUID PERMEABILITY OF SNOW,
W69-06478 02C

PERMITS
SEWERS AND DRAINS PRIVATE DRAINS.
W69-06661 06E

PERPETUAL FLOWAGE EASEMENTS
BURNQUIST V FISCHER (FLOWAGE EASEMENT APPURTENANT TO DAM).
W69-06615 06E

PHENOLS
FACTORS INFLUENCING THE CONDENSATION OF 4-AMINOANTIPYRINE WITH DERIVATIVES OF HYDROXYBENZENE-III. A STUDY OF PHENOL CONTENT IN SURFACE WATERS,
W69-06444 05A

PHOTOGRAMMETRY
GRAPHIC DETERMINATION OF SLOPE AND OF DIP AND STRIKE,
W69-06681 07B

SOILS STUDIES USING COLOR PHOTOS,
W69-06696 07B

COMPUTER-AIRPLANE COMBO SAVES QUARTER MILLION DOLLARS ON SURVEYS AND ADMINISTRATION OF CONSTRUCTION CONTRACTS,
W69-06697 07B

PHOTOGRAPHY
PRELIMINARY REMOTE SENSING OF THE DELAWARE ESTUARY,
W69-06793 02L

PHOTOINTERPRETATION
GRAPHIC DETERMINATION OF SLOPE AND OF DIP AND STRIKE,
W69-06681 07B

SOILS STUDIES USING COLOR PHOTOS,
W69-06696 07B

PHOTOSYNTHESIS
PHOTOSYNTHESIS AND WATER USE BY SALTCEDAR,
W69-06771 03B

PHREATOPHYTES
PHOTOSYNTHESIS AND WATER USE BY SALTCEDAR,
W69-06771 03B

PHYSICAL PROPERTIES
THE METAMORPHISM OF DRY SNOW AT A UNIFORM TEMPERATURE,
W69-06479 02C

PHYTOPLANKTON
APPLICATION OF AN ELECTRONIC PARTICLE COUNTER IN ANALYZING NATURAL POPULATIONS OF PHYTOPLANKTON,
W69-06540 07B

SPECIES DIVERSITY AND COMMUNITY STRUCTURE IN LACUSTRINE PHYTOPLANKTON,
W69-06542 02H

PIERS
CARNASION V PAUL (RIGHT OF A COUNTY TO TAX TIDELAND PROPERTY).
W69-06644 06E

PIPELINES
PIPELINE PLANNING BY DYNAMIC COMPUTER PROGRAMMING,
W69-06493 06A

TENNESSEE GAS TRANSMISSION CO V GREATER LAFOURCHE PORT COMM'N (PIPELINES ACROSS NAVIGABLE CHANNELS).
W69-06587 06E

PRESSURE TRANSIENTS IN HYDRAULIC PIPELINES,
W69-06700 08A

PLANNING
INTERGOVERNMENTAL PLANNING OF WATER RESOURCES,
W69-06429 06B

PIPELINE PLANNING BY DYNAMIC COMPUTER PROGRAMMING,
W69-06493 06A

WATER FOR TEXAS,
W69-06790 06B

PLANT GROWTH
TRANSPIRATION REDUCTION BY SURFACE FILMS,
W69-06532 03F

PLASTIC DEFORMATION
THE MECHANICAL PROPERTIES OF SINGLE CRYSTALS OF ICE AT LOW TEMPERATURES,
W69-06474 02C

DEFORMATION OF POLYCRYSTALLINE ICE UNDER COMBINED UNIAXIAL AND HYDROSTATIC PRESSURE,
W69-06475 02C

THE IMPORTANCE OF THE HYDROGEN ATOM ARRANGEMENT IN DETERMINING HOW ICE CAN DEFORM PLASTICALLY,
W69-06476 02C

POLICY MATTERS
SUBSTATION EXPANSION, RELIABILITY, AND TRANSFORMER LOADING POLICY ANALYSIS,
W69-06685 06A

ALLOCATION AND REALLOCATION OF WATER RESOURCES,
W69-06691 06B

POLLUTANT IDENTIFICATION
OIL AND HAZARDOUS MATERIALS-EMERGENCY PROCEDURES IN THE WATER ENVIRONMENT.
W69-06791 05G

POLLUTANTS
OIL AND HAZARDOUS MATERIALS-EMERGENCY PROCEDURES IN THE WATER ENVIRONMENT.
W69-06791 05G

POLLUTION ABATEMENT
WATER SUPPLY AND WASTEWATER TREATMENT PROBLEMS OF INDUSTRIAL AND TRADE ENTERPRISES,
W69-06723 05D

POLLUTION OF THE INTERSTATE WATERS OF THE BLACKSTONE AND TEN MILE RIVERS AND THEIR TRIBUTARIES,
W69-06802 05B

PONDING
DISPLACEMENT FRONT UNDER PONDED LEACHING,
W69-06510 02G

PONDS
APPLICATION OF AN ELECTRONIC PARTICLE COUNTER IN ANALYZING NATURAL POPULATIONS OF PHYTOPLANKTON,
W69-06540 07B

HAMMEL V CAMP RANGER, INC (PRESUMPTIONS REGARDING CONVEYANCE OF INLAND, NON-NAVIGABLE POND).
W69-06648 06E

POPULATION DYNAMICS
APPLICATION OF AN ELECTRONIC PARTICLE COUNTER IN ANALYZING NATURAL POPULATIONS OF PHYTOPLANKTON,
W69-06540 07B

POPULATION TRENDS
FORECASTING URBAN WATER DEMANDS IN DEVELOPING COUNTRIES,
W69-06727 06D

POROUS MEDIA FLOW
EXTENDED TECHNIQUES OF CALCULATION OF SOIL-WATER MOVEMENT, WITH SOME PHYSICAL CONSEQUENCES,
W69-06714 02G

PORTALES VALLEY(NEW MEXICO)
ANALOG OF GROUND WATER IN EAST-CENTRAL NEW MEXICO,
W69-06509 02F

POTASSIUM
POTASSIUM, ILLITE AND THE OCEAN,
W69-06506 02K

POWDER
EVAPORATION REDUCTION ON LARGE RESERVOIRS,
W69-06531 03F

POWER CABLES
ELECTRICAL FEATURES OF THE GRAND COULEE THIRD POWER PLANT,
W69-06684 08C

POWER SUPPLIES
INNOVATIONS AND THE FUTURE OF CATHODIC PROTECTION,
W69-06677 08A

PRECIPITATION GAGES
A UNIVERSAL SURFACE PRECIPITATION GAGE,
W69-06804 02B

PRECIPITATION PATTERNS
STREAMFLOW RECORD LENGTH FOR MODELLING CATCHMENT DYNAMICS,
W69-06781 02E

PRECIPITATION-BASE FLOW RELATIONS
PRECIPITATION AND BASE FLOW VARIABILITY,
W69-06443 02B

PRECIPITATION(ATMOSPHERIC)
DROUGHT IN THE NORTHEASTERN UNITED STATES,
W69-06436 02B

RADAR MEASUREMENT OF PRECIPITATION FOR HYDROLOGICAL PURPOSES,
W69-06812 02B

PRESCRIPTIVE RIGHTS
SBARRA V ERIE RR (DRAINAGE OF SURFACE WATERS AND PRESCRIPTIVE RIGHTS).
W69-06591 06E

SAMYN V TACEY (ARTIFICIAL DRAINAGE OF SURFACE WATERS).
W69-06593 06E

OHIO OIL CO V FERGUSON (MINERAL RIGHTS AND ROYALTIES).
W69-06594 06E

DRAPER V MOSHIER (INTERFERENCE WITH DRAINAGE DITCH).
W69-06600 06E

BURNQUIST V FISCHER (FLOWAGE EASEMENT APPURTENANT TO DAM).
W69-06615 06E

SAVOIE V TOWN OF BOURBONNAIS (PRESCRIPTIVE RIGHTS).
W69-06655 06E

HUGHES V KNIGHT (RIGHT TO UNOBSTRUCTED DRAINAGE OF SURFACE WATERS).
W69-06660 06E

PRESSURE CONDUITS
COMPUTATION OF PRESSURES AND VELOCITIES IN THE CURVILINEAR ZONE OF PRESSURE SPILLWAYS, FOR PREDICTING CAVITATION,
W69-06713 08B

PRESSURE WAVES
PRESSURE TRANSIENTS IN HYDRAULIC PIPELINES,
W69-06700 08A

PRICE INSTABILITY
CONSUMER ASPECTS OF PRICE INSTABILITY,
W69-06570 06C

PRICE STABILITY
CONSUMER ASPECTS OF PRICE INSTABILITY,
W69-06570 06C

PRICING
THE IMPACT OF PRICE ON RESIDENTIAL WATER DEMAND AND ITS RELATION TO SYSTEM DESIGN AND PRICE STRUCTURE,
W69-06502 06D

PUBLIC UTILITY PRICING AND OUTPUT UNDER RISK,
W69-06549 06C

PROBABILITY
SUBSTATION EXPANSION, RELIABILITY, AND TRANSFORMER LOADING POLICY ANALYSIS,
W69-06685 06A

PROFESSIONAL PERSONNEL
MANPOWER REQUIREMENTS FOR POLLUTION CONTROL AND WATER RESOURCES IN INDIANA AND A RELATED POLLUTION CONTROL TECHNOLOGY CURRICULUM,
W69-06507 05G

PROFIT
THE INFLUENCE OF OWNERSHIP AND CONTROL ON PROFIT RATES,
W69-06545 06B

PROJECT DESIGN
THE ROLE OF ALTERNATIVE COST IN PROJECT DESIGN AND SELECTION,
W69-06738 06B

PROJECT SELECTION
THE ROLE OF ALTERNATIVE COST IN PROJECT DESIGN AND SELECTION,
W69-06738 06B

PROPRIETARY POWER
EARLE V MCCARTY (TITLE TO LAND BETWEEN SOUND AND DEDICATED ROAD).
W69-06646 06E

PROTECTION(ELECTRICAL)
SOME ASPECTS OF INSULATION CO-ORDINATION IN HVDC SYSTEMS,
W69-06707 08C

BROWN BOVERI DISTANCE PROTECTION SYSTEMS EMPLOYING CARRIER TRANSFER,
W69-06709 08C

DISTANCE PROTECTION OF HIGH-VOLTAGE LINES CONTAINING SERIES CAPACITORS,
W69-06710 08C

PROTECTIVE DISTANCE
BROWN BOVERI DISTANCE PROTECTION SYSTEMS EMPLOYING CARRIER TRANSFER,
W69-06709 08C

DISTANCE PROTECTION OF HIGH-VOLTAGE LINES CONTAINING SERIES CAPACITORS,
W69-06710 08C

PUBLIC INVESTMENT
THE OPPORTUNITY COSTS OF PUBLIC INVESTMENT,
W69-06739 06B

CHOOSING AMONG ALTERNATIVE PUBLIC INVESTMENTS IN THE WATER RESOURCE FIELD,
W69-06740 06B

PUBLIC LANDS
CERTAIN GAME PRESERVES, AREAS, PROJECTS CONTROL.
W69-06635 06E

PUBLIC SERVITUDES
DAVIS V CITY OF ALEXANDRIA (PUBLIC USE OF LEVEE BANK AS ROADWAY).
W69-06645 06E

PUERTO RICO
FLOOD PLAIN INFORMATION, GUAYANILLA RIVER, GUAYANILLA, PUERTO RICO.
W69-06473 04A

FONADELLAS V UNITED STATES (TEMPORARY TAKING OF PROPERTY FOR PUBLIC PURPOSE).
W69-06622 06E

PUMPING
EFFECT OF SUBSIDENCE ON WELL FIELDS,
W69-06763 04B

QUADRATIC HILL-CLIMBING
MAXIMIZATION BY QUADRATIC HILL-CLIMBING,
W69-06564 06A

QUADRATIC PROGRAMMING
A PARAMETRIC SIMPLICAL FORMULATION OF HOUTHAKKER'S CAPACITY METHOD,
W69-06568 06A

QUASILINEARIZATION
QUASILINEARIZATION APPROACH TO THE IDENTIFICATION OF HYDROLOGIC SYSTEMS,
W69-06822 02A

QUICK CLAYS
STABILIZATION OF UNDISTURBED QUICK CLAY BY SALT WELLS,
W69-06719 08D

RADAR
POTENTIAL OF RADAR REMOTE SENSORS AS TOOLS IN RECONNAISSANCE GEOMORPHIC, VEGETATION AND SOIL MAPPING,
W69-06718 07B

RADAR MEASUREMENT OF PRECIPITATION FOR HYDROLOGICAL PURPOSES,
W69-06812 02B

RADAR STORM-MEASUREMENT
RADAR MEASUREMENT OF PRECIPITATION FOR HYDROLOGICAL PURPOSES,
W69-06812 02B

RADIATION
WATER USE BY IRRIGATED COTTON IN SUDAN. II. NET RADIATION AND SOIL HEAT FLUX,
W69-06756 03F

THE EFFECT OF CROP AND CLIMATIC FACTORS ON THE RADIATION BALANCE OF AN IRRIGATED MAIZE CROP,
W69-06757 03F

RADIOACTIVE SEDIMENT TRANSPORT
DISTRIBUTION OF RADIONUCLIDES IN BOTTOM SEDIMENT OF THE CLINCH RIVER, EASTERN TENNESSEE,
W69-06785 05B

RADIOACTIVE WASTE DISPOSAL

DISTRIBUTION OF RADIONUCLIDES IN BOTTOM SEDIMENT OF THE CLINCH RIVER, EASTERN TENNESSEE,
W69-06785 05B

RADIOACTIVITY EFFECTS
PROGRESS REPORT OF THE BUREAU OF COMMERCIAL FISHERIES RADIOBIOLOGICAL LABORATORY, BEAUFORT, N. C., FISCAL YEAR 1968,
W69-06769 09C

RADIOACTIVITY TECHNIQUES
NICKEL-63 IN MARINE AND TERRESTRIAL BIOTA, SOIL, AND SEDIMENT,
W69-06766 05A

GUIDEBOOK ON NUCLEAR TECHNIQUES IN HYDROLOGY,
W69-06811 07B

RADIOECOLOGICAL RESEARCH
PROGRESS REPORT OF THE BUREAU OF COMMERCIAL FISHERIES RADIOBIOLOGICAL LABORATORY, BEAUFORT, N. C., FISCAL YEAR 1968,
W69-06769 09C

RADIOECOLOGY
NICKEL-63 IN MARINE AND TERRESTRIAL BIOTA, SOIL, AND SEDIMENT,
W69-06766 05A

PROGRESS REPORT OF THE BUREAU OF COMMERCIAL FISHERIES RADIOBIOLOGICAL LABORATORY, BEAUFORT, N. C., FISCAL YEAR 1968,
W69-06769 09C

RADIOISOTOPES
USE OF TRACER TECHNIQUE IN SOIL EROSION RESEARCH,
W69-06704 04D

DISTRIBUTION OF RADIONUCLIDES IN BOTTOM SEDIMENT OF THE CLINCH RIVER, EASTERN TENNESSEE,
W69-06785 05B

GUIDEBOOK ON NUCLEAR TECHNIQUES IN HYDROLOGY,
W69-06811 07B

RADIONUCLIDES
NICKEL-63 IN MARINE AND TERRESTRIAL BIOTA, SOIL, AND SEDIMENT,
W69-06766 05A

RAIN GAGES
ESTIMATION OF RAINFALL IN SPARSELY GAUGED AREAS,
W69-06773 02B

RAINDROPS
PREDICTION OF RAINSPLASH EROSION IN THE SEASONALLY WET TROPICS,
W69-06768 02J

RAINFALL
RADAR MEASUREMENT OF PRECIPITATION FOR HYDROLOGICAL PURPOSES,
W69-06812 02B

RAINFALL DISPOSITION
FREQUENCY AND AREAL DISTRIBUTIONS OF TROPICAL STORM RAINFALL, U.S. COASTAL REGION, GULF OF MEXICO,
W69-06797 02B

RAINFALL INTENSITY
FREQUENCY AND AREAL DISTRIBUTIONS OF TROPICAL STORM RAINFALL, U.S. COASTAL REGION, GULF OF MEXICO,
W69-06797 02B

RAINFALL PATTERN
PLANNING AND DEVELOPMENT OF WATER RESOURCES IN INDIA,
W69-06728 06B

RAINFALL-RUNOFF RELATIONSHIPS
RELATION OF A HYDROLOGIC INDEX TO MEAN ANNUAL FLOW,
W69-06441 02B

PRECIPITATION AND BASE FLOW VARIABILITY,
W69-06443 02B

AN ANALYSIS OF NATIONAL BASIC INFORMATION NEEDS IN URBAN HYDROLOGY,
W69-06770 04C

STREAMFLOW RECORD LENGTH FOR MODELLING CATCHMENT DYNAMICS,
W69-06781 02E

EFFECTS OF TRUNCATION ON DEPENDENCE IN HYDROLOGICAL TIME SERIES,
W69-06789 02A

RAINFALL-RUNOFF RELATIONS FOR SOUTHEASTERN LOUISIANA AND SOUTHWESTERN MISSISSIPPI,
W69-06829 02A

IMPROVED TECHNIQUES FOR ESTIMATING RUNOFF WITH BRIEF RECORDS,
W69-06830 02E

REASONABLE USE
HARRELL V CITY OF CONWAY (USE OF IMPOUNDED WATER).
W69-06597 06E

HARRIS V BROOKS (RECREATION RIGHTS OF RIPARIAN OWNER).
W69-06599 06E

RECHARGE
CONSERVATION OF SOIL WATER BY GRAVEL MULCHES,
W69-06796 03F

RECREATION
THE COMPETITION FOR WATER QUALITY RECREATION,
W69-06573 06D

THE COMPETITION FOR WATER QUANTITY RECREATION,
W69-06578 06D

HARRIS V BROOKS (RECREATION RIGHTS OF RIPARIAN OWNER).
W69-06599 06E

REGIMEN
RECENT HISTORY OF GULKANA AND COLLEGE GLACIERS, CENTRAL ALASKA RANGE, ALASKA,
W69-06808 02C

REGIONAL ANALYSIS
PRINCIPLES OF CHOOSING EXPERIMENTAL PLOTS FOR WATER BALANCE STUDIES IN IRRIGATION REGIONS OF THE ARID ZONE,
W69-06523 02G

REGRESSION ANALYSIS
THE IMPACT OF PRICE ON RESIDENTIAL WATER DEMAND AND ITS RELATION TO SYSTEM DESIGN AND PRICE STRUCTURE,
W69-06502 06D

THE PERFORMANCE OF SOIL MOISTURE ESTIMATES AS COMPARED WITH THE DIRECT USE OF CLIMATOLOGICAL DATA FOR ESTIMATING CROP YIELDS,
W69-06519 02G

TESTING SINGLE-EQUATION LEAST SQUARES REGRESSION MODELS FOR AUTOCORRELATED DISTURBANCES,
W69-06565 06A

REGRESSION MODELS
TESTING SINGLE-EQUATION LEAST SQUARES REGRESSION MODELS FOR AUTOCORRELATED DISTURBANCES,
W69-06565 06A

REGULATION
SAFETY CONTROL OF PRIVATE DAMS,
W69-06433 04A

REINFORCED CONCRETE
TEMPERATURE VOLUMETRIC CHANGES OF CONCRETE AT SUBZERO TEMPERATURES,
W69-06672 08F

SHEAR TRANSFER IN REINFORCED CONCRETE,
W69-06676 08F

RELIABILITY
SUBSTATION EXPANSION, RELIABILITY, AND TRANSFORMER LOADING POLICY ANALYSIS,
W69-06685 06A

REMOTE SENSING
POTENTIAL OF RADAR REMOTE SENSORS AS TOOLS IN RECONNAISSANCE GEOMORPHIC, VEGETATION AND SOIL MAPPING,
W69-06718 07B

PRELIMINARY REMOTE SENSING OF THE DELAWARE ESTUARY,
W69-06793 02L

RADAR MEASUREMENT OF PRECIPITATION FOR HYDROLOGICAL PURPOSES,
W69-06812 02B

REPULSION(LEGAL ASPECTS)
SAVOIE V TOWN OF BOURBONNAIS (PRESCRIPTIVE RIGHTS).
W69-06655 06E

RESEARCH FACILITIES
PROGRESS REPORT OF THE BUREAU OF COMMERCIAL FISHERIES RADIOBIOLOGICAL LABORATORY, BEAUFORT, N. C., FISCAL YEAR 1968,
W69-06769 09C

RESERVOIR EVAPORATION
EVAPORATION REDUCTION ON LARGE RESERVOIRS,
W69-06531 03F

RESERVOIR OPERATION
SAFETY CONTROL OF PRIVATE DAMS,
W69-06433 04A

RESERVOIR MANAGEMENT THE TRADEOFF BETWEEN LOW-FLOW REGULATION AND FLOOD CONTROL,
W69-06496 04A

HEC-3, RESERVIOR SYSTEM ANALYSIS.
W69-06788 04A

RESERVOIR SYSTEM ANALYSIS
HEC-3, RESERVIOR SYSTEM ANALYSIS.
W69-06788 04A

RESERVOIRS
WATER-QUALITY RECORDS FOR THE HUBBARD CREEK WATERSHED, TEXAS, OCTOBER 1966-SEPTEMBER 1967,
W69-06786 02H

RESOURCE ALLOCATION
OPTIMALITY OF IMPERFECTLY COMPETITIVE RESOURCE ALLOCATION,
W69-06722 06C

RESOURCE USE PLANNING

SOME POSSIBLE ROLES FOR INSTITUTIONS AND ECONOMICS IN WATER RESOURCE MANAGEMENT,
W69-06725 06B

RETENTION DAMS
DESIGN AND CONSTRUCTION OF DAMS FOR RETENTION OF SOLID WASTES,
W69-06675 05G

RETURNS TO SCALE
ESTIMATION OF RETURNS TO SCALE AND THE ELASTICITY OF SUBSTITUTION,
W69-06732 06B

RHODE ISLAND
POLLUTION OF THE INTERSTATE WATERS OF THE BLACKSTONE AND TEN MILE RIVERS AND THEIR TRIBUTARIES,
W69-06802 05B

RIDDANCE(LEGAL ASPECTS)
SAVOIE V TOWN OF BOURBONNAIS (PRESCRIPTIVE RIGHTS).
W69-06655 06E

RIGHT OF ACCESS
UNITED STATES V TURNER (OWNERSHIP OF BEDS UNDER SHALLOW WATERS).
W69-06628 06E

RIPARIAN GRANTS
LEONARD V STATE HIGHWAY DEPT (ACQUISITION OF TITLE BY STATE THROUGH PERMANENT FLOODING OF LAND).
W69-06611 06E

RIPARIAN RIGHTS
HARRELL V CITY OF CONWAY (USE OF IMPOUNDED WATER).
W69-06597 06E

HARRIS V BROOKS (RECREATION RIGHTS OF RIPARIAN OWNER).
W69-06599 06E

UNITED STATES V GROEN (TITLE TO FILLED IN LAND BORDERING ON A RIVER).
W69-06608 06E

OWEN V JOHNSON (OWNERSHIP OF THE BED OF A NAVIGABLE STREAM).
W69-06639 06E

EMINENT DOMAIN.
W69-06642 06E

RIPARIAN WATERS
BENEFICIAL USES OF WATERS OF INTERNATIONAL RIVERS INTERNATIONAL LAW AND PRACTICE,
W69-06458 06E

RIVER BASIN DEVELOPMENT
CONSTRUCTION AND MANAGEMENT OF RIVER VALLEY PROJECTS IN INDIA,
W69-06457 04A

OPERATION OF MULTI-UNIT MULTI-PURPOSE WATER DEVELOPMENT SYSTEMS,
W69-06462 06D

RIVER BASINS
BENEFICIAL USES OF WATERS OF INTERNATIONAL RIVERS INTERNATIONAL LAW AND PRACTICE,
W69-06458 06E

RIVER SYSTEMS
WATER QUALITY MANAGEMENT IN IRRIGATION SYSTEMS,
W69-06499 05G

PLANNING AND DEVELOPMENT OF WATER RESOURCES IN INDIA,
W69-06728 06B

RIVERS
STATE V KIVETT (SUIT TO ENJOIN PRIVATE MINING OF STATE-OWNED RIVER BEDS).
W69-06629 06E

ROAD CONSTRUCTION
CHRISTMAN V STATE (NEGLIGENCE IN CULVERT CONSTRUCTION).
W69-06624 06E

ROCK MECHANICS
BRITTLE ROCK FAILURE UNDER TRIAXIAL STRESS,
W69-06701 08E

ROCK PROPERTIES
BRITTLE ROCK FAILURE UNDER TRIAXIAL STRESS,
W69-06701 08E

ROCKFILL DAMS
FOUNDATION PROBLEMS OF RUEDI DAM AND RESERVOIR,
W69-06673 08E

ROTATING MACHINES
MEASUREMENT OF ROTATING MACHINERY VIBRATION AND FACTORS AFFECTING INSTRUMENT ACCURACY,
W69-06702 07B

ROUTING
HEC-3, RESERVIOR SYSTEM ANALYSIS.
W69-06788 04A

RUNOFF
A PRELIMINARY FIELD STUDY OF SURFACE TREATMENTS FOR RUNOFF INDUCEMENT IN THE NEGEV OF ISRAEL,
W69-06715 02A

GRADED FURROWS FOR WATER EROSION CONTROL,
W69-06746 02J

RUNOFF FORECASTING
IMPROVED TECHNIQUES FOR ESTIMATING RUNOFF WITH BRIEF RECORDS,
W69-06830 02E

RURAL AREAS
RURAL WATER DEVELOPMENT IN KENYA,
W69-06453 04A

SAFETY
SAFETY CONTROL OF PRIVATE DAMS,
W69-06433 04A

NON-ENGINEERING ELEMENTS IN FACTORS OF SAFETY IN SOIL AND FOUNDATION ENGINEERING,
W69-06695 08D

SAFETY FACTORS
NON-ENGINEERING ELEMENTS IN FACTORS OF SAFETY IN SOIL AND FOUNDATION ENGINEERING,
W69-06695 08D

SALINE SOILS
DISPLACEMENT FRONT UNDER PONDED LEACHING,
W69-06510 02G

EXPERIENCE IN ACCELERATED IRREVERSIBLE DESALINIZATION OF SOILS IN GOLODNAYA STEPPE,
W69-06716 03F

SALINE WATER INTRUSION
CONTROL OF SEA-WATER INTRUSION IN A GROUND-WATER AQUIFER,
W69-06422 02F

SALINITY
ECONOMIC FRAMEWORK FOR SALINITY CONTROL PROJECTS,
W69-06490 05D

SALT BALANCE
SALT BALANCE AND SALT TRANSPORT PROCESSES IN IRRIGATED SOILS,
W69-06717 03F

SALT SPRAY TESTS
TOWARDS STANDARDIZING THE ARTIFICIAL-POLLUTION TEST FOR HIGH VOLTAGE INSULATORS.
W69-06708 08C

SALTS
DISPLACEMENT FRONT UNDER PONDED LEACHING,
W69-06510 02G

FIELD OBSERVATIONS OF SOME PHYSICAL PROPERTIES IN ALLUVIAL SOILS OF ARID AND SEMI-ARID REGIONS,
W69-06515 02G

SALT BALANCE AND SALT TRANSPORT PROCESSES IN IRRIGATED SOILS,
W69-06717 03F

STABILIZATION OF UNDISTURBED QUICK CLAY BY SALT WELLS,
W69-06719 08D

SAMPLING
A COMPARATIVE STUDY OF HYDRAULIC CONDUCTIVITY IN THE ALLUVIAL SOILS OF EGYPT,
W69-06517 02F

SAN JOAQUIN VALLEY
THE HYDROLOGIC AND GEOLOGIC ASPECTS OF A PERCHING LAYER - SAN JOAQUIN VALLEY, WESTERN FRESNO COUNTY, CALIFORNIA,
W69-06758 02F

SAND GRAIN ORIENTATION
LABORATORY EXPERIMENTS ON THE PRODUCTION OF GRAIN ORIENTATION IN SHEARING SAND,
W69-06799 02J

SANDS
TREND SURFACE ANALYSIS OF SAND TRACER DISTRIBUTIONS ON A CARBONATE BEACH, BIMINI, BWI,
W69-06809 02L

SANDSTONES
ARTIFICIAL RECHARGE OF A FISSURED SANDSTONE AQUIFER, TANGIERS, MOROCCO (FRENCH),
W69-06487 04B

SANTA CLARA VALLEY
EFFECT OF SUBSIDENCE ON WELL FIELDS,
W69-06763 04B

SEA WATER
THE ORIGIN OF THE TIBERIAS-NOIT MINERAL WATER ASSOCIATION IN THE TIBERIAS-DEAD SEA RIFT VALLEY, ISRAEL,
W69-06749 02F

SEDIMENT TRANSPORT
DISTRIBUTION OF RADIONUCLIDES IN BOTTOM SEDIMENT OF THE CLINCH RIVER, EASTERN TENNESSEE,
W69-06785 05B

DYNAMICS OF CHANNEL FLOW,
W69-06835 02E

SEDIMENTARY ROCKS
SOME DETAILS ON THE CIRCULATION OF GROUNDWATER IN NON-KARSTIFIED FISSURED FORMATIONS IN CZECHOSLOVAKIA (FRENCH),

W69-06485 02F

SEDIMENTATION
COASTAL EROSION AND TRANSGRESSIVE STRATIGRAPHY,
W69-06798 02L

TREND SURFACE ANALYSIS OF SAND TRACER DISTRIBUTIONS ON A CARBONATE BEACH, BIMINI, BWI,
W69-06809 02L

A CLASSIFICATION OF PALEOCURRENT MODELS,
W69-06810 02J

SEDIMENTOLOGY
A CLASSIFICATION OF PALEOCURRENT MODELS,
W69-06810 02J

SEDIMENTS
LABORATORY EXPERIMENTS ON THE PRODUCTION OF GRAIN ORIENTATION IN SHEARING SAND,
W69-06799 02J

SEEPAGE
THE MECHANISM OF WATER SEEPAGE THROUGH CONCRETE,
W69-06712 08F

SEMIARID CLIMATE
SOME CHARACTERISTICS AND FREQUENCIES OF OCCURRENCE OF DROUGHTS IN THE DRY CLIMATIC ZONES OF INDIA,
W69-06524 02G

SEMIARID CLIMATES
A GEOMORPHIC APPROACH TO EROSION CONTROL IN SEMIARID REGIONS,
W69-06513 02J

SERIAL CORRELATION
SIMULTANEOUS TESTS FOR TREND AND SERIAL CORRELATIONS FOR GAUSSIAN MARKOV RESIDUALS.
W69-06569 06A

SERIES CAPACITORS
DISTANCE PROTECTION OF HIGH-VOLTAGE LINES CONTAINING SERIES CAPACITORS,
W69-06710 08C

SERVICE LIFE
SUBSTATION EXPANSION, RELIABILITY, AND TRANSFORMER LOADING POLICY ANALYSIS,
W69-06685 06A

SETTLEMENT
HORIZONTAL MOVEMENTS RELATED TO SUBSIDENCE,
W69-06692 08D

SEWAGE DISPOSAL
SEWERAGE DISTRICTS AND BOARDS.
W69-06632 05G

SEWAGE DISTRICTS
SEWERAGE DISTRICTS AND BOARDS.
W69-06633 06E

SEWERS
GIBSON V STATE (CONSTRUCTION AND MAINTENANCE OF SEWERS).
W69-06607 06E

SEWERS COST COMPARISONS
A HEURISTIC AID FOR THE DESIGN OF SEWER NETWORKS,
W69-06498 05E

SHALLOW WATER
UNITED STATES V TURNER (OWNERSHIP OF BEDS UNDER SHALLOW WATERS).
W69-06628 06E

SHEARING SAND
LABORATORY EXPERIMENTS ON THE PRODUCTION OF GRAIN ORIENTATION IN SHEARING SAND,
W69-06799 02J

SHIPS
BELL TEL CO V DRAVO CORP (UNDERWATER OBSTRUCTION TO NAVIGATION).
W69-06610 06E

SHORE PROTECTION
USE OF ASPHALTIC CONCRETE IN COASTAL AND CANAL CONSTRUCTION,
W69-06682 08F

SHORES
A CLASSIFICATION OF PALEOCURRENT MODELS,
W69-06810 02J

SHORT-WAVE RADIATION
THE EFFECT OF CROP AND CLIMATIC FACTORS ON THE RADIATION BALANCE OF AN IRRIGATED MAIZE CROP,
W69-06757 03F

SIERRA NEVADA(CALIF)
REGIONAL HYDROLOGIC AREA STUDY AS AN ANALYSIS TOOL IN WEATHER MODIFICATION,
W69-06805 02A

SILICONES
TRANSPIRATION REDUCTION BY SURFACE FILMS,
W69-06532 03F

SIMULATION ANALYSIS
SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE.
W69-06494 04A

WATER QUALITY MANAGEMENT IN IRRIGATION SYSTEMS,
W69-06499 05G

DYNAMIC SIMULATION MODEL OF THE TRANSPIRATION PROCESS,
W69-06504 02D

SIMULATION OF AN AQUATIC ECOSYSTEM,
W69-06536 02H

THE DESIRABILITY AND APPLICABILITY OF SIMULATING ECOSYSTEMS,
W69-06537 06A

SIMULTANEOUS EQUATION MODEL
SPECIFICATION ANALYSIS IN THE ESTIMATION OF PARAMETERS OF A SIMULTANEOUS EQUATION MODEL WITH AUTOREGRESSIVE RESIDUALS,
W69-06567 06A

SIMULTANEOUS TESTS
SIMULTANEOUS TESTS FOR TREND AND SERIAL CORRELATIONS FOR GAUSSIAN MARKOV RESIDUALS,
W69-06569 06A

SLIP SURFACE
CIRCULAR AND LOGARITHMIC SPIRAL SLIP SURFACES,
W69-06694 08D

SLOPE STABILITY
CIRCULAR AND LOGARITHMIC SPIRAL SLIP SURFACES,
W69-06694 08D

SLOPES
GRAPHIC DETERMINATION OF SLOPE AND OF DIP AND STRIKE,
W69-06681 07B

GRADED FURROWS FOR WATER EROSION CONTROL,
W69-06746 02J

SLUDGE DISPOSAL
SLUDGE DISPOSAL ALTERNATIVES -- SOCIO-ECONOMIC CONSIDERATIONS,
W69-06492 05E

SMALL-SAMPLING PROPERTIES
ON THE RELATIVE SMALL-SAMPLE PROPERTIES OF SEVERAL STRUCTURAL-EQUATION ESTIMATORS,
W69-06734 06B

SNAKE RIVER PLAIN
INFLOW TO SNAKE RIVER BETWEEN MILNER AND KING HILL, IDAHO,
W69-06427 02E

SNOW
THE METAMORPHISM OF WET SNOW,
W69-06477 02C

LIQUID PERMEABILITY OF SNOW,
W69-06478 02C

THE METAMORPHISM OF DRY SNOW AT A UNIFORM TEMPERATURE,
W69-06479 02C

SNOW MANAGEMENT
A SYSTEM FOR MAKING REMOTE AND UNDISTURBED MEASUREMENTS OF SNOW SETTLEMENT AND TEMPERATURES,
W69-06803 02C

SNOW PRESSURE RECORDER
A UNIVERSAL SURFACE PRECIPITATION GAGE,
W69-06804 02B

SNOW SURVEYS
A SYSTEM FOR MAKING REMOTE AND UNDISTURBED MEASUREMENTS OF SNOW SETTLEMENT AND TEMPERATURES,
W69-06803 02C

SNOWPACK
A UNIVERSAL SURFACE PRECIPITATION GAGE,
W69-06804 02B

SNOWPACKS
A SYSTEM FOR MAKING REMOTE AND UNDISTURBED MEASUREMENTS OF SNOW SETTLEMENT AND TEMPERATURES,
W69-06803 02C

SOCIAL VALUES
SLUDGE DISPOSAL ALTERNATIVES -- SOCIO-ECONOMIC CONSIDERATIONS,
W69-06492 05E

SOCIO-ECONOMIC CONSIDERATIONS
SLUDGE DISPOSAL ALTERNATIVES -- SOCIO-ECONOMIC CONSIDERATIONS,
W69-06492 05E

SODIUM ARSENITE
ARSENIC ACCUMULATION BY FISH IN LAKES TREATED WITH SODIUM ARSENITE,
W69-06541 05B

SOIL ENGINEERING
SOIL AS AN ENGINEERING MATERIAL,
W69-06699 08D

SOIL EROSION
USE OF TRACER TECHNIQUE IN SOIL EROSION RESEARCH,
W69-06704 04D

SOIL MAPS
POTENTIAL OF RADAR REMOTE SENSORS AS TOOLS IN RECONNAISSANCE GEOMORPHIC, VEGETATION AND SOIL MAPPING,

W69-06718 07B

SOIL MECHANICS
SOIL AS AN ENGINEERING MATERIAL,
W69-06699 08D

STABILIZATION OF UNDISTURBED QUICK CLAY BY SALT WELLS,
W69-06719 08D

SOIL MOISTURE
THEORY OF SOIL MOISTURE - VOL 1, MOISTURE PROPERTIES OF SOILS AND MOVEMENT OF SOIL MOISTURE,
W69-06489 02G

EVALUATION OF THE GAMMA TRANSMISSION METHOD FOR DETERMINING SOIL WATER BALANCE AND EVAPOTRANSPIRATION,
W69-06514 02G

THE PERFORMANCE OF SOIL MOISTURE ESTIMATES AS COMPARED WITH THE DIRECT USE OF CLIMATOLOGICAL DATA FOR ESTIMATING CROP YIELDS,
W69-06519 02G

DROUGHT AND SOIL MOISTURE,
W69-06529 02G

EXTENDED TECHNIQUES OF CALCULATION OF SOIL-WATER MOVEMENT, WITH SOME PHYSICAL CONSEQUENCES,
W69-06714 02G

SOIL MOISTURE BUDGET
THE PERFORMANCE OF SOIL MOISTURE ESTIMATES AS COMPARED WITH THE DIRECT USE OF CLIMATOLOGICAL DATA FOR ESTIMATING CROP YIELDS,
W69-06519 02G

SOIL MOISTURE METERS
EVALUATION OF THE GAMMA TRANSMISSION METHOD FOR DETERMINING SOIL WATER BALANCE AND EVAPOTRANSPIRATION,
W69-06514 02G

SOIL PHYSICAL PROPERTIES
FIELD OBSERVATIONS OF SOME PHYSICAL PROPERTIES IN ALLUVIAL SOILS OF ARID AND SEMI-ARID REGIONS,
W69-06515 02G

PREDICTION OF SWELLING PRESSURE OF CLAYS,
W69-06693 08D

SOIL RECLAMATION
EXPERIENCE IN ACCELERATED IRREVERSIBLE DESALINIZATION OF SOILS IN GOLODNAYA STEPPE,
W69-06716 03F

SOIL SALINITY CONTROL
PROCEEDINGS OF TILE DRAINAGE RESEARCH CONFERENCE,
W69-06795 04A

SOIL SCIENCE
SALT BALANCE AND SALT TRANSPORT PROCESSES IN IRRIGATED SOILS,
W69-06717 03F

SOIL STABILIZATION
STABILIZATION OF UNDISTURBED QUICK CLAY BY SALT WELLS,
W69-06719 08D

SOIL SURFACES
FIELD OBSERVATIONS OF SOME PHYSICAL PROPERTIES IN ALLUVIAL SOILS OF ARID AND SEMI-ARID REGIONS,
W69-06515 02G

SOIL SURVEYS
SOILS STUDIES USING COLOR PHOTOS,
W69-06696 07B

SOIL TEXTURE
SOIL-WATER DIFFUSIVITY BY THE ONE-STEP METHOD,
W69-06528 02G

SOIL WATER
TENSION OF THE SOIL WATER WHEN PERMANENT WILTING OCCURS, AS MEASURED BY THE GRAY HYDROCAL HYGROMETER METHOD,
W69-06516 02G

SOIL-WATER DIFFUSIVITY BY THE ONE-STEP METHOD,
W69-06528 02G

EXTENDED TECHNIQUES OF CALCULATION OF SOIL-WATER MOVEMENT, WITH SOME PHYSICAL CONSEQUENCES,
W69-06714 02G

SOIL WATER MOVEMENT
THEORY OF SOIL MOISTURE - VOL 1, MOISTURE PROPERTIES OF SOILS AND MOVEMENT OF SOIL MOISTURE,
W69-06489 02G

EXTENDED TECHNIQUES OF CALCULATION OF SOIL-WATER MOVEMENT, WITH SOME PHYSICAL CONSEQUENCES,
W69-06714 02G

SOILS
SOILS STUDIES USING COLOR PHOTOS,
W69-06696 07B

SOIL-WATER-PLANT RELATIONSHIPS
A METHOD OF DETERMINING THE WATER POTENTIAL OF INTACT PLANTS,
W69-06527 02I

SOLAR RADIATION
WATER USE BY IRRIGATED COTTON IN SUDAN. II. NET RADIATION AND SOIL HEAT FLUX,
W69-06756 03F

SOLID WASTES
DESIGN AND CONSTRUCTION OF DAMS FOR RETENTION OF SOLID WASTES,
W69-06675 05G

SOLVENT EXTRACTION
RECOVERY OF SALTS FROM SALINE WATER VIA SOLVENT EXTRACTION (FINAL REPORT),
W69-06839 03A

SOUTH AFRICA
OPERATION OF MULTI-UNIT MULTI-PURPOSE WATER DEVELOPMENT SYSTEMS,
W69-06462 06D

SOUTH DAKOTA
GEOLOGY AND HYDROLOGY OF CLAY COUNTY SOUTH DAKOTA-PART 1, GEOLOGY, AND PART 2, WATER RESOURCES,
W69-06486 02F

SPARK GAPS
OPEN BREAKER PROTECTION OF EHV SYSTEMS,
W69-06688 08C

SPECIES DIVERSITY
SPECIES DIVERSITY AND COMMUNITY STRUCTURE IN LACUSTRINE PHYTOPLANKTON,
W69-06542 02H

SPECIFICATION ANALYSIS
SPECIFICATION ANALYSIS IN THE ESTIMATION OF PARAMETERS OF A SIMULTANEOUS EQUATION MODEL WITH AUTOREGRESSIVE RESIDUALS,
W69-06567 06A

SPECIFICATIONS
SPECIFICATION AND ESTIMATION OF COBB-DOUGLAS PRODUCTION FUNCTION MODELS,
W69-06560 06A

SPILLWAYS
COMPUTATION OF PRESSURES AND VELOCITIES IN THE CURVILINEAR ZONE OF PRESSURE SPILLWAYS, FOR PREDICTING CAVITATION,
W69-06713 08B

SPRINGS
INFLOW TO SNAKE RIVER BETWEEN MILNER AND KING HILL, IDAHO,
W69-06427 02E

SPRINKLER IRRIGATION
MODERN IRRIGATION FOR INCREASED AGRICULTURAL PRODUCTION,
W69-06454 03F

STABILITY
CIRCULAR AND LOGARITHMIC SPIRAL SLIP SURFACES,
W69-06694 08D

STABILITY ANALYSIS
CIRCULAR AND LOGARITHMIC SPIRAL SLIP SURFACES,
W69-06694 08D

STABLE ISOTOPES
THE STABLE ISOTOPE COMPOSITION OF MINERAL WATERS IN THE JORDON RIFT VALLEY, ISRAEL,
W69-06750 02F

GUIDEBOOK ON NUCLEAR TECHNIQUES IN HYDROLOGY,
W69-06811 07B

STAGE-DISCHARGE RELATIONS
FLOOD INUNDATION AND EFFECTS OF URBANIZATION IN METROPOLITAN CHARLOTTE, NORTH CAROLINA,
W69-06445 04C

STATE GOVERNMENTS
CONSERVATION'S CHALLENGE TO STATE GOVERNMENTS,
W69-06586 06E

STATISTICAL ANALYSIS
ON THE DISTRIBUTION OF STATISTICS SUITABLE FOR EVALUATING RAINFALL STIMULATION EXPERIMENTS,
W69-06679 03B

STATISTICAL MECHANICS
INTERMOLECULAR FORCES AND THE LIQUID STATE,
W69-06838 01A

STATISTICAL METHODS
A NEW TABLE OF PERCENTAGE POINTS OF THE PEARSON TYPE III DISTRIBUTION,
W69-06680 02E

RANDOM PROCESSES AND LITHOLOGIC TRANSITIONS,
W69-06807 02J

STOCHASTIC PROCESSES
EFFECTS OF TRUNCATION ON DEPENDENCE IN HYDROLOGICAL TIME SERIES,
W69-06789 02A

STOMATA
THE HYDROLOGIC IMPORTANCE OF TRANSPIRATION CONTROL BY STOMATA,
W69-06520 02D

STORM RUNOFF
COX V MARTIN (DISCHARGE OF SURFACE WATER THROUGH A DOWNSPOUT).

W69-06596 06E

GIBSON V STATE (CONSTRUCTION AND MAINTENANCE OF SEWERS).
W69-06607 06E

A PRELIMINARY FIELD STUDY OF SURFACE TREATMENTS FOR RUNOFF INDUCEMENT IN THE NEGEV OF ISRAEL,
W69-06715 02A

STRATIFICATION
COASTAL EROSION AND TRANSGRESSIVE STRATIGRAPHY,
W69-06798 02L

STRATIGRAPHY
COASTAL EROSION AND TRANSGRESSIVE STRATIGRAPHY,
W69-06798 02L

RANDOM PROCESSES AND LITHOLOGIC TRANSITIONS,
W69-06807 02J

STREAM GAGES
RESPONSE OF BUBBLE-GAGE SERVOMANOMETERS TO OSCILLATIONS IN WATER LEVEL,
W69-06434 07C

STREAMFLOW
EXTENSIONS OF STREAMFLOW RECORDS IN UTAH,
W69-06447 02E

STREAMFLOW FORECASTING
RELATION OF A HYDROLOGIC INDEX TO MEAN ANNUAL FLOW,
W69-06441 02B

STREAMS
COLEMAN V SCHAEFFER (OBSTRUCTION TO NAVIGABLE STREAM).
W69-06584 06E

BALL CREEK COAL CO V NAPIER (MEANDERS AS A BOUNDARY).
W69-06614 06E

ADKINS V HUGHES (BOUNDARY DISPUTE DUE TO AVULSION).
W69-06658 06E

STRESS ANALYSIS
DETERMINATION OF STRESSES IN THE ARCH OF LARGE UNDERGROUND STRUCTURES, APPEARING AT THE TIME OF EXCAVATION OF THE CORE,
W69-06706 08E

SUBHUMID CLIMATES
SOME CHARACTERISTICS AND FREQUENCIES OF OCCURRENCE OF DROUGHTS IN THE DRY CLIMATIC ZONES OF INDIA,
W69-06524 02G

SUBSIDENCE
HORIZONTAL MOVEMENTS RELATED TO SUBSIDENCE,
W69-06692 08D

EFFECT OF SUBSIDENCE ON WELL FIELDS,
W69-06763 04B

SUBSOIL
A COMPARATIVE STUDY OF HYDRAULIC CONDUCTIVITY IN THE ALLUVIAL SOILS OF EGYPT,
W69-06517 02F

SUBSTATIONS(ELECTRICAL)
SUBSTATION EXPANSION, RELIABILITY, AND TRANSFORMER LOADING POLICY ANALYSIS,
W69-06685 06A

500-KV AC SUBSTATION DESIGN CRITERIA--SUMMARY OF INDUSTRY PRACTICES,
W69-06686 08C

SUBSURFACE DRAINAGE
DRAINING AREA UNDERLAIN BY HIGHLY PERMEABLE SHALLOW SAND AQUIFER,
W69-06512 02G

POTEETE V CITY OF WATER VALLEY (ARTIFICIAL CONTROL OF SUBSURFACE DRAINAGE).
W69-06626 06E

SUBSURFACE WATERS
GEORGE V STATE (OBSTRUCTION OF SUBSURFACE FLOW).
W69-06590 06E

SUDAN
WATER USE BY IRRIGATED COTTON IN SUDAN. II. NET RADIATION AND SOIL HEAT FLUX,
W69-06756 03F

SUL-RISUL(T)
SUL-RISUL(T) ION EXCHANGE PROCESS FIELD EVALUATION ON BRACKISH WATERS,
W69-06836 03A

SURFACE DRAINAGE
BARBER PURE MILK CO V GOLDIN (SURFACE DRAINAGE).
W69-06588 06E

SBARRA V ERIE RR (DRAINAGE OF SURFACE WATERS AND PRESCRIPTIVE RIGHTS).
W69-06591 06E

NASSAU COUNTY V CHERRY VALLEY ESTATES, INC (OBSTRUCTION OF ALLEGED WATER COURSE).
W69-06592 06E

CANNON V CITY OF MACON (NATURAL DRAINAGE FLOW AND THE LOWER LAND PROPRIETOR).
W69-06595 06E

DRAPER V MOSHIER (INTERFERENCE WITH DRAINAGE DITCH).
W69-06600 06E

HANCOCK V STULL (INTERFERENCE WITH NATURAL DRAINAGE OF SURFACE WATER).
W69-06652 06E

NASSAU COUNTY V CHERRY VALLEY ESTATES (LANDOWNERS RIGHT TO PREVENT FLOW OF SURFACE WATER ONTO HIS PROPERTY).
W69-06653 06E

SURFACE FLOWS
PLANNING AND DEVELOPMENT OF WATER RESOURCES IN INDIA,
W69-06728 06B

SURFACE RUNOFF
CLEMENTS V TOWN OF CARROLLTON (DAM ACROSS DRAINAGE DITCH).
W69-06627 06E

RINZLER V FOLSOM (ARTIFICIAL INCREASE OF SURFACE RUNOFF).
W69-06657 06E

A PRELIMINARY FIELD STUDY OF SURFACE TREATMENTS FOR RUNOFF INDUCEMENT IN THE NEGEV OF ISRAEL,
W69-06715 02A

SURFACE SEALING
FIELD OBSERVATIONS OF SOME PHYSICAL PROPERTIES IN ALLUVIAL SOILS OF ARID AND SEMI-ARID REGIONS,
W69-06515 02G

SURFACE TREATMENT
A PRELIMINARY FIELD STUDY OF SURFACE TREATMENTS FOR RUNOFF INDUCEMENT IN THE NEGEV OF ISRAEL,
W69-06715 02A

SURFACE WATERS
WATER-RESOURCES APPRAISAL OF THE LOWER MOAPA-LAKE MEAD AREA, CLARK COUNTY, NEVADA,
W69-06435 02F

FACTORS INFLUENCING THE CONDENSATION OF 4-AMINOANTIPYRINE WITH DERIVATIVES OF HYDROXYBENZENE-III. A STUDY OF PHENOL CONTENT IN SURFACE WATERS,
W69-06444 05A

WATER AVAILABILITY, CONECUH COUNTY, ALABAMA,
W69-06451 02E

WATER AVAILABILITY, COFFEE COUNTY, ALABAMA,
W69-06452 02F

FIELD OBSERVATIONS OF SOME PHYSICAL PROPERTIES IN ALLUVIAL SOILS OF ARID AND SEMI-ARID REGIONS,
W69-06515 02G

SAMYN V TACEY (ARTIFICIAL DRAINAGE OF SURFACE WATERS).
W69-06593 06E

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF PIKE COUNTY, ALABAMA,
W69-06815 02F

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF HENRY COUNTY, ALABAMA,
W69-06816 02F

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF CRENSHAW COUNTY, ALABAMA,
W69-06817 02F

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF DALE COUNTY, ALABAMA,
W69-06818 02F

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF COVINGTON COUNTY, ALABAMA,
W69-06819 02F

SURFACE-GROUNDWATER RELATIONSHIPS
PRECIPITATION AND BASE FLOW VARIABILITY,
W69-06443 02B

CONSERVATION OF SOIL WATER BY GRAVEL MULCHES,
W69-06796 03F

SURFACTANTS
TRANSPIRATION REDUCTION BY SURFACE FILMS,
W69-06532 03F

SURVEYING
COMPUTER-AIRPLANE COMBO SAVES QUARTER MILLION DOLLARS ON SURVEYS AND ADMINISTRATION OF CONSTRUCTION CONTRACTS,
W69-06697 07B

SURVEYS
GROUND WATER, GRAVITY AND RIFT VALLEYS IN MALAWI,
W69-06431 02F

SUSQUEHANNA RIVER BASIN
RELATION OF A HYDROLOGIC INDEX TO MEAN ANNUAL FLOW,
W69-06441 02B

SWELLING
PREDICTION OF SWELLING PRESSURE OF CLAYS,
W69-06693 08D

SWELLING PRESSURES
PREDICTION OF SWELLING PRESSURE OF CLAYS,

W69-06693 08D

SWIMMING
ICE DEALERS BATHING WATER SUPPLY FOR RURAL FIRE PROTECTION.
W69-06631 06E

SWITCHING
SHUNT CAPACITOR ENERGIZATION WITH VACUUM INTERRUPTERS--A POSSIBLE SOURCE OF OVERVOLTAGE,
W69-06689 08C

SWITCHING SURGES
OPEN BREAKER PROTECTION OF EHV SYSTEMS,
W69-06688 08C

SWITCHYARDS(ELECTRICAL)
ELECTRICAL FEATURES OF THE GRAND COULEE THIRD POWER PLANT,
W69-06684 08C

SYNOPTIC ANALYSIS
CLIMATOLOGY STUDIES OF BAFFIN ISLAND, NORTHWEST TERRITORIES,
W69-06814 02B

SYNTHETIC HYDROLOGY
EFFECTS OF TRUNCATION ON DEPENDENCE IN HYDROLOGICAL TIME SERIES,
W69-06789 02A

SYSTEMS ANALYSIS
SIGNIFICANCE OF GROUNDWATER MANAGEMENT STRATEGY-A SYSTEMS APPROACH,
W69-06424 06A

HYDROLOGIC CYCLE AS A CLOSED SYSTEM,
W69-06442 02A

CIVIL ENGINEERING AND URBAN SYSTEMS,
W69-06491 06A

SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE.
W69-06494 04A

SIMULATION OF AN AQUATIC ECOSYSTEM,
W69-06536 02H

HEC-3, RESERVIOR SYSTEM ANALYSIS.
W69-06788 04A

ON MULTILEVEL OPTIMIZATION IN GROUND WATER SYSTEMS,
W69-06813 02F

QUASILINEARIZATION APPROACH TO THE IDENTIFICATION OF HYDROLOGIC SYSTEMS,
W69-06822 02A

SYSTEMS APPROACH FOR INTEGRATING GROUND WATER AND SURFACE WATER USE.
W69-06834 06A

TACONITE MINING
EMINENT DOMAIN.
W69-06642 06E

TAILINGS
DESIGN AND CONSTRUCTION OF DAMS FOR RETENTION OF SOLID WASTES,
W69-06675 05G

TAXATION
CARNASION V PAUL (RIGHT OF A COUNTY TO TAX TIDELAND PROPERTY).
W69-06644 06E

TEMPERATURE
A TEMPERATURE PROFILE THROUGH THE MEIGHEN ICE CAP, ARCTIC CANADA,
W69-06482 02C

TEMPERATURE VOLUMETRIC CHANGES OF CONCRETE AT SUBZERO TEMPERATURES,
W69-06672 08F

TENNESSEE
STREAM POLLUTION CONTROL IN THE UPPER CUMBERLAND RIVER BASIN 1965.
W69-06488 05G

DISTRIBUTION OF RADIONUCLIDES IN BOTTOM SEDIMENT OF THE CLINCH RIVER, EASTERN TENNESSEE,
W69-06785 05B

TERTIARY TREATMENT
RECLAIMED WASTE WATER IN LAS VEGAS VALLEY,
W69-06832 05D

TEST HOLES
RECORDS OF WELLS AND TEST HOLES IN THE NEVADA TEST SITE AND VICINITY,
W69-06820 02F

TEST PROCEDURES
TOWARDS STANDARDIZING THE ARTIFICIAL-POLLUTION TEST FOR HIGH VOLTAGE INSULATORS.
W69-06708 08C

TEST RESULTS
TOWARDS STANDARDIZING THE ARTIFICIAL-POLLUTION TEST FOR HIGH VOLTAGE INSULATORS.
W69-06708 08C

TEXAS
ARTIFICIAL RECHARGE TO THE EDWARDS LIMESTONE AQUIFER IN SOUTH TEXAS,
W69-06483 04B

THE POTENTIAL CONTRIBUTION OF DESALTING TO FUTURE WATER SUPPLY IN TEXAS.
W69-06558 03A

MANUAL OF PROCEDURES AND METHODS FOR CALCULATING COMPARATIVE COSTS OF MUNICIPAL WATER SUPPLY FROM SALINE AND CONVENTIONAL WATER SOURCES IN TEXAS,
W69-06559 03A

WATER-QUALITY RECORDS FOR THE HUBBARD CREEK WATERSHED, TEXAS, OCTOBER 1966-SEPTEMBER 1967,
W69-06786 02H

WATER FOR TEXAS,
W69-06790 06B

THERMAL EXPANSION
TEMPERATURE VOLUMETRIC CHANGES OF CONCRETE AT SUBZERO TEMPERATURES,
W69-06672 08F

THERMAL STRESS
THERMAL STRESS CONDITION OF EXPERIMENTAL LONG BLOCKS DURING CONSTRUCTION PERIOD OF THE BRATSK HYDROELECTRIC STATION DAM,
W69-06711 08F

THYRISTORS
SOME ASPECTS OF INSULATION CO-ORDINATION IN HVDC SYSTEMS,
W69-06707 08C

TIDAL EFFECTS
LEONARD V STATE HIGHWAY DEPT (ACQUISITION OF TITLE BY STATE THROUGH PERMANENT FLOODING OF LAND).
W69-06611 06E

TIDAL WATERS
BAILEY V DRISCOLL (IMPLIED LIMITATION ON GRANT OF SUBMERGED LAND).
W69-06618 06E

TIDELANDS
CARNASION V PAUL (RIGHT OF A COUNTY TO TAX TIDELAND PROPERTY).
W69-06644 06E

TILE DRAINAGE
PROCEEDINGS OF TILE DRAINAGE RESEARCH CONFERENCE,
W69-06795 04A

TILES
DRAINING AREA UNDERLAIN BY HIGHLY PERMEABLE SHALLOW SAND AQUIFER,
W69-06512 02G

TIME SERIES ANALYSIS
EFFECTS OF TRUNCATION ON DEPENDENCE IN HYDROLOGICAL TIME SERIES,
W69-06789 02A

TIME SERIES DATA
THE USE OF ERROR COMPONENTS MODELS IN COMBINING CROSS SECTION WITH TIME SERIES DATA,
W69-06552 06A

TOPOGRAPHY
ESTIMATION OF RAINFALL IN SPARSELY GAUGED AREAS,
W69-06773 02B

TORSIONAL VIBRATIONS
THEORETICAL AND EXPERIMENTAL INVESTIGATIONS OF THE VIBRATIONS OF THE ROTOR OF A FULL-SCALE-MODEL HYDROELECTRIC INSTALLATION,
W69-06698 08C

TRACERS
USE OF TRACER TECHNIQUE IN SOIL EROSION RESEARCH,
W69-06704 04D

TRACER METHOD FOR DETERMINING THE VELOCITY OF FLOW IN A CONFINED KARSTIC AQUIFER,
W69-06774 07B

TRANSDUCERS
MEASUREMENT OF ROTATING MACHINERY VIBRATION AND FACTORS AFFECTING INSTRUMENT ACCURACY,
W69-06702 07B

TRANSIENTS
PRESSURE TRANSIENTS IN HYDRAULIC PIPELINES,
W69-06700 08A

TRANSMISSION LINES
BROWN BOVERI DISTANCE PROTECTION SYSTEMS EMPLOYING CARRIER TRANSFER,
W69-06709 08C

DISTANCE PROTECTION OF HIGH-VOLTAGE LINES CONTAINING SERIES CAPACITORS,
W69-06710 08C

TRANSMISSION(ELECTRICAL)
A SWING RELAY FOR THE EAST-WEST INTERTIE,
W69-06687 08C

TRANSPIRATION
DYNAMIC SIMULATION MODEL OF THE TRANSPIRATION PROCESS,

W69-06504 02D

TRANSPIRATION OF DESERT PLANTS UNDER DIFFERENT ENVIRONMENTAL CONDITIONS,
W69-06526 02D

TRANSPIRATION CONTROL
THE HYDROLOGIC IMPORTANCE OF TRANSPIRATION CONTROL BY STOMATA,
W69-06520 02D

TRANSPIRATION REDUCTION BY SURFACE FILMS,
W69-06532 03F

TREND
SIMULTANEOUS TESTS FOR TREND AND SERIAL CORRELATIONS FOR GAUSSIAN MARKOV RESIDUALS,
W69-06569 06A

TREND SURFACE ANALYSIS
TREND SURFACE ANALYSIS OF SAND TRACER DISTRIBUTIONS ON A CARBONATE BEACH, BIMINI, BWI,
W69-06809 02L

TRIAXIAL COMPRESSION
BRITTLE ROCK FAILURE UNDER TRIAXIAL STRESS,
W69-06701 08E

TRIAXIAL SHEAR
BRITTLE ROCK FAILURE UNDER TRIAXIAL STRESS,
W69-06701 08E

TROPICAL CYCLONES
FREQUENCY AND AREAL DISTRIBUTIONS OF TROPICAL STORM RAINFALL, U.S. COASTAL REGION, GULF OF MEXICO,
W69-06797 02B

TROPICAL REGIONS
PREDICTION OF RAINSPLASH EROSION IN THE SEASONALLY WET TROPICS,
W69-06768 02J

TUCKER ACT
PONADELLAS V UNITED STATES (TEMPORARY TAKING OF PROPERTY FOR PUBLIC PURPOSE).
W69-06622 06E

TUG BOATS
SOUTHERN TRANSPORTATION CO V CITY OF NEW YORK (NEGLIGENCE OF BRIDGE OPERATOR AND TUG MASTER CAUSING BARGE COLLISION).
W69-06638 06E

TWO-STAGE LEAST SQUARES
SPECIFICATION ANALYSIS IN THE ESTIMATION OF PARAMETERS OF A SIMULTANEOUS EQUATION MODEL WITH AUTOREGRESSIVE RESIDUALS,
W69-06567 06A

UNDERGROUND CORROSION
INNOVATIONS AND THE FUTURE OF CATHODIC PROTECTION,
W69-06677 08A

UNDERGROUND POWERPLANTS
DETERMINATION OF STRESSES IN THE ARCH OF LARGE UNDERGROUND STRUCTURES, APPEARING AT THE TIME OF EXCAVATION OF THE CORE,
W69-06706 08E

UNDERGROUND STRUCTURES
DETERMINATION OF STRESSES IN THE ARCH OF LARGE UNDERGROUND STRUCTURES, APPEARING AT THE TIME OF EXCAVATION OF THE CORE,
W69-06706 08E

UNITED ARAB REPUBLIC
A COMPARATIVE STUDY OF HYDRAULIC CONDUCTIVITY IN THE ALLUVIAL SOILS OF EGYPT,
W69-06517 02F

UNITED NATIONS
THE ROLE OF THE INTERNATIONAL ATOMIC ENERGY AGENCY IN THE DEVELOPMENT, USE AND CONTROL OF WATER RESOURCES.
W69-06456 03A

UNITED STATES
KANSAS CITY LIFE INS CO V UNITED STATES (IMPAIRMENT OF LAND VALUE DUE TO DAM CONSTRUCTION).
W69-06623 06E

URBAN HYDROLOGY
AN ANALYSIS OF NATIONAL BASIC INFORMATION NEEDS IN URBAN HYDROLOGY,
W69-06770 04C

URBAN WATER USE
WATER RESOURCES AND THE URBAN ENVIRONMENT,
W69-06428 04C

URBANIZATION
WATER RESOURCES AND THE URBAN ENVIRONMENT,
W69-06428 04C

FLOOD INUNDATION AND EFFECTS OF URBANIZATION IN METROPOLITAN CHARLOTTE, NORTH CAROLINA,
W69-06445 04C

CIVIL ENGINEERING AND URBAN SYSTEMS,
W69-06491 06A

FORECASTING URBAN WATER DEMANDS IN DEVELOPING COUNTRIES,
W69-06727 06D

WATER POLLUTION CONTROL,
W69-06731 05G

AN ANALYSIS OF NATIONAL BASIC INFORMATION NEEDS IN URBAN HYDROLOGY,
W69-06770 04C

USSR
THEORY OF SOIL MOISTURE - VOL 1, MOISTURE PROPERTIES OF SOILS AND MOVEMENT OF SOIL MOISTURE,
W69-06489 02G

DYNAMICS OF CHANNEL FLOW,
W69-06835 02E

UTAH
EXTENSIONS OF STREAMFLOW RECORDS IN UTAH,
W69-06447 02E

VALUE
COST, PRECISION, AND VALUE RELATIONSHIPS OF DATA COLLECTION AND DESIGN ACTIVITIES IN WATER DEVELOPMENT PLANNING,
W69-06733 06B

VEGETATION
POTENTIAL OF RADAR REMOTE SENSORS AS TOOLS IN RECONNAISSANCE GEOMORPHIC, VEGETATION AND SOIL MAPPING,
W69-06718 07B

VERMONT
GROUND WATER FAVORABILITY MAP OF THE OTTAUQUECHEE-SAXTONS RIVER BASIN, VERMONT,
W69-06463 02F

GROUND WATER FAVORABILITY MAP OF THE WEST-DEERFIELD RIVER BASIN, VERMONT,
W69-06464 02F

GROUND WATER FAVORABILITY MAP OF THE WELLS-OMPOMPANOOSUC RIVER BASIN, VERMONT,
W69-06465 02F

GROUND WATER FAVORABILITY MAP OF THE WHITE RIVER BASIN, VERMONT,
W69-06466 02F

VIBRATIONS
THEORETICAL AND EXPERIMENTAL INVESTIGATIONS OF THE VIBRATIONS OF THE ROTOR OF A FULL-SCALE-MODEL HYDROELECTRIC INSTALLATION,
W69-06698 08C

MEASUREMENT OF ROTATING MACHINERY VIBRATION AND FACTORS AFFECTING INSTRUMENT ACCURACY,
W69-06702 07B

VIRGINIA
CITY OF PORTSMOUTH V CULPEPPER (SUIT FOR DAMAGES RESULTING FROM OVERFLOW OF OBSTRUCTED CANAL).
W69-06602 06E

CHESAPEAKE BAY CASE STUDY.
W69-06794 06B

VOLUME CHANGE
TEMPERATURE VOLUMETRIC CHANGES OF CONCRETE AT SUBZERO TEMPERATURES,
W69-06672 08F

VON BERTALANFFY CURVES
A REVIEW OF THE LIFESPANS AND MORTALITY RATES OF FISH IN NATURE, AND THEIR RELATION TO GROWTH AND OTHER PHYSIOLOGICAL CHARACTERISTICS,
W69-06533 05C

WASHINGTON
FLOOD PLAIN INFORMATION, WALLA WALLA RIVER TRIBUTARIES IN THE VICINITY OF WALLA WALLA, WASHINGTON.
W69-06469 04A

FLOOD PLAIN INFORMATION, YAKIMA RIVER, BENTON COUNTY, WASHINGTON.
W69-06470 04A

WASTE DISPOSAL
ROLE OF GROUND WATER CONTAMINATION IN WATER MANAGMENT,
W69-06762 05G

WASTE TREATMENT
WATER SUPPLY AND WASTEWATER TREATMENT PROBLEMS OF INDUSTRIAL AND TRADE ENTERPRISES,
W69-06723 05D

22 ND INDUSTRIAL WASTE CONFERENCE, 1967, PART ONE,
W69-06821 05D

WATER ALLOCATION(POLICY)
CONFERENCE ON WATER DECISIONS IN THE CRITICAL 1960'S,
W69-06572 06B

THE COMPETITION FOR WATER QUANTITY AGRICULTURE,
W69-06575 06D

THE COMPETITION FOR WATER QUANTITY INDUSTRY,
W69-06577 06D

ALLOCATION AND REALLOCATION OF WATER RESOURCES,
W69-06691 06B

WATER BALANCE
PRINCIPLES OF CHOOSING EXPERIMENTAL PLOTS FOR WATER BALANCE STUDIES IN IRRIGATION REGIONS OF THE ARID ZONE,
W69-06523 02G

THE GENERAL WATER SCHEME - AN ESSENTIAL BASIS FOR THE MOST RATIONAL USE OF WATER RESOURCES,
W69-06724 06B

WATER CHEMISTRY
FACTORS INFLUENCING THE CONDENSATION OF 4-AMINOANTIPYRINE WITH DERIVATIVES OF HYDROXYBENZENE-III. A STUDY OF PHENOL CONTENT IN SURFACE WATERS,
W69-06444 05A

GEOCHEMICAL TRACING OF MINERAL WATER SOURCES IN THE SOUTH WESTERN DEAD SEA BASIN, ISRAEL,
W69-06747 02F

GEOCHEMICAL TRACING OF MINERAL AND FRESH WATER SOURCES IN THE LAKE TIBERIAS BASIN, ISRAEL,
W69-06748 02F

WATER CIRCULATION
HYDROLOGIC CICLE AS A CLOSED SYSTEM,
W69-06442 02A

SOME DETAILS ON THE CIRCULATION OF GROUNDWATER IN NON-KARSTIFIED FISSURED FORMATIONS IN CZECHOSLOVAKIA (FRENCH),
W69-06485 02F

WATER CONSERVATION
IRRIGATION WATER SYSTEM--ISRAEL'S NATIONAL WATER GRID,
W69-06459 03F

WATER COST
THE STATUS OF SEA WATER CONVERSION,
W69-06583 03A

WATER COSTS
DESALTED SEAWATER FOR AGRICULTURE IS IT ECONOMIC,
W69-06765 03F

WATER DEMAND
THE IMPACT OF PRICE ON RESIDENTIAL WATER DEMAND AND ITS RELATION TO SYSTEM DESIGN AND PRICE STRUCTURE,
W69-06502 06D

THE COMPETITION FOR WATER QUANTITY,
W69-06574 06D

FORECASTING URBAN WATER DEMANDS IN DEVELOPING COUNTRIES,
W69-06727 06D

WATER DISTRIBUTION(APPLIED)
OPERATION OF MULTI-UNIT MULTI-PURPOSE WATER DEVELOPMENT SYSTEMS,
W69-06862 06D

USE OF DIGITAL COMPUTERS IN DISTRIBUTION SYSTEM ANALYSES,
W69-06503 07C

WATER DISTRICTS
WATER SUPPLY DISTRICTS.
W69-06630 06E

WATER EQUIVALENT
A UNIVERSAL SURFACE PRECIPITATION GAGE,
W69-06804 02B

WATER HAMMER
PRESSURE TRANSIENTS IN HYDRAULIC PIPELINES,
W69-06700 08A

WATER HARVESTING
A PRELIMINARY FIELD STUDY OF SURFACE TREATMENTS FOR RUNOFF INDUCEMENT IN THE NEGEV OF ISRAEL,
W69-06715 02A

WATER LAW
WATER LAWS AND CONCEPTS,
W69-06683 08E

WATER MANAGEMENT
THE GENERAL WATER SCHEME - AN ESSENTIAL BASIS FOR THE MOST RATIONAL USE OF WATER RESOURCES,
W69-06724 06B

SOME POSSIBLE ROLES FOR INSTITUTIONS AND ECONOMICS IN WATER RESOURCE MANAGEMENT,
W69-06725 06B

WATER MANAGEMENT(APPLIED)
SIGNIFICANCE OF GROUNDWATER MANAGEMENT STRATEGY-A SYSTEMS APPROACH,
W69-06424 06A

WATER RESOURCES AND THE URBAN ENVIRONMENT,
W69-06428 04C

MODERN IRRIGATION FOR INCREASED AGRICULTURAL PRODUCTION,
W69-06454 03F

IRRIGATION WATER SYSTEM--ISRAEL'S NATIONAL WATER GRID,
W69-06459 03F

SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE.
W69-06494 04A

WATER QUALITY MANAGEMENT ENGINEERING-ECONOMIC FACTORS IN MUNICIPAL WASTE DISPOSAL,
W69-06505 05D

THE COMPETITION FOR WATER QUANTITY INDUSTRY,
W69-06577 06D

WATER RESOURCES DEVELOPMENT BY THE US ARMY CORPS OF ENGINEERS IN COLORADO.
W69-06782 09D

WATER RESOURCES DEVELOPMENT BY THE US ARMY CORPS OF ENGINEERS IN DELAWARE.
W69-06783 09D

WATER RESOURCES DEVELOPMENT IN MINNESOTA.
W69-06784 09D

WATER POLICY
CONFERENCE ON WATER DECISIONS IN THE CRITICAL 1960'S,
W69-06572 06B

ROLE OF GROUND WATER CONTAMINATION IN WATER MANAGMENT,
W69-06762 05G

CHESAPEAKE BAY CASE STUDY.
W69-06794 06B

WATER POLLUTION
EFFECTS OF MINE DRAINAGE ON GROUND WATER,
W69-06425 05C

MICROBIAL PROBLEMS IN GROUNDWATER,
W69-06426 05C

ROLE OF GROUND WATER CONTAMINATION IN WATER MANAGMENT,
W69-06762 05G

POLLUTION OF THE INTERSTATE WATERS OF THE BLACKSTONE AND TEN MILE RIVERS AND THEIR TRIBUTARIES,
W69-06802 05B

WATER POLLUTION CONTROL
STREAM POLLUTION CONTROL IN THE UPPER CUMBERLAND RIVER BASIN 1965.
W69-06488 05G

ECONOMIC FRAMEWORK FOR SALINITY CONTROL PROJECTS,
W69-06490 05D

SEWERAGE DISTRICTS AND BOARDS.
W69-06632 05G

WATER POLLUTION CONTROL,
W69-06731 05G

POLLUTION OF THE INTERSTATE WATERS OF THE BLACKSTONE AND TEN MILE RIVERS AND THEIR TRIBUTARIES,
W69-06802 05B

WATER POLLUTION TREATMENT
STREAM POLLUTION CONTROL IN THE UPPER CUMBERLAND RIVER BASIN 1965.
W69-06488 05G

OIL AND HAZARDOUS MATERIALS-EMERGENCY PROCEDURES IN THE WATER ENVIRONMENT.
W69-06791 05G

POLLUTION OF THE INTERSTATE WATERS OF THE BLACKSTONE AND TEN MILE RIVERS AND THEIR TRIBUTARIES,
W69-06802 05B

WATER POTENTIAL
A METHOD OF DETERMINING THE WATER POTENTIAL OF INTACT PLANTS,
W69-06527 02I

WATER PROPERTIES
ECONOMIC EFFECTS OF MINERAL CONTENT IN MUNICIPAL WATER SUPPLIES.
W69-06555 03A

WATER QUALITY
THE IMPROVEMENT OF WATER QUALITY UNDER A FINANCIAL CONSTRAINT A COMMENTARY ON 'LINEAR PROGRAMMING APPLIED TO WATER QUALITY MANAGEMENT',
W69-06547 05F

SOME POSSIBLE ROLES FOR INSTITUTIONS AND ECONOMICS IN WATER RESOURCE MANAGEMENT,
W69-06725 06B

WATER-QUALITY RECORDS FOR THE HUBBARD CREEK WATERSHED, TEXAS, OCTOBER 1966-SEPTEMBER 1967,
W69-06786 02H

CHESAPEAKE BAY CASE STUDY.
W69-06794 06B

WATER QUALITY CONTROL
WATER QUALITY MANAGEMENT IN IRRIGATION SYSTEMS,
W69-06499 05G

STOCHASTIC MODEL FOR BOD AND DO IN STREAMS,
W69-06500 05B

WATER QUALITY MANAGEMENT ENGINEERING-ECONOMIC FACTORS IN MUNICIPAL WASTE DISPOSAL,
W69-06505 05D

WATER QUALITY MANAGEMENT
THE IMPROVEMENT OF WATER QUALITY UNDER A FINANCIAL CONSTRAINT A COMMENTARY ON 'LINEAR PROGRAMMING APPLIED TO WATER QUALITY MANAGEMENT',
W69-06547 05F

WATER RESOURCE DEPENDENCIES
INTERREGIONAL PRODUCTION AND WATER RESOURCE DEPENDENCIES AMONG THE WESTERN STATES,
W69-06721 06B

WATER RESOURCE DEVELOPMENT
LEGAL ALTERNATIVES,
W69-06579 06E

THE LEGISLATIVE POINT OF VIEW,
W69-06580 06E

WATER RESOURCES
WATER-RESOURCES APPRAISAL OF THE LOWER MOAPA-LAKE MEAD AREA, CLARK COUNTY, NEVADA,
W69-06435 02F

SUMMARY OF GROUND-WATER RESOURCES OF ATLANTIC COUNTY, NEW JERSEY,
W69-06448 02F

GEOLOGY AND GROUND-WATER RESOURCES OF BURLINGTON COUNTY, NEW JERSEY,
W69-06449 02F

GEOLOGY AND GROUND-WATER RESOURCES OF THE RAHWAY AREA, NEW JERSEY,
W69-06450 02F

WATER AVAILABILITY, CONECUH COUNTY, ALABAMA,
W69-06451 02E

WATER AVAILABILITY, COFFEE COUNTY, ALABAMA,
W69-06452 02F

GROUND WATER FAVORABILITY MAP OF THE OTTAUQUECHEE-SAXTONS RIVER BASIN, VERMONT,
W69-06463 02F

GROUND WATER FAVORABILITY MAP OF THE WEST-DEERFIELD RIVER BASIN, VERMONT,
W69-06464 02F

GROUND WATER FAVORABILITY MAP OF THE WELLS-OMPOMPANOOSUC RIVER BASIN, VERMONT,
W69-06465 02F

GROUND WATER FAVORABILITY MAP OF THE WHITE RIVER BASIN, VERMONT,
W69-06466 02F

GEOLOGY AND HYDROLOGY OF CLAY COUNTY SOUTH DAKOTA-PART 1, GEOLOGY, AND PART 2, WATER RESOURCES,
W69-06486 02F

PERMUTED TITLE INDEX TO WATER RESEARCH JOURNALS, 1967.
W69-06539 10

CONSERVATION'S CHALLENGE TO STATE GOVERNMENTS,
W69-06586 06E

ALLOCATION AND REALLOCATION OF WATER RESOURCES,
W69-06691 06B

THE GENERAL WATER SCHEME - AN ESSENTIAL BASIS FOR THE MOST RATIONAL USE OF WATER RESOURCES,
W69-06724 06B

CHOOSING AMONG ALTERNATIVE PUBLIC INVESTMENTS IN THE WATER RESOURCE FIELD,
W69-06740 06B

WATER RESOURCES DEVELOPMENT IN MINNESOTA.
W69-06784 09D

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF PIKE COUNTY, ALABAMA,
W69-06815 02F

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF HENRY COUNTY, ALABAMA,
W69-06816 02F

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF CRENSHAW COUNTY, ALABAMA,
W69-06817 02F

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF DALE COUNTY, ALABAMA,
W69-06818 02F

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF COVINGTON COUNTY, ALABAMA,
W69-06819 02F

SYSTEMS APPROACH FOR INTEGRATING GROUND WATER AND SURFACE WATER USE.
W69-06834 06A

WATER RESOURCES COUNCIL
INTERGOVERNMENTAL PLANNING OF WATER RESOURCES,
W69-06429 06B

WATER RESOURCES DEVELOPMENT
A SIMPLIFIED TECHNIQUE FOR WELL-FIELD DESIGN,
W69-06421 02F

WATER RESOURCES AND THE URBAN ENVIRONMENT,
W69-06428 04C

INTERGOVERNMENTAL PLANNING OF WATER RESOURCES,
W69-06429 06B

RURAL WATER DEVELOPMENT IN KENYA,
W69-06453 04A

THE ROLE OF THE INTERNATIONAL ATOMIC ENERGY AGENCY IN THE DEVELOPMENT, USE AND CONTROL OF WATER RESOURCES.
W69-06456 03A

AGRICULTURE USE OF WATER IN TAIWAN, REPUBLIC OF CHINA,
W69-06460 03F

OPERATION OF MULTI-UNIT MULTI-PURPOSE WATER DEVELOPMENT SYSTEMS,
W69-06462 06D

SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE.
W69-06494 04A

ALLOCATION AND REALLOCATION OF WATER RESOURCES,
W69-06691 06B

PLANNING AND DEVELOPMENT OF WATER RESOURCES IN INDIA,
W69-06728 06B

KANSAS RIVER BASIN FLOOD CONTROL,
W69-06729 06B

WATER RESOURCES DEVELOPMENT BY THE US ARMY CORPS OF ENGINEERS IN COLORADO.
W69-06782 09D

WATER RESOURCES DEVELOPMENT BY THE US ARMY CORPS OF ENGINEERS IN DELAWARE.
W69-06783 09D

WATER FOR TEXAS,
W69-06790 06B

WATER RESOURCES PLANNING
REGIONAL PLANNING FOR WATER DEVELOPMENT IN THE WESTERN UNITED STATES - THE RELEVANCE OF AMERICAN EXPERIENCE FOR OTHER NATIONS,
W69-06726 06B

WATER REUSE
22 ND INDUSTRIAL WASTE CONFERENCE, 1967, PART ONE,
W69-06821 05D

RECLAIMED WASTE WATER IN LAS VEGAS VALLEY,
W69-06832 05D

WATER RIGHTS
WATER LAWS AND CONCEPTS,
W69-06683 08E

WATER SHORTAGE
DROUGHT IN THE NORTHEASTERN UNITED STATES,
W69-06436 02B

EFFECTS OF THE DROUGHT ON WATER RESOURCES-SURFACE AND SUBSURFACE HYDROLOGY,
W69-06440 02B

WATER SUPPLY
ANALOG OF GROUND WATER IN EAST-CENTRAL NEW MEXICO,
W69-06509 02F

THE COMPETITION FOR WATER QUANTITY INDUSTRY,
W69-06577 06D

FIRES.
W69-06598 06E

WATER SUPPLY DISTRICTS.
W69-06630 06E

WATER SUPPLY AND WASTEWATER TREATMENT PROBLEMS OF INDUSTRIAL AND TRADE ENTERPRISES,
W69-06723 05D

REGIONAL PLANNING FOR WATER DEVELOPMENT IN THE WESTERN UNITED STATES - THE RELEVANCE OF AMERICAN EXPERIENCE FOR OTHER NATIONS,
W69-06726 06B

ROLE OF GROUND WATER CONTAMINATION IN WATER MANAGMENT,
W69-06762 05G

SYSTEMS APPROACH FOR INTEGRATING GROUND WATER AND SURFACE WATER USE.
W69-06834 06A

WATER SURFACE PROFILES
HEC-2, WATER SURFACE PROFILES.
W69-06787 04A

WATER TABLE
THE HYDROLOGIC AND GEOLOGIC ASPECTS OF A PERCHING LAYER - SAN JOAQUIN VALLEY, WESTERN FRESNO COUNTY, CALIFORNIA,
W69-06758 02F

WATER TRANSPORTATION
WATER TRANSPORTATION-IMPACT ON ECONOMIC DEVELOPMENT,
W69-06730 06B

WATER UTILIZATION
ESTIMATED WATER USE IN NEVADA, 1950-65,
W69-06446 06D

EFFICIENT WHEAT IRRIGATION WITH LIMITED WATER,

W69-06511 03F

WATER USE BY IRRIGATED COTTON IN SUDAN. II. NET RADIATION AND SOIL HEAT FLUX,
W69-06756 03F

CHESAPEAKE BAY CASE STUDY.
W69-06794 06B

SYSTEMS APPROACH FOR INTEGRATING GROUND WATER AND SURFACE WATER USE.
W69-06834 06A

WATER WELLS
A DESIGN METHOD FOR DEEP WELL DEWATERING INSTALLATIONS,
W69-06430 02F

GEOLOGY, DESIGN, AND CONSTRUCTION OF DEEP WELLS IN SEDIMENTARY FOUNDATIONS,
W69-06759 02F

A RIGID PLATE MODEL OF THE BAROMETRIC EFFECT,
W69-06775 02F

WATER YIELD
SUMMARY OF GROUND-WATER RESOURCES OF ATLANTIC COUNTY, NEW JERSEY,
W69-06448 02F

GEOLOGY AND GROUND-WATER RESOURCES OF THE RAHWAY AREA, NEW JERSEY,
W69-06450 02F

GROUND WATER FAVORABILITY MAP OF THE OTTAUQUECHEE-SAXTONS RIVER BASIN, VERMONT,
W69-06463 02F

GROUND WATER FAVORABILITY MAP OF THE WEST-DEERFIELD RIVER BASIN, VERMONT,
W69-06464 02F

GROUND WATER FAVORABILITY MAP OF THE WELLS-OMPOMPANOOSUC RIVER BASIN, VERMONT,
W69-06465 02F

GROUND WATER FAVORABILITY MAP OF THE WHITE RIVER BASIN, VERMONT,
W69-06466 02F

WATER YIELD IMPROVEMENT
THE HYDROLOGIC IMPORTANCE OF TRANSPIRATION CONTROL BY STOMATA,
W69-06520 02D

A PRELIMINARY FIELD STUDY OF SURFACE TREATMENTS FOR RUNOFF INDUCEMENT IN THE NEGEV OF ISRAEL,
W69-06715 02A

WATERWORKS
WHITE OAK BOROUGH AUTH V PENN PUB U COMM'N (AQUISITION OF PUBLIC WATER FACILITIES).
W69-06601 06E

WEATHER DATA
EVALUATION OF SOME PRACTICAL METHODS OF ESTIMATING EVAPOTRANSPIRATION IN ARID CLIMATES AT LOW LATITUDES,
W69-06530 02D

WEATHER MODIFICATION
ON THE DISTRIBUTION OF STATISTICS SUITABLE FOR EVALUATING RAINFALL STIMULATION EXPERIMENTS,
W69-06679 03B

REGIONAL HYDROLOGIC AREA STUDY AS AN ANALYSIS TOOL IN WEATHER MODIFICATION,
W69-06805 02A

WELFARE(ECONOMICS)
PUBLIC UTILITY PRICING AND OUTPUT UNDER RISK,
W69-06549 06C

WELL SPACING
A SIMPLIFIED TECHNIQUE FOR WELL-FIELD DESIGN,
W69-06421 02F

WELLS
STABILIZATION OF UNDISTURBED QUICK CLAY BY SALT WELLS,
W69-06719 08D

GEOLOGY, DESIGN, AND CONSTRUCTION OF DEEP WELLS IN SEDIMENTARY FOUNDATIONS,
W69-06759 02F

EFFECT OF SUBSIDENCE ON WELL FIELDS,
W69-06763 04B

RECORDS OF WELLS AND TEST HOLES IN THE NEVADA TEST SITE AND VICINITY,
W69-06820 02F

WELL-FIELD DESIGN
A SIMPLIFIED TECHNIQUE FOR WELL-FIELD DESIGN,
W69-06421 02F

WEST VIRGINIA
FLOOD WALL BOARD.
W69-06647 06E

WESTERN STATES
INTERREGIONAL PRODUCTION AND WATER RESOURCE DEPENDENCIES AMONG THE WESTERN STATES,
W69-06721 06B

WESTERN UNITED STATES
REGIONAL PLANNING FOR WATER DEVELOPMENT IN THE WESTERN UNITED STATES - THE RELEVANCE OF AMERICAN EXPERIENCE FOR OTHER NATIONS,
W69-06726 06B

WHEAT
EFFICIENT WHEAT IRRIGATION WITH LIMITED WATER,
W69-06511 03F

WILDLIFE
JURISDICTION OVER WATERS.
W69-06634 06E

WILTING POINT
TENSION OF THE SOIL WATER WHEN PERMANENT WILTING OCCURS, AS MEASURED BY THE GRAY HYDROCAL HYGROMETER METHOD,
W69-06516 02G

WISCONSIN
PRECIPITATION AND BASE FLOW VARIABILITY,
W69-06443 02B

ZOMBKOWSKI V WISCONSIN RIVER POWER CO (FLOODING DAMAGES CAUSED BY DAM CONSTRUCTION).
W69-06603 06E

SKALITSKY V CONSOL BADGER CO-OPERATIVE (OWNERSHIP OF FILLED POND BED).
W69-06650 06E

WITHDRAWAL
ANALOG OF GROUND WATER IN EAST-CENTRAL NEW MEXICO,
W69-06509 02F

WORLD HEALTH ORGANIZATION
WATER POLLUTION CONTROL,
W69-06731 05G

YAQUINA RIVER
SOME POSSIBLE ROLES FOR INSTITUTIONS AND ECONOMICS IN WATER RESOURCE MANAGEMENT,
W69-06725 06B

YUGOSLAVIA
A CONTRIBUTION TO THE STUDY OF GROUNDWATER INTAKE RECHARGE IN KARST,
W69-06484 02F

AUTHOR INDEX

ABD EL RAHMAN, A. A.
TRANSPIRATION OF DESERT PLANTS UNDER DIFFERENT ENVIRONMENTAL CONDITIONS,
W69-06526 02D

AHUJA, P. R.
BENEFICIAL USES OF WATERS OF INTERNATIONAL RIVERS INTERNATIONAL LAW AND PRACTICE,
W69-06458 06E

ALEXANDER, LYLE T.
DESALTED SEAWATER FOR AGRICULTURE IS IT ECONOMIC,
W69-06765 03F

ALLEN, R. R.
DRAINING AREA UNDERLAIN BY HIGHLY PERMEABLE SHALLOW SAND AQUIFER,
W69-06512 02G

ALLISON, STEPHEN V.
COST, PRECISION, AND VALUE RELATIONSHIPS OF DATA COLLECTION AND DESIGN ACTIVITIES IN WATER DEVELOPMENT PLANNING,
W69-06733 06B

AMBROGGI, ROBERT
ARTIFICIAL RECHARGE OF A FISSURED SANDSTONE AQUIFER, TANGIERS, MOROCCO (FRENCH),
W69-06487 04B

AMEMIYA, TAKESHI
SPECIFICATION ANALYSIS IN THE ESTIMATION OF PARAMETERS OF A SIMULTANEOUS EQUATION MODEL WITH AUTOREGRESSIVE RESIDUALS,
W69-06567 06A

ANAND, D. B.
A CENTURY OF DESIGN AND CONSTRUCTION OF IRRIGATION WORKS IN INDIA,
W69-06461 04A

ANDERSON, HENRY R.
GEOLOGY AND GROUND-WATER RESOURCES OF THE RAHWAY AREA, NEW JERSEY,
W69-06450 02F

ANDERSON, PETER W.
FACTORS INFLUENCING THE CONDENSATION OF 4-AMINOANTIPYRINE WITH DERIVATIVES OF HYDROXYBENZENE-III. A STUDY OF PHENOL CONTENT IN SURFACE WATERS,
W69-06444 05A

ANGUS, D. E.
TRANSPIRATION REDUCTION BY SURFACE FILMS,
W69-06532 03F

ARMSTRONG, DAVID L.
WATER TRANSPORTATION-IMPACT ON ECONOMIC DEVELOPMENT,
W69-06730 06B

ARRIEL, M.
OPTIMIZATION THEORY APPLIED TO PRELIMINARY DESIGN OF A SINGLE EFFECT MULTISTAGE FLASH DESALINATION PLANT,
W69-06495 03A

AVRETT, J. R.
WATER AVAILABILITY, CONECUH COUNTY, ALABAMA,
W69-06451 02E

WATER AVAILABILITY, COFFEE COUNTY, ALABAMA,
W69-06452 02F

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF PIKE COUNTY, ALABAMA,
W69-06815 02F

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF HENRY COUNTY, ALABAMA,
W69-06816 02F

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF CRENSHAW COUNTY, ALABAMA,
W69-06817 02F

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF DALE COUNTY, ALABAMA,
W69-06818 02F

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF COVINGTON COUNTY, ALABAMA,
W69-06819 02F

BAIER, W.
THE PERFORMANCE OF SOIL MOISTURE ESTIMATES AS COMPARED WITH THE DIRECT USE OF CLIMATOLOGICAL DATA FOR ESTIMATING CROP YIELDS,
W69-06519 02G

BAILEY, JOHN J.
USE OF DIGITAL COMPUTERS IN DISTRIBUTION SYSTEM ANALYSES,
W69-06503 07C

BAIRD, R. W.
GRADED FURROWS FOR WATER EROSION CONTROL,
W69-06746 02J

BALASUBRAMANIAM, S.
A CENTURY OF DESIGN AND CONSTRUCTION OF IRRIGATION WORKS IN INDIA,
W69-06461 04A

BAPTIST, JOHN V.
ELECTRICAL FEATURES OF THE GRAND COULEE THIRD POWER PLANT,
W69-06684 08C

BARKSDALE, HENRY C.
EFFECTS OF THE DROUGHT ON WATER RESOURCES-SURFACE AND SUBSURFACE HYDROLOGY,
W69-06440 02B

BARRETT, R.
RURAL WATER DEVELOPMENT IN KENYA,
W69-06453 04A

BARRY, R. G.
CLIMATOLOGY STUDIES OF BAFFIN ISLAND, NORTHWEST TERRITORIES,
W69-06814 02B

BATANOUNY, K. H.
TRANSPIRATION OF DESERT PLANTS UNDER DIFFERENT ENVIRONMENTAL CONDITIONS,
W69-06526 02D

BEAMER, J. H.
OPTIMIZATION THEORY APPLIED TO PRELIMINARY DESIGN OF A SINGLE EFFECT MULTISTAGE FLASH DESALINATION PLANT,
W69-06495 03A

BEASLEY, T. M.
NICKEL-63 IN MARINE AND TERRESTRIAL BIOTA, SOIL, AND SEDIMENT,
W69-06766 05A

BEAVER, J. A.
SIGNIFICANCE OF GROUNDWATER MANAGEMENT STRATEGY-A SYSTEMS APPROACH,
W69-06424 06A

BECK, J. E.
RESPONSE OF BUBBLE-GAGE SERVOMANOMETERS TO OSCILLATIONS IN WATER LEVEL,
W69-06434 07C

BELINSKII, A. S.
THEORETICAL AND EXPERIMENTAL INVESTIGATIONS OF THE VIBRATIONS OF THE ROTOR OF A FULL-SCALE-MODEL HYDROELECTRIC INSTALLATION,
W69-06698 08C

BELL, F. C.
IMPROVED TECHNIQUES FOR ESTIMATING RUNOFF WITH BRIEF RECORDS,
W69-06830 02E

BERGSTROM, A. R.
NONRECURSIVE MODELS AS DISCRETE APPROXIMATIONS TO SYSTEMS OF STOCHASTIC DIFFERENTIAL EQUATIONS,
W69-06571 06A

BERRY, DONALD S.
CIVIL ENGINEERING AND URBAN SYSTEMS,
W69-06491 06A

BERRY, L. M.
500-KV AC SUBSTATION DESIGN CRITERIA--SUMMARY OF INDUSTRY PRACTICES,
W69-06686 08C

BEVERTON, R. J. H.
A REVIEW OF THE LIFESPANS AND MORTALITY RATES OF FISH IN NATURE, AND THEIR RELATION TO GROWTH AND OTHER PHYSIOLOGICAL CHARACTERISTICS,
W69-06533 05C

BHUIYA, REZAUL K.
EFFECTS OF TRUNCATION ON DEPENDENCE IN HYDROLOGICAL TIME SERIES,
W69-06789 02A

BIANCHI, W. C.
THE HYDROLOGIC AND GEOLOGIC ASPECTS OF A PERCHING LAYER - SAN JOAQUIN VALLEY, WESTERN FRESNO COUNTY, CALIFORNIA,
W69-06758 02F

BIELORAI, H.
TRANSPIRATION REDUCTION BY SURFACE FILMS,
W69-06532 03F

BIERWAG, G. O.
AGGREGATE KOYCK FUNCTIONS,
W69-06561 06B

BLAKELY, ROBERT F.
RANDOM PROCESSES AND LITHOLOGIC TRANSITIONS,
W69-06807 02J

BLANCHARD, R. R.
500-KV AC SUBSTATION DESIGN CRITERIA--SUMMARY OF INDUSTRY PRACTICES,
W69-06686 08C

BLOODGOOD, DON E.
22 ND INDUSTRIAL WASTE CONFERENCE, 1967, PART ONE,
W69-06821 05D

BOBCHENKO, V. E.

EXPERIENCE IN ACCELERATED IRREVERSIBLE DESALINIZATION OF SOILS IN GOLODNAYA STEPPE,
W69-06716 03F

BOEHNE, E. W.
SHUNT CAPACITOR ENERGIZATION WITH VACUUM INTERRUPTERS--A POSSIBLE SOURCE OF OVERVOLTAGE,
W69-06689 08C

BOERSMA, L.
DYNAMIC SIMULATION MODEL OF THE TRANSPIRATION PROCESS,
W69-06504 02D

BOON, JOHN D., III.
TREND SURFACE ANALYSIS OF SAND TRACER DISTRIBUTIONS ON A CARBONATE BEACH, BIMINI, BWI,
W69-06809 02L

BOTTORFF, ALLEN
THE COMPETITION FOR WATER QUANTITY AGRICULTURE,
W69-06575 06D

BOUYOUCOS, GEORGE J.
TENSION OF THE SOIL WATER WHEN PERMANENT WILTING OCCURS, AS MEASURED BY THE GRAY HYDROCAL HYGROMETER METHOD,
W69-06516 02G

BRILLINGER, DAVID R.
AN HARMONIC ANALYSIS OF NONSTATIONARY MULTIVARIATE ECONOMIC PROCESSES,
W69-06553 06A

BROWER, DAVID R.
COMMENTS ON THE COMPETITION FOR WATER QUALITY AGRICULTURE,
W69-06576 06D

BROWN, GARDNER
PUBLIC UTILITY PRICING AND OUTPUT UNDER RISK,
W69-06549 06C

BRUINGTON, A. E.
CONTROL OF SEA-WATER INTRUSION IN A GROUND-WATER AQUIFER,
W69-06422 02F

BRUTSAERT, WILFRIED
EVALUATION OF SOME PRACTICAL METHODS OF ESTIMATING EVAPOTRANSPIRATION IN ARID CLIMATES AT LOW LATITUDES,
W69-06530 02D

BRYANT, EDWARD A.
FORECASTING URBAN WATER DEMANDS IN DEVELOPING COUNTRIES,
W69-06727 06D

BUGOV, A. U.
THEORETICAL AND EXPERIMENTAL INVESTIGATIONS OF THE VIBRATIONS OF THE ROTOR OF A FULL-SCALE-MODEL HYDROELECTRIC INSTALLATION,
W69-06698 08C

BUKHARI, S. A.
ITERATIVE ANALYSIS BOUNDED LEAKY ARTESIAN AQUIFER,
W69-06508 02F

BURKE, HARRIS H.
DESIGN AND CONSTRUCTION OF DAMS FOR RETENTION OF SOLID WASTES,
W69-06675 05G

BUTCHER, WILLIAM S.
QUASILINEARIZATION APPROACH TO THE IDENTIFICATION OF HYDROLOGIC SYSTEMS,
W69-06822 02A

BUTTERFIELD, DAVID
GROUND WATER FAVORABILITY MAP OF THE OTTAUQUECHEE-SAXTONS RIVER BASIN, VERMONT,
W69-06463 02F

GROUND WATER FAVORABILITY MAP OF THE WEST-DEERFIELD RIVER BASIN, VERMONT,
W69-06464 02F

GROUND WATER FAVORABILITY MAP OF THE WELLS-OMPOMPANOOSUC RIVER BASIN, VERMONT,
W69-06465 02F

GROUND WATER FAVORABILITY MAP OF THE WHITE RIVER BASIN, VERMONT,
W69-06466 02F

CALANDRO, ANTHONY J.
RAINFALL-RUNOFF RELATIONS FOR SOUTHEASTERN LOUISIANA AND SOUTHWESTERN MISSISSIPPI,
W69-06829 02A

CARROON, L. E.
EXTENSIONS OF STREAMFLOW RECORDS IN UTAH,
W69-06447 02E

CHEN-HSING, LIU
ON THE ESTIMATION OF EVAPORATION FROM A LAND SURFACE,
W69-06833 02D

CHETYRKIN, M. S.
DETERMINATION OF STRESSES IN THE ARCH OF LARGE UNDERGROUND STRUCTURES, APPEARING AT THE TIME OF EXCAVATION OF THE CORE,
W69-06706 08E

CHILDERS, RALPH E.
MANUAL OF PROCEDURES AND METHODS FOR CALCULATING COMPARATIVE COSTS OF MUNICIPAL WATER SUPPLY FROM SALINE AND CONVENTIONAL WATER SOURCES IN TEXAS,
W69-06559 03A

CHRISTENSEN, CLEO M.
GEOLOGY AND HYDROLOGY OF CLAY COUNTY SOUTH DAKOTA-PART 1, GEOLOGY, AND PART 2, WATER RESOURCES,
W69-06486 02F

CHRISTENSEN, J. J.
A FEASIBILITY STUDY ON THE UTILIZATION OF WASTE BRINE FROM SALINATION PLANTS PART 1,
W69-06556 03C

CHRISTIANSEN, JERALD E.
ESTIMATING PAN EVAPORATION AND EVAPOTRANSPIRATION FROM CLIMATIC DATA,
W69-06522 02D

CLARK, GLENN A.
SUMMARY OF GROUND-WATER RESOURCES OF ATLANTIC COUNTY, NEW JERSEY,
W69-06448 02F

CLASSEN, G.
RURAL WATER DEVELOPMENT IN KENYA,
W69-06453 04A

CLAWSON, MARION
DESALTED SEAWATER FOR AGRICULTURE IS IT ECONOMIC,
W69-06765 03F

CLYMER, A. B.
THE DESIRABILITY AND APPLICABILITY OF SIMULATING ECOSYSTEMS,
W69-06537 06A

COFFEY, PHILIP J.
ECONOMIC FRAMEWORK FOR SALINITY CONTROL PROJECTS,
W69-06490 05D

COOK, RAY L.
TENSION OF THE SOIL WATER WHEN PERMANENT WILTING OCCURS, AS MEASURED BY THE GRAY HYDROCAL HYGROMETER METHOD,
W69-06516 02G

COREY, ARTHUR THOMAS
CONSERVATION OF SOIL WATER BY GRAVEL MULCHES,
W69-06796 03F

COWAN, W. R.
SOILS STUDIES USING COLOR PHOTOS,
W69-06696 07B

COX, J. T. H.
THE EFFECT OF CROP AND CLIMATIC FACTORS ON THE RADIATION BALANCE OF AN IRRIGATED MAIZE CROP,
W69-06757 03F

COX, LLOYD M.
A UNIVERSAL SURFACE PRECIPITATION GAGE,
W69-06804 02B

CRAFT, R. C.
SUBSTATION EXPANSION, RELIABILITY, AND TRANSFORMER LOADING POLICY ANALYSIS,
W69-06685 06A

CRAGG, J. G.
ON THE RELATIVE SMALL-SAMPLE PROPERTIES OF SEVERAL STRUCTURAL-EQUATION ESTIMATORS,
W69-06734 06B

DALALY, H.
SUL-BISUL(T) ION EXCHANGE PROCESS FIELD EVALUATION ON BRACKISH WATERS,
W69-06836 03A

DANILIN, A. I.
GUIDEBOOK ON NUCLEAR TECHNIQUES IN HYDROLOGY,
W69-06811 07B

DARAB, K.
SALT BALANCE AND SALT TRANSPORT PROCESSES IN IRRIGATED SOILS,
W69-06717 03F

DAVIDHAZY, ANDREW
BEHAVIOR OF LIQUID SURFACES DURING EVAPORATION AND CONDENSATION,
W69-06840 03A

DAVIDSON, HELEN J.
WATER-QUALITY RECORDS FOR THE HUBBARD CREEK WATERSHED, TEXAS, OCTOBER 1966-SEPTEMBER 1967,
W69-06786 02H

DAVIDSON, R. S.
THE DESIRABILITY AND APPLICABILITY OF SIMULATING ECOSYSTEMS,
W69-06537 06A

DAVID, DAVID
PREDICTION OF SWELLING PRESSURE OF CLAYS,
W69-06693 08D

DAVIS, H. CRAIG
INTERREGIONAL PRODUCTION AND WATER RESOURCE DEPENDENCIES AMONG THE WESTERN STATES,
W69-06721 06B

DAVIS, J. C.
RECOVERY OF SALTS FROM SALINE WATER VIA SOLVENT EXTRACTION (FINAL REPORT),

W69-06839 03A

DAVIS, RICHARD W.
GROUND WATER, GRAVITY AND RIFT VALLEYS IN MALAWI,
W69-06431 02F

DE ALESSI, LOUIS
IMPLICATIONS OF PROPERTY RIGHTS FOR GOVERNMENT INVESTMENT CHOICES,
W69-06548 06B

DE QUERVAIN, M.
DEFORMATION OF POLICRYSTALLINE ICE UNDER COMBINED UNIAXIAL AND HYDROSTATIC PRESSURE,
W69-06475 02C

DEPREE, D. O.
RECOVERY OF METAL SALTS FROM CONCENTRATED BRINES BY CHELATION,
W69-06837 03A

DIETRICH, GARY
THE IMPROVEMENT OF WATER QUALITY UNDER A FINANCIAL CONSTRAINT A COMMENTARY ON 'LINEAR PROGRAMMING APPLIED TO WATER QUALITY MANAGEMENT',
W69-06547 05F

DOERING, E. J.
SOIL-WATER DIFFUSIVITY BY THE ONE-STEP METHOD,
W69-06528 02G

DOLAN, PAUL R.
500-KV AC SUBSTATION DESIGN CRITERIA--SUMMARY OF INDUSTRY PRACTICES,
W69-06686 08C

DOMINY, FLOYD E.
ALLOCATION AND REALLOCATION OF WATER RESOURCES,
W69-06691 06B

DOOGE, JAMES C. I.
HYDROLOGIC CYCLE AS A CLOSED SYSTEM,
W69-06442 02A

DRACUP, JOHN A.
ON MULTILEVEL OPTIMIZATION IN GROUND WATER SYSTEMS,
W69-06813 02F

QUASILINEARIZATION APPROACH TO THE IDENTIFICATION OF HYDROLOGIC SYSTEMS,
W69-06822 02A

DREZE, J.
SPECIFICATION AND ESTIMATION OF COBB-DOUGLAS PRODUCTION FUNCTION MODELS,
W69-06560 06A

DUGAN, H. P.
THE COMPETITION FOR WATER QUANTITY,
W69-06574 06D

DUSEK, D. A.
EFFICIENT WHEAT IRRIGATION WITH LIMITED WATER,
W69-06511 03F

EAGLESON, PETER S.
STREAMFLOW RECORD LENGTH FOR MODELLING CATCHMENT DYNAMICS,
W69-06781 02E

EIDEL'MAN, S. YA
THERMAL STRESS CONDITION OF EXPERIMENTAL LONG BLOCKS DURING CONSTRUCTION PERIOD OF THE BRATSK HYDROELECTRIC STATION DAM,
W69-06711 08F

EISENPRESS, HARRY
THE ESTIMATION OF NONLINEAR ECONOMETRIC SYSTEMS,
W69-06562 06A

EKSTEIN, J.
GEOCHEMICAL TRACING OF MINERAL WATER SOURCES IN THE SOUTH WESTERN DEAD SEA BASIN, ISRAEL,
W69-06747 02F

EL-ANSARI, A. E.
COMPUTATION OF PRESSURES AND VELOCITIES IN THE CURVILINEAR ZONE OF PRESSURE SPILLWAYS, FOR PREDICTING CAVITATION,
W69-06713 08B

EMRICH, GROVER H.
EFFECTS OF MINE DRAINAGE ON GROUND WATER,
W69-06425 05C

ENGELBERT, ERNEST A.
REGIONAL PLANNING FOR WATER DEVELOPMENT IN THE WESTERN UNITED STATES - THE RELEVANCE OF AMERICAN EXPERIENCE FOR OTHER NATIONS,
W69-06726 06B

ERIKSSON, E.
GUIDEBOOK ON NUCLEAR TECHNIQUES IN HYDROLOGY,
W69-06811 07B

FAUST, SAMUEL D.
FACTORS INFLUENCING THE CONDENSATION OF 4-AMINOANTIPYRINE WITH DERIVATIVES OF HYDROXYBENZENE-III. A STUDY OF PHENOL CONTENT IN SURFACE WATERS,
W69-06444 05A

FEDER, PAUL
ON THE DISTRIBUTION OF STATISTICS SUITABLE FOR EVALUATING RAINFALL STIMULATION EXPERIMENTS,
W69-06679 03B

FERNANDEZ, PEDRO
DISPLACEMENT FRONT UNDER PONDED LEACHING,
W69-06510 02G

FOGARASI, S.
CLIMATOLOGY STUDIES OF BAFFIN ISLAND, NORTHWEST TERRITORIES,
W69-06814 02B

FONG-YIH, LIU
AGRICULTURE USE OF WATER IN TAIWAN, REPUBLIC OF CHINA,
W69-06460 03F

FOSSETTE, CARL
THE COMPETITION FOR WATER QUANTITY INDUSTRY,
W69-06577 06D

FRANKEL, M. L.
SIGNIFICANCE OF GROUNDWATER MANAGEMENT STRATEGY-A SYSTEMS APPROACH,
W69-06424 06A

FRANKEL, RICHARD J.
WATER QUALITY MANAGEMENT ENGINEERING-ECONOMIC FACTORS IN MUNICIPAL WASTE DISPOSAL,
W69-06505 05D

FREEDMAN, SIDNEY
RX CONCRETE,
W69-06678 08F

FRUH, E. GUS
THE AGING OF LAKES,
W69-06535 02H

FRYREAR, D. W.
GRADED FURROWS FOR WATER EROSION CONTROL,
W69-06746 02J

GABRIEL, K. R.
ON THE DISTRIBUTION OF STATISTICS SUITABLE FOR EVALUATING RAINFALL STIMULATION EXPERIMENTS,
W69-06679 03B

GANTNER, J.
BROWN BOVERI DISTANCE PROTECTION SYSTEMS EMPLOYING CARRIER TRANSFER,
W69-06709 08C

GAT, JOEL R.
THE STABLE ISOTOPE COMPOSITION OF MINERAL WATERS IN THE JORDON RIFT VALLEY, ISRAEL,
W69-06750 02F

GEBHART, LLOYD R.
HIGH EARTHFILL DAM FOUNDATION GROUTING DESIGN AND CONSTRUCTION PROCEDURES,
W69-06674 08D

GEMMELL, ROBERT S.
CIVIL ENGINEERING AND URBAN SYSTEMS,
W69-06491 06A

GIARDINI, A. A.
BRITTLE ROCK FAILURE UNDER TRIAXIAL STRESS,
W69-06701 08E

GILLILAND, J. A.
A RIGID PLATE MODEL OF THE BAROMETRIC EFFECT,
W69-06775 02F

GILL, HAROLD E.
SUMMARY OF GROUND-WATER RESOURCES OF ATLANTIC COUNTY, NEW JERSEY,
W69-06448 02F

GLEN, J. W.
THE MECHANICAL PROPERTIES OF SINGLE CRYSTALS OF ICE AT LOW TEMPERATURES,
W69-06474 02C

THE IMPORTANCE OF THE HYDROGEN ATOM ARRANGEMENT IN DETERMINING HOW ICE CAN DEFORM PLASTICALLY,
W69-06476 02C

GOLDBERG, DAN
MODERN IRRIGATION FOR INCREASED AGRICULTURAL PRODUCTION,
W69-06454 03F

GOLDEN, H. G.
WATER AVAILABILITY, CONECUH COUNTY, ALABAMA,
W69-06451 02E

WATER AVAILABILITY, COFFEE COUNTY, ALABAMA,
W69-06452 02F

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF PIKE COUNTY, ALABAMA,
W69-06815 02F

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF CRENSHAW COUNTY, ALABAMA,
W69-06817 02F

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF DALE COUNTY, ALABAMA,
W69-06818 02F

GOLDFELD, STEPHEN M.
MAXIMIZATION BY QUADRATIC HILL-CLIMBING,

W69-06564 06A

GONCHAROV, V. N.
DYNAMICS OF CHANNEL FLOW,
W69-06835 02E

GOODWIN, C. R.
RESPONSE OF BUBBLE-GAGE SERVOMANOMETERS TO OSCILLATIONS IN WATER LEVEL,
W69-06434 07C

GOODYEAR, HUGO V.
FREQUENCY AND AREAL DISTRIBUTIONS OF TROPICAL STORM RAINFALL, U.S. COASTAL REGION, GULF OF MEXICO,
W69-06797 02B

GRAYMAN, WALTER M.
STREAMFLOW RECORD LENGTH FOR MODELLING CATCHMENT DYNAMICS,
W69-06781 02E

GREENSTADT, JOHN
THE ESTIMATION OF NONLINEAR ECONOMETRIC SYSTEMS,
W69-06562 06A

GREEN, MELVIN G.
ARTIFICIAL RECHARGE TO THE EDWARDS LIMESTONE AQUIFER IN SOUTH TEXAS,
W69-06483 04B

GRINSTEAD, R. R.
RECOVERY OF SALTS FROM SALINE WATER VIA SOLVENT EXTRACTION (FINAL REPORT),
W69-06839 03A

GROVE, M. A.
AGGREGATE KOYCK FUNCTIONS,
W69-06561 06B

GUINDI, BISHAY
A COMPARATIVE STUDY OF HYDRAULIC CONDUCTIVITY IN THE ALLUVIAL SOILS OF EGYPT,
W69-06517 02F

HACKETT, JAMES E.
WATER RESOURCES AND THE URBAN ENVIRONMENT,
W69-06428 04C

HADAR, JOSEF
OPTIMALITY OF IMPERFECTLY COMPETITIVE RESOURCE ALLOCATION,
W69-06722 06C

HAEFELI, R.
DEFORMATION OF POLYCRYSTALLINE ICE UNDER COMBINED UNIAXIAL AND HYDROSTATIC PRESSURE,
W69-06475 02C

HAGAN, ROBERT
CONFERENCE ON WATER DECISIONS IN THE CRITICAL 1960'S,
W69-06572 06B

HAIMES, YACOV Y.
ON MULTILEVEL OPTIMIZATION IN GROUND WATER SYSTEMS,
W69-06813 02F

HALEVY, E.
GUIDEBOOK ON NUCLEAR TECHNIQUES IN HYDROLOGY,
W69-06811 07B

HAMDI, H.
A COMPARATIVE STUDY OF HYDRAULIC CONDUCTIVITY IN THE ALLUVIAL SOILS OF EGYPT,
W69-06517 02F

HAMILTON, N.
LABORATORY EXPERIMENTS ON THE PRODUCTION OF GRAIN ORIENTATION IN SHEARING SAND,
W69-06799 02J

HAMON, W. RUSSELL
A UNIVERSAL SURFACE PRECIPITATION GAGE,
W69-06804 02B

HANNAFORD, JACK F.
REGIONAL HYDROLOGIC AREA STUDY AS AN ANALYSIS TOOL IN WEATHER MODIFICATION,
W69-06805 02A

HANNAN, E. J.
CANONICAL CORRELATION AND MULTIPLE EQUATION SYSTEMS IN ECONOMICS,
W69-06735 06B

HANSEN, VAUGHN E.
EVAPORATION REDUCTION ON LARGE RESERVOIRS,
W69-06531 03F

HARRILL, J. R.
ESTIMATED WATER USE IN NEVADA, 1950-65,
W69-06446 06D

HARRIS, PETER J.
BEHAVIOR OF LIQUID SURFACES DURING EVAPORATION AND CONDENSATION,
W69-06840 03A

HARTER, H. LEON
A NEW TABLE OF PERCENTAGE POINTS OF THE PEARSON TYPE III DISTRIBUTION,
W69-06680 02E

HASKELL, P. E., JR.
THE HYDROLOGIC AND GEOLOGIC ASPECTS OF A PERCHING LAYER - SAN JOAQUIN VALLEY, WESTERN FRESNO COUNTY, CALIFORNIA,
W69-06758 02F

HATANAKA, MICHIO
AN HARMONIC ANALYSIS OF NONSTATIONARY MULTIVARIATE ECONOMIC PROCESSES,
W69-06553 06A

HAZAN, RAYMOND
ARTIFICIAL RECHARGE OF A FISSURED SANDSTONE AQUIFER, TANGIERS, MOROCCO (FRENCH),
W69-06487 04B

HEGINBOTTOM, J. A.
SOILS STUDIES USING COLOR PHOTOS,
W69-06696 07B

HEINDL, L. A.
GROUNDWATER IN FRACTURED VOLCANIC ROCKS IN SOUTHERN ARIZONA,
W69-06831 02F

HELD, E. E.
NICKEL-63 IN MARINE AND TERRESTRIAL BIOTA, SOIL, AND SEDIMENT,
W69-06766 05A

HENSHAW, RICHARD C., JR.
TESTING SINGLE-EQUATION LEAST SQUARES REGRESSION MODELS FOR AUTOCORRELATED DISTURBANCES,
W69-06565 06A

HERBERT, R.
A DESIGN METHOD FOR DEEP WELL DEWATERING INSTALLATIONS,
W69-06430 02F

HICKMAN, KENNETH
BEHAVIOR OF LIQUID SURFACES DURING EVAPORATION AND CONDENSATION,
W69-06840 03A

HILEMAN, ANDREW R.
OPEN BREAKER PROTECTION OF EHV SYSTEMS,
W69-06688 08C

HILLEL, D.
A PRELIMINARY FIELD STUDY OF SURFACE TREATMENTS FOR RUNOFF INDUCEMENT IN THE NEGEV OF ISRAEL,
W69-06715 02A

HITE, J. C.
ECONOMIC ANALYSIS OF THE DEVELOPMENT POTENTIAL OF THE COMMERCIAL FISHERIES INDUSTRY OF THE COASTAL PLAINS REGION,
W69-06554 06B

HOBBS, P. V.
THE METAMORPHISM OF DRY SNOW AT A UNIFORM TEMPERATURE,
W69-06479 02C

HODGES, ARTHUR L., JR.
GROUND WATER FAVORABILITY MAP OF THE OTTAUQUECHEE-SAXTONS RIVER BASIN, VERMONT,
W69-06463 02F

GROUND WATER FAVORABILITY MAP OF THE WEST-DEERFIELD RIVER BASIN, VERMONT,
W69-06464 02F

GROUND WATER FAVORABILITY MAP OF THE WELLS-OMPOMPANOOSUC RIVER BASIN, VERMONT,
W69-06465 02F

GROUND WATER FAVORABILITY MAP OF THE WHITE RIVER BASIN, VERMONT,
W69-06466 02F

HOFBECK, J. A.
SHEAR TRANSFER IN REINFORCED CONCRETE,
W69-06676 08F

HOLLOWAY, HAROLD D.
MANUAL OF PROCEDURES AND METHODS FOR CALCULATING COMPARATIVE COSTS OF MUNICIPAL WATER SUPPLY FROM SALINE AND CONVENTIONAL WATER SOURCES IN TEXAS,
W69-06559 03A

HOLTZ, W. G.
SOIL AS AN ENGINEERING MATERIAL,
W69-06699 08D

HOLT, S. J.
A REVIEW OF THE LIFESPANS AND MORTALITY RATES OF FISH IN NATURE, AND THEIR RELATION TO GROWTH AND OTHER PHYSIOLOGICAL CHARACTERISTICS,
W69-06533 05C

HOWE, CHARLES W.
THE IMPACT OF PRICE ON RESIDENTIAL WATER DEMAND AND ITS RELATION TO SYSTEM DESIGN AND PRICE STRUCTURE,
W69-06502 06D

HOWE, EVERETT D.
THE STATUS OF SEA WATER CONVERSION,
W69-06583 03A

HUSMANN, W.
WATER SUPPLY AND WASTEWATER TREATMENT PROBLEMS OF INDUSTRIAL AND TRADE ENTERPRISES,
W69-06723 05D

HUSSAIN, ASHIG

THE USE OF ERROR COMPONENTS MODELS IN COMBINING CROSS SECTION WITH TIME SERIES DATA,
W69-06552 06A

HUTCHINSON, PETER
ESTIMATION OF RAINFALL IN SPARSELY GAUGED AREAS,
W69-06773 02B

IBRAHIM, I. O.
SHEAR TRANSFER IN REINFORCED CONCRETE,
W69-06676 08F

ISRAELSEN, C. EARL
EVAPORATION REDUCTION ON LARGE RESERVOIRS,
W69-06531 03F

ISSAR, A.
THE GROUNDWATER PROVINCES OF IRAN,
W69-06772 04B

JACCARD, C.
DEFORMATION OF POLYCRYSTALLINE ICE UNDER COMBINED UNIAXIAL AND HYDROSTATIC PRESSURE,
W69-06475 02C

JENNINGS, WILLIAM H.
LEGAL ALTERNATIVES,
W69-06579 06E

JOHNSON, BRUCE
PUBLIC UTILITY PRICING AND OUTPUT UNDER RISK,
W69-06549 06C

JOHNSON, GERALD W.
NUCLEAR EXPLOSIVES,
W69-06581 08H

JONES, S. J.
THE MECHANICAL PROPERTIES OF SINGLE CRYSTALS OF ICE AT LOW TEMPERATURES,
W69-06474 02C

KADANE, J. B.
ESTIMATION OF RETURNS TO SCALE AND THE ELASTICITY OF SUBSTITUTION,
W69-06732 06B

KALLY, ELISHA
PIPELINE PLANNING BY DYNAMIC COMPUTER PROGRAMMING,
W69-06493 06A

KAMAT, D. L.
BENEFICIAL USES OF WATERS OF INTERNATIONAL RIVERS INTERNATIONAL LAW AND PRACTICE,
W69-06458 06E

KAMERSCHEN, DAVID R.
THE INFLUENCE OF OWNERSHIP AND CONTROL ON PROFIT RATES,
W69-06545 06B

KAPKIN, M. M.
TEMPERATURE VOLUMETRIC CHANGES OF CONCRETE AT SUBZERO TEMPERATURES,
W69-06672 08F

KATZ, D. M.
PRINCIPLES OF CHOOSING EXPERIMENTAL PLOTS FOR WATER BALANCE STUDIES IN IRRIGATION REGIONS OF THE ARID ZONE,
W69-06523 02G

KEENE, PHILIP
NON-ENGINEERING ELEMENTS IN FACTORS OF SAFETY IN SOIL AND FOUNDATION ENGINEERING,
W69-06695 08D

KEMPER, WILLIAM D.
CONSERVATION OF SOIL WATER BY GRAVEL MULCHES,
W69-06796 03F

KESSLER, E.
RADAR MEASUREMENT OF PRECIPITATION FOR HYDROLOGICAL PURPOSES,
W69-06812 02B

KINGSBURY, JOHN M.
APPLICATION OF AN ELECTRONIC PARTICLE COUNTER IN ANALYZING NATURAL POPULATIONS OF PHYTOPLANKTON,
W69-06540 07B

KIRILLOV, A. P.
THE MECHANISM OF WATER SEEPAGE THROUGH CONCRETE,
W69-06712 08F

KISNER, RICHARD B., JR.
OPEN BREAKER PROTECTION OF EHV SYSTEMS,
W69-06688 08C

KMENTA, J.
SPECIFICATION AND ESTIMATION OF COBB-DOUGLAS PRODUCTION FUNCTION MODELS,
W69-06560 06A

KOISCH, F. P.
ALLOCATION AND REALLOCATION OF WATER RESOURCES,
W69-06691 06B

KOMORNIK, AMOS
PREDICTION OF SWELLING PRESSURE OF CLAYS,
W69-06693 08D

KOVALENKO, V. A.
THEORETICAL AND EXPERIMENTAL INVESTIGATIONS OF THE VIBRATIONS OF THE ROTOR OF A FULL-SCALE-MODEL HYDROELECTRIC INSTALLATION,
W69-06698 08C

KRISHNAIAH, P. R.
SIMULTANEOUS TESTS FOR TREND AND SERIAL CORRELATIONS FOR GAUSSIAN MARKOV RESIDUALS,
W69-06569 06A

KRUTCHKOFF, RICHARD G.
STOCHASTIC MODEL FOR BOD AND DO IN STREAMS,
W69-06500 05B

KULIK, M. S.
DROUGHT AND SOIL MOISTURE,
W69-06529 02G

KUROIWA, DAISUKE
LIQUID PERMEABILITY OF SNOW,
W69-06478 02C

LABADIE, JOHN W.
QUASILINEARIZATION APPROACH TO THE IDENTIFICATION OF HYDROLOGIC SYSTEMS,
W69-06822 02A

LADD, GEORGE W.
LINEAR PROBABILITY FUNCTIONS AND DISCRIMINANT FUNCTIONS,
W69-06563 06A

LAMBERT, JERRY R.
A METHOD OF DETERMINING THE WATER POTENTIAL OF INTACT PLANTS,
W69-06527 02I

LANDSBERG, HANS H.
DESALTED SEAWATER FOR AGRICULTURE IS IT ECONOMIC,
W69-06765 03F

LANG, HEBBERT
RELATIONS BETWEEN GLACIER RUNOFF AND METEOROLOGICAL FACTORS OBSERVED ON AND OUTSIDE THE GLACIER,
W69-06481 02C

LAWTON, VINCENT
CONFERENCE ON WATER DECISIONS IN THE CRITICAL 1960'S,
W69-06572 06B

LEE, G. FRED
THE AGING OF LAKES,
W69-06535 02H

LEE, KENNETH L.
HORIZONTAL MOVEMENTS RELATED TO SUBSIDENCE,
W69-06692 08D

LEE, RICHARD
THE HYDROLOGIC IMPORTANCE OF TRANSPIRATION CONTROL BY STOMATA,
W69-06520 02D

LEGRAND, HARRY E.
ROLE OF GROUND WATER CONTAMINATION IN WATER MANAGMENT,
W69-06762 05G

LENNOX, D. H.
ITERATIVE ANALYSIS BOUNDED LEAKY ARTESIAN AQUIFER,
W69-06508 02F

LEWANDOWSKI, EDWARD R.
FOUNDATION PROBLEMS OF RUEDI DAM AND RESERVOIR,
W69-06673 08E

LIEBMAN, JON C.
A HEURISTIC AID FOR THE DESIGN OF SEWER NETWORKS,
W69-06498 05E

LIGON, JAMES T.
EVALUATION OF THE GAMMA TRANSMISSION METHOD FOR DETERMINING SOIL WATER BALANCE AND EVAPOTRANSPIRATION,
W69-06514 02G

LINAWEAVER, F. P., JR.
THE IMPACT OF PRICE ON RESIDENTIAL WATER DEMAND AND ITS RELATION TO SYSTEM DESIGN AND PRICE STRUCTURE,
W69-06502 06D

LISACK, J. P.
MANPOWER REQUIREMENTS FOR POLLUTION CONTROL AND WATER RESOURCES IN INDIANA AND A RELATED POLLUTION CONTROL TECHNOLOGY CURRICULUM,
W69-06507 05G

LLOYD, L. W.
A SWING RELAY FOR THE EAST-WEST INTERTIE,
W69-06687 08C

LOKEN, TOR
STABILIZATION OF UNDISTURBED QUICK CLAY BY SALT WELLS,
W69-06719 08D

LOW, S. S.
SHUNT CAPACITOR ENERGIZATION WITH VACUUM INTERRUPTERS--A POSSIBLE SOURCE OF OVERVOLTAGE,
W69-06689 08C

LUTHIN, JAMES N.
DISPLACEMENT FRONT UNDER PONDED LEACHING,
W69-06510 02G

MADDALA, G. S.
ESTIMATION OF RETURNS TO SCALE AND THE ELASTICITY OF SUBSTITUTION,
W69-06732 06B

MAKEDONSKII, G. M.
THERMAL STRESS CONDITION OF EXPERIMENTAL LONG BLOCKS DURING CONSTRUCTION PERIOD OF THE BRATSK HYDROELECTRIC STATION DAM,
W69-06711 08F

MARGLIN, STEPHEN A.
THE OPPORTUNITY COSTS OF PUBLIC INVESTMENT,
W69-06739 06B

MARTENS, LAWRENCE A.
FLOOD INUNDATION AND EFFECTS OF URBANIZATION IN METROPOLITAN CHARLOTTE, NORTH CAROLINA,
W69-06445 04C

MARTINEC, J.
GUIDEBOOK ON NUCLEAR TECHNIQUES IN HYDROLOGY,
W69-06811 07B

MAR, BRIAN W.
SLUDGE DISPOSAL ALTERNATIVES -- SOCIO-ECONOMIC CONSIDERATIONS,
W69-06492 05E

MASLOC, BORIS
DISPLACEMENT FRONT UNDER PONDED LEACHING,
W69-06510 02G

MATHRANI, K. P.
CONSTRUCTION AND MANAGEMENT OF RIVER VALLEY PROJECTS IN INDIA,
W69-06457 04A

MATTOCK, ALAN H.
SHEAR TRANSFER IN REINFORCED CONCRETE,
W69-06676 08F

MAZOR, EMANUEL
GEOCHEMICAL TRACING OF MINERAL AND FRESH WATER SOURCES IN THE LAKE TIBERIAS BASIN, ISRAEL,
W69-06748 02F

THE ORIGIN OF THE TIBERIAS-NOIT MINERAL WATER ASSOCIATION IN THE TIBERIAS-DEAD SEA RIFT VALLEY, ISRAEL,
W69-06749 02F

MAZOR, E.
GEOCHEMICAL TRACING OF MINERAL WATER SOURCES IN THE SOUTH WESTERN DEAD SEA BASIN, ISRAEL,
W69-06747 02F

THE STABLE ISOTOPE COMPOSITION OF MINERAL WATERS IN THE JORDON RIFT VALLEY, ISRAEL,
W69-06750 02F

MAZUR, B. M.
TEMPERATURE VOLUMETRIC CHANGES OF CONCRETE AT SUBZERO TEMPERATURES,
W69-06672 08F

MCCAIN, J. F.
GEOLOGIC MAP AND WATER AVAILABILITY MAP OF HENRY COUNTY, ALABAMA,
W69-06816 02F

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF COVINGTON COUNTY, ALABAMA,
W69-06819 02F

MCCORMICK, JAMES F.
THE COMPETITION FOR WATER QUALITY RECREATION,
W69-06573 06D

MCDONALD, HARRIS R.
ANALOG OF GROUND WATER IN EAST-CENTRAL NEW MEXICO,
W69-06509 02F

MCHENRY, J. ROGER,
USE OF TRACER TECHNIQUE IN SOIL EROSION RESEARCH,
W69-06704 04D

MCITHENNEY, W. F.
A FEASIBILITY STUDY ON THE UTILIZATION OF WASTE BRINE FROM SALINATION PLANTS PART 1,
W69-06556 03C

MCPHERSON, M. B.
AN ANALYSIS OF NATIONAL BASIC INFORMATION NEEDS IN URBAN HYDROLOGY,
W69-06770 04C

MCWILLIAMS, R. D.
GEOLOGIC MAP AND WATER AVAILABILITY MAP OF CRENSHAW COUNTY, ALABAMA,
W69-06817 02F

MEISLER, HAROLD
SUMMARY OF GROUND-WATER RESOURCES OF ATLANTIC COUNTY, NEW JERSEY,
W69-06448 02F

MERO, FELIX
GEOCHEMICAL TRACING OF MINERAL AND FRESH WATER SOURCES IN THE LAKE TIBERIAS BASIN, ISRAEL,
W69-06748 02F

THE ORIGIN OF THE TIBERIAS-NOIT MINERAL WATER ASSOCIATION IN THE TIBERIAS-DEAD SEA RIFT VALLEY, ISRAEL,
W69-06749 02F

MERRITT, GARY L.
EFFECTS OF MINE DRAINAGE ON GROUND WATER,
W69-06425 05C

MIDGLEY, D. C.
OPERATION OF MULTI-UNIT MULTI-PURPOSE WATER DEVELOPMENT SYSTEMS,
W69-06462 06D

MILLER, ERVIN E.
COMPUTER-AIRPLANE COMBO SAVES QUARTER MILLION DOLLARS ON SURVEYS AND ADMINISTRATION OF CONSTRUCTION CONTRACTS,
W69-06697 07B

MINSHALL, NEAL E.
PRECIPITATION AND BASE FLOW VARIABILITY,
W69-06443 02B

MITCHELL, J. MURRAY, JR.
SOME REMARKS ON THE PREDICTABILITY OF DROUGHT AND RELATED CLIMATIC ANOMALIES,
W69-06439 02B

MITWALLY, SALAH ELDIN
A COMPARATIVE STUDY OF HYDRAULIC CONDUCTIVITY IN THE ALLUVIAL SOILS OF EGYPT,
W69-06517 02F

MORESHET, S.
THE EFFECT OF CROP AND CLIMATIC FACTORS ON THE RADIATION BALANCE OF AN IRRIGATED MAIZE CROP,
W69-06757 03F

MORGAN, ELMO B.
ALLOCATION AND REALLOCATION OF WATER RESOURCES,
W69-06691 06B

MORTIMER, C. H.
THE WORK OF THE FRESHWATER BIOLOGICAL ASSOCIATION OF GREAT BRITAIN IN REGARD TO WATER SUPPLIES. (A) THE NITROGEN BALANCE OF LARGE QUANTITIES OF WATER,
W69-06538 02K

MOSKVIN, V. M.
TEMPERATURE VOLUMETRIC CHANGES OF CONCRETE AT SUBZERO TEMPERATURES,
W69-06672 08F

MOSSLANG, HANS
USE OF ASPHALTIC CONCRETE IN COASTAL AND CANAL CONSTRUCTION,
W69-06682 08F

MOUM, JOHAN
STABILIZATION OF UNDISTURBED QUICK CLAY BY SALT WELLS,
W69-06719 08D

MOUNT, J. RUSSELL
A SIMPLIFIED TECHNIQUE FOR WELL-FIELD DESIGN,
W69-06421 02F

MUEHLBERG, P. E.
A FEASIBILITY STUDY ON THE UTILIZATION OF WASTE BRINE FROM SALINATION PLANTS PART 1,
W69-06556 03C

MUELLER, C. R.
INTERMOLECULAR FORCES AND THE LIQUID STATE,
W69-06838 01A

MUHLECK, HEINZ
THE GENERAL WATER SCHEME - AN ESSENTIAL BASIS FOR THE MOST RATIONAL USE OF WATER RESOURCES,
W69-06724 06B

MULLIGAN, HUGH F.
APPLICATION OF AN ELECTRONIC PARTICLE COUNTER IN ANALYZING NATURAL POPULATIONS OF PHYTOPLANKTON,
W69-06540 07B

MUNDLAK, YAIR
LONG-RUN COEFFICIENTS AND DISTRIBUTED LAG ANALYSIS A REFORMULATION,
W69-06557 06A

MURTHY, V. K.
SIMULTANEOUS TESTS FOR TREND AND SERIAL CORRELATIONS FOR GAUSSIAN MARKOV RESIDUALS,
W69-06569 06A

MUSICK, J. T.
EFFICIENT WHEAT IRRIGATION WITH LIMITED WATER,
W69-06511 03F

MUTH, RICHARD F.
HOUSEHOLD PRODUCTION AND CONSUMER DEMAND FUNCTIONS,
W69-06566 06D

MYERS, V. I.
DRAINING AREA UNDERLAIN BY HIGHLY PERMEABLE SHALLOW SAND AQUIFER,
W69-06512 02G

NAMIAS, JEROME
FURTHER STUDIES OF DROUGHT OVER NORTHEASTERN UNITED STATES,
W69-06438 02B

NARAYAN, C. V.
DISTANCE PROTECTION OF HIGH-VOLTAGE LINES CONTAINING SERIES

CAPACITORS,
W69-06710 08C

NEILL, D. E.
MEASUREMENT OF ROTATING MACHINERY VIBRATION AND FACTORS AFFECTING INSTRUMENT ACCURACY,
W69-06702 07B

NEWTON, J. G.
WATER AVAILABILITY, COFFEE COUNTY, ALABAMA,
W69-06452 02F

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF HENRY COUNTY, ALABAMA,
W69-06816 02F

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF CRENSHAW COUNTY, ALABAMA,
W69-06817 02F

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF DALE COUNTY, ALABAMA,
W69-06818 02F

NITTA, ROY Y.
ELECTRICAL FEATURES OF THE GRAND COULEE THIRD POWER PLANT,
W69-06684 08C

NORTHROP, WILLIA L.
KANSAS RIVER BASIN FLOOD CONTROL,
W69-06729 06B

ORCUTT, GUY H.
FIRST ORDER AUTO REGRESSION INFERENCE, ESTIMATION, AND PREDICTION,
W69-06550 06A

ORCUTT, R. G.
RECLAIMED WASTE WATER IN LAS VEGAS VALLEY,
W69-06832 05D

ORLOB, GERALD T.
WATER QUALITY MANAGEMENT IN IRRIGATION SYSTEMS,
W69-06499 05G

ORTOLANO, LEONARD
ECONOMIC FRAMEWORK FOR SALINITY CONTROL PROJECTS,
W69-06490 05D

OSSMAN, W. R.
SUBSTATION EXPANSION, RELIABILITY, AND TRANSFORMER LOADING POLICY ANALYSIS,
W69-06685 06A

OWENS, WILLARD G.
GEOLOGY, DESIGN, AND CONSTRUCTION OF DEEP WELLS IN SEDIMENTARY FOUNDATIONS,
W69-06759 02F

OWENS, W. H.
LABORATORY EXPERIMENTS ON THE PRODUCTION OF GRAIN ORIENTATION IN SHEARING SAND,
W69-06799 02J

PALMER, WAYNE C.
THE ABNORMALLY DRY WEATHER OF 1961-1966 IN THE NORTHEASTERN UNITED STATES,
W69-06437 02B

PARKER, MARSHALL E.
INNOVATIONS AND THE FUTURE OF CATHODIC PROTECTION,
W69-06677 08A

PARKER, RICHARD A.
SIMULATION OF AN AQUATIC ECOSYSTEM,
W69-06536 02H

PARRY, J. T.
SOILS STUDIES USING COLOR PHOTOS,
W69-06696 07B

PATTERSON, W. S. B.
A TEMPERATURE PROFILE THROUGH THE MEIGHEN ICE CAP, ARCTIC CANADA,
W69-06482 02C

PAULSON, RICHARD W.
PRELIMINARY REMOTE SENSING OF THE DELAWARE ESTUARY,
W69-06793 02L

PAVANELLO, R.
WATER POLLUTION CONTROL,
W69-06731 05G

PAYNE, B. R.
GUIDEBOOK ON NUCLEAR TECHNIQUES IN HYDROLOGY,
W69-06811 07B

PETERSON, GEORGE L.
CIVIL ENGINEERING AND URBAN SYSTEMS,
W69-06491 06A

PHADKE, A. G.
CALCULATION OF BALANCED AND UNBALANCED FAULT CURRENTS IN AC-DC POWER SYSTEMS,
W69-06690 08C

PHILIP, J. R.
EXTENDED TECHNIQUES OF CALCULATION OF SOIL-WATER MOVEMENT, WITH SOME PHYSICAL CONSEQUENCES,
W69-06714 02G

PHILLIPS, CLIFFORD J.
KANSAS RIVER BASIN FLOOD CONTROL,
W69-06729 06B

PHILLIPS, H. BOYD
ANALOG OF GROUND WATER IN EAST-CENTRAL NEW MEXICO,
W69-06509 02F

PICKERING, R. J.
DISTRIBUTION OF RADIONUCLIDES IN BOTTOM SEDIMENT OF THE CLINCH RIVER, EASTERN TENNESSEE,
W69-06785 05B

PIGFORD, THOMAS
NUCLEAR REACTORS,
W69-06582 03A

PILLSBURY, ARTHUR F.
PROCEEDINGS OF TILE DRAINAGE RESEARCH CONFERENCE,
W69-06795 04A

POTTER, PAUL E.
RANDOM PROCESSES AND LITHOLOGIC TRANSITIONS,
W69-06807 02J

PREHN, W. LAWRENCE
MANUAL OF PROCEDURES AND METHODS FOR CALCULATING COMPARATIVE COSTS OF MUNICIPAL WATER SUPPLY FROM SALINE AND CONVENTIONAL WATER SOURCES IN TEXAS,
W69-06559 03A

PYPER, G. E.
EXTENSIONS OF STREAMFLOW RECORDS IN UTAH,
W69-06447 02E

QUANDT, RICHARD E.
MAXIMIZATION BY QUADRATIC HILL-CLIMBING,
W69-06564 06A

RADWANSKI, S. A.
FIELD OBSERVATIONS OF SOME PHYSICAL PROPERTIES IN ALLUVIAL SOILS OF ARID AND SEMI-ARID REGIONS,
W69-06515 02G

RAO, K. L.
PLANNING AND DEVELOPMENT OF WATER RESOURCES IN INDIA,
W69-06728 06B

RAWITZ, E.
A PRELIMINARY FIELD STUDY OF SURFACE TREATMENTS FOR RUNOFF INDUCEMENT IN THE NEGEV OF ISRAEL,
W69-06715 02A

REED, P. C.
WATER AVAILABILITY, CONECUH COUNTY, ALABAMA,
W69-06451 02E

REES, A. I.
LABORATORY EXPERIMENTS ON THE PRODUCTION OF GRAIN ORIENTATION IN SHEARING SAND,
W69-06799 02J

REGER, RICHARD D.
RECENT HISTORY OF GULKANA AND COLLEGE GLACIERS, CENTRAL ALASKA RANGE, ALASKA,
W69-06808 02C

REID, J. K.
EXTENSIONS OF STREAMFLOW RECORDS IN UTAH,
W69-06447 02E

RESTALL, ROBERT
SAFETY CONTROL OF PRIVATE DAMS,
W69-06433 04A

REVELLE, CHARLES
THE IMPROVEMENT OF WATER QUALITY UNDER A FINANCIAL CONSTRAINT A COMMENTARY ON 'LINEAR PROGRAMMING APPLIED TO WATER QUALITY MANAGEMENT',
W69-06547 05F

RHODEHAMEL, EDWARD C.
SUMMARY OF GROUND-WATER RESOURCES OF ATLANTIC COUNTY, NEW JERSEY,
W69-06448 02F

RICE, T. R.
PROGRESS REPORT OF THE BUREAU OF COMMERCIAL FISHERIES RADIOBIOLOGICAL LABORATORY, BEAUFORT, N. C., FISCAL YEAR 1968,
W69-06769 09C

RICHARDSON, C. W.
GRADED FURROWS FOR WATER EROSION CONTROL,
W69-06746 02J

RICHARDS, RICHARD
THE LEGISLATIVE POINT OF VIEW,
W69-06580 06E

RICHARDS, WILLIAM E.
CONSERVATION'S CHALLENGE TO STATE GOVERNMENTS,
W69-06586 06E

RIJKS, D. A.
WATER USE BY IRRIGATED COTTON IN SUDAN. II. NET RADIATION AND SOIL HEAT FLUX,
W69-06756 03F

ROBECK, GORDON G.

MICROBIAL PROBLEMS IN GROUNDWATER,
W69-06426 05C

ROBERTSON, GEORGE W.
THE PERFORMANCE OF SOIL MOISTURE ESTIMATES AS COMPARED WITH THE DIRECT USE OF CLIMATOLOGICAL DATA FOR ESTIMATING CROP YIELDS,
W69-06519 02G

ROBINSON, FRANK
DISPLACEMENT FRONT UNDER PONDED LEACHING,
W69-06510 02G

RODE, A. A.
THEORY OF SOIL MOISTURE - VOL 1, MOISTURE PROPERTIES OF SOILS AND MOVEMENT OF SOIL MOISTURE,
W69-06489 02G

ROLL, J. ROBERT
EFFECT OF SUBSIDENCE ON WELL FIELDS,
W69-06763 04B

ROSENTHAL, E.
GEOCHEMICAL TRACING OF MINERAL WATER SOURCES IN THE SOUTH WESTERN DEAD SEA BASIN, ISRAEL,
W69-06747 02F

RU MAA, JER
BEHAVIOR OF LIQUID SURFACES DURING EVAPORATION AND CONDENSATION,
W69-06840 03A

RUNKLES, J. R.
WATER FOR TEXAS,
W69-06790 06B

RUSH, EUGENE F.
GEOLOGY AND GROUND-WATER RESOURCES OF BURLINGTON COUNTY, NEW JERSEY,
W69-06449 02F

RUSH, F. EUGENE
WATER-RESOURCES APPRAISAL OF THE LOWER MOAPA-LAKE MEAD AREA, CLARK COUNTY, NEVADA,
W69-06435 02F

RUTLAND, R. W. R.
GRAPHIC DETERMINATION OF SLOPE AND OF DIP AND STRIKE,
W69-06681 07B

SAGER, PAUL EDWIN
SPECIES DIVERSITY AND COMMUNITY STRUCTURE IN LACUSTRINE PHYTOPLANKTON,
W69-06542 02H

SANDERSON, WALLACE W.
ARSENIC ACCUMULATION BY FISH IN LAKES TREATED WITH SODIUM ARSENITE,
W69-06541 05B

SARBACH, E.
SOME ASPECTS OF INSULATION CO-ORDINATION IN HVDC SYSTEMS,
W69-06707 08C

SARVARY, I.
TRACER METHOD FOR DETERMINING THE VELOCITY OF FLOW IN A CONFINED KARSTIC AQUIFER,
W69-06774 07B

SCHAEFER, ROBERT W.
ARSENIC ACCUMULATION BY FISH IN LAKES TREATED WITH SODIUM ARSENITE,
W69-06541 05B

SCHLEIF, F. R.
A SWING RELAY FOR THE EAST-WEST INTERTIE,
W69-06687 08C

SCHMIDT, K.
SUL-BISUL(T) ION EXCHANGE PROCESS FIELD EVALUATION ON BRACKISH WATERS,
W69-06836 03A

SCHNEIDER, A. D.
EFFICIENT WHEAT IRRIGATION WITH LIMITED WATER,
W69-06511 03F

SCHUMM, S. A.
A GEOMORPHIC APPROACH TO EROSION CONTROL IN SEMIARID REGIONS,
W69-06513 02J

SCHWARK, D.
SUL-BISUL(T) ION EXCHANGE PROCESS FIELD EVALUATION ON BRACKISH WATERS,
W69-06836 03A

SCOTT, J. C.
WATER AVAILABILITY, CONECUH COUNTY, ALABAMA,
W69-06451 02E

WATER AVAILABILITY, COFFEE COUNTY, ALABAMA,
W69-06452 02F

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF PIKE COUNTY, ALABAMA,
W69-06815 02F

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF CRENSHAW COUNTY, ALABAMA,
W69-06817 02F

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF DALE COUNTY, ALABAMA,
W69-06818 02F

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF COVINGTON COUNTY, ALABAMA,
W69-06819 02F

SELLEY, RICHARD C.
A CLASSIFICATION OF PALEOCURRENT MODELS,
W69-06810 02J

SENGER, D.
SUL-BISUL(T) ION EXCHANGE PROCESS FIELD EVALUATION ON BRACKISH WATERS,
W69-06836 03A

SEWELL, WADE P.
LEAST SQUARES, CONDITIONAL PREDICTIONS, AND ESTIMATOR PROPERTIES,
W69-06551 06A

SHAMBURGER, VICTOR M., JR.
GEOLOGIC MAP AND WATER AVAILABILITY MAP OF PIKE COUNTY, ALABAMA,
W69-06815 02F

SHANNON, WALTER
THE COMPETITION FOR WATER QUANTITY RECREATION,
W69-06578 06D

SHEN, C. K.
HORIZONTAL MOVEMENTS RELATED TO SUBSIDENCE,
W69-06692 08D

SHIRLEY, WILLIAM O.
USE OF DIGITAL COMPUTERS IN DISTRIBUTION SYSTEM ANALYSES,
W69-06503 07C

SIMONETT, DAVID S.
POTENTIAL OF RADAR REMOTE SENSORS AS TOOLS IN RECONNAISSANCE GEOMORPHIC, VEGETATION AND SOIL MAPPING,
W69-06718 07B

SLISSKII, S. M.
COMPUTATION OF PRESSURES AND VELOCITIES IN THE CURVILINEAR ZONE OF PRESSURE SPILLWAYS, FOR PREDICTING CAVITATION,
W69-06713 08B

SMITH, H. G.
A FEASIBILITY STUDY ON THE UTILIZATION OF WASTE BRINE FROM SALINATION PLANTS PART 1,
W69-06556 03C

SMITH, W. KERRY
THE CES PRODUCTION FUNCTION A DERIVATION,
W69-06720 06B

SNIDER, S. W.
RECOVERY OF SALTS FROM SALINE WATER VIA SOLVENT EXTRACTION (FINAL REPORT),
W69-06839 03A

SOKOLOSKI, ADAM A.
SOME POSSIBLE ROLES FOR INSTITUTIONS AND ECONOMICS IN WATER RESOURCE MANAGEMENT,
W69-06725 06B

SOPP, OLVA IHLEN
STABILIZATION OF UNDISTURBED QUICK CLAY BY SALT WELLS,
W69-06719 08D

SPAR, JEROME
DROUGHT IN THE NORTHEASTERN UNITED STATES,
W69-06436 02B

SPENCER, ERIC
CIRCULAR AND LOGARITHMIC SPIRAL SLIP SURFACES,
W69-06694 08D

STANHILL, G.
THE EFFECT OF CROP AND CLIMATIC FACTORS ON THE RADIATION BALANCE OF AN IRRIGATED MAIZE CROP,
W69-06757 03F

STEINER, PETER O.
THE ROLE OF ALTERNATIVE COST IN PROJECT DESIGN AND SELECTION,
W69-06738 06B

CHOOSING AMONG ALTERNATIVE PUBLIC INVESTMENTS IN THE WATER RESOURCE FIELD,
W69-06740 06B

STEIN, MURRAY
POLLUTION OF THE INTERSTATE WATERS OF THE BLACKSTONE AND TEN MILE RIVERS AND THEIR TRIBUTARIES,
W69-06802 05B

STENSEL, DAVID
THE IMPROVEMENT OF WATER QUALITY UNDER A FINANCIAL CONSTRAINT A COMMENTARY ON 'LINEAR PROGRAMMING APPLIED TO WATER QUALITY MANAGEMENT',
W69-06547 05F

STEPHENS, JERRY C.
GEOLOGY AND HYDROLOGY OF CLAY COUNTY SOUTH DAKOTA-PART 1, GEOLOGY, AND PART 2, WATER RESOURCES,
W69-06486 02F

STEPP, J. M.
ECONOMIC ANALYSIS OF THE DEVELOPMENT POTENTIAL OF THE COMMERCIAL FISHERIES INDUSTRY OF THE COASTAL PLAINS REGION,
W69-06554 06B

STONE, L. W.
DYNAMIC SIMULATION MODEL OF THE TRANSPIRATION PROCESS,
W69-06504 02D

SUBRAHMANYAM, V. P.
SOME CHARACTERISTICS AND FREQUENCIES OF OCCURRENCE OF DROUGHTS IN THE DRY CLIMATIC ZONES OF INDIA,
W69-06524 02G

SUBRAMANIAM, A. R.
SOME CHARACTERISTICS AND FREQUENCIES OF OCCURRENCE OF DROUGHTS IN THE DRY CLIMATIC ZONES OF INDIA,
W69-06524 02G

SWANSON, ROBERT H.
A SYSTEM FOR MAKING REMOTE AND UNDISTURBED MEASUREMENTS OF SNOW SETTLEMENT AND TEMPERATURES,
W69-06803 02C

SWIFT, DONALD J.
COASTAL EROSION AND TRANSGRESSIVE STRATIGRAPHY,
W69-06798 02L

SYDKO, A. A.
EXPERIENCE IN ACCELERATED IRREVERSIBLE DESALINIZATION OF SOILS IN GOLODNAYA STEPPE,
W69-06716 03F

SYKES, JAMES E.
REPORT OF THE BUREAU OF COMMERCIAL FISHERIES BIOLOGICAL LABORATORY, ST. PETERSBURG BEACH, FLORIDA, FISCAL YEAR 1968,
W69-06767 09C

SZABOLCS, I.
SALT BALANCE AND SALT TRANSPORT PROCESSES IN IRRIGATED SOILS,
W69-06717 03F

TAYLOR, D. C.
AN ANALYSIS OF NATIONAL BASIC INFORMATION NEEDS IN URBAN HYDROLOGY,
W69-06770 04C

THAYER, RICHARD P.
STOCHASTIC MODEL FOR BOD AND DO IN STREAMS,
W69-06500 05B

THOMAS, C. A.
INFLOW TO SNAKE RIVER BETWEEN MILNER AND KING HILL, IDAHO,
W69-06427 02E

THOMAS, HAROLD E.
WATER LAWS AND CONCEPTS,
W69-06683 06E

THORDARSON, WILLIAM
RECORDS OF WELLS AND TEST HOLES IN THE NEVADA TEST SITE AND VICINITY,
W69-06820 02F

THORLEY, A. R. D.
PRESSURE TRANSIENTS IN HYDRAULIC PIPELINES,
W69-06700 08A

TROTTER, HALE F.
MAXIMIZATION BY QUADRATIC HILL-CLIMBING,
W69-06564 06A

TUCKER, L. S.
AN ANALYSIS OF NATIONAL BASIC INFORMATION NEEDS IN URBAN HYDROLOGY,
W69-06770 04C

TURNER, J. D.
WATER AVAILABILITY, COFFEE COUNTY, ALABAMA,
W69-06452 02F

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF COVINGTON COUNTY, ALABAMA,
W69-06819 02F

TURNER, WILLIAM R.
A COMPUTER-ORIENTED GROUND-WATER INFORMATION STORAGE AND RETRIEVAL SYSTEM,
W69-06764 07C

TZUR, Y.
THE STABLE ISOTOPE COMPOSITION OF MINERAL WATERS IN THE JORDON RIFT VALLEY, ISRAEL,
W69-06750 02F

ULLMANN, WILLIAM W.
ARSENIC ACCUMULATION BY FISH IN LAKES TREATED WITH SODIUM ARSENITE,
W69-06541 05B

UNGENACH, P.
THE USE OF ELECTRIC ANALOG MODELS IN HYDRODYNAMICAL STUDY OF THE ALSACE AQUIFERS (FRENCH),
W69-06806 02F

VAHIDI, M.
THE POSSIBILITY OF USING A MOVABLE DAM THE 'FABRIDAM' AND ITS APPLICATION IN ARID REGIONS,
W69-06455 04A

VAN DE PANNE, C.
A PARAMETRIC SIMPLICAL FORMULATION OF HOUTHAKKER'S CAPACITY METHOD,
W69-06568 06A

VAN HYLCKAMA, T. E. A.
PHOTOSYNTHESIS AND WATER USE BY SALTCEDAR,
W69-06771 03B

VAN SCHILFGAARDE, JAN
A METHOD OF DETERMINING THE WATER POTENTIAL OF INTACT PLANTS,
W69-06527 02I

VANDEN BERG, A.
ITERATIVE ANALYSIS BOUNDED LEAKY ARTESIAN AQUIFER,
W69-06508 02F

VILIMONOVIC, J.
A CONTRIBUTION TO THE STUDY OF GROUNDWATER INTAKE RECHARGE IN KARST,
W69-06484 02F

WAGGONER, EUGENE B.
GEOLOGY, DESIGN, AND CONSTRUCTION OF DEEP WELLS IN SEDIMENTARY FOUNDATIONS,
W69-06759 02F

WAGNER, CHARLES L.
OPEN BREAKER PROTECTION OF EHV SYSTEMS,
W69-06688 08C

WAKAHAMA, GOROW
THE METAMORPHISM OF WET SNOW,
W69-06477 02C

WALLACE, T. D.
THE USE OF ERROR COMPONENTS MODELS IN COMBINING CROSS SECTION WITH TIME SERIES DATA,
W69-06552 06A

WAUGH, FREDERICK V.
CONSUMER ASPECTS OF PRICE INSTABILITY,
W69-06570 06C

WEAVER, CHARLES E.
POTASSIUM, ILLITE AND THE OCEAN,
W69-06506 02K

WEAVER, THOMAS R.
MANUAL OF PROCEDURES AND METHODS FOR CALCULATING COMPARATIVE COSTS OF MUNICIPAL WATER SUPPLY FROM SALINE AND CONVENTIONAL WATER SOURCES IN TEXAS,
W69-06559 03A

WEINMANN, T.
TOWARDS STANDARDIZING THE ARTIFICIAL-POLLUTION TEST FOR HIGH VOLTAGE INSULATORS.
W69-06708 08C

WELLER, G.
THE ANNUAL HEAT ENERGY TRANSFER ABOVE AND INSIDE ANTARCTICA BLUE ICE,
W69-06480 02C

WEYLAND, HERMAN
RECOVERY OF METAL SALTS FROM CONCENTRATED BRINES BY CHELATION,
W69-06837 03A

WHINSTON, ANDREW
A PARAMETRIC SIMPLICAL FORMULATION OF HOUTHAKKER'S CAPACITY METHOD,
W69-06568 06A

WHITE, O. D.
RELATION OF A HYDROLOGIC INDEX TO MEAN ANNUAL FLOW,
W69-06441 02B

WHITE, WILLIAM B.
CONCEPTUAL MODELS FOR CARBONATE AQUIFERS,
W69-06423 02F

WIENER, A.
IRRIGATION WATER SYSTEM--ISRAEL'S NATIONAL WATER GRID,
W69-06459 03F

WILDE, D. J.
OPTIMIZATION THEORY APPLIED TO PRELIMINARY DESIGN OF A SINGLE EFFECT MULTISTAGE FLASH DESALINATION PLANT,
W69-06495 03A

WILK, K. E.
RADAR MEASUREMENT OF PRECIPITATION FOR HYDROLOGICAL PURPOSES,
W69-06812 02B

WILLIAMS, B. A.
OPTIMIZATION THEORY APPLIED TO PRELIMINARY DESIGN OF A SINGLE EFFECT MULTISTAGE FLASH DESALINATION PLANT,
W69-06495 03A

WILLIAMS, MERLIN C.
REGIONAL HYDROLOGIC AREA STUDY AS AN ANALYSIS TOOL IN WEATHER MODIFICATION,
W69-06805 02A

WILLIAMS, M. A. J.
PREDICTION OF RAINSPLASH EROSION IN THE SEASONALLY WET TROPICS,
W69-06768 02J

WILLIS, WALTER J.
WATER TRANSPORTATION-IMPACT ON ECONOMIC DEVELOPMENT,
W69-06730 06B

WILM, HAROLD G.
INTERGOVERNMENTAL PLANNING OF WATER RESOURCES,
W69-06429 06B

WINOGRAD, I. J.
RECORDS OF WELLS AND TEST HOLES IN THE NEVADA TEST SITE AND VICINITY,
W69-06820 02F

WINOKUR, HERBERT S., JR.
FIRST ORDER AUTO REGRESSION INFERENCE, ESTIMATION, AND PREDICTION,
W69-06550 06A

WOERNER, JACK
DISPLACEMENT FRONT UNDER PONDED LEACHING,
W69-06510 02G

WOODLEY, N. H.
SUBSTATION EXPANSION, RELIABILITY, AND TRANSFORMER LOADING POLICY ANALYSIS,
W69-06685 06A

WOODS, PHILIP C.
WATER QUALITY MANAGEMENT IN IRRIGATION SYSTEMS,
W69-06499 05G

WOO, K. B.
DYNAMIC SIMULATION MODEL OF THE TRANSPIRATION PROCESS,
W69-06504 02D

WORLD, R. W.
A SWING RELAY FOR THE EAST-WEST INTERTIE,
W69-06687 08C

WORRALL, RICHARD D.
CIVIL ENGINEERING AND URBAN SYSTEMS,
W69-06491 06A

WORTS, G. F., JR.
ESTIMATED WATER USE IN NEVADA, 1950-65,
W69-06446 06D

YEVJEVICH, VUJICA
EFFECTS OF TRUNCATION ON DEPENDENCE IN HYDROLOGICAL TIME SERIES,
W69-06789 02A

YOUNG, G. K.
RESERVOIR MANAGEMENT THE TRADEOFF BETWEEN LOW-FLOW REGULATION AND FLOOD CONTROL,
W69-06496 04A

YOUNG, R. A.
RECORDS OF WELLS AND TEST HOLES IN THE NEVADA TEST SITE AND VICINITY,
W69-06820 02F

ZELLNER, A.
SPECIFICATION AND ESTIMATION OF COBB-DOUGLAS PRODUCTION FUNCTION MODELS,
W69-06560 06A

ZIMA, K.
SOME DETAILS ON THE CIRCULATION OF GROUNDWATER IN NON-KARSTIFIED FISSURED FORMATIONS IN CZECHOSLOVAKIA (FRENCH),
W69-06485 02F

ZLATEN, ALEXANDER
FOUNDATION PROBLEMS OF RUEDI DAM AND RESERVOIR,
W69-06673 08E

ORGANIZATIONAL INDEX

AEROJET-GENERAL CORP., EL MONTE, CALIF.
RECOVERY OF METAL SALTS FROM CONCENTRATED BRINES BY CHELATION,
W69-06837 03A

AEROJET-GENERAL CORP., EL MONTE, CALIF. ENVIRONMENTAL SYSTEMS DIV. AND ENGINEERING-SCIENCE, INC., ARCADIA, CALIF.
SYSTEMS APPROACH FOR INTEGRATING GROUND WATER AND SURFACE WATER USE.
W69-06834 06A

AEROSPACE RESEARCH LABS., WRIGHT-PATTERSON AFB, OHIO AND DOUGLAS AIRCRAFT CO., INC., SANTA MONICA, CALIF.
SIMULTANEOUS TESTS FOR TREND AND SERIAL CORRELATIONS FOR GAUSSIAN MARKOV RESIDUALS,
W69-06569 06A

AEROSPACE RESEARCH LABS., WRIGHT-PATTERSON AFB, OHIO.
A NEW TABLE OF PERCENTAGE POINTS OF THE PEARSON TYPE III DISTRIBUTION,
W69-06680 02E

AGRICULTURAL RESEARCH SERVICE, BOISE, IDAHO. SOIL AND WATER CONSERVATION RESEARCH DIV.
A UNIVERSAL SURFACE PRECIPITATION GAGE,
W69-06804 02B

AGRICULTURAL RESEARCH SERVICE, MADISON, WIS. SOIL AND WATER CONSERVATION RESEARCH DIV.
PRECIPITATION AND BASE FLOW VARIABILITY,
W69-06443 02B

AGRICULTURAL RESEARCH SERVICE, OXFORD, MISS.
USE OF TRACER TECHNIQUE IN SOIL EROSION RESEARCH,
W69-06704 04D

AGRICULTURAL RESEARCH SERVICE, RIVERSIDE, CALIF. SALINITY LAB.
SOIL-WATER DIFFUSIVITY BY THE ONE-STEP METHOD,
W69-06528 02G

AGRICULTURAL RESEARCH SERVICE, WASHINGTON, D. C. SOIL AND WATER RESEARCH DIV. AND SOUTH DAKOTA STATE UNIV., BROOKINGS. REMOTE SENSING INST.
DRAINING AREA UNDERLAIN BY HIGHLY PERMEABLE SHALLOW SAND AQUIFER,
W69-06512 02G

AIN SHAMS UNIV., CAIRO (EGYPT). DEPT. OF SOILS.
A COMPARATIVE STUDY OF HYDRAULIC CONDUCTIVITY IN THE ALLUVIAL SOILS OF EGYPT,
W69-06517 02F

AKADEMIYA NAUK SSSR, MOSCOW. POCHVENNYI INSTITUT.
THEORY OF SOIL MOISTURE - VOL 1, MOISTURE PROPERTIES OF SOILS AND MOVEMENT OF SOIL MOISTURE,
W69-06489 02G

ALABAMA GEOLOGICAL SURVEY, UNIVERSITY AND GEOLOGICAL SURVEY, WASHINGTON, D. C.
WATER AVAILABILITY, CONECUH COUNTY, ALABAMA,
W69-06451 02E

WATER AVAILABILITY, COFFEE COUNTY, ALABAMA,
W69-06452 02F

ALABAMA GEOLOGICAL SURVEY, UNIVERSITY AND GEOLOGICAL SURVEY, UNIVERSITY, ALA.
GEOLOGIC MAP AND WATER AVAILABILITY MAP OF PIKE COUNTY, ALABAMA,
W69-06815 02F

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF HENRY COUNTY, ALABAMA,
W69-06816 02F

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF CRENSHAW COUNTY, ALABAMA,
W69-06817 02F

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF DALE COUNTY, ALABAMA,
W69-06818 02F

GEOLOGIC MAP AND WATER AVAILABILITY MAP OF COVINGTON COUNTY, ALABAMA,
W69-06819 02F

ALL-UNION SCIENTIFIC RESEARCH INST. OF HYDROGEOLOGY AND ENGINEERING GEOLOGY, MOSCOW (USSR).
PRINCIPLES OF CHOOSING EXPERIMENTAL PLOTS FOR WATER BALANCE STUDIES IN IRRIGATION REGIONS OF THE ARID ZONE,
W69-06523 02G

AMERICAN SOCIETY OF CIVIL ENGINEERS, CAMBRIDGE, MASS. URBAN HYDROLOGY RESEARCH COUNCIL.
AN ANALYSIS OF NATIONAL BASIC INFORMATION NEEDS IN URBAN HYDROLOGY,
W69-06770 04C

ANDHRA UNIV., WALTAIR (INDIA). DEPT. OF METEOROLOGY AND OCEANOGRAPHY.
SOME CHARACTERISTICS AND FREQUENCIES OF OCCURRENCE OF DROUGHTS IN THE DRY CLIMATIC ZONES OF INDIA,
W69-06524 02G

ARIZONA STATE UNIV., TEMPE. DEPT. OF GEOLOGY.
RECENT HISTORY OF GULKANA AND COLLEGE GLACIERS, CENTRAL ALASKA RANGE, ALASKA,
W69-06808 02C

ASSOCIATED SPORTSMEN OF CALIFORNIA, SAN FRANCISCO.
THE COMPETITION FOR WATER QUALITY RECREATION,
W69-06573 06D

AUSTRALIAN NATIONAL UNIV., CANBERRA.
CANONICAL CORRELATION AND MULTIPLE EQUATION SYSTEMS IN ECONOMICS,
W69-06735 06B

AUSTRALIAN NATIONAL UNIV., CANBERRA. RESEARCH SCHOOL OF PACIFIC STUDIES.
PREDICTION OF RAINSPLASH EROSION IN THE SEASONALLY WET TROPICS,
W69-06768 02J

BATTELLE MEMORIAL INST., COLUMBUS, OHIO.
THE DESIRABILITY AND APPLICABILITY OF SIMULATING ECOSYSTEMS,
W69-06537 06A

BECHTEL CORP., SAN FRANCISCO, CALIF.
DESIGN AND CONSTRUCTION OF DAMS FOR RETENTION OF SOLID WASTES,
W69-06675 05G

BIRMINGHAM UNIV. (ENGLAND). DEPT. OF CIVIL ENGINEERING.
A DESIGN METHOD FOR DEEP WELL DEWATERING INSTALLATIONS,
W69-06430 02F

BIRMINGHAM UNIV. (ENGLAND). DEPT. OF GEOLOGY.
LABORATORY EXPERIMENTS ON THE PRODUCTION OF GRAIN ORIENTATION IN SHEARING SAND,
W69-06799 02J

BIRMINGHAM UNIV. (ENGLAND). DEPT. OF PHYSICS.
THE MECHANICAL PROPERTIES OF SINGLE CRYSTALS OF ICE AT LOW TEMPERATURES,
W69-06474 02C

THE IMPORTANCE OF THE HYDROGEN ATOM ARRANGEMENT IN DETERMINING HOW ICE CAN DEFORM PLASTICALLY,
W69-06476 02C

BLACK AND VEATCH, KANSAS CITY, MO.
ECONOMIC EFFECTS OF MINERAL CONTENT IN MUNICIPAL WATER SUPPLIES.
W69-06555 03A

BLACKLANDS EXPERIMENT WATERSHED, RIESEL, TEX. AND TEXAS A AND M UNIV., COLLEGE STATION. BIG SPRING FIELD STATION.
GRADED FURROWS FOR WATER EROSION CONTROL,
W69-06746 02J

BRIGHAM YOUNG UNIV., PROVO, UTAH AND DOW CHEMICAL CO., MIDLAND, MICH.
A FEASIBILITY STUDY ON THE UTILIZATION OF WASTE BRINE FROM SALINATION PLANTS PART 1,
W69-06556 03C

BRITISH COLUMBIA UNIV., VANCOUVER.
INTERREGIONAL PRODUCTION AND WATER RESOURCE DEPENDENCIES AMONG THE WESTERN STATES,
W69-06721 06B

ON THE RELATIVE SMALL-SAMPLE PROPERTIES OF SEVERAL STRUCTURAL-EQUATION ESTIMATORS,
W69-06734 06B

BROWN BOVERI AND CO. LTD., BADEN (SWITZERLAND).
TOWARDS STANDARDIZING THE ARTIFICIAL-POLLUTION TEST FOR HIGH VOLTAGE INSULATORS.
W69-06708 08C

BROWN, BOVERI AND CO. LTD., BADEN (SWITZERLAND).
SOME ASPECTS OF INSULATION CO-ORDINATION IN HVDC SYSTEMS,
W69-06707 08C

BROWN BOVERI DISTANCE PROTECTION SYSTEMS EMPLOYING CARRIER TRANSFER,
W69-06709 08C

DISTANCE PROTECTION OF HIGH-VOLTAGE LINES CONTAINING SERIES CAPACITORS,
W69-06710 08C

BUREAU OF COMMERCIAL FISHERIES, BEAUFORT, N. C. RADIOBIOLOGICAL LAB.
PROGRESS REPORT OF THE BUREAU OF COMMERCIAL FISHERIES RADIOBIOLOGICAL LABORATORY, BEAUFORT, N. C., FISCAL YEAR 1968,
W69-06769 09C

BUREAU OF RECLAMATION, BOISE, IDAHO.
COMPUTER-AIRPLANE COMBO SAVES QUARTER MILLION DOLLARS ON SURVEYS AND ADMINISTRATION OF CONSTRUCTION CONTRACTS,
W69-06697 07B

BUREAU OF RECLAMATION, DENVER, COLO.
FOUNDATION PROBLEMS OF RUEDI DAM AND RESERVOIR,
W69-06673 08E

HIGH EARTHFILL DAM FOUNDATION GROUTING DESIGN AND CONSTRUCTION PROCEDURES,
W69-06674 08D

ELECTRICAL FEATURES OF THE GRAND COULEE THIRD POWER PLANT,
W69-06684 08C

A SWING RELAY FOR THE EAST-WEST INTERTIE,
W69-06687 08C

SOIL AS AN ENGINEERING MATERIAL,
W69-06699 08D

BUREAU OF RECLAMATION, DENVER, COLO. EXPERIMENTAL DESIGN ANALYSIS SECTION AND BUREAU OF RECLAMATION, DENVER, COLO. WATER UTILIZATION BRANCH.
ANALOG OF GROUND WATER IN EAST-CENTRAL NEW MEXICO,
W69-06509 02F

BUREAU OF RECLAMATION, SACRAMENTO, CALIF.
THE COMPETITION FOR WATER QUANTITY,
W69-06574 06D

CAIRO UNIV. (EGYPT). DEPT. OF BOTANY.
TRANSPIRATION OF DESERT PLANTS UNDER DIFFERENT ENVIRONMENTAL CONDITIONS,
W69-06526 02D

CALIFORNIA DEPT. OF FISH AND GAME, SACRAMENTO.
THE COMPETITION FOR WATER QUANTITY RECREATION,
W69-06578 06D

CALIFORNIA UNIVERSITY, DAVIS. WATER RESOURCES CENTER.
CONFERENCE ON WATER DECISIONS IN THE CRITICAL 1960'S,
W69-06572 06B

CALIFORNIA UNIV., BERKELEY, CALIF.
COST, PRECISION, AND VALUE RELATIONSHIPS OF DATA COLLECTION AND DESIGN ACTIVITIES IN WATER DEVELOPMENT PLANNING,
W69-06733 06B

CALIFORNIA UNIV., BERKELEY.
WATER QUALITY MANAGEMENT ENGINEERING-ECONOMIC FACTORS IN MUNICIPAL WASTE DISPOSAL,
W69-06505 05D

NUCLEAR REACTORS,
W69-06582 03A

THE STATUS OF SEA WATER CONVERSION,
W69-06583 03A

CALIFORNIA UNIV., EL CENTRO. EL CENTRO FIELD STATION.
DISPLACEMENT FRONT UNDER PONDED LEACHING,
W69-06510 02G

CALIFORNIA UNIV., LIVERMORE. LAWRENCE RADIATION LAB.
NUCLEAR EXPLOSIVES,
W69-06581 08H

CALIFORNIA UNIV., LOS ANGELES. DEPT. OF ENGINEERING AND NEVADA UNIV., RENO. DEPT. OF WATER RESOURCES.
QUASILINEARIZATION APPROACH TO THE IDENTIFICATION OF HYDROLOGIC SYSTEMS,
W69-06822 02A

CALIFORNIA UNIV., LOS ANGELES. DEPT. OF ENGINEERING.
ON MULTILEVEL OPTIMIZATION IN GROUND WATER SYSTEMS,
W69-06813 02F

CALIFORNIA, UNIV., LOS ANGELES AND CALIFORNIA UNIV., DAVIS.
HORIZONTAL MOVEMENTS RELATED TO SUBSIDENCE,
W69-06692 08D

CARRIER CORP., SYRACUSE, N. Y.
MEASUREMENT OF ROTATING MACHINERY VIBRATION AND FACTORS AFFECTING INSTRUMENT ACCURACY,
W69-06702 07B

CASE WESTERN RESERVE UNIV., CLEVELAND, OHIO.
OPTIMALITY OF IMPERFECTLY COMPETITIVE RESOURCE ALLOCATION,
W69-06722 06C

CENTRAL WATER AND POWER COMMISSION (INDIA).
A CENTURY OF DESIGN AND CONSTRUCTION OF IRRIGATION WORKS IN INDIA,
W69-06461 04A

CHICAGO UNIV., ILL. AND INSTITUTE FOR DEFENSE ANALYSES, ARLINGTON, VA.
HOUSEHOLD PRODUCTION AND CONSUMER DEMAND FUNCTIONS,
W69-06566 06D

CHICAGO UNIV., ILL. MICHIGAN STATE UNIV., EAST LANSING AND LOUVAIN UNIV. (BELGIUM).
SPECIFICATION AND ESTIMATION OF COBB-DOUGLAS PRODUCTION FUNCTION MODELS,
W69-06560 06A

CITY UNIV., LONDON (ENGLAND).
PRESSURE TRANSIENTS IN HYDRAULIC PIPELINES,
W69-06700 08A

CLEMSON UNIV., S. C.
EVALUATION OF THE GAMMA TRANSMISSION METHOD FOR DETERMINING SOIL WATER BALANCE AND EVAPOTRANSPIRATION,
W69-06514 02G

ECONOMIC ANALYSIS OF THE DEVELOPMENT POTENTIAL OF THE COMMERCIAL FISHERIES INDUSTRY OF THE COASTAL PLAINS REGION,
W69-06554 06B

CLEVELAND ELECTRIC ILLUMINATING CO., OHIO AND WESTINGHOUSE ELECTRIC CORP., PITTSBURGH, PA.
SUBSTATION EXPANSION, RELIABILITY, AND TRANSFORMER LOADING POLICY ANALYSIS,
W69-06685 06A

COLORADO STATE UNIV., FORT COLLINS.
A GEOMORPHIC APPROACH TO EROSION CONTROL IN SEMIARID REGIONS,
W69-06513 02J

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF AGRICULTURAL AND IRRIGATION ENGINEERING AND AGRICULTURAL RESEARCH SERVICE, FORT COLLINS, COLO. SOIL AND WATER CONSERVATION RESEARCH DIV.
CONSERVATION OF SOIL WATER BY GRAVEL MULCHES,
W69-06796 03F

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF CIVIL ENGINEERING.
EFFECTS OF TRUNCATION ON DEPENDENCE IN HYDROLOGICAL TIME SERIES,
W69-06789 02A

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, ASPENDALE (AUSTRALIA). DIV. OF METEOROLOGICAL PHYSICS.
TRANSPIRATION REDUCTION BY SURFACE FILMS,
W69-06532 03F

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, CANBERRA (AUSTRALIA).
EXTENDED TECHNIQUES OF CALCULATION OF SOIL-WATER MOVEMENT, WITH SOME PHYSICAL CONSEQUENCES,
W69-06714 02G

CONNECTICUT STATE HIGHWAY DEPT., WETHERSFIELD.
NON-ENGINEERING ELEMENTS IN FACTORS OF SAFETY IN SOIL AND FOUNDATION ENGINEERING,
W69-06695 08D

COOPERATIVE STATE RESEARCH SERVICE, WASHINGTON, D. C.
PROCEEDINGS OF TILE DRAINAGE RESEARCH CONFERENCE,
W69-06795 04A

CORNELL UNIV., ITHACA, N. Y.
A HEURISTIC AID FOR THE DESIGN OF SEWER NETWORKS,
W69-06498 05E

THE IMPROVEMENT OF WATER QUALITY UNDER A FINANCIAL CONSTRAINT A COMMENTARY ON 'LINEAR PROGRAMMING APPLIED TO WATER QUALITY MANAGEMENT',
W69-06547 05F

CORNELL UNIV., ITHACA, N. Y. DEPT. OF BOTANY.
APPLICATION OF AN ELECTRONIC PARTICLE COUNTER IN ANALYZING NATURAL POPULATIONS OF PHYTOPLANKTON,
W69-06540 07B

CORNELL UNIV., ITHACA, N. Y. SCHOOL OF CIVIL ENGINEERING.
EVALUATION OF SOME PRACTICAL METHODS OF ESTIMATING EVAPOTRANSPIRATION IN ARID CLIMATES AT LOW LATITUDES,
W69-06530 02D

CORNELL UNIV., ITHACA, N. Y. WATER RESOURCES AND MARINE SCIENCES CENTER.
PERMUTED TITLE INDEX TO WATER RESEARCH JOURNALS, 1967.
W69-06539 10

CORPS OF ENGINEERS, BUFFALO, N. Y.
FLOOD PLAIN INFORMATION, ROCKY RIVER IN CITIES OF ROCKY RIVER AND LAKEWOOD, CUYAHOGA COUNTY, OHIO.
W69-06468 04A

FLOOD PLAIN INFORMATION OF SENECA LAKE, NEW YORK.
W69-06825 04A

FLOOD PLAIN INFORMATION, CAYUGA LAKE, NEW YORK.
W69-06826 04A

FLOOD PLAIN INFORMATION, CANANDAIGUA LAKE, NEW YORK.
W69-06827 04A

CORPS OF ENGINEERS, CHICAGO, ILL.
WATER RESOURCES DEVELOPMENT IN MINNESOTA.
W69-06784 09D

CORPS OF ENGINEERS, FORT WORTH, TEX.
ARTIFICIAL RECHARGE TO THE EDWARDS LIMESTONE AQUIFER IN SOUTH TEXAS,
W69-06483 04B

CORPS OF ENGINEERS, JACKSONVILLE, FLA.
FLOOD PLAIN INFORMATION, GUAYANILLA RIVER, GUAYANILLA, PUERTO RICO.
W69-06473 04A

CORPS OF ENGINEERS, LITTLE ROCK, ARK.
FLOOD PLAIN INFORMATION, WILSON CREEK AND TRIBUTARIES, SPRINGFIELD, MISSOURI-PART 1.
W69-06467 04A

CORPS OF ENGINEERS, LOS ANGELES, CALIF.
FLOOD PLAIN INFORMATION OF SPRING VALLEY CREEK, SAN DIEGO COUNTY, CALIFORNIA.
W69-06824 04A

CORPS OF ENGINEERS, OMAHA, NEBR.
FLOOD PLAIN INFORMATION, OMAHA METROPOLITAN REGION, NEBRASKA - VOLUME 1.
W69-06471 04A

WATER RESOURCES DEVELOPMENT BY THE US ARMY CORPS OF

ENGINEERS IN COLORADO.
W69-06782 09D

CORPS OF ENGINEERS, PHILADELPHIA, PA.
WATER RESOURCES DEVELOPMENT BY THE US ARMY CORPS OF ENGINEERS IN DELAWARE.
W69-06783 09D

CORPS OF ENGINEERS, ROCK ISLAND, ILL.
FLOOD PLAIN INFORMATION, CEDAR RIVER, LINN COUNTY, IOWA.
W69-06472 04A

CORPS OF ENGINEERS, SACRAMENTO, CALIF.
HEC-2, WATER SURFACE PROFILES.
W69-06787 04A

HEC-3, RESERVIOR SYSTEM ANALYSIS.
W69-06788 04A

CORPS OF ENGINEERS, SEATTLE, WASH.
FLOOD PLAIN INFORMATION, YAKIMA RIVER, BENTON COUNTY, WASHINGTON.
W69-06470 04A

CORPS OF ENGINEERS, WALLA WALLA, WASH.
FLOOD PLAIN INFORMATION, WALLA WALLA RIVER TRIBUTARIES IN THE VICINITY OF WALLA WALLA, WASHINGTON.
W69-06469 04A

FLOOD PLAIN INFORMATION, BOISE RIVER AND NORTHSIDE TRIBUTARIES, BOISE, IDAHO AND VICINITY.
W69-06823 04A

DAMES AND MOORE, LOS ANGELES, CALIF.
A SIMPLIFIED TECHNIQUE FOR WELL-FIELD DESIGN,
W69-06421 02F

DEPARTMENT OF AGRICULTURE, OTTAWA (ONTARIO). PLANT RESEARCH INST.
THE PERFORMANCE OF SOIL MOISTURE ESTIMATES AS COMPARED WITH THE DIRECT USE OF CLIMATOLOGICAL DATA FOR ESTIMATING CROP YIELDS,
W69-06519 02G

DEPARTMENT OF AGRICULTURE, WASHINGTON, D. C.
CONSUMER ASPECTS OF PRICE INSTABILITY,
W69-06570 06C

DEPARTMENT OF ENERGY, MINES AND RESOURCES, OTTAWA (ONTARIO). POLAR CONTINENTAL SHELF PROJECT.
A TEMPERATURE PROFILE THROUGH THE MEIGHEN ICE CAP, ARCTIC CANADA,
W69-06482 02C

DEPARTMENT OF ENERGY, MINES AND RESOURCES, OTTAWA (ONTARIO). INLAND WATERS BRANCH.
A RIGID PLATE MODEL OF THE BAROMETRIC EFFECT,
W69-06775 02F

CLIMATOLOGY STUDIES OF BAFFIN ISLAND, NORTHWEST TERRITORIES,
W69-06814 02B

DEPARTMENT OF THE INTERIOR, WASHINGTON, D. C. AND CORPS OF ENGINEERS, WASHINGTON, D. C.
ALLOCATION AND REALLOCATION OF WATER RESOURCES,
W69-06691 06B

DEPARTMENT OF WATER DEVELOPMENT (KENYA).
RURAL WATER DEVELOPMENT IN KENYA,
W69-06453 04A

DOW CHEMICAL CO., WALNUT CREEK, CALIF.
RECOVERY OF SALTS FROM SALINE WATER VIA SOLVENT EXTRACTION (FINAL REPORT),
W69-06839 03A

DUKE UNIV., DURHAM, N. C.
COASTAL EROSION AND TRANSGRESSIVE STRATIGRAPHY,
W69-06798 02L

EIDGENOESSISCHE TECHNISCHE HOCHSCHULE, ZURICH (SWITZERLAND). VERSUCHSANSTALT FUER WASSERBAU UND ERBAU.
RELATIONS BETWEEN GLACIER RUNOFF AND METEOROLOGICAL FACTORS OBSERVED ON AND OUTSIDE THE GLACIER,
W69-06481 02C

ELGIN INTERNATIONAL, INC.
SUL-BISUL(T) ION EXCHANGE PROCESS FIELD EVALUATION ON BRACKISH WATERS,
W69-06836 03A

ENVIRONMENTAL DATA SERVICE, SILVER SPRING, MD.
THE ABNORMALLY DRY WEATHER OF 1961-1966 IN THE NORTHEASTERN UNITED STATES,
W69-06437 02B

ENVIRONMENTAL SCIENCE SERVICES ADMINISTRATION, SILVER SPRING, MD.
SOME REMARKS ON THE PREDICTABILITY OF DROUGHT AND RELATED CLIMATIC ANOMALIES,
W69-06439 02B

FEATHER RIVER PROJECT ASSOCIATION, BAKERSFIELD, CALIF.
THE COMPETITION FOR WATER QUANTITY AGRICULTURE,
W69-06575 06D

FEDERAL INST. FOR SNOW AND AVALANCHE RESEARCH, WEISSFLUHJOCH DAVOS (SWITZERLAND).
DEFORMATION OF POLYCRYSTALLINE ICE UNDER COMBINED UNIAXIAL AND HYDROSTATIC PRESSURE,
W69-06475 02C

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, EDISON, N. J. NORTH ATLANTIC WATER QUALITY MANAGEMENT CENTER.
OIL AND HAZARDOUS MATERIALS-EMERGENCY PROCEDURES IN THE WATER ENVIRONMENT.
W69-06791 05G

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, WASHINGTON, D. C.
RESERVOIR MANAGEMENT THE TRADEOFF BETWEEN LOW-FLOW REGULATION AND FLOOD CONTROL,
W69-06496 04A

POLLUTION OF THE INTERSTATE WATERS OF THE BLACKSTONE AND TEN MILE RIVERS AND THEIR TRIBUTARIES,
W69-06802 05B

FISH AND WILDLIFE SERVICE, WASHINGTON D. C. AND BUREAU OF COMMERCIAL FISHERIES, WASHINGTON, D. C.
REPORT OF THE BUREAU OF COMMERCIAL FISHERIES BIOLOGICAL LABORATORY, ST. PETERSBURG BEACH, FLORIDA, FISCAL YEAR 1968,
W69-06767 09C

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, ROME (ITALY).
FIELD OBSERVATIONS OF SOME PHYSICAL PROPERTIES IN ALLUVIAL SOILS OF ARID AND SEMI-ARID REGIONS,
W69-06515 02G

FOREST SERVICE (USDA), FORT COLLINS, COLO. ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION.
A SYSTEM FOR MAKING REMOTE AND UNDISTURBED MEASUREMENTS OF SNOW SETTLEMENT AND TEMPERATURES,
W69-06803 02C

FRESNO GROUND-WATER RECHARGE FIELD STATION, CALIF. SOUTHWEST BRANCH.
THE HYDROLOGIC AND GEOLOGIC ASPECTS OF A PERCHING LAYER - SAN JOAQUIN VALLEY, WESTERN FRESNO COUNTY, CALIFORNIA,
W69-06758 02F

GEOLOGICAL SURVEY, ARLINGTON, VA.
EFFECTS OF THE DROUGHT ON WATER RESOURCES-SURFACE AND SUBSURFACE HYDROLOGY,
W69-06440 02B

GROUNDWATER IN FRACTURED VOLCANIC ROCKS IN SOUTHERN ARIZONA,
W69-06831 02F

GEOLOGICAL SURVEY, AUSTIN, TEX.
WATER-QUALITY RECORDS FOR THE HUBBARD CREEK WATERSHED, TEXAS, OCTOBER 1966-SEPTEMBER 1967,
W69-06786 02H

GEOLOGICAL SURVEY, BATON ROUGE, LA.
RAINFALL-RUNOFF RELATIONS FOR SOUTHEASTERN LOUISIANA AND SOUTHWESTERN MISSISSIPPI,
W69-06829 02A

GEOLOGICAL SURVEY, CARSON CITY, NEV.
WATER-RESOURCES APPRAISAL OF THE LOWER MOAPA-LAKE MEAD AREA, CLARK COUNTY, NEVADA,
W69-06435 02F

GEOLOGICAL SURVEY, CARSON CITY, NEV., AND NEVADA STATE DEPT. OF CONSERVATION AND NATURAL RESOURCES.
ESTIMATED WATER USE IN NEVADA, 1950-65,
W69-06446 06D

GEOLOGICAL SURVEY, LUBBOCK, TEX.
PHOTOSYNTHESIS AND WATER USE BY SALTCEDAR,
W69-06771 03B

GEOLOGICAL SURVEY, MENLO PARK, CALIF.
RESPONSE OF BUBBLE-GAGE SERVOMANOMETERS TO OSCILLATIONS IN WATER LEVEL,
W69-06434 07C

GEOLOGICAL SURVEY, MONTPELIER, VT. AND VERMONT DEPT. OF NATURAL RESOURCES.
GROUND WATER FAVORABILITY MAP OF THE OTTAUQUECHEE-SAXTONS RIVER BASIN, VERMONT,
W69-06463 02F

GEOLOGICAL SURVEY, MONTPELIER, VT. AND VERMONT DEPT. OF WATER RESOURCES.
GROUND WATER FAVORABILITY MAP OF THE WEST-DEERFIELD RIVER BASIN, VERMONT,
W69-06464 02F

GROUND WATER FAVORABILITY MAP OF THE WELLS-OMPOMPANOOSUC RIVER BASIN, VERMONT,
W69-06465 02F

GROUND WATER FAVORABILITY MAP OF THE WHITE RIVER BASIN, VERMONT,
W69-06466 02F

GEOLOGICAL SURVEY, PHILADELPHIA, PA.
PRELIMINARY REMOTE SENSING OF THE DELAWARE ESTUARY,
W69-06793 02L

GEOLOGICAL SURVEY, RALEIGH, N. C.
ROLE OF GROUND WATER CONTAMINATION IN WATER MANAGMENT,
W69-06762 05G

GEOLOGICAL SURVEY, TRENTON, N. J.
GEOLOGY AND GROUND-WATER RESOURCES OF BURLINGTON COUNTY, NEW JERSEY,
W69-06449 02F

GEOLOGY AND GROUND-WATER RESOURCES OF THE RAHWAY AREA, NEW JERSEY,
W69-06450 02F

GEOLOGICAL SURVEY, WASHINGTON, D. C.
INFLOW TO SNAKE RIVER BETWEEN MILNER AND KING HILL, IDAHO,
W69-06427 02E

FLOOD INUNDATION AND EFFECTS OF URBANIZATION IN METROPOLITAN CHARLOTTE, NORTH CAROLINA,
W69-06445 04C

EXTENSIONS OF STREAMFLOW RECORDS IN UTAH,
W69-06447 02E

SUMMARY OF GROUND-WATER RESOURCES OF ATLANTIC COUNTY, NEW JERSEY,
W69-06448 02F

WATER LAWS AND CONCEPTS,
W69-06683 08E

DISTRIBUTION OF RADIONUCLIDES IN BOTTOM SEDIMENT OF THE CLINCH RIVER, EASTERN TENNESSEE,
W69-06785 05B

RECORDS OF WELLS AND TEST HOLES IN THE NEVADA TEST SITE AND VICINITY,
W69-06820 02F

GEORGE WASHINGTON UNIV., WASHINGTON, D. C.
IMPLICATIONS OF PROPERTY RIGHTS FOR GOVERNMENT INVESTMENT CHOICES,
W69-06548 06B

GEORGIA INST. OF TECH., ATLANTA.
POTASSIUM, ILLITE AND THE OCEAN,
W69-06506 02K

GEORGIA UNIV., ATHENS.
BRITTLE ROCK FAILURE UNDER TRIAXIAL STRESS,
W69-06701 08E

GRONINGEN RIJKSUNIVERSITEIT (NETHERLANDS) AND VIRGINIA UNIV., CHARLOTTESVILLE, VA.
A PARAMETRIC SIMPLICAL FORMULATION OF HOUTHAKKER'S CAPACITY METHOD,
W69-06568 06A

HARVARD UNIV., CAMBRIDGE, MASS.
THE OPPORTUNITY COSTS OF PUBLIC INVESTMENT,
W69-06739 06B

HARVARD UNIV., CAMBRIDGE, MASS. AND COLORADO RIVER BASIN PROJECT, DENVER.
ECONOMIC FRAMEWORK FOR SALINITY CONTROL PROJECTS,
W69-06490 05D

HEBREW UNIV., JERUSALEM (ISRAEL) GEOLOGICAL SURVEY OF ISRAEL, JERUSALEM AND CENTER FOR GROUNDWATER RESEARCH, JERUSALEM (ISRAEL).
THE GROUNDWATER PROVINCES OF IRAN,
W69-06772 04B

HEBREW UNIV., JERUSALEM (ISRAEL).
LONG-RUN COEFFICIENTS AND DISTRIBUTED LAG ANALYSIS A REFORMULATION,
W69-06557 06A

A PRELIMINARY FIELD STUDY OF SURFACE TREATMENTS FOR RUNOFF INDUCEMENT IN THE NEGEV OF ISRAEL,
W69-06715 02A

HEBREW UNIV., JERUSALEM (ISRAEL). DEPT. OF IRRIGATION.
MODERN IRRIGATION FOR INCREASED AGRICULTURAL PRODUCTION,
W69-06454 03F

HOKKAIDO UNIV., SAPPORO (JAPAN). INST. OF LOW TEMPERATURE SCIENCE.
THE METAMORPHISM OF WET SNOW,
W69-06477 02C

LIQUID PERMEABILITY OF SNOW,
W69-06478 02C

HORNER AND SHIFRIN, INC., CONS. ENGRS., ST. LOUIS, MO.
USE OF DIGITAL COMPUTERS IN DISTRIBUTION SYSTEM ANALYSES,
W69-06503 07C

HYDROMETEOROLOGICAL SERVICE OF THE USSR (MOSCOW).
DROUGHT AND SOIL MOISTURE,
W69-06529 02G

IMPERIAL COLL. OF SCIENCE AND TECHNOLOGY, LONDON (ENGLAND). DEPT. OF GEOLOGY.
A CLASSIFICATION OF PALEOCURRENT MODELS,
W69-06810 02J

INDIANA UNIV., BLOOMINGTON. DEPT. OF GEOLOGY AND INDIANA GEOLOGICAL SURVEY, BLOOMINGTON.
RANDOM PROCESSES AND LITHOLOGIC TRANSITIONS,
W69-06807 02J

INSTITUT DE PHYSIQUE DU GLOBE, STRASBOURG (FRANCE).
THE USE OF ELECTRIC ANALOG MODELS IN HYDRODYNAMICAL STUDY OF THE ALSACE AQUIFERS (FRENCH),
W69-06806 02F

INSTITUTE FOR DEFENSE ANALYSES, ARLINGTON, VA.
LEAST SQUARES, CONDITIONAL PREDICTIONS, AND ESTIMATOR PROPERTIES,
W69-06551 06A

INSTITUTE FOR GEOLOGICAL AND GEOPHYSICAL RESEARCH, BELGRADE (YUGOSLAVIA).
A CONTRIBUTION TO THE STUDY OF GROUNDWATER INTAKE RECHARGE IN KARST,
W69-06484 02F

INTERNATIONAL ATOMIC ENERGY AGENCY, VIENNA (AUSTRIA).
THE ROLE OF THE INTERNATIONAL ATOMIC ENERGY AGENCY IN THE DEVELOPMENT, USE AND CONTROL OF WATER RESOURCES.
W69-06456 03A

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT, NEW YORK AND OFFICE OF THE SECRETARY OF DEFENSE, WASHINGTON, D. C.
FIRST ORDER AUTO REGRESSION INFERENCE, ESTIMATION, AND PREDICTION,
W69-06550 06A

INTERNATIONAL BUSINESS MACHINES CORP., NEW YORK.
THE ESTIMATION OF NONLINEAR ECONOMETRIC SYSTEMS,
W69-06562 06A

IOWA STATE UNIV. OF SCIENCE AND TECHNOLOGY, AMES.
LINEAR PROBABILITY FUNCTIONS AND DISCRIMINANT FUNCTIONS,
W69-06563 06A

I-T-E IMPERIAL CORP., PHILADELPHIA, PA. AND CITY OF LOS ANGELES, CALIF.
SHUNT CAPACITOR ENERGIZATION WITH VACUUM INTERRUPTERS--A POSSIBLE SOURCE OF OVERVOLTAGE,
W69-06689 08C

KANSAS UNIV., LAWRENCE.
POTENTIAL OF RADAR REMOTE SENSORS AS TOOLS IN RECONNAISSANCE GEOMORPHIC, VEGETATION AND SOIL MAPPING,
W69-06718 07B

LAND-SEA INTERACTION LAB., NORFOLK, VA.
TREND SURFACE ANALYSIS OF SAND TRACER DISTRIBUTIONS ON A CARBONATE BEACH, BIMINI, BWI,
W69-06809 02L

LONDON SCHOOL OF ECONOMICS AND POLITICAL SCIENCE (ENGLAND) AND OSAKA UNIV. (JAPAN). INST. OF SOCIAL AND ECONOMIC RESEARCH.
AN HARMONIC ANALYSIS OF NONSTATIONARY MULTIVARIATE ECONOMIC PROCESSES,
W69-06553 06A

LONDON SCHOOL OF ECONOMICS AND POLITICAL SCIENCE (ENGLAND).
NONRECURSIVE MODELS AS DISCRETE APPROXIMATIONS TO SYSTEMS OF STOCHASTIC DIFFERENTIAL EQUATIONS,
W69-06571 06A

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT, CALIF.
CONTROL OF SEA-WATER INTRUSION IN A GROUND-WATER AQUIFER,
W69-06422 02F

MANCHESTER UNIV. (ENGLAND).
CIRCULAR AND LOGARITHMIC SPIRAL SLIP SURFACES,
W69-06694 08D

MANITOBA UNIV., WINNIPEG. DEPT. OF ACTUARIAL MATHEMATICS AND STATISTICS AND RESEARCH COUNCIL OF ALBERTA, EDMONTON. GROUNDWATER DIV.
ITERATIVE ANALYSIS BOUNDED LEAKY ARTESIAN AQUIFER,
W69-06508 02F

MASSACHUSETTS INST. OF TECH., CAMBRIDGE. DEPT. OF CIVIL ENGINEERING.
STREAMFLOW RECORD LENGTH FOR MODELLING CATCHMENT DYNAMICS,
W69-06781 02E

MCGILL UNIV., MONTREAL (QUEBEC).
SOILS STUDIES USING COLOR PHOTOS,
W69-06696 07B

MELBOURNE UNIV., PARKVILLE (AUSTRALIA). DEPT. OF METEOROLOGY AND MELBOURNE UNIV., PARKVILLE (AUSTRALIA). ANTARCTIC DIV.
THE ANNUAL HEAT ENERGY TRANSFER ABOVE AND INSIDE ANTARCTICA BLUE ICE,
W69-06480 02C

MICHIGAN STATE UNIV., EAST LANSING.
TENSION OF THE SOIL WATER WHEN PERMANENT WILTING OCCURS, AS MEASURED BY THE GRAY HYDROCAL HYGROMETER METHOD,
W69-06516 02G

TESTING SINGLE-EQUATION LEAST SQUARES REGRESSION MODELS FOR AUTOCORRELATED DISTURBANCES,
W69-06565 06A

MINISTRY OF AGRICULTURE, FISHERIES AND FOOD, LOWESTOFT (ENGLAND). FISHERIES LAB AND FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, ROME (ITALY). FISHERIES BIOLOGY BRANCH.
A REVIEW OF THE LIFESPANS AND MORTALITY RATES OF FISH IN NATURE, AND THEIR RELATION TO GROWTH AND OTHER PHYSIOLOGICAL CHARACTERISTICS,
W69-06533 05C

MINISTRY OF AGRICULTURE, WAD MEDANI (SUDAN). RESEARCH DIV.
WATER USE BY IRRIGATED COTTON IN SUDAN. II. NET RADIATION AND SOIL HEAT FLUX,
W69-06756 03F

MINISTRY OF IRRIGATION AND POWER (INDIA).
CONSTRUCTION AND MANAGEMENT OF RIVER VALLEY PROJECTS IN

INDIA,
W69-06457 04A

BENEFICIAL USES OF WATERS OF INTERNATIONAL RIVERS INTERNATIONAL LAW AND PRACTICE,
W69-06458 06E

MISSOURI UNIV., COLUMBIA.
THE INFLUENCE OF OWNERSHIP AND CONTROL ON PROFIT RATES,
W69-06545 06B

NATIONAL INST. FOR AGRICULTURAL QUALITY TESTING BUDAPEST (HUNGARY).
SALT BALANCE AND SALT TRANSPORT PROCESSES IN IRRIGATED SOILS,
W69-06717 03F

NATIONAL SEVERE STORMS LAB., NORMAN, OKLA.
RADAR MEASUREMENT OF PRECIPITATION FOR HYDROLOGICAL PURPOSES,
W69-06812 02B

NATIONAL WATER SUPPLY RESEARCH LAB., WASHINGTON, D. C.
MICROBIAL PROBLEMS IN GROUNDWATER,
W69-06426 05C

NAVAL AIR STATION, MOFFET FIELD, CALIF. MINISTRY OF WORKS (SUDAN) AND WASHINGTON UNIV., SEATTLE.
SHEAR TRANSFER IN REINFORCED CONCRETE,
W69-06676 08F

NEVADA UNIV., RENO. DEPT. OF CIVIL ENGINEERING AND NEVADA UNIV., RENO. DESERT RESEARCH INST.
RECLAIMED WASTE WATER IN LAS VEGAS VALLEY,
W69-06832 05D

NEW ENGLAND RIVER BASINS COMMISSION, BOSTON, MASS.
SAFETY CONTROL OF PRIVATE DAMS,
W69-06433 04A

NEW SOUTH WALES UNIV., MANLY (AUSTRALIA). WATER RESEARCH LAB.
IMPROVED TECHNIQUES FOR ESTIMATING RUNOFF WITH BRIEF RECORDS,
W69-06830 02E

NEW YORK STATE DEPT. OF HEALTH, ALBANY. DIV. OF LABORATORIES AND RESEARCH.
ARSENIC ACCUMULATION BY FISH IN LAKES TREATED WITH SODIUM ARSENITE,
W69-06541 05B

NEW YORK UNIV., N. Y. DEPT. OF METEOROLOGY AND OCEANOLOGY.
DROUGHT IN THE NORTHEASTERN UNITED STATES,
W69-06436 02B

NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION, RALEIGH.
A METHOD OF DETERMINING THE WATER POTENTIAL OF INTACT PLANTS,
W69-06527 02I

NORTH CAROLINA STATE UNIV., RALEIGH AND ISLAMABAD UNIV., RAWALPINDI (PAKISTAN).
THE USE OF ERROR COMPONENTS MODELS IN COMBINING CROSS SECTION WITH TIME SERIES DATA,
W69-06552 06A

NORTHWESTERN UNIV., EVANSTON, ILL.
CIVIL ENGINEERING AND URBAN SYSTEMS,
W69-06491 06A

NORWEGIAN GEOTECHNICAL INST., OSLO.
STABILIZATION OF UNDISTURBED QUICK CLAY BY SALT WELLS,
W69-06719 08D

OREGON STATE UNIV., CORVALLIS.
DYNAMIC SIMULATION MODEL OF THE TRANSPIRATION PROCESS,
W69-06504 02D

OREGON UNIV., EUGENE.
AGGREGATE KOYCK FUNCTIONS,
W69-06561 06B

OTAGO UNIV., DUNEDIN (NEW ZEALAND). DEPT. OF GEOGRAPHY.
ESTIMATION OF RAINFALL IN SPARSELY GAUGED AREAS,
W69-06773 02B

PENNSYLVANIA DEPT. OF HEALTH, HARRISBURG AND WEST VIRGINIA UNIV., MORGANTOWN.
EFFECTS OF MINE DRAINAGE ON GROUND WATER,
W69-06425 05C

PENNSYLVANIA STATE UNIV., UNIVERSITY PARK.
CONCEPTUAL MODELS FOR CARBONATE AQUIFERS,
W69-06423 02F

PENNSYLVANIA STATE UNIV., UNIVERSITY PARK. INST. FOR RESEARCH ON LAND AND WATER RESOURCES.
THE HYDROLOGIC IMPORTANCE OF TRANSPIRATION CONTROL BY STOMATA,
W69-06520 02D

PLAN ORGANIZATION (IRAN). WATER PLANNING GROUP.
THE POSSIBILITY OF USING A MOVABLE DAM THE 'FABRIDAM' AND ITS APPLICATION IN ARID REGIONS,
W69-06455 04A

PRINCETON UNIV., N. J.
MAXIMIZATION BY QUADRATIC HILL-CLIMBING,
W69-06564 06A

PRINCETON UNIV., N. J. STANFORD UNIV., CALIF.
ON THE DISTRIBUTION OF STATISTICS SUITABLE FOR EVALUATING RAINFALL STIMULATION EXPERIMENTS,
W69-06679 03B

PURDUE UNIV., LAFAYETTE, IND.
MANPOWER REQUIREMENTS FOR POLLUTION CONTROL AND WATER RESOURCES IN INDIANA AND A RELATED POLLUTION CONTROL TECHNOLOGY CURRICULUM,
W69-06507 05G

INTERMOLECULAR FORCES AND THE LIQUID STATE,
W69-06838 01A

PURDUE UNIV., LAFAYETTE, IND. SCHOOL OF ENGINEERING AND PURDUE UNIV., LAFAYETTE, IND. DIV. OF CONFERENCES AND CONTINUATION SERVICES.
22 ND INDUSTRIAL WASTE CONFERENCE, 1967, PART ONE,
W69-06821 05D

RESEARCH COUNCIL OF ALBERTA, EDMONTON.
A COMPUTER-ORIENTED GROUND-WATER INFORMATION STORAGE AND RETRIEVAL SYSTEM,
W69-06764 07C

RESEARCH INST. FOR WATER RESOURCES DEVELOPMENT, BUDAPEST (HUNGARY).
TRACER METHOD FOR DETERMINING THE VELOCITY OF FLOW IN A CONFINED KARSTIC AQUIFER,
W69-06774 07B

RESOURCES FOR THE FUTURE, INC., WASHINGTON, D. C.
DESALTED SEAWATER FOR AGRICULTURE IS IT ECONOMIC,
W69-06765 03F

RESOURCES FOR THE FUTURE, INC., WASHINGTON, D. C. AND JOHNS HOPKINS UNIV., BALTIMORE, MD.
THE IMPACT OF PRICE ON RESIDENTIAL WATER DEMAND AND ITS RELATION TO SYSTEM DESIGN AND PRICE STRUCTURE,
W69-06502 06D

RIVER FORECAST CENTER, HARRISBURG, PA.
RELATION OF A HYDROLOGIC INDEX TO MEAN ANNUAL FLOW,
W69-06441 02B

ROCHESTER INST. OF TECH., N. Y.
BEHAVIOR OF LIQUID SURFACES DURING EVAPORATION AND CONDENSATION,
W69-06840 03A

RUTGERS - THE STATE UNIV., NEW BRUNSWICK, N. J.
THE CES PRODUCTION FUNCTION A DERIVATION,
W69-06720 06B

RUTGERS - THE STATE UNIV., NEW BRUNSWICK, N. J. DEPT. OF ENVIRONMENTAL SCIENCES AND GEOLOGICAL SURVEY, WASHINGTON, D. C.
FACTORS INFLUENCING THE CONDENSATION OF 4-AMINOANTIPYRINE WITH DERIVATIVES OF HYDROXYBENZENE-III. A STUDY OF PHENOL CONTENT IN SURFACE WATERS,
W69-06444 05A

SAN BERNARDINO VALLEY MUNICIPAL WATER DISTRICT, CALIF. AND TRW SYSTEMS GROUP, REDONDO BEACH, CALIF.
SIGNIFICANCE OF GROUNDWATER MANAGEMENT STRATEGY-A SYSTEMS APPROACH,
W69-06424 06A

SANTA CLARA VALLEY WATER CONSERVATION DISTRICT, SAN JOSE, CALIF.
EFFECT OF SUBSIDENCE ON WELL FIELDS,
W69-06763 04B

SIERRA CLUB, SAN FRANCISCO, CALIF.
COMMENTS ON THE COMPETITION FOR WATER QUALITY AGRICULTURE,
W69-06576 06D

SIERRA HYDROTECHNOLOGY, PLACERVILLE, CALIF. AND ATMOSPHERIC WATER RESOURCES RESEARCH, FRESNO, CALIF.
REGIONAL HYDROLOGIC AREA STUDY AS AN ANALYSIS TOOL IN WEATHER MODIFICATION,
W69-06805 02A

SOUTH DAKOTA GEOLOGICAL SURVEY, VERMILLION AND GEOLOGICAL SURVEY, VERMILLION, S. DAK.
GEOLOGY AND HYDROLOGY OF CLAY COUNTY SOUTH DAKOTA-PART 1, GEOLOGY, AND PART 2, WATER RESOURCES,
W69-06486 02F

SOUTHERN ILLINOIS UNIV., CARBONDALE. DEPT. OF GEOLOGY.
GROUND WATER, GRAVITY AND RIFT VALLEYS IN MALAWI,
W69-06431 02F

SOUTHWEST RESEARCH INST., HOUSTON, TEX. AND TEXAS WATER DEVELOPMENT BOARD, AUSTIN.
THE POTENTIAL CONTRIBUTION OF DESALTING TO FUTURE WATER SUPPLY IN TEXAS.
W69-06558 03A

MANUAL OF PROCEDURES AND METHODS FOR CALCULATING COMPARATIVE COSTS OF MUNICIPAL WATER SUPPLY FROM SALINE AND CONVENTIONAL WATER SOURCES IN TEXAS,
W69-06559 03A

SOUTHWESTERN GREAT PLAINS RESEARCH CENTER, BUSHLAND, TEX.
EFFICIENT WHEAT IRRIGATION WITH LIMITED WATER,
W69-06511 03F

STANFORD UNIV., CALIF.
ESTIMATION OF RETURNS TO SCALE AND THE ELASTICITY OF SUBSTITUTION,

W69-06732 06B

STANFORD UNIV., CALIF. AND MOBIL OIL CO., PAULBORO, N. J.
OPTIMIZATION THEORY APPLIED TO PRELIMINARY DESIGN OF A SINGLE EFFECT MULTISTAGE FLASH DESALINATION PLANT,
W69-06495 03A

STANFORD UNIV., PALO ALTO, CALIF.
SPECIFICATION ANALYSIS IN THE ESTIMATION OF PARAMETERS OF A SIMULTANEOUS EQUATION MODEL WITH AUTOREGRESSIVE RESIDUALS,
W69-06567 06A

TAHAL CONSTRUCTION ENGINEERS LTD., TEL AVIV (ISRAEL).
PIPELINE PLANNING BY DYNAMIC COMPUTER PROGRAMMING,
W69-06493 06A

TAIWAN PROVINCIAL GOVERNMENT, TAIPEI. WATER CONSERVANCY BUREAU.
AGRICULTURE USE OF WATER IN TAIWAN, REPUBLIC OF CHINA,
W69-06460 03F

TECHNION - ISRAEL INST. OF TECH., HAIFA (ISRAEL) AND MINISTRY OF HOUSING (ISRAEL).
PREDICTION OF SWELLING PRESSURE OF CLAYS,
W69-06693 08D

TENNESSEE DEPT. OF PUBLIC HEALTH, NASHVILLE. STREAM POLLUTION CONTROL DIV.
STREAM POLLUTION CONTROL IN THE UPPER CUMBERLAND RIVER BASIN 1965.
W69-06488 05G

TEXAS A AND M UNIV., COLLEGE STATION. WATER RESOURCES INST.
WATER FOR TEXAS,
W69-06790 06B

TEXAS WATER DEVELOPMENT BOARD, AUSTIN AND WATER RESOURCES ENGINEERS, INC., LAFAYETTE, CALIF.
SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE.
W69-06494 04A

TRIDENT ENGINEERING ASSOCIATES, INC., ANNAPOLIS, MD.
CHESAPEAKE BAY CASE STUDY.
W69-06794 06B

UNIVERSITY COLL., CORK (IRELAND).
HYDROLOGIC CYCLE AS A CLOSED SYSTEM,
W69-06442 02A

UNIVERSITY COLL., LONDON (ENGLAND).
GRAPHIC DETERMINATION OF SLOPE AND OF DIP AND STRIKE,
W69-06681 07B

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG (SOUTH AFRICA).
OPERATION OF MULTI-UNIT MULTI-PURPOSE WATER DEVELOPMENT SYSTEMS,
W69-06462 06D

UTAH STATE UNIV., LOGAN UTAH ENGINEERING EXPERIMENT STATION, SALT LAKE CITY AND UTAH WATER RESEARCH LAB., LOGAN.
EVAPORATION REDUCTION ON LARGE RESERVOIRS,
W69-06531 03F

UTAH WATER RESEARCH LAB., LOGAN.
ESTIMATING PAN EVAPORATION AND EVAPOTRANSPIRATION FROM CLIMATIC DATA,
W69-06522 02D

VIRGINIA POLYTECHNIC INST., BLACKSBURG, VA.
STOCHASTIC MODEL FOR BOD AND DO IN STREAMS,
W69-06500 05B

VIRGINIA POLYTECHNIC INST., BLACKSBURG.
WATER RESOURCES AND THE URBAN ENVIRONMENT,
W69-06428 04C

VOLCANI INST. OF AGRICULTURAL RESEARCH, BET-DAGAN (ISRAEL). DIV. OF AGRICULTURAL METEOROLOGY.
THE EFFECT OF CROP AND CLIMATIC FACTORS ON THE RADIATION BALANCE OF AN IRRIGATED MAIZE CROP,
W69-06757 03F

VSESOYUZNYI NAUCHNO-ISSLEDOVATELSKII INSTITUT GIDROTEKHNIKI I MELIORATSII, MOSCOW (USSR).
EXPERIENCE IN ACCELERATED IRREVERSIBLE DESALINIZATION OF SOILS IN GOLODNAYA STEPPE,
W69-06716 03F

WASH UNIV., SEATTLE. DEPT. OF ATMOSPHERIC SCIENCES.
THE METAMORPHISM OF DRY SNOW AT A UNIFORM TEMPERATURE,
W69-06479 02C

WASHINGTON STATE UNIV., PULLMAN. DEPT. OF ZOOLOGY AND WASHINGTON STATE UNIV., PULLMAN. DEPT. OF INFORMATION SCIENCE.
SIMULATION OF AN AQUATIC ECOSYSTEM,
W69-06536 02H

WASHINGTON UNIV., SEATTLE AND CALIFORNIA UNIV., SANTA BARBARA.
PUBLIC UTILITY PRICING AND OUTPUT UNDER RISK,
W69-06549 06C

WASHINGTON UNIV., SEATTLE.
SLUDGE DISPOSAL ALTERNATIVES -- SOCIO-ECONOMIC CONSIDERATIONS,
W69-06492 05E

WASHINGTON UNIV., SEATTLE. LAB. OF RADIATION ECOLOGY.
NICKEL-63 IN MARINE AND TERRESTRIAL BIOTA, SOIL, AND SEDIMENT,
W69-06766 05A

WATER PLANNING FOR ISRAEL LTD., HAIFA.
IRRIGATION WATER SYSTEM--ISRAEL'S NATIONAL WATER GRID,
W69-06459 03F

WATER RESOURCES COUNCIL, WASHINGTON, D. C.
INTERGOVERNMENTAL PLANNING OF WATER RESOURCES,
W69-06429 06B

WATER RESOURCES ENGINEERS, INC., LAFAYETTE, CALIF. AND CALIFORNIA UNIV., BERKELEY.
WATER QUALITY MANAGEMENT IN IRRIGATION SYSTEMS,
W69-06499 05G

WEATHER BUREAU, SILVER SPRING, MD. OFFICE OF HYDROLOGY.
FREQUENCY AND AREAL DISTRIBUTIONS OF TROPICAL STORM RAINFALL, U.S. COASTAL REGION, GULF OF MEXICO,
W69-06797 02B

WEATHER BUREAU, WASHINGTON, D. C. EXTENDED FORECAST DIV.
FURTHER STUDIES OF DROUGHT OVER NORTHEASTERN UNITED STATES,
W69-06438 02B

WEIZMANN INST OF SCIENCE, REHOVOTH (ISRAEL). DEPT. OF ISOTOPES.
THE STABLE ISOTOPE COMPOSITION OF MINERAL WATERS IN THE JORDON RIFT VALLEY, ISRAEL,
W69-06750 02F

WEIZMANN INST. OF SCIENCE, REHOVOTH (ISRAEL) ISRAEL ATOMIC ENERGY COMMISSION, REHOVOTH AND GEOLOGICAL SURVEY OF ISRAEL, JERUSALEM. HYDROGEOLOGICAL DIV.
GEOCHEMICAL TRACING OF MINERAL WATER SOURCES IN THE SOUTH WESTERN DEAD SEA BASIN, ISRAEL,
W69-06747 02F

WEIZMANN INST. OF SCIENCE, REHOVOTH (ISRAEL) ISRAEL ATOMIC ENERGY COMMISSION, REHOVOTH AND WATER PLANNING FOR ISRAEL LTD., HAIFA.
GEOCHEMICAL TRACING OF MINERAL AND FRESH WATER SOURCES IN THE LAKE TIBERIAS BASIN, ISRAEL,
W69-06748 02F

THE ORIGIN OF THE TIBERIAS-NOIT MINERAL WATER ASSOCIATION IN THE TIBERIAS-DEAD SEA RIFT VALLEY, ISRAEL,
W69-06749 02F

WEST BASIN MUNICIPAL WATER DISTRICT, HERMOSA BEACH, CALIF.
THE COMPETITION FOR WATER QUANTITY INDUSTRY,
W69-06577 06D

WESTINGHOUSE ELECTRIC CORP., EAST PITTSBURGH, PA. AND MONONGAHELA POWER CO., FAIRMONT, W. VA.
OPEN BREAKER PROTECTION OF EHV SYSTEMS,
W69-06688 08C

WISCONSIN UNIV., MADISON.
CALCULATION OF BALANCED AND UNBALANCED FAULT CURRENTS IN AC-DC POWER SYSTEMS,
W69-06690 08C

THE ROLE OF ALTERNATIVE COST IN PROJECT DESIGN AND SELECTION,
W69-06738 06B

CHOOSING AMONG ALTERNATIVE PUBLIC INVESTMENTS IN THE WATER RESOURCE FIELD,
W69-06740 06B

WISCONSIN UNIV., MADISON. DEPT. OF ZOOLOGY.
SPECIES DIVERSITY AND COMMUNITY STRUCTURE IN LACUSTRINE PHYTOPLANKTON,
W69-06542 02H

WISCONSIN UNIV., MADISON. WATER CHEMISTRY LAB.
THE AGING OF LAKES,
W69-06535 02H

ACCESSION NUMBER INDEX

02F	W69-06421	05E	W69-06498	08H	W69-06581	06E	W69-06662
02F	W69-06422	05G	W69-06499	03A	W69-06582	06E	W69-06663
02F	W69-06423	05B	W69-06500	03A	W69-06583	06E	W69-06664
06A	W69-06424	06D	W69-06502	06E	W69-06584	06E	W69-06665
05C	W69-06425	07C	W69-06503	06E	W69-06586	06E	W69-06666
05C	W69-06426	02D	W69-06504	06E	W69-06587	06E	W69-06667
02E	W69-06427	05D	W69-06505	06E	W69-06588	06E	W69-06668
04C	W69-06428	02K	W69-06506	06E	W69-06589	06E	W69-06669
06B	W69-06429	05G	W69-06507	06E	W69-06590	06E	W69-06670
02F	W69-06430	02F	W69-06508	06E	W69-06591	06E	W69-06671
02F	W69-06431	02F	W69-06509	06E	W69-06592	08F	W69-06672
04A	W69-06433	02G	W69-06510	06E	W69-06593	08E	W69-06673
07C	W69-06434	03F	W69-06511	06E	W69-06594	08D	W69-06674
02F	W69-06435	02G	W69-06512	06E	W69-06595	05G	W69-06675
02B	W69-06436	02J	W69-06513	06E	W69-06596	08F	W69-06676
02B	W69-06437	02G	W69-06514	06E	W69-06597	08A	W69-06677
02B	W69-06438	02G	W69-06515	06E	W69-06598	08F	W69-06678
02B	W69-06439	02G	W69-06516	06E	W69-06599	03B	W69-06679
02B	W69-06440	02F	W69-06517	06E	W69-06600	02E	W69-06680
02B	W69-06441	02G	W69-06519	06E	W69-06601	07B	W69-06681
02A	W69-06442	02D	W69-06520	06E	W69-06602	08F	W69-06682
02B	W69-06443	02D	W69-06522	06E	W69-06603	08E	W69-06683
05A	W69-06444	02G	W69-06523	06E	W69-06604	08C	W69-06684
04C	W69-06445	02G	W69-06524	06E	W69-06605	06A	W69-06685
06D	W69-06446	02D	W69-06526	06E	W69-06606	08C	W69-06686
02E	W69-06447	02I	W69-06527	06E	W69-06607	08C	W69-06687
02F	W69-06448	02G	W69-06528	06E	W69-06608	08C	W69-06688
02F	W69-06449	02G	W69-06529	06E	W69-06609	08C	W69-06689
02F	W69-06450	02D	W69-06530	06E	W69-06610	08C	W69-06690
02E	W69-06451	03F	W69-06531	06E	W69-06611	06B	W69-06691
02F	W69-06452	03F	W69-06532	06E	W69-06612	08D	W69-06692
04A	W69-06453	05C	W69-06533	06E	W69-06613	08D	W69-06693
03F	W69-06454	02H	W69-06535	06E	W69-06614	08D	W69-06694
04A	W69-06455	02H	W69-06536	06E	W69-06615	08D	W69-06695
03A	W69-06456	06A	W69-06537	06E	W69-06616	07B	W69-06696
04A	W69-06457	02K	W69-06538	06E	W69-06617	07B	W69-06697
06E	W69-06458	10	W69-06539	06E	W69-06618	08C	W69-06698
03F	W69-06459	07B	W69-06540	06E	W69-06619	08D	W69-06699
03F	W69-06460	05B	W69-06541	06E	W69-06620	08A	W69-06700
04A	W69-06461	02H	W69-06542	06E	W69-06621	08E	W69-06701
06D	W69-06462	06B	W69-06545	06E	W69-06622	07B	W69-06702
02F	W69-06463	05F	W69-06547	06E	W69-06623	04D	W69-06704
02F	W69-06464	06B	W69-06548	06E	W69-06624	08E	W69-06706
02F	W69-06465	06C	W69-06549	06E	W69-06625	08C	W69-06707
02F	W69-06466	06A	W69-06550	06E	W69-06626	08C	W69-06708
04A	W69-06467	06A	W69-06551	06E	W69-06627	08C	W69-06709
04A	W69-06468	06A	W69-06552	06E	W69-06628	08C	W69-06710
04A	W69-06469	06A	W69-06553	06E	W69-06629	08F	W69-06711
04A	W69-06470	06B	W69-06554	06E	W69-06630	08F	W69-06712
04A	W69-06471	03A	W69-06555	06E	W69-06631	08B	W69-06713
04A	W69-06472	03C	W69-06556	05G	W69-06632	02G	W69-06714
04A	W69-06473	06A	W69-06557	06E	W69-06633	02A	W69-06715
02C	W69-06474	03A	W69-06558	06E	W69-06634	03F	W69-06716
02C	W69-06475	03A	W69-06559	06E	W69-06635	03F	W69-06717
02C	W69-06476	06A	W69-06560	06E	W69-06636	07B	W69-06718
02C	W69-06477	06B	W69-06561	06E	W69-06638	08D	W69-06719
02C	W69-06478	06A	W69-06562	06E	W69-06639	06B	W69-06720
02C	W69-06479	06A	W69-06563	06E	W69-06641	06B	W69-06721
02C	W69-06480	06A	W69-06564	06E	W69-06642	06C	W69-06722
02C	W69-06481	06A	W69-06565	06E	W69-06643	05D	W69-06723
02C	W69-06482	06D	W69-06566	06E	W69-06644	06B	W69-06724
04B	W69-06483	06A	W69-06567	06E	W69-06645	06B	W69-06725
02F	W69-06484	06A	W69-06568	06E	W69-06646	06B	W69-06726
02F	W69-06485	06A	W69-06569	06E	W69-06647	06D	W69-06727
02F	W69-06486	06C	W69-06570	06E	W69-06648	06B	W69-06728
04B	W69-06487	06A	W69-06571	06E	W69-06649	06B	W69-06729
05G	W69-06488	06B	W69-06572	06E	W69-06650	06B	W69-06730
02G	W69-06489	06D	W69-06573	06E	W69-06652	05G	W69-06731
05D	W69-06490	06D	W69-06574	06E	W69-06653	06B	W69-06732
06A	W69-06491	06D	W69-06575	06E	W69-06655	06B	W69-06733
05E	W69-06492	06D	W69-06576	06E	W69-06656	06B	W69-06734
06A	W69-06493	06D	W69-06577	06E	W69-06657	06B	W69-06735
04A	W69-06494	06D	W69-06578	06E	W69-06658	06B	W69-06738
03A	W69-06495	06E	W69-06579	06E	W69-06660	06B	W69-06739
04A	W69-06496	06E	W69-06580	06E	W69-06661	06B	W69-06740

02J	W69-06746	02B	W69-06773	02J	W69-06799	05D	W69-06821
02F	W69-06747	07B	W69-06774	05B	W69-06802	02A	W69-06822
02F	W69-06748	02F	W69-06775	02C	W69-06803	04A	W69-06823
02F	W69-06749	02E	W69-06781	02B	W69-06804	04A	W69-06824
02F	W69-06750	09D	W69-06782	02A	W69-06805	04A	W69-06825
03F	W69-06756	09D	W69-06783	02F	W69-06806	04A	W69-06826
03F	W69-06757	09D	W69-06784	02J	W69-06807	04A	W69-06827
02F	W69-06758	05B	W69-06785	02C	W69-06808	02A	W69-06829
02F	W69-06759	02H	W69-06786	02L	W69-06809	02E	W69-06830
05G	W69-06762	04A	W69-06787	02J	W69-06810	02F	W69-06831
04B	W69-06763	04A	W69-06788	07B	W69-06811	05D	W69-06832
07C	W69-06764	02A	W69-06789	02B	W69-06812	02D	W69-06833
03F	W69-06765	06B	W69-06790	02F	W69-06813	06A	W69-06834
05A	W69-06766	05G	W69-06791	02B	W69-06814	02E	W69-06835
09C	W69-06767	02L	W69-06793	02F	W69-06815	03A	W69-06836
02J	W69-06768	06B	W69-06794	02F	W69-06816	03A	W69-06837
09C	W69-06769	04A	W69-06795	02F	W69-06817	01A	W69-06838
04C	W69-06770	03F	W69-06796	02F	W69-06818	03A	W69-06839
03B	W69-06771	02B	W69-06797	02F	W69-06819	03A	W69-06840
04B	W69-06772	02L	W69-06798	02F	W69-06820		

ABSTRACT SOURCES

	Accession Numbers	Total
. **Centers of Competence:**		
(1) U.S. Geological Survey - Hydrology	W69-06421 -- W69-06489 W69-06765 -- W69-06835	130
(2) Cornell University - Policy Models for Water Resource Systems	W69-06490 -- W69-06505	14
(3) University of Arizona - Arid Lands Water Resources	W69-06508 -- W69-06532 W69-06746 -- W69-06764	34
(4) University of Wisconsin - Eutrophication	W69-06533 -- W69-06542	9
(5) Rutgers University - Water Resources Economics	W69-06545 -- W69-06583 W69-06720 -- W69-06740	57
(6) Bureau of Reclamation - Engineering Works	W69-06672 -- W69-06719	46
(7) University of Florida - Eastern U.S. Water Law	W69-06586 -- W69-06671 W69-06584	82
. **Other Sources:**		
(1) Georgia Institute of Technology - Water Resources Center	W69-06506	1
(2) Purdue University - Water Resources Research Center	W69-06507	1
(3) Office of Saline Water	W69-06836 -- W69-06840	5
	Grand Total	379

Subject Fields

- 1 NATURE OF WATER
- 2 WATER CYCLE
- 3 WATER SUPPLY AUGMENTATION AND CONSERVATION
- 4 WATER QUANTITY MANAGEMENT AND CONTROL
- 5 WATER QUALITY MANAGEMENT AND PROTECTION
- 6 WATER RESOURCES PLANNING
- 7 RESOURCES DATA
- 8 ENGINEERING WORKS
- 9 MANPOWER, GRANTS, AND FACILITIES
- 10 SCIENTIFIC AND TECHNICAL INFORMATION

INDEXES

- SUBJECT INDEX
- AUTHOR INDEX
- ORGANIZATIONAL INDEX
- ACCESSION NUMBER INDEX
- ABSTRACT SOURCES

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF COMMERCE

LIBRARY RATE
PRINTED MATTER

U.S. DEPARTMENT OF COMMERCE
CLEARINGHOUSE FOR FEDERAL
SCIENTIFIC AND TECHNICAL INFORMATION
Springfield, Va. 22151

OFFICIAL BUSINESS

LIBRARY-U. OF I., URBANA-CHAMPAIGN

UNIVERSITY OF ILLINOIS-URBANA
3 0112 084231916